A surgeon's fight to rebuild men : an autobiography / Fred H. Albee.

Contributors

Albee, Fred H. 1876-1945.

Publication/Creation

London : Robert Hale, 1950.

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A SURGEON'S FIGHT TO REBUILD MEN


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Dr. Fred H. Albee dedicating the operating room named for him at the University of Buenos Aires, August 21, 1942

A SURGEON'S FIGHT TO REBUILD MEN

AN AUTOBIOGRAPHY

FRED H. ALBEE
M.D., F.A.C.S., F.I.C.S.



LONDON
ROBERT HALE LIMITED
18 Bedford Square W.C.1

ALBEE, Fred Hoadlett [1876-1945]
BONES, Transplantation: 20 cent.

First published 1950

This book is dedicated to my wife

LOUELLA B. ALBEE

who has been my faithful and sympathetic helper for the past thirty-five years

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FOREWORD

THE HISTORY OF SURGERY gives us one of the most fascinating but curious chapters in the annals of civilized progress. Not the least curious is the fact that as a science it has advanced more in the last hundred years than in the previous twenty-one hundred. A symbol of that is the number of great surgeons of the nineteenth and twentieth centuries.

It is a pity that we don't know the names of the ancient Egyptians—undoubtedly priests attached to the temples—who developed and performed such complicated exploits as the removal of calculi and even tricky operations upon the eye in those remote days. Neither is there any record of the personalities of the Hindus who also practised lithotomy and are believed to have anticipated us in the art of plastic surgery long, long ago.

The list of great surgeons of whom we know begins virtually with Herophilus of Alexandria, who discovered the nervous system and founded the first recorded school of surgery in the third century B.C. To be sure, Hippocrates wrote about surgery as well as medicine, but we think of him principally as the father of the physicians' art. After Herophilus there comes a gap of almost seventeen hundred years, a fallow period that lasted until the day of Ambroise Paré, sometimes called the father of modern surgery. But it wasn't until more than a hundred years later than Paré that Peyronie of Montpellier liberated the surgeon from the necessity of being also a barber.

It is interesting to find that the first name in the Golden Age of modern surgery is that of Ephraim McDowell of Kentucky, and that at a time when Kentucky was still frontier. As long ago as 1809 McDowell performed what is believed to have been the first ovariotomy—at any rate, in modern times.

From that day on, the history of surgery becomes literally studded with the names of great men such as Lord Lister, whom we have to thank for aseptic operations, Sir Charles Bell, Sir Astley Cooper. In the United States McDowell of Kentucky was followed by an extraordinary succession of surgical geniuses, J. Marion Sims, the founder of modern gyncæology, Samuel B. Gross of Philadelphia, John B. Murphy of Chicago, George

Crile, the Mayos. And so we come to one of the great surgeons of all time, Fred H. Albee of New York. They call him the "Burbank of Surgery", and even his colleagues and contemporaries look upon him literally as a miracle man. It is a definite fact that thousands of men to-day are walking about and enjoying their strength only because Fred Albee discovered how to graft the human bone, thousands who would otherwise be either crippled or dead. If we search through the entire history of the science that he has practised so magnificently, we shall find few single contributions of greater importance or even as great. But that is not all. He has evolved at least a hundred new operations in the healing of men and women.

Not the least of the amazing accomplishments of this man is that, in the intervals between consultations and studies and performing over thirty thousand operations (!), he has found time to write a fascinating autobiography. Imagine what vitality a man must have just to perform those thirty thousand operations! But on the side Fred Albee has lived a life of such richness and activity, and pursued a range of interests vast enough to suffice for half a dozen ordinary fellows. And into the bargain he is a crack fisherman!

Of such calibre is the author of this book. Wouldn't it be interesting to read a review of it by Herophilus of Alexandria? Or even by the barber-surgeon Ambroise Paré?

LOWELL THOMAS

CONTENTS

PAGE

FOREWORD BY LOWELL THOMAS 5

AUTHOR'S PREFACE 13

Part One

AS THE TWIG IS BENT 15

Part Two

THE WITCH'S BREW 79

Part Three

THE HUMAN SCRAP HEAP 169

Part Four

NO TIME TO LOSE 197

APPENDIX 251

INDEX 263

ILLUSTRATIONS

DR. FRED H. ALBEE, UNIVERSITY OF BUENOS AIRES, AUGUST 21, 1942 . . . . . *Frontispiece*

FACING PAGE

LABORATORY AT BOWDOIN COLLEGE, 1898 . . . 64

BORLAND ELECTRIC HELPS SURGEON, 1912 . . . 64

VICTIM OF SPINAL TUBERCULOSIS, 1909 . . . 68

DR. AND MRS. ALBEE AT THE HOME OF DR. ALFRED LORENZ IN THE ALPS, 1913 129

DR. ALBEE AND HIS STAFF AT THE TIME OF THE FIRST BONE GRAFT OF THE SPINE, U. S. GENERAL HOSPITAL NO. 3, COLONIA, N. J., 1918 129

DR. ALBEE OPERATING AT RIZZOLI INSTITUTE, BOLOGNA, ITALY, 1919 168

FOUR WORLD-WIDE FIGURES IN ORTHOPÆDIC SURGERY, LONDON, JULY 1929 197

MENU CARD FROM THE JOINT MEETING OF THE AMERICAN AND BRITISH ORTHOPÆDIC ASSOCIATIONS, JULY 4, 1929 198

DR. ALBEE USING THE ALBEE BONE MILL DURING AN OPERATION IN RIO DE JANEIRO, 1936 . . . 219

DR. ALBEE LECTURING AT THE UNIVERSITY OF BUENOS AIRES, 1942 246

ACKNOWLEDGMENT

MY GRATEFUL ACKNOWLEDGMENT for inspirational suggestions, aid, or assistance in the course of achievements narrated in this volume, or in its preparation, is hereby given to the following:

To my tree-grafting Grandfather, Charles G. Houdlette, from whom I received the key to the then secret chambers of bone-graft surgery:

To the Research Laboratory of the School of Medicine, Cornell University, with especial reference to Dr. S. P. Beebe, and Dr. James Ewing, for practical aid in developing the principles of bone-graft surgery:

To Miss Elinore Denniston for her literary assistance in the preparation of these pages.

FRED H. ALBEE, M.D.

PREFACE

WRITING YOUR AUTOBIOGRAPHY is not unlike taking your own picture in one of those infernal machines in which you pose yourself. You are responsible for the attitudes which you assume, but it is safe to say that you are stunned by the results. The pictures don't look like you. At least they don't look as you thought you did.

The worst feature of writing an autobiography, however, is that it is a long process of looking back. Personally, I have never liked looking back. There is so little time and so much to be done, that one must look ahead. Now of all times one must look ahead. The past is a matter of history; the present, alas, is a time of chaos, but the future must be a time of restoration, of rebuilding a sick world. And the moment to prepare for that is now.

The daily papers remind us constantly that we must build machines, and more machines—aeroplanes, ships, tanks, guns. They do not remind us sufficiently, I think, that behind every machine, behind every gun there is a man, and that a man, too, needs building and repair, that he needs maintenance and upkeep. This is primarily the work of the doctor. But, if only because of man's vital importance to his world, it must be the work of society as well.

It was my privilege in the First World War to see the gospel of the bone-graft which I had begun preaching in 1911, reach its first mass acceptance among medical men at the front. By it, thousands of limbs were saved. Shattered bodies, previously considered "amputation cases" as a matter of routine, were given a fighting chance; and more and more surgeons saw their faith justified, as limbs and men were returned to life sound and fit—either by the bone-graft itself, or thanks to the bone-graft which by raising the odds against amputation, permitted nature to effect her own cure in many cases.

In World War II the same bone-graft principles operated on even a wider scale—both because of the character of the War, and the wider knowledge of the surgeons entering the field—and who knows what new methods will be yet further

evolved to meet the exigencies of both civilian and military casualties.

I have struggled to write and to record with detachment, but I may as well confess at the outset that I am not geared to wait for things to happen. I am not humble when I am told things are impossible. I am not afraid when I am told they have never been done before. Long ago, Benjamin Franklin proved that if you need a swivel chair or bifocal lenses, the best system is to invent them, instead of pining because they do not exist. It is a system I have followed. It is only by using all you have, all your energy, ability, learning, imagination, that you become a full man. So I have been a fighter all my life. I do not recommend this for an easy life—I guarantee it for a full one.

FRED H. ALBEE

PART ONE AS THE TWIG IS BENT

I

SETTING DOWN an account of my experiences in this strange business of living, I am faced with the dilemma of every man who attempts to assess, on his own private balance sheet, his successes and his failures. His eyes are apt to linger, with what he hopes is modest pride, on the sum total of his achievements. They tend to wince away from the long list of things not yet done, perhaps never to be done. For the doctor, that list seems to stretch out beyond the farthest outposts of man's knowledge. For there is still so much to learn.

In this story of one man's life, I have not tried to adhere to any rigid chronology. Time is a fluid thing, and one remembers events not so much in the order in which they happened, as in their relationship to one another, in which, after all, lies their only significance.

The doctor is an intellectual gypsy. Whether to learn or to teach, he is a born wanderer. Assure him of a decent income for the rest of his life, and he will disappear by the next train. He never knows enough; he can never know enough. The only thing that holds him to practice, year in and year out, is the whine of the wolf. His dream is to travel, study, and return to retrieve his errors and be more useful to his fellowmen.

Intellectual intercourse and spiritual encouragement are as necessary to him as his food. If isolated, even in a land of cultural plenty, he stagnates mentally and starves spiritually.

He has the insatiable curiosity of a village gossip, and a Gargantuan appetite for knowledge, for more and more facts to add to his store of information.

With the passage of time, his need for still wider learning has increased as his own function has broadened in scope. It is no longer enough to cure a patient. Or, to put it another way, a complete cure entails more than the healing of a wound or the setting of an arm. It entails restoring a patient to mental and spiritual as well as to physical health. It entails restoring him to his place in the economic structure of society.

Sentimental pity is one of society's ways of applying balm to its own injured sensibilities at the sight of pain and suffering. It is a substitute for doing something. But we can no longer simply feel sorry. An example of this sentimental attitude which has always stuck in my mind was the well-meaning woman who was taken through a jail in one of our less-enlightened communities. There was no ventilation. The men, sick and well, were herded into a single large room, without windows. They slept on shelves around the wall. Criminal and first offender were thrown together. For sanitation there was a hole in the centre of the room.

The place was filthy, ill-smelling, a breeder of disease and crime. The kindly woman looked about her, looked at the men who lived like neglected animals, and sighed. "I do wish," she murmured, "I had thought to bring them some flowers."

It is not enough to pity the sick and the crippled; it is not enough to give them charity. The sick and the crippled are an economic waste. It is criminal nonsense to point to the old law of the survival of the fittest, and shrug our shoulders. Society itself is sick when large numbers of its people are physically inefficient.

The doctor can no longer stop when he has bound up a wound. He cannot stop until he has mended the wounds in the mind and the spirit; he cannot stop until he has prepared his patient to take up again a useful place in society.

Out of the horror and the cruelty and the stupidity and the pain of the First World War came some good and useful lessons. One was the lesson of rehabilitation, which taught doctors all over the world that their work was no longer confined to the sick room and the operating theatre, that it had a profound relationship to the economic scheme of things and the very fabric of society itself.

Because I am an incurable optimist, because I learned as a boy on a meagre Maine farm how fertile the rockiest soil may be if it is carefully tended, I believe that out of the fires of the Second World War may come new lessons with as vital an effect in forging stronger bonds of co-operation between man and society.

In the meantime I look, Janus-like, two ways: back over my shoulder at the busy years, and ahead to the promise of the future. What has been done is only a beginning. There is still time.

I was born on a farm in the township of Alna, Maine, on Friday, April 13, 1876. From some hundred acres of stony soil my father wrenched a scanty living for nine of us. I do not recommend this for the ideal life. But there is a dogged quality about Maine farmers—that grim struggle between them and the soil and the harsh climate, where winters come early and spring comes late, becomes almost a personal conflict. And while sometimes the man goes under, he usually wins his grim victory—but only if he has put into it everything he had: his time, his strength, his energy, his faith.

Magnificent as the struggle is, it tends to develop a kind of tight-lipped, do-or-die quality, which is extremely admirable but rather trying to live with. Perhaps that is why, though I remember that Maine farm with affection, and my father's tireless labours on it with respect, I find myself turning towards Florida when the winter comes along, where nature has been more gracious and things seem to grow just for the fun of it.

There was not much fun about growing things in Maine. We were as remote from the outside world as pioneers. By the time I was eight, I was old enough to carry my load of the farm work. The day began with the light and ended after dark. Nothing was wasted. Even the rocks and boulders were used for building fences. It was existence stripped near to the bone, but, for the most part, the farming people in the community were inured to hardships, to long hours of labour with slight reward, to frugality and self-denial. This was their lot and they were resigned to it.

Roads were crude, rough, and in the slushy springtime, hub-deep in mud and practically impassable. Winters were very severe—the mercury dropping to ten, twenty, and at times even forty degrees below zero. Many a cold morning found my father, Stephen—my brother, two years younger—and me walking through deep snowdrifts in search of firewood. Often the drifts were so high that we had to tunnel our way through them to the barn. Many times I had to stand on the window sill in order to see above them.

Of course, we had no furnace in those days, and the house was heated either by a fireplace or a so-called "air-tight" stove. These would go out as soon as we went to bed, and a freezing cold would set in throughout the house.

Living conditions throughout the township were generally primitive and educational facilities were of the scantiest.

Illiteracy was widespread in the community. To achieve anything beyond the barest living required a great deal of resourcefulness. In Maine you must either be resourceful or resigned.

My father, Freling Huysen Albee, met conditions by physically and spiritually tightening his belt. Having started out, like many young men on the coast of Maine, as a sailor, he had learned to take hardships in his stride, and he expected his family to do likewise. He combined a Spartan quality with an unflinching discipline and an authoritativeness acquired when he had served as deputy sheriff of our county.

My mother, Mary Charlotte Houdlette Albee, outwardly accepted her husband's code and tried to abide by it, but as she joined us children in our attempts to escape the rigid discipline from time to time, and as she maintained an unconquerable girlish spirit all her life, I suspect that she was always something of a rebel.

Our family numbered seven children. I was the oldest. The next born was Stephen, two years my junior; then, like a flight of steps came four sisters, Carolyn, Blanche, Geraldine, and Marion, and my youngest brother, Cleveland.

Our nearest market centre was Wiscasset, which in Indian signifies "the meeting place of three tides", a quaint, charming village, idly dreaming away the years. It is as old as America itself, and many years ago it was an important seaport. Its harbour, one of the deepest and best of the sheltered havens along the New England states, attracted commerce, and shipbuilding flourished there.

Whalers and ships from Europe and the Far East crowded Wiscasset Harbour. In those early days, it seemed more important than Boston. The spirit of adventure, which habitually moves in wild, romantic ways, walked in that region. Pirates used the entrances to the Kennebec and Sheepscot Rivers as hide-outs and there were rumours that they buried their plunder along the shores.

These tales survived down to my time. Around Pittston there were many great excavations in the ground where, to the accompaniment of selected readings from the Bible and weird rites during certain phases of the moon, men dug in search of buried pirate treasure. In my boyhood they were still digging, with an optimism which failure never seemed to dull.

Wiscasset was a hotbed of adventure, and many expeditions

set out from there bound on strange missions. Many of those adventurers returned bearing tales of odd incidents in far-off quarters of the globe. But some of them never returned.

In recent years, Wiscasset has been a favourite starting-point for polar expeditions, and it was from there that Commander Donald B. MacMillan, U.S.N., who accompanied Admiral Perry when he discovered the North Pole, and whom I had known during the months when we played on the Bowdoin football team, set forth on several of his journeys to the North.

My father's family had been identified with the region from the beginning of its development by the English. My grandmother, Margaret Parsons Albee, was lineally descended from Joseph Parsons, co-grantee with John Winthrop, head of the Massachusetts Bay Company, and William Pynchon in the original royal grant of territory issued by the British sovereign in 1630, which included the Alna, Edgecomb, Dresden, Pittston, and Wiscasset townships within its larger bounds. The Albees traced back through earliest Maine pioneers to Norman-English origin.

One of my ancestors, for whom I have always had a certain sneaking fondness, was one Obadiah Albee, who, according to the early records, was tried for murder. Obadiah, it appears, was a hunter by trade and an athlete by inclination. On one occasion he set off on a hunting expedition and ran into a party of Indians.

Considering discretion the better part of valour, Obadiah promptly flung away his musket and took to his heels. He soon outdistanced all but one of his pursuers, but the latter was hot on his trail.

When his breath was labouring in his throat and it was obvious he could not run much longer, Obadiah flung himself down beside a fallen tree. In a moment the Indian leaped upon the trunk. Obadiah reached up, caught his pursuer by the legs and threw him to the ground. Then, with his hand, he tore out the Indian's windpipe!

With such an atmosphere for a background, and the tang of the sea in his nostrils, it was small wonder that my grandfather, Sewell Albee, went to sea at the age of sixteen. That was in 1821.

At twenty-three, he had won his way to a sea-captaincy and was placed in command of the brig *Ajax*. For the next forty-two years, until he retired to a life ashore, he trod the

poop decks of a number of ships that were the pride of Wiscasset.

Grandfather was the first to bring word to America of the death of William IV. This important news stimulated two rival captains to speed the story to America. The result was a hard-fought and exciting race, during which both ships were struck by heavy gales. My grandfather's competitor shortened sail, to be on the safe side; but Grandfather, with less reefing of canvas, ploughed through to victory.

In Grandfather's time, a captain had to be not only an able navigator, but also a strict disciplinarian. If there was mutiny aboard his ship, he would have to take care of it. He could not send for help, nor did he expect any, for once upon the seas, he was utterly cut off from the world.

This is not a bad heritage for a surgeon who, in the operating theatre, finds himself in a somewhat analogous position. He, too, must exact instant obedience. A moment's delay or bungling on the part of his assistants may cost the life of the patient on the operating table. He, too, once he has begun the operation, is cut off from outside help. He must depend upon himself, his own skill, his own knowledge.

Large families were good investments in those days, and Grandfather had eleven children—seven boys and four girls. All of the boys shipped off to sea. My two eldest uncles, Sutton and Stephen, became sea captains. The other boys, Ebenezer, Sewell, Samuel, and my father—for a time—followed the sea in various capacities. My four aunts all married seafaring men.

My uncle Stephen must have been a man of understatement for he wrote his wife mildly: "I am sick of being shipwrecked. I should much rather be at home with you."

"I hope you will either leave the sea," his wife wrote to him, "or let me go with you so I can share with you. I am neither contented nor happy staying at home while you are away on the sea, and I know not what you suffer. It is bad to live so."

That was her last letter, for on the next voyage she had her wish and sailed with her husband and son. The married lovers, together with their son, were lost at sea.

Three of my father's brothers died at sea. They lived simply and died stoically. And simple living and stoicism became the heart of my father's code.

Agriculture, manufacture of lumber and wooden articles,

shipbuilding, whaling, and other shipping and commerce were the chief industries in the region of Maine where I was born. Lesser activities included pottery-making and the distilling of rum from imported West Indies molasses.

Elbow-crooking appears to have been a side industry that may be counted in this class. In Pittston, where the population numbered less than four hundred, fifty hogsheads (or 3,150 gallons) of rum were sold for consumption by a single store each winter. That amount of rum, on a per capita basis, was about eight quarts per person—men, women, and babies.

With no irreverence, religion, too, may almost be counted an early regional industry—at least to the extent that considerable industry entered into its practice. Meeting houses, or other places of worship, were few and far between. And in winter, hard work was required to clear the snow from the approaches. So industrious was Pittston's Major Reuben Colburn in his religious practice, that every Saturday he took his family thirty-five miles down the river in a canoe to worship through Sunday, and returned by canoe on Monday. A seventy-mile round trip lasting three days.

Both of my parents were members of the Methodist Church, which was the prevailing religious sect in that region. We attended the Alna Meeting House, three miles distant, an historic structure, erected in 1789. After the manner of religious architecture of that time in Maine, it was designed to foster John Wesley's religion on the inside and to keep the Indians on the outside. Loopholes were ranged along the walls between and above the windows, which were equipped with massive shutters. A number of bullets are still imbedded in the walls, reminders of an age when pioneers prayed, sang hymns, and worshipped under the shadow of Indian raids and massacres.

In their religious zeal, my parents imposed strict church requirements upon their children—including attendance at regular services, prayer meetings, and Sunday school. I am afraid that I did not derive much religious enlightenment from the services which I attended at the Alna Meeting House under duress. But I recall some pearls of wisdom that dropped from the lips of old Elijah Harris in the course of experience meetings, which were a combination of testimony and preachment. He was an exhorter and, not being held to the theological restrictions imposed on duly qualified members of the ministry,

he often spoke his thoughts freely and gave his construction of mooted passages of the Scriptures without restraint.

There was one passage in the New Testament which up to then had bothered me. It was that command to turn the other cheek, a difficult doctrine for a pugnacious boy of my type to swallow. But the old exhorter interpreted it one Sunday afternoon in a manner that appealed to me as being more reasonable. He read the passage painstakingly and then, closing the Book, he said:

"Now, Brethren and Sisters, the Good Book tells us that if an enemy smacks you on one cheek, you ought to turn the other cheek and let him smack you on that. But, Brethren and Sisters, the third lick, *the third lick*, I say, is yours!"

That was Scriptural pacifism stripped to practical terms.

My father's principles were based on a kind of unrelenting non-indulgence. He believed, I think, that anything we really liked must be bad for us. Any temptations to indulge in the delights of the flesh were carefully kept out of our way. He carried this principle so far that he even refused to raise any berries or vegetables which might in any way be called delicacies. Our farm was limited to producing Irish potatoes, corn, turnips, or rutabagas, and a variety of marketable apples, known as Ben Davis, whose chief virtues were that they could be kept in storage through the winter for sale in the spring, and that they were such wretched eating apples that they did not offer an unconquerable temptation to the family during the long winter.

Along the edges of the fields there were patches of wild horse radish, and the surrounding woodland was studded with sugar maple trees. The house was an old frame structure, designed merely for existence. There was no allowance for space for romping play and only meagre allowance for living. A large dining-room that also served as living-room, work space, and parlour; three bedrooms, and a kitchen made up the first floor. On the second, or attic floor, were additional sleeping quarters for the boys, with space for stowing old furniture and other trumpery. Down below there was a large cellar used for storage. In the centre of the first floor was a large chimney, with fireplaces in three sides, and an oven space for baking beans and other "delicacies" on the fourth side.

There was little cash, and buying and selling was largely

replaced in the community by a system of barter. When we needed a barrel of flour, father would take a number of bushels of Irish potatoes to the merchant and get it.

Occasionally, when Father was away, we children would surreptitiously take a few pounds of Irish potatoes to town and exchange them for sweet potatoes, which were considered a delicacy and therefore rigorously banned from the table. But mother would cook them for us and her unregenerate spirit was such that she enjoyed the sinful luxury as much as we did.

My father divided each day into two major parts. One, from the first crack of dawn to the last ray of daylight, was allotted to "serious business"—outdoor work in the garden or field, or indoor chores in barn, house, or in going to school. The remaining part of the day was given over to the evening meal, study, play, and sleep.

There was one chore which was so fascinating to me that it seemed like play; that was assisting my mother's father in his self-appointed task of tree-grafting. Charles G. Houdlette came of a long line of French Huguenots who had settled in Dresden. He was a rather small man with an immense beard half-concealing a kindly face. In his younger days, Grandfather Houdlette had been a ship's carpenter and a house carpenter. He was a master at precision work with tools and had made himself an expert at beautiful cabinet work. From him I learned a lesson in precision which, added to a natural mechanical bent, has stood me in good stead all my life.

As a cabinet maker, the quality of Grandfather's work was based upon precision. Exactitude was the measure of its excellence. So, at a very early age, he instilled in my mind the necessity for accuracy and precision. He brought the precision that he had developed on inanimate material to bear upon living substances, and there its significance was tremendous.

Unlike my father, Grandfather Houdlette taught by example rather than by precept. It was unnecessary to point out that infinite pains and care in details were more rewarding than sloppy workmanship. I could see the results for myself, but I could not measure their lesson until, years later, I put some of his teachings into effect in human carpentry.

This exacting and accurate technique of his was employed in the grafting of fruit trees, particularly apple trees, in which

he employed me as a kind of assistant-apprentice. Because of his success in this field, he was called upon for his services by farmers far and wide.

I went about the countryside with him, carrying bundles of apple scions which I handed up to him to graft on to a tree. His success was based upon the precision with which he would fit the scion into the host tissues, and the care that he gave each graft, to immobilize and protect it from any contamination with moulds or fungi, which would destroy the result.

When, as a result of his labours, I saw sweet apples growing on a sour apple tree, I felt that I was looking on white magic. But I was merely seeing the results of careful workmanship, carrying out the dictates of biology.

Grafting is not a very complicated process. But it requires utmost skill and precision in every step and in every part. The best results of grafting are usually obtained from operations in the spring, at least in the New England climate. Selection of a hardy stock on which a grafting of another variety of the same or related species is desired and the finding of a scion with shoots and buds suitable for grafting are preliminary steps in the process.

Having selected the tree stock and the scion to be grafted on it, Grandfather would then determine the procedure to be followed. Each case presented its own peculiar problems. A number of different methods are used in grafting and Grandfather had to determine which was best suited for the case in hand.

With a jackknife, he then prepared the surface of a tree stock for insertion of a graft scion. This generally consisted of slitting the bark to the desired depth and turning it back. Then the graft scion was inserted, the bark was pressed down in place upon it, and the patch was covered with paraffin or wax.

Grafting, in every method, requires that the cambium layer (or the growing tissues of the scion), which lies between the bark and the sap wood, be placed in juxtaposition to the cambium layer of the tree stock in such a manner that the two will form a union and grow together.

Success in grafting operations depends very largely upon the precision with which the work is done and the efficacy of the safeguards against infection from the outside and displacement as the result of the bending of the tree during high winds.

The paraffin served as an effective armour against infection from the outside. Its transparency also allowed penetration of the sun's rays to activate the plants' chlorophyl (the secret of growth). By immobilizing the scion in its position with ligatures and bands, the "blood" of the stock tree was enabled to flow through the cambium "veins" of the insert. Thus, the scion drew its strength from the tree on which it had been grafted and steadily grew without loss of its own characteristics. It put forth its own leaves and yielded its own fruit.

These lessons learned from nature were far more effective than if they had been studied in a laboratory. Much that I learned from Grandfather Houdlette in our fruit-tree grafting activities has since served me constructively in the development of bone-grafting operations. He was a disciplinarian of the first order. He insisted, with Yankee tenacity, that if a tree graft were to live, it must be inserted into the host tissue with the greatest care and precision to fit. The principles I learned from my grandfather while helping him graft apple tree twigs, were these:

1. Accuracy of fit means immobility of graft in host tissues.

2. A close fit makes for early and profuse vegetable sap circulation (blood circulation in the animal kingdom) from host tissue to graft.

3. The closer the fit, the less likelihood of vegetable infection in the form of fungi, and so forth.

4. Inasmuch as the wind tends to produce motion between the tree graft and its host tissues, every means of immobilizing it should be carried out. The slightest motion, Grandfather emphasized, would not only thwart the establishment of sap circulation, but would make for infection and death of the graft.

How strangely similar the fundamental principles of tree grafting, as taught me by my grandfather, to those involved in bone grafting to-day!

Not so very long ago, a newspaper in Buenos Aires referred to me as the "Burbank of Surgery". The description took me back to Grandfather Houdlette, and once more I saw him pointing triumphantly to the branch of the sour apple tree where the sweet apples grew.

II

THE RIGOROUS DISCIPLINE of those youthful days on the Maine farm did not prevent, perhaps they stimulated, the secret dream world in which I lived. There was a special dream which went on and on, taking up each night where it had left off the night before, like a serial story. That was the story of my adult life, when I was to become a surgeon. I cannot recall any time when my ambition faltered, or when I was tempted to prepare for any other kind of life. Medicine, and particularly surgery, was the alpha and omega of all my dreams.

I fashioned a medical case out of an old salt box and stocked it with my medicines: bread pills made from dough given me by my mother on baking days, and drugs concocted from colourful berries gathered in the woods. I even made a set of surgical instruments out of white pine, including cruel-looking saws and scalpels and an intricately carved needle.

Our family doctor did nothing to dim this ambition. The country doctor is looked on to-day as a slow sort of fellow, kindly in a homespun sort of way. But to us Dr. A. M. Card was a creature of glamour. He never ambled along the country roads, he went flying past, whipping up his span of fine horses, dashing past in a cloud of dust. He was the hero of the countryside. Not a boy of us but wanted to be like him. He stood for romance and adventure, for power and authority, for comfort and healing.

After the manner of country doctors, he served the community in multitudinous ways. He did everything: treated palpitations, ministered to the fever-stricken, occasionally amputated an arm or leg, and even pulled teeth when sufferers were *in extremis*.

One of the chief reasons for Dr. Card's great popularity was his willingness to tell a joke on himself. There was a quack in the community who practised as a herb doctor among the poor. He never went through the formality of obtaining a licence as practitioner, and consequently was a frequent repeater in the Prisoner's Dock at County Court, where, time after time, he was tried on charges of practising medicine without a licence and was convicted and fined. None of this abashed the quack, who blithely paid his fine and resumed his way,

administering mysteriously concocted assortments of remedies to his patients.

On one occasion, a seafaring citizen of Alna was stricken with hiccoughs. Dr. Card was called in and tried every specific he could find in the materia medica on his patient. He worked on the case from midday way into the night, but the hiccoughs refused to respond to his treatment. About midnight, the condition of the patient changed. It got worse. Dr. Card wandered out of the house to enter into undistracted consultation with himself on the case.

At that moment, the quack passed by. Dr. Card hailed him and asked what remedy he would give a man stricken with a violent attack of hiccoughs. The quack did not even slow down. Over his shoulder, he threw back advice "to give the victim a glass of vinegar".

Dr. Card had never heard of that specific, but, he reasoned, it could not do the patient any harm, so he decided to try it, and it worked. The hiccoughs knocked off almost on the first sip and stayed away.

Marvelling at the efficacy of the simple remedy, Dr. Card questioned the quack the next time he met him as to the source of his prescription. Again the quack did not slow down but tossed back over his shoulder the fact that he obtained all his remedies from the Bible, and when the Master was on the cross, they gave him vinegar on a hiccough.

Dr. Card, whose memory was somewhat rusty, thumbed through the pages of his Bible until he found the great story and the passage to which the quack had evidently referred:

"And they gave Him vinegar on a hyssop."

All my life I have had a mania for machinery. This mechanical bent gave me a real interest, but it also added to my work, for on discovering it, my parents promptly turned over to me all the simple, mechanical problems that arise around a house and farm for solution.

When I was about nine, I discovered the most fascinating place in the neighbourhood, a sawmill operated near our farm by Emory Averill. There was endless fascination in every movement of the machinery, in the up and down saws biting their way through the logs and turbine-driven circular or rotary saws snapping off shingles. Every spare moment I could seize I spent watching the sawmill and learning how it functioned.

I could not rest until I had a sawmill of my own and I set about making one. There was no money for a rotary saw, but there were advantages, after all, in our pioneer type of living. One had to be ingenious. Learning to make use of the things at hand had been our earliest lesson.

Therefore, I improvised a rotary saw from some zinc left over on the farm, and made the gears out of wood. It was a good saw. There was only one trouble with it. It could not saw wood. The zinc teeth curled up on the first bite into wood. But they would saw rutabagas, and after I had cut them into imitation logs with my mother's butcher knife, I triumphantly transformed them into fine shingles or boards on my circular zinc saw.

My father was filled with consternation at this destructive waste of rutabagas, but that primitive sawmill served a practical purpose, after all. Years later, it was the basis of the Albee bone-mill.

Grandfather Houdlette, Dr. Card, and Emory Averill with his sawmill accomplished far more in my early education than the little red schoolhouse, two and a half miles away, where home study and instruction in the three R's, through the short midwinter seasons, resulted in a preparatory education of a very limited sort. I was six when I first began to attend classes in the little ungraded schoolhouse, a poorly heated structure with uncomfortable desks. With long stretches of time taken out for seasonal ploughing, planting, and reaping, my attendance continued sporadically for several years.

In the early summer of 1891, during my sixteenth year, my father decided to let me go to Lincoln Academy in the village of Newcastle, six and a half miles from our home. By home study I had fairly well prepared myself for class work there. Heavy underwear of red flannel, shirts, socks, a suit, a pair of new shoes, and an old pair designed for wear and tear rather than style, were all packed with careful instructions from my mother.

Board, room, and tuition would have to be worked out, but with my muscles developed by hard work on the farm, I was in splendid physical condition when I entered the Academy, well-equipped for athletics, in which I had to limit myself, however, to baseball and football, for much of my time, outside of studies, was devoted to earning my way.

I had made arrangements with a Mr. Alvin Hussey of New-

castle, whereby my tuition, board, and lodging were, for the time being, taken care of in exchange for my services.

Mr. Hussey was the owner of a drygoods store in the village and had many outside errands which required him to go about a great deal, but as he was a sufferer from an ununited fracture of the hip, he could move only with the aid of crutches. Motion was very painful, so almost invariably he rode from place to place through the village in a buggy.

One of my duties was to act as his driver. I also ran errands for him and did a number of chores around the house, such as milking cows, feeding chickens, and caring for the horses. This hip injury, the first I had ever encountered, made a profound impression on me, and my dreams of surgery, which had been vague before, began to crystallize in a definite direction.

The chores which I did for Mr. Hussey did not provide me with enough money for my needs, so I began to take on whatever outside jobs I could get. I became a member of the local Volunteer Fire Company, that carried a salary of twenty-five cents a week for attendance at meetings. We went into action on the smallest excuse. A field on fire was a "large blaze"; a barn in flames was a "conflagration"; and by local correspondents of country weeklies serving that district, a residence afire was invariably compared to the burning of ancient Rome.

We made a brave show in our uniforms—red shirts and shiny helmets. The Chief carried a long brass speaking trumpet. He never used it, but it served as an insignia of his position. The members of our company would not take a step to a fire until they had duly bedecked themselves in uniforms. And the Chief would have to dash to his house to get his speaking trumpet before we could budge.

In midwinter I could add to my income by cutting ice on the Kennebec River. At that time, the Kennebec was the greatest source of natural ice in all New England. The season was short and the work was arduous. Grooving ploughs were run across the ice, laying it off into squares. Large saws were used to cut the ice along the grooves into great cubes or cakes which were then removed, covered with sawdust, and either stored in nearby icehouses or routed on vessels for transport to other places. Some of that ice was sent to South America.

Vacations between terms at the Academy were spent helping my father with the haying. Our working days ran from four-

thirty in the morning until about seven-thirty in the evening. The work was done in sweltering heat.

Once I farmed myself out to a neighbour for a dollar and a quarter a day during the haying season, but he was even more strenuous a taskmaster than my father. Both men firmly believed in the old saying that it was "better to wear out than to rust out".

Lincoln Academy served chiefly as a preparatory school for Bowdoin College. Rules of thumb and short cuts, now so often resorted to as speed-up tricks in education, did not figure in the curriculum. The teaching was thorough. Mr. White, the Principal of the School, taught us history. He was an imposing figure, and his kindness and sympathetic understanding, combined with fine scholarship, endeared him to his pupils. With my background of the three R's on my entrance to the Academy, the instruction I received opened new mental vistas: mathematics, physics, history, grammar that unfolded into rhetoric, Latin, Greek, and modern languages.

There is no intoxication, perhaps, like the first discovery of new fields of knowledge; new, unexplored worlds whose very existence one had not suspected. Surely no explorer in search of new land, no collector on the trail of a rare item, experiences a greater thrill than the searcher after knowledge who sees his quarry always in sight and always a little ahead of him. For there is no point at which the seeker after knowledge reaches his goal. A new fact, a wider understanding are merely the beginnings of new inquiries.

It is only the very young who find themselves equipped with all the knowledge they are likely to need in life. Certainly, I have never been so inclined to believe that I was a fairly well-informed man as in that fall of 1895 when I entered Bowdoin College to begin my education.

Bowdoin was not a rich man's college, but rather typified the struggles of her Maine pioneers who had built her with indomitable persistence. In the course of my freshman year, I was pledged to the Kappa Sigma fraternity in the Alpha Rho chapter, and I was inducted with much the same type of initiation as exists to-day. I was paddled, taken to the woods blindfolded and forced to find my way home in the dark alone. It was all right for some of the other candidates to get lost and to arrive back sometime in the mid-morning, but I knew

it wouldn't do for me, because I was waiting on the table in the fraternity house, to pay for my room and board—quite an item always, but to me with my limited experience with cash money, an otherwise appalling and insurmountable hurdle.

I could hardly wait for my sophomore year, because I had a tremendous urge to play varsity football. When sophomore year finally came and I tried out for the team, the coach tried to make me play guard, on account of my husky build, but I had my heart set on right tackle, and the coach finally saw my point.

At the end of the football season in my junior year, the superintendent of schools at Westbrook, near Portland, Maine, asked the Bowdoin faculty to recommend a student physically as well as mentally competent to take charge of an unruly and rebellious school, largely made up of rowdies, who had thrown out the last two teachers bodily. The faculty recommended me, and I accepted the position. The pay was much higher than it would have been for an ordinary teaching position, because of the physical hazards involved. Twice I had to do battle with the larger boys in order to control my class. At the end of the first semester when a regular teacher was appointed, I returned to Bowdoin, and had to work doubly hard to make up the studies I had missed, so I could pass with my class.

All through my college career the need to earn enough money to carry myself along was an ever-present worry. One day while walking across the football field with Professor Whittier, Professor of Bacteriology and Pathology, who was also director of athletics, I asked him if he knew how I could earn some extra money. Whittier said he could use me himself, and assigned me to the work of checking and propagating the bacteriological cultures in his laboratory, at fifteen cents an hour. He also let me prepare the stained slides of tissues of all kinds, tumours, cancers, and so forth, for microscopic study.

As a result, when during my senior year I approached "Pinky" Lee, Professor of Biology, for permission to take a special post-graduate course in his private laboratory—the only essentially postgraduate laboratory course in biology which has ever been credited on an A.B. degree at Bowdoin—I discovered the way had been prepared for me, probably by Professor Whittier. In "Pinky" Lee I found a professor who gave intel-

lectual direction to my tremendous inquisitiveness about life. It was "Pinky" Lee with his sound, deep-probing thinking, who really opened the door of biological research to me, and to whom I am eternally grateful.

My long absences from Bowdoin, in an attempt to make enough money to carry me through, and my football playing, combined to make it difficult for me to catch up with my class. However, in the subjects which really mattered to me, thanks to Professors Whittier and Lee, by the time I was graduated, I was better equipped than the rest of my class, and my extra-curriculum work in bacteriology, biology and practical laboratory technique paid rich dividends later at Harvard when I sought the competitive scholarship without which my medical education would have been impossible.

Naturally most of my senior year's spare time thoughts were devoted to my choice of a medical school. Finances, of course, created my largest stumbling block. My younger brother, Steve, who was then employed as roadmaster on the Boston-Albany branch of the New York Central Railroad, offered some financial assistance, but this was not enough. Even hard work during vacations would not make up the deficit. There was only one answer: I must win a scholarship.

In the midst of my hesitations, I received a letter from the athletic coach of a Pennsylvania college which had a fine medical school. The letter stated that a scholarship paying two hundred and fifty dollars a year was open to me on condition that I report regularly for football practice. Although this scholarship—with its attached strings—flew in the face of inter-collegiate conventions in regard to amateur sports, a number of educational institutions throughout the country were known to be following the same practice—a condition which is alleged, as the newspapers cautiously put it, to be much improved to-day.

After much anxious deliberation, I came to the conclusion that I preferred to base my medical education on scholastic attainments, rather than on athletic prowess, and decided on Harvard Medical School. Harvard would have been completely out of my reach except for the fact that it offered two scholarships after mid-years to the freshmen who had the highest average grades in all subjects for the first semester. With the optimism of a youngster, I was determined to win

one of those scholarships for myself. As it happened, however, 1899 was the last year in which an A.B. degree was not required for matriculation, and my class was the largest in the school's history. All the other one hundred and sixty-four members of it seemed to have the same immediate goal in mind—one of those scholarships. I wasn't the only medical student who knew the winning of one of the scholarships would spell the difference between staying at Harvard or leaving—perhaps never to go further with a medical education.

Then I knew I had to work hard. There were many in the class who seemed to have better equipment than I, but I knew there was no one who wanted that scholarship more than I did. I clung tenaciously to the hope that my advanced work under "Pinky" Lee and Professor Whittier would somehow see me through.

When the mid-year examinations were over, and long before common sense told us the papers could possibly be corrected, a group of us started hovering over the bulletin board in the old Hall on Boylston Street. The first thing in the morning we'd look there, and the last thing at night, and as often in between as we could pass that way.

Time passed, and still no announcement was made. One morning I went past the bulletin board. There was the announcement. I had won my precious scholarship.

Within two weeks, another instance of what some of my friends call "the Albee luck" followed. "Billy" Richardson, Dean of the Medical School and Professor of Obstetrics, summoned me to his office. One of my classmates, it appeared, was in need of a tutor for whose services he was willing to pay five hundred dollars.

I turned to my new tasks with the lightness of heart that comes with the realization that one's financial worries are at an end—temporarily, at least. My charge was a good fellow, agreeable and docile. His weakness was procrastination; *mañana* was his watchword. He proceeded on the theory that if he put off until to-morrow what should have been done to-day, he might never have to do it. By the end of the year, I was divided between worry over his passing the examinations and being able to pass them myself. To my great relief, my charge came through, and I found my own examinations easier than any I had ever taken—by teaching someone else, I too had become thoroughly familiar with the work.

III

IN THEIR FIRST ENCOUNTERS with cadavers and the stench of the dissecting room, medical students are apt either to buckle in altogether, and decide that perhaps the whole idea was a mistake and they had better try something else; or they develop a veneer of callousness and a ribald spirit which help to carry them over the early bumps.

With our Professor of Urology, the subject of his course was almost an obsession. He used to say that the urine held the key to practically every human ailment. Urinary analysis, he told us, could disclose maladies and ills of patients with accuracy far exceeding that of ordinary diagnosis. A group of the students, given to practical joking, decided to challenge the professor.

As it happened, the landlady at our boarding-house was suffering from severe sprains in her legs and back from a fall down the cellar stairs. A specimen of urine was vicariously supplied, and carried to the professor with the request for a diagnosis of the patient's ailment from urinary analysis. But there was a traitor in our camp, a chap who had difficulty in passing his courses, and thought he saw a chance to curry favour with the intended victim of our joke. He tipped the professor off to the cause of our landlady's ailment.

The professor, thus primed for us, looked at the bottle containing the specimen of urine, held it up to the light, and remarked that no analysis was needed, the naked eye could detect the obvious cause of the patient's ailment. It was apparent, he said, that the patient was a woman, and that she was suffering from sprains caused from a fall down the stairs.

The jokers, myself included, were amazed. But one regained his composure and made a last-ditch stand.

"How many stairs did she fall down, professor?" he queried.

This put the professor out on a limb, for his informant had not told him the answer to that. But taking another squint at the bottle, he said:

"I would say that she had fallen down about six steps."

"Ah," said the fellow-joker, "we have you there, professor. She fell down twelve steps."

"Well," said the professor, doing some quick thinking, "obviously you brought me only half the urine."

The jokers retired from the field then and there, and the professor carried off the honours.

It was at Harvard Medical School that I encountered Dr. Richard Cabot, who was then beginning his pioneer investigations as to the importance of measuring blood pressure. Small and unimpressive in looks, he was, in fact, one of the great men at Harvard. When he spoke he made every word count, and it was a delight to sit under him, to hear his clear, concise, succinct interpretations and instructions. A tireless worker, with the very spirit of research burning in him, he inspired all who came in contact with him with his own white flame of enthusiasm.

One day I asked Dr. Cabot if I couldn't help him with his experiments. The apparatus used for measuring blood pressure in those days—invented by Dr. G. W. Fitz, and long since antiquated—consisted of a plunger with a graduated scale which worked like a spring scale in reverse. The technic was for an assistant to hold the tip of his index finger *passively* on the radial pulse at the wrist and on top of the finger nail was placed the plunger which showed how much pressure had to be applied to eliminate the pulse. Naturally this method was crude and subject to many errors—in part due to the varying degrees of passivity of the assistant's finger, the normal tendency being to bear down with the finger, in spite of the desire to keep it passive. The contrast between the clumsy primitive method of those days, and to-day's familiar rubber "sleeve" placed over the upper arm, is striking.

The research work was done on patients in the various departments of the Massachusetts General Hospital. Patients in the out-patient department were tested to see what influence posture had on blood pressure. Tests were made with the patients sitting, standing, lying down, etc. Patients in the disease wards were checked to see what influence disease had on their blood pressure, and what re-action medication had on blood pressure. Some had cardio-vascular ailments; others showed no apparent circulatory disturbance. Dr. Cabot delegated to me the job of finding out the answers to his questions in every case, and as the pay was fifteen cents an hour, I piled up many dollars and hours—as well as the much more valuable experience in research technique.

It would be difficult for any medical student to work with

Dr. Cabot without having his own interests directed into channels of research. He was a born scientist, and he carried the scientific attitude into his dealings with patients. Whether he was unable to distinguish the patient from the disease, or whether he carried his love of abstract truth to fanatical lengths, I do not know, but it was his habit invariably to tell the patient the exact truth, without softening it. If he were attending a very nervous woman with incurable cancer, he would bluntly inform her of what ailed her. There was no suggestion of cruelty in this, but there was, I think, a certain lack of imagination. Because he himself was a stoic, he expected stoical responses from his patients. Because he could not condone a lie, he felt impelled to reveal a fatal condition even to a person whose mental and nervous nature was such that the result could only be bad.

This is a problem, of course, which confronts every doctor frequently in the course of his practice. Personally, it has always seemed to me that to pronounce a death sentence is a needlessly brutal action. There are few cases in which it could convey any comfort, and certainly fewer still in which it would add to a patient's well-being or mental peace. Most of us accept the thought of death casually enough because it belongs to a dim future which has nothing whatever to do with us. Like the hope of Heaven, we are quite reconciled to postponing it a little while. This seems to be increasingly true as we advance in age.

It is possible, as a rule, in the case of an incurable illness, to avoid direct statements, to lead a patient's thoughts away from the unbearable truth, though it is essential, of course, in thus sparing the patient a fruitless shock, that the complete truth be known to the family, or at least to some responsible member of the family.

While we are at it, there is another phase of this problem of telling the truth in which Dr. Cabot's rule should be rigorously followed. That is the surgeon's first rule: Always tell the exact truth about a proposed operation. Never, on any account, exaggerate its possibilities of success. If there are risks, these must be made clear at the outset. It is essential to point out: This is what we recommend; this, barring accidents, is what should be the result; but we cannot guarantee it.

About the middle of my junior year at the Harvard Medical

School, I found another way of adding to my exchequer. In addition to the work with Dr. Cabot, I secured a position as technician at the Colby Hydrotherapy Institute, where I was under the instruction and guidance of the consulting physician of the Institute, Dr. J. J. Putnam, Professor of Neurology at the Harvard Medical School.

In the course of these hydrotherapeutic treatments, patients were subjected to carefully regulated "cooking" in electric cabinets, with applications of cold water compresses to the head.

One of the first "patients" to whom I ministered, was Professor Hugo Munsterberg, noted psychologist and Professor of Philosophy at Harvard University. In appearance, at least, the Professor lost much of his impressiveness when he sat locked in the electric cabinet, being cooked at a temperature running as high as 125 degrees, only his head projecting, with a gruesome suggestion of decapitation, rendered somewhat grotesque by cold water compresses piled on top.

One day I happened to tell Dr. Putnam of the very interesting pioneer blood pressure work I had been doing with Dr. Cabot in the various departments of the Massachusetts General Hospital, and I was much gratified when he volunteered to initiate similar blood pressure work at the Colby Hydrotherapy Institute, and to let me assist him, in company with Dr. G. W. Fitz.

Professor Putnam, then a man of sixty-five years or more, was so deeply interested, he volunteered to be the first guinea pig. In the course of our experiments with water applications, the "patient" sat behind canvas shields with wrists thrust through holes for pulse readings, as the needle spray played upon his body. The two questions involved were: (1) How will the rapid change of temperature of the water in the needle spray influence the blood pressure? (2) How much will rapid change of the needle spray's pressure alter the blood pressure?

During the experiments, Professor Putnam's enthusiasm rose to such a pitch that he cast discretion aside and directed me, as I worked the water apparatus, to increase the pressure to the limit. When he came out from behind the canvas shields on one occasion, we were all surprised to find blood trickling down his sides in several places.

The results in blood pressure work by both these remarkable

men, Dr. Richard C. Cabot and Dr. J. J. Putnam, were incorporated in the earliest reports on the subject.

It was my lot to enter the medical profession in the days of giants, to be associated, from my student days, with men who were pioneers.

One of my greatest privileges at Harvard was that of being a pupil, throughout my entire medical course, of Professor Regnall H. Fitz, the discoverer of appendicitis. He was the traditional, rather than the typical, professor. Once he was called out of Boston on a clinical case to make an examination, and absent-mindedly left all his apparatus on the train, arriving at the house with nothing to use. As Professor of Theory and Practice at the Harvard Medical School, an independent thinker, analytical, and a marvellous teacher, he exerted a great influence, and in my own case, a lasting one.

Early in my fourth year, I was notified, in a letter from Dr. Maurice H. Richardson, Professor of Surgery, that I had been chosen as one of the two Prosectors annually selected from the senior class. This was a signal honour—and much to be desired from a professional standpoint, because it meant stepping in to assist the Professor of Surgery, not only at the operating table, but also with the cadavers used in teaching.

Professor Richardson was so "finicky" about the condition of his cadavers that I gained invaluable experience without realizing it. His cadavers were always "hand picked", which meant they could not be too obese and they had to be of a well-developed, muscular type. They were preserved with a special embalming solution which Professor Richardson had prepared particularly for him, and at his direction. In preparing the dissections used in the teaching of the classical operations, for which Richardson was especially famous, the Prosectors had to take special and unusual care to preserve every piece of membrane and muscle, and to prepare the bony parts with equal thoroughness, gaining invaluable practice in dexterity and precision.

My fellow-Prosector was John Homans, who has since attained eminence as one of America's outstanding surgeons. As the son of a famous doctor, whose Prosector, incidentally, Professor Richardson had once been, young John Homans was carrying on the tradition of an eminent medical family and was the best kind of co-Prosector for a young green lad from

down East. The elder Dr. Homans too had been a real pioneer. He had started taking out ovaries before Massachusetts General Hospital permitted it, but he was not daunted by being ahead of his field. He knew he was right and had the courage of his convictions. So he established a private hospital in which he could operate in the way he believed best for his patients.

Everyone loved Dr. Richardson. Even in the great medical centre which Boston was at that time, he stood out like a lighthouse. He was a big, magnetic person, always affable. No student ever slept during his lectures. I can see him yet, producing those marvellous anatomical drawings of his, sketching with both hands at the same time—the right hand for the left side, and the left hand for the right—each sketch illustrating some problem in anatomy or surgery with precise exactitude.

Richardson was without peer at the operating table. No pioneer in blazing new trails, he was technically a master. His dexterity was astounding. It was taken for granted that no one was so capable of surgical marvels as he. No man to-day dominates surgery as he did in his period.

He was a glamorous figure to his students and the young men came from far and near for an opportunity to see him operate. He was a great entertainer in his day, and as his star gained in its ascendancy, the magnificent house he owned on Beacon Hill proved too small for his entertaining needs, so he bought the one next door, and cut through the walls, achieving among other spacious rooms a vast reception room. I can still remember the excitement John Homans and I felt when we attended those parties at which all the elect of the world of medicine were present.

Often Homans and I worked in the special surgical mortuary long after midnight. But we felt that we were fully compensated for our work, not only in the special training it gave us, but because the appointment carried with it considerable prestige. Up to that time, no man who had received this appointment had failed to win a surgical interneship at Massachusetts General Hospital, and in those days, surgical interneship in that institution was the most coveted in the whole country.

My finances had run so low that I hardly dared think in terms of an interneship, but when it began to appear that my chances of securing this most highly prized one were good, I

threw caution to the wind and began to make plans to finance myself accordingly.

While the fact that hospital internes generally do not receive one cent for their services beyond board and lodging may seem hard, the custom is not really unfair. Association with leaders of the profession, the confidence and poise gained in actual practice, and the prestige of identification with a great institution make up a reward for such service far greater than monetary remuneration.

My efforts at high financing in anticipation of interneship were carried to a happy ending almost before they started by the unexpected proffer of financial aid from Dr. Franklin Dexter, Associate Professor of Anatomy, who made a practice of lending money from his private fortune to students needing funds to tide them over.

The day of the examination for interneship at Massachusetts General Hospital arrived, and the interval between the writing of the last answer and the posting of the names of the three who had won the coveted positions, passed like a nightmare. Finally I learned that two of my classmates—Dr. Roy Garland and Dr. Robert Graves—and I had been successful.

The other house officers, or internes, at that time were Dr. John Homans, who had taken his examination four months before, later to become Associate Professor of Surgery at Harvard Medical School; and Dr. Frederick C. Kidner, later a prominent orthopædic surgeon of Detroit, Michigan, and now an ex-president of the American Orthopædic Association.

The Staff of the Massachusetts General Hospital included such distinguished surgeons and teachers as J. Collins Warren, "Pa" Porter, Maurice H. Richardson, H. H. Beach, A. T. Cabot, W. N. Conant, J. G. Mumford, J. W. Elliott. The senior surgeons were all of exceptionally mature experience, and because of their outstanding ability, the prestige of the hospital was as great, or greater, at that period than at any time in its long and illustrious history. The surgical teaching of Harvard Medical School was done almost entirely at the hospital. So, in addition to the experience and prestige to be gained by association with the brilliant staff of the hospital, internes had an opportunity of following the surgical courses of the Harvard Medical School.

There may have been hospitals with a larger number of patients, but I do not believe that there was a hospital in the

country where more major surgery was performed—for the reason that the giants of the surgical world were there. This was before general surgery was split into specialities, and surgical service at the hospital included not only what has continued to be general surgery (or abdominal surgery) but orthopædic, traumatic and thoracic surgery, as well as neuro-surgery and urology.

The months of my interneship were among the hardest of my whole life but they were also the most beneficial. Life in the white, aseptic world of a hospital is the most exciting life in the world. The interne is practically on twenty-four hour duty, but he is too interested to notice it. In my time, sixteen months was the usual length of interneship and it passed like a flash.

I was barely out of the hospital, month in and month out. Every day, every hour of the day, brought new problems and experiences. It was hard to remember that there was a world outside those hospital walls. There was energy and thought for nothing but acquiring the apprentice experience so necessary to the making of a surgeon.

On one occasion, I remember standing at the operating table opposite that marvellous technician and teacher, the irascible A. T. Cabot, and receiving a sharp rap over my knuckles from the handle of his heavy scissors, without any reason that I could possibly deduce. But any impatience at Dr. Cabot's irritability was overshadowed by admiration of his great surgery. Over and over he impressed upon the internes his professional philosophy. "To the true surgeon," he used to say, "the interest and welfare of the patient comes before everything else."

He had lofty ideals but no sense of humour. He was never known to smile; his movements were rapid, and he always expected those around him to move with equal speed. One day he rushed to the theatre for an abdominal operation and, with knife and scalpel in hand, made a first incision. He then realized that his glasses were not on his nose as usual. They were in his breast pocket, under his sterile gown.

He dropped his scalpel, turned to his assistant nurse, tapped his chest with a finger of his rubber-gloved hand, and at the same time held himself sideways to her, grimacing all the while, pantomiming to her that she should reach under his sterile gown and procure his glasses. But his histrionic abilities were

limited, and they failed to score. The nurse misinterpreted his grimaces, and reaching under his gown, she scratched his side vigorously.

Her mistake brought an explosion from the doctor, and infinite embarrassment to the nurse, but the hilarity of the assembled internes and doctors was not quelled because it had to be suppressed.

Unlike the dour Dr. Cabot, Professor J. Collins Warren saw the humorous side of experiences in a busy professional life. He frequently related some of the incidents that happened following the discovery of ether and its use in the Dome of the Massachusetts General Hospital.

One of his best anecdotes dealt with a mix-up in the operating room where ether was originally discovered and where at the time it was being administered to a patient upon whom Warren's illustrious grandfather was to perform an operation.

It was an emergency case which had come in during the early hours of the morning. The patient, a husky athletic man, started to take the ether quietly enough, but all of a sudden as frequently happens, he began to struggle with the violence of a maniac. He broke away from the internes and rolled down from the operating table. At the same time, the candles—this was long before the days of electric lights—were knocked over and extinguished.

The internes promptly ganged up and tackled the patient in the darkness under the table.

Holding the patient down was no sinecure, for in the darkness he seemed to redouble the frenzy of his resistance, but the internes won out. The victim was spread-eagled and the anæsthetist continued the administration of ether. At last, with deep gratification they heard the stertorous breathing of deep sleep.

Then the candles were lit. With consternation they saw the patient cowering in a corner, while the victim beneath the ether cone was an interne!

About three o'clock one morning I was aroused out of a deep sleep by an orderly from the emergency reception operating room. An urgent accident case had just been admitted. Dressing hurriedly, I went to the patient. He was a man about thirty-five years of age, who, while working in the yards of

the Boston-Maine Railroad Company, had fallen between the rails and had been run over by a locomotive.

He was partially unconscious and could not give an account of the accident. He was in great shock, and, even before his clothes were removed, he was hastily placed upon a shock table. This device is equipped with a heating apparatus and is so constructed that it can be tipped head down and feet up, thus allowing the blood to flow from the rest of the body to the brain made anæmic by shock. The shock-table treatment, supplemented by stimulants and a pint of salt solution introduced into the patient's veins, brought him out of the shock sufficiently for us to obtain a meagre description of the accident.

The patient had fallen lengthwise between the railroad tracks with his feet towards an oncoming locomotive. Apparently there had been sufficient clearance for the cow-catcher to pass over and clear his body. As the engine was moving over him, he had raised his knee in a reflex action and some portion of the under surface of the locomotive had hit his right knee with tremendous force, driving the thigh bone (or femur) upwards and backwards, not only dislocating the hip joint but carrying away, at the same time, the posterior and upper portions of the rim of the hip socket. This was demonstrated by X-ray. There were other cuts and severe bruises, and the attending surgeon thought that there was no use administering general anæsthesia for the reduction of the dislocated hip (setting the bones in place) until later in the morning.

The reduction proved extremely easy, principally because the depth of the hip socket had been much diminished by the breaking away of the back and the upper part of its rim. But, by the same token, the hip was subject to redislocation unless the splintage and posture of the limb were so effected that they would hold the hip securely in position. The limbs were placed parallel to each other and a broad dressing applied to hold them together at the knees. The hip promptly redislocated, as the thigh muscles pushed the femoral (thigh bone) head upward and out of the flattened socket. The case was then etherized and the hip was reduced and immobilized in precisely the same posture twice afterwards. As a result of the faulty post-operative fixation posture, redislocation again occurred.

Thus another man fell victim to the limitations of surgery then current and was doomed to be a cripple for the rest of

his life—like Alvin Hussey, my good samaritan during my Academy days. More and more I was struck by the fact that the average general surgeon, not interested in fractures and mechanical surgery, was inadequately equipped, both by training and by mechanical adaptability, to handle these conditions. As I assisted at such cases, the mechanical instincts in me revolted. The conventions of surgery were ably followed, but those conventions were not adequate. To me the mechanical imperfections were obvious.

As I look back on this case of the poor railroad yard worker, I realize that by its very inadequacy it opened my eyes to the future. If even eminent surgeons, I figured, were deficient in the handling of bone and joint cases, why couldn't a surgeon who was both a skilled operator and a good mechanic not only serve humanity in a great new measure, but literally find an unploughed field for his own?

IV

My appointment as Surgeon House at the Massachusetts General Hospital carried a moment of triumph, followed by a new, accelerated pitch of activity. Day by day, that word "responsibility" took on new proportions; it rode us all like a nightmare. The complete trust of a patient is an overwhelming reminder of the surgeon's responsibility. The patient lies down on the operating table, permits the anæsthetist to induce unconsciousness, waits helplessly for the surgeon to do what he will with him; placing his life, with serene confidence, in the hands of another person. God help the surgeon who is not strongly aware of his responsibility!

We experienced the bitter sense of defeat that follows long, cold vigils beside a bed, when, after we had done all we knew how to do, used all our skill, the patient died. Was there something we had left undone? Would a wiser doctor have chosen a different course? And our own profound dejection was followed by the hardest of all our tasks, breaking the news to the family.

One thing we all learned by our first encounters with death. It is not the dead who suffer, but the living; and death itself is horrible not in itself but only in the fear it engenders.

And yet death, which so often strikes the layman as the harshest trial of the young doctor, is not so difficult to encounter —except in those dark hours before dawn when the stoutest, most self-confident nature begins to wonder if he has overlooked anything—as the ills which seem so much more horrible, because, unlike death, they do not carry their simple remedy with them.

Poverty is one of these—not everyday, genteel poverty; not keeping-up-appearances poverty; but stark, hopeless want. Bodies emaciated by lack of sufficient food, children who have never really had enough to eat; disease running unchecked because people cannot live healthy lives.

The misshapen bodies of children is another—bodies crippled by disease or accident; children set apart from their fellows by insurmountable handicaps. I had spent one summer while at Harvard in the dispensary of the Children's Hospital in Boston, and I had learned a great deal, not only about children but about mothers.

You can always see the mother in the child. If I were not afraid that the amateur psychologists who diagnose our mental attitudes so glibly would leap to unjustified conclusions, and that the sentimentalists who join the merchants in lauding Mother's Day would attack me, I would like to discuss some of the foolish mothers I have known. I have seen as many children's lives wrecked, often lost, through the actions of misguided mothers, as I have seen benefited by devotion more intelligently directed. This is particularly apparent in a hospital when the child is ill. A good patient is a controllable patient, and the controllable child has a good mother.

I have known children who screamed and spat and struck at their mothers, who would not permit a doctor to examine or to care for them. I have known children to lose their lives because they were so undisciplined that nothing could be done to help them. I have known mothers so viciously stupid that, in a blind attempt to frighten a child into obedience they used the threat: "Do as I tell you or I will call the doctor." The effect of this conditioning is obvious when illness comes and the doctor appears. The child is frightened, does not trust the doctor, and a state of fear is set up which it takes time to overcome. Sometimes, unfortunately, there is no time.

The impact of crippled children on my imagination, the bone operations which I had seen performed and in which I

had taken part, were all helping to crystallize my own intentions. It grew on me more and more that I could employ what mechanical ability and aptitude for surgery I might have most usefully in orthopædic and traumatic surgery, that is, in the prevention and cure of deformities, so I bent all my efforts in this direction, but the outlook was not promising.

Then the Albee luck came to the fore again. A patient was admitted to the Massachusetts General Hospital with a badly infected hand. In the course of routine, another interne was assigned to the case, but while he performed the necessary dressings, his heart was not in the case—for the simple reason that it was occupied elsewhere. He was in a dazed but happy state of infatuation with a beautiful brunette nurse.

One night, shortly after midnight, I went past the room of this patient. By the sounds coming from within, I could tell he was awake. It turned out that he was hoping my fellow house surgeon would stop in to redress his hand, for the dressing had dried out, and he was in considerable pain. Although this case was on another surgical service, I felt that the hand should be dressed, and, being young and knowing my colleague would not take offence, I did it.

The patient was Dr. John R. Poore, a tall, kindly man who practised medicine in Waterbury, Connecticut. He requested that he be put on my service, and from then on it was I who attended to his dressings. One day he asked me what I planned to do when my interneship ended. I admitted that the only opening I had been able to find was a position as surgeon on a ship engaged in trans-Atlantic trade.

"Suppose," suggested Dr. Poore, "you come up to Waterbury and try out as assistant in my practice there." I had no idea then of the exceptional opportunity I was being offered. But I accepted with grateful alacrity, none the less.

A few nights later, exactly at midnight, in accordance with the tradition at Massachusetts General, the house surgeons carried me to the front door on their shoulders. My interneship was over. Ahead lay an uncharted course. Gone was the prop of the great hospital with its associations and prestige, its long hours of supervised responsibility. I was on my own.

Dr. Poore was President of the Waterbury Medical Society and he had built up a large and varied practice both in medicine and in general or abdominal surgery. He was also surgeon to the police department in Waterbury. While his

infected hand was healing, I took care of his practice. On his recovery, he was so well pleased with the work I had done that he decided to go on an extensive European trip, leaving his practice in my charge. As can be imagined, this delighted me, and I began to feel a new sense of security in my profession.

One of the first cases which I handled alone, was that of a woman who had been under the care of a rival doctor for some time. She had lost thirty pounds in weight, and was in constant distress. The local doctor had been treating her for prolapsed uterus with a pessary. After examining her, I appreciated with new awareness the value of my interneship at Massachusetts General Hospital where such a wealth and variety of cases received attention. I diagnosed her case as one of gall stones and recommended an operation. She agreed, and the operation was performed in the local hospital before all the prominent doctors of Waterbury and its environs who wanted to see what the new "cub" could do. What I did was to remove ninety-eight gall stones.

Every two weeks Dr. Charles Ogilvy, Assistant Professor of Orthopædic Surgery, at the New York Post Graduate Medical School, came to Waterbury to take care of orthopædic and traumatic surgical cases from neighbouring cities and states. While there he used Dr. Poore's office for his consultations.

At Massachusetts General, my background had been in general surgery. Dr. Ogilvy was the first bone and joint mechanical surgeon I had ever encountered. He was an able orthopædist and I learned much from observation of his technique. Our association soon developed into an enduring friendship, and I told him of my desire to specialize in orthopædic surgery. Almost immediately he responded by creating an opportunity for me to work three afternoons a week as an assistant to Dr. Henry Ling Taylor, head of the department of Orthopædic Surgery in the New York Post Graduate Medical School Clinic.

At that time, some thirty-five years ago, abdominal surgery was all the rage in medical circles. Orthopædics was not regarded as being of much importance, and in those days of its infancy it was something of a pioneer's choice to resolve to devote oneself to that field. There was practically no open technical operative orthopædic surgery being done, yet I felt that such surgery was desperately needed. I have always been

glad that I trusted my own instinct—for the medical world of those days was full of well-meaning men who would have dissuaded me.

After working with Dr. Taylor a few months, I was appointed, by Dr. V. P. Gibney, Surgeon-in-Chief, assistant in the dispensary of the Hospital for the Ruptured and Crippled in New York City. During the next few months, I would get up early in the morning, three times a week, attend to the urgent house calls in Waterbury, and catch the seven-thirty morning train for New York. On the way down I had a chance to catch up on my professional reading. I reached New York in time for lunch, then went to the Clinic for the Hospital of the Ruptured and Crippled at one p.m.

This was an old, rickety building, then located at 42nd Street and Lexington Avenue. Here I worked at a furious pace until half-past three—sometimes seeing as many as twenty patients in an afternoon. Then I hustled down to the New York Post Graduate Hospital Orthopædic Clinic, which began at four o'clock and lasted until eight. Although this was a most strenuous schedule, it gave me a kaleidoscopic view of thousands of cases, typical of millions.

Most time-consuming of all these cases, were those with tuberculosis of the bones and joints whose treatment required the application of plaster of Paris splints and jackets. In some instances of spinal tuberculosis, the patient might have been coming to the clinic for ten years with an average of a new plaster of Paris jacket every two months. And the application of each jacket required from thirty to forty-five minutes.

Many times I had difficulty in getting through the large amount of work in time to catch my eight o'clock train for Waterbury. If I was lucky, I got home at midnight. If, however, I caught a late milk train, I was in for a long, hot, dusty ride, and reached home near dawn.

Dr. Poore finally returned from Europe, went over the record of my work while he was away, and asked me to become his partner. We entered into this partnership with the understanding that Dr. Poore would take on all the medical work, particularly obstetrical cases, for that was a field in which he had specialized, and I would do all the surgical work. The total receipts of the firm were to be divided equally between us. Dr. Poore's unusual generosity was further illustrated by his urgent advice that I should not, under any circumstances,

miss my visits or alter my relationships with the New York hospitals on account of our partnership.

On one of his regular Waterbury visits, Dr. Ogilvy informed me abruptly that he was planning to leave New York within a few weeks to go to Montreal, Canada, where he had accepted a Professorship of Orthopædic Surgery at McGill University. This information hit me hard, as I had been counting heavily on Dr. Ogilvy's aid and influence for the development of opportunities in orthopædic surgery which had opened to me in New York. While waiting for his next visit, I mulled over his departure with much concern. But when he returned, he brought stunning news. He had arranged for me to take over not only his position at the Post Graduate Hospital Medical School as instructor in Orthopædic Surgery, without pay, but also his connection in office practice with Dr. Henry Ling Taylor.

With his unfailing kindness, Dr. Poore gave his approval to my plans, and my pleasant partnership with him terminated. In a very short time I moved to New York and took over the vacancies left by Dr. Ogilvy.

Up to now my earnings had gone into paying my debts to my brother Stephen who had helped me through the Harvard Medical School and to Professor Dexter who had financed me through my interneship at Massachusetts General. Now I was prepared to support myself while getting established in practice in New York, always a hard job for a young doctor.

Henry Ling Taylor's father had been a physiotherapist. He had no use for surgery and thought his son should have the same education he had had. Henry Ling told me his education had been almost backwards. His father had not even allowed him to have an interneship.

Now there is no such thing as a born surgeon. Good surgery comes with experience in developing skill, dexterity, complete mastery at the operating table. It comes with performing the same operation over and over again. And for this, interneship —which is the doctor's apprenticeship—is essential.

I used to call Taylor in as a consultant while I was struggling along as a young man. I had been accustomed to the methods of Professor Richardson who always knew how to keep his own counsel, and kept his meditations to himself, mentioning only his conclusions. Taylor, however, did so much thinking aloud before the patients that he nearly scared them to death.

I was worse off than I had been before, for though I learned a lot from Taylor's meditations, I lost my patients.

A few months after taking over Dr. Ogilvy's vacancies, I added another post to my list of activities—that of radiologist at the Hospital for the Ruptured and Crippled. That was in the summer of 1906 and as radiologist I had to deal with the rapidly developing uses of the X-ray and other applications of radiant energy.

Late in 1905, I had a case that was to prove very important in the development of my orthopædic surgery. Morris Noonan of Waterbury became my patient. He had been on the police force for some years but, having fallen victim to chronic rheumatism (osteoarthritis) he had been forced to retire from active work.

As a result of the malady, his hip was distorted and motion, which had become very painful, was limited to a few degrees. All this was disclosed by X-ray pictures, which I studied intensively in search of a curative solution.

Up to that time, treatment for such cases was palliative—easing pain, perhaps, but not dealing with the malady itself. Such treatment usually consisted of a clumsy brace, or heavy plaster of Paris splint.

Although some open hip operations had been tried in such cases, they had not generally been approved by the profession and were seldom advised.

I suggested a conventional brace treatment to the patient, but, like many others, he declined. I then sent Mr. Noonan back to Waterbury with instructions to return in two weeks.

In the interval, I exhausted medical literature on the subject and directed inquiries to my elders in the Medical School in an effort to deal with the difficulties presented by this case. But the search and the inquiries proved futile. Old conventions still held sway and they were inadequate. I refused, however, to consider the case hopeless and decided to work out a solution in my own way. Late at night, the mechanic, the tree grafter, and the surgeon in me went into consultation. For hours on end I struggled with the basic problem—of preventing pain by removing motion at the hip. At the same time the posture of the limb must be so placed as to overcome the shortening of the limb, which he had to the degree of about three inches.

With uncomfortable punctuality, Mr. Noonan appeared at my office. I put my cards on the table frankly, and explained the matter fully to him. I told him that I recommended an operation of my own design, one that had never been done before and that was, therefore, to be regarded as wholly experimental and necessarily subject to some risk. (Actually it was the first bone graft operation ever done for the cure of a disease.)

I drew diagrams showing Mr. Noonan how I proposed to build up around the periphery or rim of the hip socket with bone grafts so that the hip bones would firmly fuse together. I told him that this would necessarily render the hip stiff and would limit the amount of motion there to less than that already existing. But his hip motion was already limited to a few degrees and all movement was invariably accompanied by great pain, and relief of that pain would produce in him the sensation of increased rather than reduced hip locomotion, by overcoming muscle spasm and resulting in more motion in the nearby lumbar spine.

After seriously considering the matter, Mr. Noonan accepted my advice and was admitted to the New York Post Graduate Hospital in New York City in the fall of 1906.

The operation was successful. In fact, the patient was so completely reconstructed that he returned to the Waterbury Police Force on which he served for a number of years, and twelve months after his operation, at the age of fifty, he married again.

The Noonan operation attracted wide attention, both in the metropolitan area and throughout New England. I was requested to show the case before a number of medical authorities. And, at the annual meeting of the American Orthopædic Medical Association in Hartford, Connecticut, towards the close of 1906, I was asked to present the patient as well as my design of the operation, along with reports of somewhat similar work on other cases.

This successful operation occurred in the second year after my graduation from Harvard and at once it focused medical attention on this field. From that time on, I broke away from conventionalities, whenever necessary, blazing the way in an untrodden surgical field, that of bone surgery, which developed in time into a wholly new concept of surgery.

In the wake of the Noonan case came an appointment as

instructor under Professor V. P. Gibney in the College of Physicians and Surgeons of Columbia University, which proved somewhat taxing as I was, at the same time, carrying on my work at the New York Post Graduate Medical School and at the Hospital for the Ruptured and Crippled, as well as handling my own practice, which was increasing along orthopædic lines, although I was still doing some work in general, or abdominal, surgery. Besides my ever-present desire to broaden my professional contacts, there was a very personal reason for my accepting this post with its additional income.

For it was in this year that my greatest and most enduring adventure began when I met Louella May Berry. Her family, like my own, had its roots in Maine. Her father, William E. Berry, came of early pioneer stock. His great-great-grandfather, Nathaniel Berry, and his brothers had homesteaded near Pittston. Nathaniel had been one of George Washington's guards. William's great-great-grandmother was the first white woman born in Pittston, or Gardiner, Maine.

Louella Berry and I were married in Grace Church in New York, and since then we have worked together and seen much of the world together. A happy life, they say, has no history.

In 1918, our son, Fred Houdlette Albee junior, was born, and to-day he is preparing, in his turn, to follow the rough path of the doctor.

V

THERE ARE TIMES in the experience of everyone when life seems to be a meaningless series of fortuitous circumstances occurring without rhyme or reason. For the physician, however, there is a relentless logic, an inescapable sequence of cause and effect.

Certainly, in my own life, there has been a pattern which I can trace clearly from the very beginning of my childhood experiences to the present time.

My bone graft concept, which was to develop into a curative spine fusion operation for hunchback caused by tuberculosis of the spine (Pott's Disease), traced back to a seed planted in my mind in childhood when I trudged beside Grandfather Houd-

lette over the bleak countryside around Alna, Maine, on his fruit tree grafting expeditions.

From that seed had grown grafting ideas of wider biological scope, whose development had been furthered in the course of my medical education at Harvard. For, in my anatomical study there, the mechanical bent of boyhood had reasserted itself and had focused my interest on the mechanics of the human body with special relation to the levers, hinges, ball and socket joints, that make up the bony structure.

Most difficult of all problems in this field was spinal tuberculosis, or Pott's disease. In the middle of the eighteenth century, Sir Percival Potts, a famous London surgeon, discovered that, except when congenital or due to accident, hunchback is a result of tuberculosis of the spine. Subsequent research in the eighteenth and nineteenth centuries disclosed that certain malignant joint conditions and other bone maladies originate from tuberculosis.

In these cases, tubercular germs eat away growing tissues, desiccate blood-conveying capillaries and perforate bone structures much after the manner of termites boring through wood. And, as a result, the bone structures ultimately collapse wholly or in part, like hollowed-out and riddled shells.

In the course of the development of spinal tuberculosis, the hunch begins with the earliest changes in the alignment of the vertebrae due to the collapse of bone structure. Generally this occurs in the victim's early years. As growth of body proceeds, collapse of bone structure due to ravages of the disease continues and vertical elongation is taken up in a buckling accentuation of the hunch. So the curvature of the spine increases and the victim may become a distorted dwarf.

At that time there were vastly more cases of tuberculous hunchbacks than now—in fact they glutted the hospital clinics throughout the country. For, in those days, cows were not inspected and milk was not pasteurized as it has been in more recent years. Tuberculous milk was proven to be the cause of many hunchback cases.

Cure for Pott's disease was regarded by the medical profession in general as almost impossible if there was any motion of the spinal bones. To insure a rigid position, therefore, the patients were placed in plaster casts, buckled in metal braces, or strapped to flat boards or frames for years to attain immobilization while nature and sunshine checked the infection

which was destroying the bones. It was a long, painful process although, of course, it did achieve some successful results.

It was, however, impossible to achieve complete immobilization by this method. The very movement of the vertebrae with the ribs in breathing was an irritant and obviously any device which would prevent movement of the ribs would prevent breathing itself. Not only that. A cast tight enough to cause effective immobilization would not merely make it impossible for the tuberculous patient to draw a full breath or to have freedom for normal digestive processes, it also prevented him from gaining weight and shut out the sunlight so important in the cure of the disease.

If a cast is applied to a child during the period of growth, the tendency to produce muscle and bone atrophy by prolonged recumbency and inactivity is most unfortunate biologically, anatomically, and physiologically. I feel that it is a divine right of childhood to be able to run and play at the earliest possible moment, and that only by doing so, can normal growth and development, mental and physical, be assured. It seemed to me that if we could find some way of preventing the diseased bones from crushing and rubbing together, we would have taken a great step towards curing the disease.

As I have pointed out in my *Bone Graft Surgery*, the story of the evolution of the spine fusion operation constitutes an interesting chapter in the history of present-day orthopædics. Although a number of operations had previously been performed on the spine for purely cosmetic purposes, it was Hadra of Galveston, Texas, who, in 1891, first attempted to stay the process of spinal curvature by twisting silver wire about the spinous processes of the sixth and seventh cervical vertebrae in a case of fracture-dislocation.

Lange, in 1910, presented before the American Orthopædic Association, a method which he had tried wherein celluloid plates were placed on either side of the spinous processes, secured by metal or silk sutures. In each of these incidents the materials used were foreign bodies. The suggestion was offered that if some means could be provided for immobilizing the posterior arms of the vertebral lever, a consequent arrest of the increasing deformity and disability could be rendered more certain.

In a folder of the American Orthopædic Association, pub-

lished May 15, 1911, I described a method of joining together the spinous processes of tuberculous-infected vertebrae by using living bone instead of metal.

In the course of my orthopædic work in the clinics of the New York Post Graduate Hospital and the Hospital for the Ruptured and Crippled, I had observed cases of spontaneous fusion (solidification or immobilization) of spinal vertebræ and limb joints.

I noticed that spontaneous fusion brought fresh blood supply to the original diseased bone or its remnant, thereby repairing the ravages of tuberculosis in vertebral or other joints. And in these cases a cure had been effected.

Instances of spontaneous fusion at the posterior part of the vertebrae were rare—only about two in every hundred cases observed. In the remaining ninety-eight per cent, I noted that nature failed to put in new bone and little curb on the malady was detectable. But, rare as they were, the instances of spontaneous fusion were sufficient to show me the way. They gave me the prompter's cue for which I had been waiting. If nature could effect a cure by putting in bone, I reasoned, then why could not a surgeon achieve a correspondingly curative effect by putting in bone graft? Over and over again I asked myself that question. Logic seemed to indicate that it could be done. But that was not enough. The truth had to be proved scientifically, if it was to be accepted by the profession. Would the graft in this environment live and remain in place permanently? This called for research and experiment.

As far back as 1860, the famous French surgeon, Ollier of Lyons, experimented with grafting of the periosteum (membrane of connective tissue investing bones) but—as the Bible says—"There is a season for all things." Ollier was out of season, ahead of the times.

Electricity had not then been fully harnessed, aseptic surgery was just beginning to glimmer through the dusk of ignorance, and the X-ray was unknown.

But these things, so necessary to the success of bone grafting, had now come into being and were in full swing. I merely had to reach out and utilize them.

What I needed, it seemed to me, was a collaborator in my

research, whose maturity and prestige would give his pronouncements convincing weight in the professional world. I cast around in quest of such a scientist and decided that Dr. Alexis Carrel, then on the staff of the Rockefeller Institute for Medical Research, and later head of that Institute's Division of Experimental Surgery, would fill the bill in every way.

At that time he was experimenting with living tissue from an embryonic chick's and turtle's heart to prove or disprove the prolongability of life. That was preliminary to his world-famous experiment with a strain of fibroblast from a chick's heart which he began in 1912.

I telephoned him for a conference which he was kind enough to give me, and at that conference—with great trepidation—I explained my hope that the bone graft could be proved trustworthy and permanent. Experiments, of course, would have to start with animal subjects, to be followed later with humans.

Dr. Carrel was interested, and when he said that from his own experience in keeping tissue alive, my proposition struck him as feasible and he would be glad to undertake such research with me as soon as he had completed his own, I left his office jubilant.

But as the months went by and I heard nothing from Dr. Carrel, I lost much of my jubilation. Finally I communicated with him again, only to learn that he was still engaged with his own research. Several months later, he was still busy. When I realized that his experiments might go on for years—in fact they did for more than twenty years, when with the aid of Colonel Lindbergh they were eventually completed—I resolved to tackle my research alone.

The first objective was to determine whether or not a fusion could be obtained by implanting bone grafts and at the same time to ascertain the dependability, durability, and permanence of the result. The second objective was to determine the biological and physiological laws controlling such grafting.

The final task would be to prove or disprove the effectiveness of bone graft fusion as a curative treatment for hunchback and tuberculous joints.

Animal research held the key to the solutions of the problems involved in the preliminary task. Obviously the problem involved in the final task could be conclusively solved only by experimentation on human beings.

As I was then filling the chair of orthopædic surgery in the

Medical College of Cornell University, the facilities of the Loomis (Animal) Laboratory, a unit of the college operated under the direction of the late Professor S. P. Beebe, were placed at my disposal for the research I had undertaken.

I shall never cease to be grateful for the kindness of Professor Beebe and of Dr. James Ewing, Professor of Pathology at Cornell University Medical School, who at that time was doing considerable research upon the blood of the sheep and who made available to me a number of sheep for research work in conjunction with the numerous dogs I was using.

My theory was that the surgeon could duplicate the work of nature in supplying bone to immobilize diseased vertebræ. My object was to try to graft a piece of bone to the vertebræ. If it grew into place it would, I believed, keep the vertebræ from moving.

So I set to work. Every night, however strenuous the day's work might have been, I shut myself up alone in the laboratory. A football player's body, incidentally, is no mean asset to a surgeon. With chisel and mallet and surgical hand saw, similar to a carpenter's saw, I performed a series of bone graft operations on dogs, fusing a number of spines.

My immediate objective was to fuse or amalgamate together the spinous processes of the dog's spine. Therefore, on innumerable occasions, I transplanted a portion of the dog's ulna (leg bone) into the split spinous processes of his vertebræ. I found considerable difficulty at first in trying to avoid infected conditions in the back. Because of the tremendous looseness of the dog's skin over his back, certain accumulation of blood clots occurred which were likely to become infected.

By an unaccountable stroke of luck we escaped the wrath, always at boiling point but with the feeble explosion of an uncorked soda pop bottle, of the anti-vivisectionists. Not that their ire would have been mitigated by the possibility of seeing countless children saved from hunchback by experiments on the dear little sheep. They just overlooked us. Perhaps they were too concerned with the hard fate of the monkeys. For about this time, Dr. Henry W. Frauthenthal commented at the Clinical Congress:

"We have been given considerable trouble at the Rockefeller Institute by the clamouring of the anti-vivisectionists, but it was through experimenting there with monkeys that we first

ascertained that infantile paralysis is a contagious disease which helped us to know how to treat the disease."

It is always possible, of course, that we are inclined to overestimate human beings and underestimate the monkey and the dog and the sheep. I cannot help but believe, however, that the anti-vivisectionist carries the matter too far.

All my findings ran along unvarying lines. Barring accident, a bone graft from the ulna of a dog, when implanted in its spine in accordance with certain biological and physiological laws, which had been disclosed in my investigation, fused successfully. And in every experiment in which I implanted a sheep bone in a dog's vertebræ (spinous processes), the bones refused to unite. In fact, they actively rebelled against fusion by exuding a serous liquefaction as though in protest against a foreign body.

In the course of these experiments I realized why my early attempts at spine fusion without using bone graft material from elsewhere had not been satisfactory. The spinous processes supplied an insufficient amount of bone to anchor or fuse the vertebræ securely, and of still greater fundamental importance was the extremely low osteogenic (bone-forming) value. This was confirmed when cubes of the same size of vertebral bone and ulnar bone from the dog were transplanted into muscle under identical conditions. After varying periods the ulnar bone showed unmistakable superiority in osteogenic value.

For two years I burned the midnight oil in my laboratory. At the end of that period I felt that my research task was completed. I had ascertained the biological laws controlling bone graft. I had proved to my own satisfaction that, if those controlling laws were followed, a bone graft could be implanted in a dog's spine and fusion could be effected. In other words, the grafted bone would continue to live and would adapt itself to the new function which it was called upon to perform. Its function determined its shape, and its growth was dependent upon its environment.

I had tried it out—had tested it—had checked it and double-checked it. But that was not enough. I had to prove to the satisfaction of the scientific world that the grafted bones were actually alive in their new position.

So I went to Professor Beebe, who was an authority on histology and pathology, and asked him to examine and verify the results of my experiments.

Under his direction, an assistant cut off several thin specimen slices from a fused bone graft in a dog's spine and proceeded to prepare and stain them for microscopic examination. The preparation required about two weeks of detailed treatment.

At the end of that period, Professor Beebe was informed that all was in readiness, and he appeared with his assistants in the operating room of the laboratory, where a microscope had been set up. The prepared specimens of fused bone graft were placed before him.

The occasion was desperately important to me. Every detail burned itself into my memory and the scene rises vividly before me now.

Within a small circle of light that had been turned on the specimens, Professor Beebe applied the high power objective of a microscope to decide whether the cells of the bone graft were living or dead. I held my breath as he adjusted the microscope to his eye and peered painstakingly through the lens at the bits of organic tissue.

Then Professor Beebe raised his head from the instrument and, turning to those around him, exclaimed:

"Why, these cells are living!"

In the course of my animal research at the Loomis Laboratory and in operations at the clinics of the New York Post Graduate Hospital, Bellevue Hospital, Roosevelt Hospital, and the Sea Breeze Hospital, I had discovered certain controlling laws of the bone graft, and I had also found opportunities to check certain already known laws by practical tests.

The basic law of bone graft is that, to be successful, a bone graft must be so selected and so fitted in the host bone (the bone in which it is implanted) that blood circulation through the two bony parts will be effected and maintained.

The second law is that bones should be grafted only from the same species. While some instances of the successful grafting of bones of different animal species have been reported, they are exceedingly rare. In animal research, my own attempts to graft sheep bones in spines of dogs unvaryingly resulted in failure. And in my thirty-eight years of orthopædic surgical experience, I have never encountered a case in which experimental or practitional attempt at inter-species bone grafting by other surgeons has proved successful. Many such

cases have been brought to me for correction. These have included surgically attempted graftings of living bones of sheep, dogs, oxen, and other animals in human bones. And, in every instance, utter failure has resulted. In these exhibits of attempted inter-species bone grafting, I have also noted active resistance to fusion similar to that observed in my experimental efforts to graft sheep bones in spines of dogs—that is, a rebellious exudation.

This may be listed as the law against grafting heterogeneous bones. The reason underlying the law is the differentiation of tissue and blood cells between the varying species—which results in the refusal of graft and host bones to unite.

Ignorance of the law against heterogeneous bone grafting sometimes leads the lay mind into flights of unconscious humour.

Some years later, when I was on duty as Chief Surgeon in U.S. General Hospital No. 3, where a great number of bone injuries received in the First World War were being treated—and in fact where I did approximately one-half of all the bone graft operations done in that period—a well-dressed woman, about thirty years old, entered the office and requested to see me.

One of the officers made an effort to sidetrack her to one of my junior officers, but she insisted on a personal interview. Insistence finally won. She was ushered to my desk, and, with the elation of high and noble service shining in her eyes, she placed upon the desk a large and cumbersome package.

"I understand that you are performing many bone graft operations on the boys from overseas," she said, "so you must need a lot of bones. I have been saving all I could get hold of for you."

With that she unwrapped the package. I expected to see a sizeable assortment of meat bones, which a person uninitiated in bone graft surgery might think would be usable. But, by George, she displayed a pile of whale bones which she had collected from ladies' corsets of an ancient vintage! Choking down a roar of laughter that was bursting in my throat, I thanked her and beat a hasty retreat, saying that my adjutant, Captain Weigel, would attend to the matter.

In the course of animal research and in clinical experience,

it became apparent that results from the grafting of homologous bones, that is, bones from the same species but from another individual, are successful only to a limited extent. As effectuation and maintenance of blood circulation between graft and host bones are basic to success, homologous bones, if used at all, should be selected with reference to blood types. The classification of blood types in transfusion of blood applies to bone types in grafting.

In some cases that have come to me, homologous bone grafts taken from parents have been found to be of proper type and have been used with success, though, as a rule, a graft from a brother or sister stands a better chance.

In all cases of homologous bone grafting, only bones free from transmittable diseases can be used with safety. The transmittable diseases to be guarded against include syphilis, virulent forms of sore throat, and other circulatory maladies. Sometimes it may be difficult to obtain bones of the type desired. Hardly any two individuals in the world have the same chemical and biological make-up. On one occasion I had to delay an operation for several days because no bones of the required type could be obtained. Then early one morning Professor James Ewing, who was co-operating with me in my quest, telephoned to say that the bones of two illegitimate babies strangulated at birth and of the right classification were available, and the graft was successful.

On another occasion, I had as a patient a little five-year-old girl who had lost the head of her thigh bone at the hip from infection. I was about to perform a bone graft on an Italian for a fractured arm, as it happened, and on a Polish woman with a foot deformity which required the removal of the astragalus, the round bone in front of the heel. This was just the bone to replace the head of the little girl's thigh bone. So when I took the bone graft from the Italian's tibia, I borrowed enough extra bone to make a dowel. With it I fastened a portion of the Polish woman's astragalus to the neck of the little girl's femur, at the hip, thus producing at least one League of Nations which operated efficiently.

Some years ago a heart-moving offer of bones for grafting purposes came to me from a woman in a midwestern state. She was a victim of an incurable disease and was sorely in need of money. So she wrote me that she was willing to sell her bones—to be removed as I saw fit, piecemeal, or bone by

bone. Her only specification was that I should leave to the last the bone whose loss would end her life.

Another law, which is of major importance, asserts that the use of autogenous bone grafts—that is, bone grafts taken from the patients themselves—assure the greatest measure of success.

An autogenous bone graft may be taken from one bone of the patient and inserted in another, or it may be cut from one part of the host bone and slipped into another place.

In operations to effect bone graft fusion as a curative treatment for hunchback, autogenous grafts from the shin bone (tibia) are the most to be preferred, for that bone has greater bone-forming power than any other part of the bony structure.

Utmost precision is required in all bone graft operations—precision in preparing the host bone for reception of the graft, precision in shaping the graft, and precision in placing the graft in the host bone so that the greatest possible number of capillaries in the two bone parts may be brought into juxtaposition. Immobilization of the bone graft is also essential.

If the operation is precisely performed and the graft is properly immobilized, a living union of the graft and host bone results—with adjustment of blood canalization (or channels) and effectuation of a maintained blood circulation.

While the bone from which the autogenous graft is taken must necessarily be weakened, it is a biological law (Wolff's law of stress) that in the course of time a bone so weakened will grow and develop needed strength until the loss is entirely made up.

Due to this biological-mechanical law of stress, bone grafts will grow in conformity with the mechanical stress brought to bear upon the host bone into which they are incorporated. Because of this general biological law, the trunk of a tree is larger than any other portion, for at this point it bears the greatest degree of stress. Similarly, the base of a tree limb at its attachment to the trunk develops in proportion to the stress placed upon it, and its diameter diminishes with its stress as the distance increases from the trunk. In other words, for this reason, both the trunk and the branches of the tree are conical in their general conformation, in accordance with the mechanical demands exerted upon each segment.

If a man has seven or eight inches of his thigh bone shot

away, or removed because of cancerous involvement, the lost part may be replaced by a graft no larger than a lead pencil. When first inserted, the graft will not have one-tenth of the strength necessary to stand the pull of the thigh muscles or the stress of weight bearing, and must be protected by the use of splintage. But, in time, it will increase in diameter until it has ample strength to withstand the stresses to which it is subject.

That is, a bone no larger than a lead pencil, when grafted to replace part of a thigh bone, will take on the characteristics of the thigh bone, in strength, size, and shape, even developing a marrow cavity.

The shin bone has a higher degree of callus-forming potentiality than bones from the spinal column and therefore it is more frequently used in grafting. This is particularly important if some time has elapsed since the injury to the bone, as the biological urge to repair diminishes with time. Callus is to the bone surgeon what glue is to the cabinet maker. Another attribute of the shin bone is that, when part of it is used for grafting, the bone quickly fills in and repairs itself.

VI

When I had completed my research in the Loomis (Animal) Laboratory and Professor Beebe had given scientific sanction to my proof of the surgical practicality of bone graft fusion in dog spines, I felt that I was ready to proceed with the establishment of my major concept—the concept that such graft fusion could be curatively applied to human beings afflicted with tuberculosis in spines and joints.

So I placed the matter before my superior, Dr. Henry Ling Taylor, head of the orthopædic department of the New York Post Graduate Hospital, and asked his permission to try my bone graft fusion operation in some cases of tuberculous hunchback in the clinic, then rated as unresponsive to conventional treatment.

Dr. Taylor, not only granted my request, but later performed bone graft operations himself.

At the outset, I was confronted by a "ways and means"

problem. The instruments then available for surgical bone grafting operations were very limited. They included chisels, osteotomes (chisels bevelled on both sides), hand saws similar to carpenters' saws, and a few crude mechanical "tool" auxiliaries. While a surgical rotary power-driven saw was then in existence, it was devised for attachment to large stationary motors and its use was limited to the cutting of skull bones.

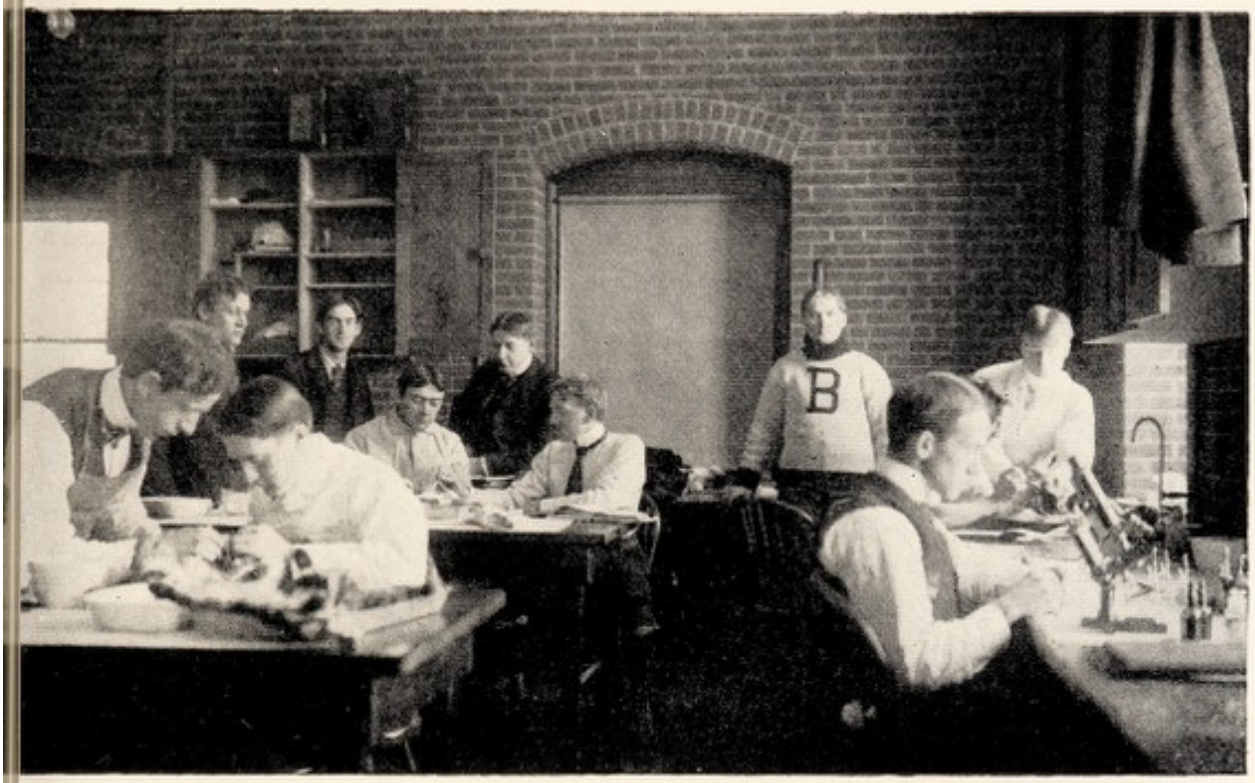
The precision required for successful bone grafting could not possibly be obtained by such a limited instrument and tool equipment. In addition, there were operative time requirements imposed by anæsthetization and by the demand for proper protection of the patient against infection from the outside during an "open operation", which could not possibly be met with the inadequate array of instruments then at hand. A difficult requirement which must be met was sterilizability by boiling of every vestige of the complicated surfaces of the instruments.

The surgeon labours under a disadvantage that the wood and metal worker never encounters. The bone he cuts is surrounded by soft tissues, and by important structures such as nerves and blood vessels which must not be unduly injured, and which usually allow him to approach the bone from one side only.

A bone graft must fit as neatly as a glass stopper in a bottle, and uncrushed cells are absolutely essential. When cells are crushed, as they are by the chisel and heavy blows of the mallet, they are known as *cytos*, and when absorbed into the circulation, they will produce, in quantities, evidences of shock.

Obviously, the answer to the precision instrument problem and the system of surgery this made possible, lay in automatic power-driven machine tools, some with reciprocating action, for application to work in which especially speedy and precise results were demanded.

So I directed my efforts towards producing such equipment. The crude surgical power-driven rotary saw then in the current "armamentarium" had possibilities, if its application were simplified and enlarged. But machine tools for rapid and precise cutting of bone and for boring and drilling, and lathes for making pegs and screws and dies for threading host bones were also required.



Laboratory at Bowdoin College, 1898 : Dr. Fred H. Albee (with "B" on sweater), Dr. Winford Henry Smith (extreme left), now Medical Director at John Hopkins



An electric automobile supplying direct current to the Albee Bone Mill during an operation in a Chicago clinic, 1912, where there was only alternating current in the building

Surgical treatment in the past had produced some makeshift and often grotesque methods. In many instances, surgeons resorted to metal gadgets in their practice. In the course of my professional experience, I have come upon cases in which metal plates, screws, nails, and wires ranging from silver threads to piano strings had been used. Much of this bizarre practice in the past was due to necessity, of course, but even at the present time, metal gadgets are too often used. Lately, in fact, such usage appears to have taken on new life. "Novelty" products of oxidized vanadium, stainless steel and vitallium, have been marketed with exaggerated claims of special merit as auxiliaries to surgical bone treatment.

As I laboured at my task, I realized that I was attempting to perfect the design which had begun to crystallize at the age of eight when I built my miniature rotary water-driven saw mill.

The small portable electrical motor had just come out, so I purchased one, and left it at an electrical shop with instructions that it be remodelled so that a number of different instruments or tools could be quickly attached and detached from the armature shaft, as a flexible shaft would not be suitable. This device is now known as the Albee Bone Mill.

In no field of medical science are the tools with which the surgeon works of greater importance than in bone and joint surgery. Speed and accuracy of cutting are essential in the shaping of a hard brittle substance such as bone. Also, from a mechanical standpoint, many of our modern operations, which deal more and more effectively with deformity, would be impossible of execution were it not for electrically driven machine tools which reduce operating time, shock to the patient, and make possible precision of work and mechanical intricacies of reconstruction.

Shortly after I had brought out the first model of the bone mill, I went to Chicago for two operative clinics—one at St. Luke's Hospital and the other at the Children's Memorial Hospital. At St. Luke's the electrical current was direct and the bone mill worked but, at the Children's Memorial Hospital, the current was alternating.

That stalled us until someone telephoned the Borland Automobile Company for aid. And that organization had a solution. They placed a large, electrically driven automobile, equipped with sufficient batteries to bring the current to 110

volts direct in front of the hospital and, by means of a temporarily installed cable, extending to the operating room on the second floor, the needed current was obtained.

Passers-by saw the automobile standing there, with batteries working, and queried an orderly on duty at the door as to what was going on. He told them that a New York surgeon was in the operating room "cutting bones with an electric saw". The news buzzed around and quite a crowd assembled. The more tenaciously curious found a roof level with the hospital operating room, and, perching there like rows of Dutch storks, they peered at the proceedings until one of the nurses noticed them and ended the show by placing sheets over the windows.

A little later, a small universal portable motor, which is run either by direct or alternating current, appeared on the market. And since then I have used that mechanism as the driving engine of my bone mill.

When the bone mill's equipment of instruments and tools was finally completed, it included the following:

1. Rotary single saws of different diameters.
2. Adjustable twin saws or cutting calipers.
3. Various types of reciprocal (oscillating) finger type saws for deep work, scroll work, or cutting of segments of any size of a circle.
4. End mill cutters for enlarging gutters and mortices. Also for starting drill holes on oblique, hard, or slippery bone surfaces.
5. Drills of various sizes and types, up to one-half inch.
6. Lathe for manufacture of living bone graft pegs and screws of different sizes.
7. Corresponding size drills for pegs or screws.
8. Different size taps, to cut threads on the inside of the drill holes.
9. Die cutters, to make threads upon bone graft pegs of different sizes.
10. Motor-driven oscillating chisels and files.

We have learned that the most advantageous power-driven cutting tool for hard surfaces is a rotary one; that is true in bone surgery as well as in the manufacturing industries. As a matter of fact, the rotary saw is of particular merit in surgery,

as the bone to be cut is surrounded by important soft tissues and, as a rule, can be approached from one side only. The rotary saw allows the surgeon to penetrate from one side, as far as he elects, without permitting the cutting tool to penetrate the full thickness of the bone.

The groove, of varying shapes and dimensions, in the host bone, as well as the bone graft for inlay, can be made with the same twin circular saw, with the minutest accuracy of fit. The diameter of the graft gutter may be varied as desired, since twin saws are adjustable within wide limits. With the same twin rotary saw the surgeon can remove a strip of bone of any length, and by means of the lathe, or dowel cutter, in the space of minutes, fashion it into a perfect dowel-peg for use in ununited fractures, or any other reconstruction purpose. With the proper sized drill, he may make a drill hole of the exact size and unite the fractured fragments with the dowel-peg.

Later on, a screw-making attachment was added whereby the dowel peg can be made into a screw, and the drill hole tapped with threads precisely as in a machine shop. One must not think that because the bone has taken on the conformation of a screw, it has become dead issue. It is still vitally alive. The whole screw-making process consumes but a few minutes, nor is the surgical aseptic technic broken. Every external surface of the bone mill is sterilized by boiling.

When the problem of tools had been solved, the problem of an operating table confronted me. A great deal of orthopædic surgery resulting from automobile, sports, and industrial accidents is necessarily of a major nature and, through lack of traction facilities, cannot be performed on the surgical operating table. On the other hand, fracture tables, designed chiefly for the reduction of fractures, lack many essentials of operating procedure. What I needed was a table which combined the useful features of both types, and I eventually evolved an operating table with which I could obtain the necessary degree of immobilization and fixation in position of neutral muscle pull, and various mechanical postures.

Up to this time there had been comparatively little interest in mechanical surgery. In the first place, the average young man going into medicine had little interest in mechanics. In the second place, he had practically no training in precision reconstructive surgery because he had no tools to work with.

Now we can not only cut down the length of the operation, thus reducing the shock to the patient, and making some otherwise non-operative patients, operative; but a whole new realm of operative work has been made possible by electrically driven machinery.

Every man has experienced the thrill of using new tools and seeing how many things he can accomplish with them. I felt much this way about my new bone mill and table, and was emboldened to try various bone plastic operations which I had been turning over in my mind, but which could not have been executed with the old hand tools. The variety of these reconstructive procedures has, during the years, reached enormous numbers.

I have sometimes been accused of too much enthusiasm about motor-driven instruments. But, in my experience, their use is essential to good bone surgery. Human bone is one of the most precious materials in the world—it cannot be replaced except by itself, either naturally or by surgical operation.

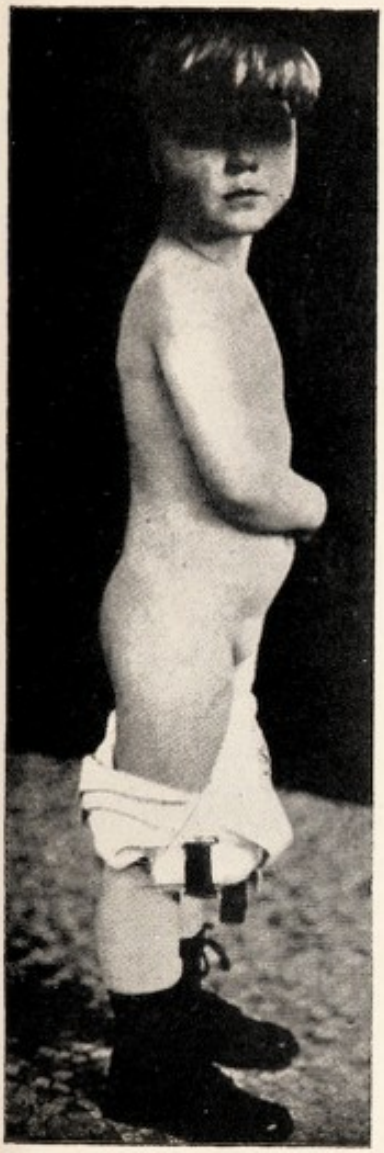
Of innumerable examples of the application of the bone graft, an outstanding one is the removal of cancerous bone of arm, leg, or jaw and its replacement by bone taken from the shin or pelvis.

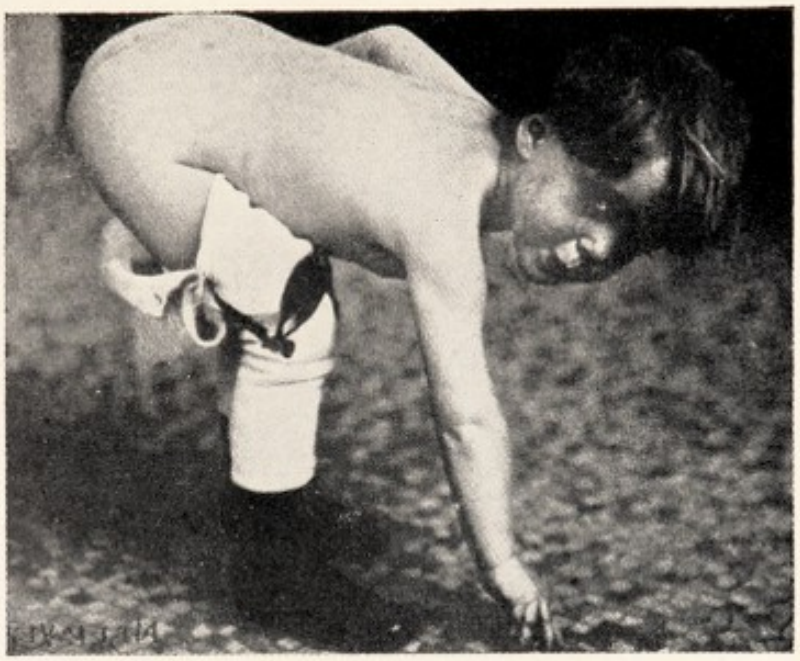
Another application of the bone graft is in the curing of disease. One of the best examples of this is its use in cases of tuberculosis of the spine.

So, step by step, from the evolution of the theory of the bone graft to the development of machine-driven tools and a technic of procedure, not only a new method for the treatment of Pott's disease took shape, but a realization that the same basic method had countless ramifications and applications and variations; that the human body, diseased or congenitally misshapen or maimed in war and in accidents and in industry could be repaired and restored beyond the imagination of men.

VII

IT IS A CURIOUS EXPERIENCE to sum up in a chapter, as I have just done, the hopes and dreams and incessant effort of years.





A victim of a very acute case of tuberculosis of the lumbar spine was operated on at the age of five years, in 1909. The above photographs show him three months after bone graft was inserted, with excellent spinal function in static posture and flexion posture (both figures taken from Albee, *Bone Graft Surgery*, W. B. Saunders). This patient returned at the age of 38 years (33 years after bone graft operation) to inquire whether it was safe for him to enlist. After careful study, Dr. Albee informed him that it would be perfectly safe for him to enter military service. This is only one of many such cases. He is shown below as he appeared in 1929



They are co-ordinated and become curiously simple. They seem carefully planned, when, in actual fact, all one's plans are constantly being changed and adapted to circumstances. Expediency, which has modified so much, appears to be part of a carefully worked out pattern.

Perhaps that is why people read autobiographies. All the complexities of living become smoothed out and fit neatly into a chapter. It is a pity that one cannot write the book first and then live afterwards in accordance with the printed page. Certainly, it would be easier. It is a great comfort to know what is coming next.

What came after the research into bone grafting, of course, was applying what had been learned from animals on the living bones of men, women, and children. Working with children is one of the most rewarding experiences one can have. They are more responsive than adults, more honest in their reactions; they are valiant and trusting.

I have learned much from children who have lain strapped to boards for months or years, who have been crippled from babyhood and never known freedom of action to run and play, who have encountered too soon a stern knowledge of frustration and pain. I have learned that self-denial and discipline develop marvellous characters, and discovered there is no one so wise as the person who knows what he cannot have. Certainly it has been proved, times without number, that self-restraint and discipline are as necessary as food to the future well-being of an individual.

Freedom to live normally is necessary, too, if a child is to develop as he should. That is another reason why I have always opposed the prolonged inactivity of children, strapped to frames years on end in an attempt to achieve immobilization in the case of tuberculosis of the spine, instead of submitting the child to an operation of such slight magnitude (ten to fifteen minutes operating time) with such outstanding curative value. If the patient is referred for operation after prolonged treatment, the disease has frequently progressed to such a degree that deformity cannot be entirely corrected or prevented. The late end-results of cases in which the bone graft operation for Pott's disease was performed in early childhood are so favourable, and I have seen so many tragic cases resulting from unsuccessful, prolonged, conservative treatment with operation too late, that I stand emphatically for early operation. Recent

literature shows that more and more surgeons are inclining towards this view.

An important consideration is the length of time required for an operation and the shock occasioned by it. An operation that consumes little time and induces comparatively little shock may obviously be undertaken when the surgical risk is not of the best. The bone graft operation may be completed in as little as nine minutes in a favourable case, if one's operating team is thoroughly familiar with the routine and the special instruments required. The technic does not require excessive retraction and there is no necessity to operate more or less blindly in regions difficult of access. The small amount of shock produced by this operation is due to its simplicity and consequent shortness of duration, as well as the minimum amount of retraction and traumatization of tissue it entails.

In 1909, right after the Noonan operation and the report of a number of successful cases to the American Orthopædic Association, much to my surprise, I was invited to attend the Congress of the International Association of Medicine and Surgery at Budapest, and to present my method of arthrodesing (fusing or stiffening) advanced cases of osteoarthritis and other conditions of the hip.

Berlin, when I stopped there on my way to Budapest, as all surgeons did in those days, was in a frenzy. The streets were packed, the roof-tops crowded, decorations and flags were everywhere. A carnival spirit kept the throngs merry and excited.

It seemed that a holiday had been proclaimed throughout Germany and Austria in honour of Count Zeppelin, who was making his first flight, of some four hundred miles, from Lake Constance to Berlin, in the dirigible which bore his name.

Tremendous preparations had been made to receive him on his arrival in Berlin. For the Zeppelin, according to German calculations, would revolutionize warfare—the all-important consideration to the Germans—an expectation which, as later events proved, was ill-founded.

Through a colleague, Dr. Boehm, I secured a box at the Royal Grand Opera House for that evening, as well as "watching" space on a house-top located on Unter den Linden, about a block from the Kaiser's castle. . . . We settled down to wait.

For three hours and a half we searched the skies. The Count's arrival, it developed, was delayed because of a broken propeller shaft. But at two-thirty in the afternoon a great shout shook the streets of Berlin. In the distance, a dim, cigar-shaped object appeared. As he came nearer, Count Zeppelin circled the Kaiser's castle three times, and the Kaiser's flag, which had been flying, was lowered, indicating that he was about to leave.

Presently, with great fanfare, the Royal automobiles, a brilliant orange, made their appearance, carrying the Kaiser, the Crown Prince, and other German and Austrian royalties, on their way to the aviation field to welcome Count Zeppelin.

That night a celebration in his honour was held in the Royal Grand Opera House. All the trappings of that dazzling régime were present—ermine, diamonds, precious stones; the splendour of military and diplomatic regalia, decked out with cream, gold, scarlet, and blue.

A trumpet sounded. The audience rose and into the royal box marched the Kaiser, the Crown Prince, assorted royalties, and Count Zeppelin, all gorgeous in uniform, their breasts covered with decorations.

A pageant, written by the Kaiser himself, was presented in honour of the Count. Its symbolism escaped me, and the writing was confused, but I remember that it contained battle scenes that would have aroused the envy of Cecil de Mille.

My first act on reaching Budapest was to make a temporarily disastrous error in diagnosis. Fortunately, I was my own patient so no great harm was done. I had hardly settled down in my hotel before my great toe began to swell. Ingrowing toe-nail was my snap judgment, the usual treatment of which was an incision. Unhesitatingly, I resorted to one of the sharp scalpels that I had just purchased in Berlin, and opened the end of my big toe. Much to my surprise, there was no evidence of infection.

As the years have rolled by, my diagnosis has proved to be completely erroneous. That was my first attack of gout, which I have had off and on for thirty-one years. The days following my self-inflicted operation proved to be painful ones, especially as I was compelled to travel up and down the Danube to the Congress. There is, for some reason, nothing quite as ludicrous as a doctor who has something the matter with him. His affliction is the object of good-natured jibes from the layman

who never overlooks an opportunity to say, "Physician, heal thyself."

The President of the Congress was the famous Budapest surgeon, Dr. Julius Doelinger, who later helped me to organize the International Society of Orthopædic Surgeons. The meeting was a large one and it was with considerable trepidation that I presented my new method, with the help of lantern slides, before this group of mature surgeons. But I had a moment of jubilation when the eminent Dr. John B. Murphy said: "For years, surgeons have sent away patients suffering from this condition of the hip, and here is a youngster who has devised a very simple operation that cures them!"

On my way back to America, I stopped in Vienna, with professional friends, to pay my respects to Dr. Adolph Lorenz, the great Austrian surgeon. When we arrived at his clinic, it was jammed full. Men pressed so closely around him that had it not been for his extreme height—about six feet three inches—we should have been unable either to see or to hear him. To my great pleasure, one of my companions whispered to me: "Dr. Lorenz is describing in most flattering terms your hip operation," presented only two days before at Budapest.

In those days, it was a sign of respect for one's profession to do honour to Dr. Lorenz, and having met the great surgeon in his own environment, we went on our way newly inspired.

On my return home, I found my life cast along easier lines than I had known before. The problem of becoming established as a surgeon in a large city had been accomplished. I found my time, like all Gaul, divided into three parts, with private practice, charitable hospital cases, and clinics all over the country.

One case I remember particularly was that of a little boy from Leysin, Switzerland. When it first came to my attention, the child had been strapped to a frame for six years. His father came to see me, bringing X-rays which showed the boy's condition was getting worse. A steady destruction of the bones was going on.

The child's mother, it appeared, was a Christian Scientist who would not consent to an operation to immobilize the spine. It is difficult for any physician to grasp the state of mind which refuses to recognize the presence of disease.

A year later, the harassed father came again, with new X-

rays. The boy's condition was worse. The father at length put his foot down and demanded that something be done, and with the mother's reluctant consent, an operation was performed, putting in a bone graft from the boy's shin bone.

Within a few weeks the little patient was on his way to recovery, but he could not walk. He had been strapped to a frame so long that his heel cords were affected and shortened and he could not step on his feet. To-day he is no longer a cripple.

It is hard, sometimes, to determine which is more dangerous: the mother who lacks faith in operations, or the mother who insists on them.

The antithesis of the mother to whom I have just referred visited me not long ago. She brought with her a twenty-four-year-old daughter who, she had decided for herself, needed a spinal operation. I examined the girl and found every sign of high nervous tension—and nothing else.

But the mother was not convinced. She refused to be convinced. She knew something was wrong. She knew her daughter. She had looked after her every day of her life. She never let her out of her sight. She even had the daughter sleep with her at night so that she would not be left alone!

There was only one trouble with the daughter, of course—too much mother. I told her so, rather bluntly. She protested that she loved her daughter unselfishly. The fact that the girl was a neurotic was not her fault. What she wanted was a surgeon who would perform an operation and prove to her that there was a tangible focus of trouble. She refused point-blank to let me tell the girl that there was nothing the matter with her but nerves. It would upset her.

It developed that this devoted mother had already consulted eight doctors. She left me in high dudgeon, saying: "There are always the chiropractors."

One of my most gratifying cases came to me in 1912 when J. Frank Davis, a writer from San Antonio, Texas, was sent to me. He was brought on a stretcher, suffering from acute tuberculosis of the spine for which he had been treated for many years. I operated on him by grafting a strip of shinbone, eight inches long, into the spinous processes of the vertebræ. The result was successful, and within several months Mr. Davis was able to go back to his writing.

Since that time he has written six novels, one of which, *The Chinese Label*, he dedicated to me. He is best known, however, for his play, *The Ladder*, based on the theme of reincarnation, which had a unique history on Broadway. A Texas oil man became so much taken with the idea that he became the angel for the play, which was presented without charge for eighteen months in a New York theatre.

Every year, on the twenty-fourth of June—the day of his operation—Mr. Davis writes me a letter of thanks. There have been twenty-eight of them. That is a very rewarding experience.

A ridiculous problem, quite unlike the preceding one, involved a patient of mine from Pittsburg, Pennsylvania. This gentleman came to me one day, saying that his wife, to whom he had been married eighteen years, and who was the mother of his two children, had suddenly become very much disturbed about his short stature. Because of this, she had refused to go out with him, and constantly talked about his shortcomings—that pun seems inevitable—to the children. He was only five feet tall, and she was five feet four. He had come to the conclusion that, if it was possible, he must have an operation to increase his height.

With much fervour he inquired if it would be possible to have his legs lengthened to as much as four inches. I told him that it was possible but that it would be difficult and would have to be done in two steps. He was anxious to know the worst, so I explained that the first operation would lengthen his thighs about two inches, and that he would be laid up after this for approximately two months. The second operative step would mean about the same.

Despite all this, he seemed perfectly satisfied and said that if his wife were pleased with the result, he would not hesitate to have the operations done.

Feeling that some other man was responsible for this poor husband's troubled state of mind, I reminded him that I had not yet given my final opinion. This was for him to return to Pittsburg and tell his wife that she should come in and have *her* legs shortened, as that would require only one operation.

I am still waiting for her to come in!

While occasional absurdities such as this were requested of the bone graft, we were learning that the concept could be adapted to many uses.

The method used in inlaying a bone graft in the spine applied to joints in general. The bone graft not only provided immobilization to tubercular spines but it brought a blood supply to the anæmic bone, and was equally efficacious with any tuberculous joints, fingers, shoulders, ankles, knees, and so forth.

Fifteen years later, this same fundamental principle involved in the surgical immobilization of the bone was applied to lung tuberculosis by sinking in the ribs over the diseased areas of the lung.

The bone graft principle, as has been pointed out, led inevitably to new concepts of what could be done in the reconstruction of the body. One of the first applications was made in cases of congenital absence of the bone in any part of the body. One such case was that of a young girl who had no radius. After the reconstruction operation, she acquired complete use of the wrist, and not only was able to drive her own car, but the last time I saw her she was runner-up for the tennis championship of her school.

The next application of the bone graft was in cases of bone cancer. Formerly the only choice had been amputation, but now the diseased bone could be removed and replaced by bone grafts which, in accordance with natural laws, in time acquired the proper size to stand the stress placed upon them. Great portions of the skeleton, half a thigh bone, or the whole knee joint, for instance, can be removed in such cases.

One of the unusual applications of bone graft is the enlargement of the childbirth canal of the female pelvis, which may have been made smaller by congenital deformity, rickets, fracture, tuberculosis of the hip, and other causes. The first case of this type was that of a young woman about twenty-five years old, who had lost her first child because her pelvis was so small the child's head had to be removed in parts. When she was brought to me by Dr. Druskin, the obstetrician, with whom I had previously been discussing the possibility of enlarging the pelvis in such cases, she was five months pregnant. I enlarged her pelvis by two inches by the insertion of a tibial bone graft at the symphysis, and she not only gave birth normally, but with comparative ease. By figuring out how this one woman could bear healthy children, we had devised an operation making the Caesarian section unnecessary.

The Caesarian operation was created to make sure that no boy babies, who might grow up to be soldiers, should be lost to the State. There was an old Roman law according to which the doctor was compelled, in case the mother died in childbirth, to save the child by an operation. This so-called Caesarian operation, by the way, was not performed on Caesar's mother. In contrast with the bone graft operation which performed once lasts for a woman's lifetime, the Caesarian operation must be repeated for each birth.

For centuries Caesarians were performed in cases where the mother could not have a normal birth. In the beginning, nearly all women died under it. Up to the last century, half of them died of it. Now it is handled successfully.

There is something of the quarterdeck spirit in every surgeon. This is inevitable, of course, in the operating room, but there are other occasions when it is useful for the welfare of the patient.

One Sunday evening, some years ago, at about nine-thirty, a young doctor came to my country place with a Mexican woman whom he introduced as a relative. She was desperate. She had just arrived that very afternoon with her nine-year-old daughter who was suffering from tuberculosis of the hip. Medical authorities in Mexico City had said the child was in need of an immediate bone graft operation; and had sent her to me. So together the mother and child had made the long trip—at Heaven only knows what sacrifices, for they had literally no money. And the immigration authorities in New York were insisting that they each post a bond of $1,000 by the following Wednesday, or face deportation immediately.

I told the young doctor to have the child placed in the orthopædic ward of the Post Graduate Hospital on my service. I would see her the next day.

Early the next morning I called the invaluable Miss Leedingham, who had been Head Nurse of that ward for forty years. "Don't allow anyone to see the child," I instructed. "Have an X-ray taken. I'll see her this afternoon."

On examining the child I found she had acute extensive destructive tuberculosis of the hip. An operation was her only chance for recovery. Weeks of convalescence must follow.

And then began my struggle with the immigration authorities. I explained the child's condition, the imperativeness of

her operation, the fact that she and her mother already had their return tickets. On their side, they quoted the law. I explained that to send the child home after such an operation without weeks of convalescence, would be nothing short of murder.

"Then you cannot operate," the immigration men argued. "The child must go back at once."

"The child is under orders not to be disturbed," I countered. "To remove her from the hospital now would imperil her life. Do you want to assume that risk?"

Incoherent mutterings sounded at the other end of the line, then finally: "We will send an ambulance."

"Your ambulance will come back empty," I warned. The immigration authorities realized that this was one situation where a doctor's word must take precedence over ordinary interpretations of the law—for the ambulance never arrived. I operated.

In 1913, I was invited to demonstrate the bone mill before the seventeenth Congress of the International Association of Medicine and Surgery in London. That was the year before Europe was enveloped in a curtain of fire, but we surgeons did not even smell the smoke of the coming conflagration. When we weren't thinking in terms of medical science, we were thinking in terms of having a good time, and on one occasion we combined the two.

On the last night out on the steamer before reaching England a masquerade ball was in full swing. Just when the fun was at its peak, one of the doctors shouted: "Stop the music! Dr. Fitzgibbon is ill and an operation may be necessary."

Dr. Fitzgibbon was emitting blood-curdling groans of pain from a couch in the corner of the ballroom. A man undergoing Indian torture could not have suffered more. The music came to a sudden stop. The dancers and onlookers stood rooted to their respective spots, too shocked to move. A consultation was being held before their eyes, a dozen or more doctors were noisily disputing just what should be done. There were loud and violent opinions, ranging everywhere from appendicitis to gall stones. But everyone was agreed on an immediate operation.

Dr. Seaman and I, hastily decked out in operating clothes, dashed in, drawing on gloves. With a lunge, more like using a scimitar than a scalpel, Dr. Seaman made the incision. For

a moment he hesitated. Surprise covered his face. Then he started hauling out first a loaf of bread, then a pineapple, then a ham.

The groans ceased. Dr. Fitzgibbon's deep voice could be heard all over the room. "I want a glass of beer!"

The relieved audience shouted at the hoax.

The next day we reached London to attend the Congress. There was a milling crowd outside Albert Hall where the meetings were to be held, and our credentials were examined minutely lest, I suppose, one of us conceal about our person a suffragette. For the militant ladies, at that time, had an all-pervasive desire to put in an appearance wherever they thought they might prove to be most annoying. Up and down they marched, carrying placards which read: "What do the doctors think of woman torture?"

In presenting my bone mill, I supplemented my discussion of its operation with motion pictures interspersed with animated drawings, and I was more than delighted with the audience's reaction.

From the world of medicine, we came out into an England at its tranquil loveliest. Sir Watson Cheyne, President of the Congress, gave us a yachting party on the Thames, King George and Queen Mary gave us a lawn party at Windsor Castle. And we returned to America, with a memory of England at peace, firm in its traditions, gracious in its ageless dignity. Against the impact of restless America, England seemed changeless.

That was the year before the First World War.

PART TWO THE WITCH'S BREW

VIII

THE ISSUE OF *The Times* of London which described the opening meeting of the seventeenth International Congress of Medicine and Surgery had, as its leader, an editorial entitled "Peace in the Balkans". Peace had just been concluded among all five of the Balkan States, but there was only modified rapture in England. For that peace, like so many others, contained the seeds of future wars.

". . . the prospects of a settlement, stable because it would have been friendly and just, and paving the way for a firm and powerful Balkan Confederation in which each of the partners might have sought and found their own advantage in the common advantage of all," commented the editorial, "appeared for a brief moment to be full of hope. The hope was quickly dashed . . . Bulgaria has submitted to the terms imposed on her, but she had submitted to them only because she was incapable of further resistance. . . . She yields . . . to *force majeure*, and submission under duress of that kind seldom constitutes the basis of an enduring compact. . . .

"Few things have been more impressive or more gratifying in recent history than the revelation amongst them all of this new sense of responsibility to Europe as a whole. It is upon that sense that we must rely, not only for the adjustment of the differences to which the present situation may give rise, but for abstention from the intrigues for which the reconstituted Balkans promise to offer a too fruitful field."

It was August, 1913, when this editorial, with its wry mixture of forebodings and uncertain faith in Europe's growing "sense of responsibility" appeared.

It was April, 1914, when I was invited to open the German Orthopædic Surgical Congress which convened in Berlin. Both my English and American colleagues congratulated me. This was a signal honour—one, they said, which had never been paid to an English-speaking surgeon. With a young man's *naïveté*, I was myself inclined to regard this as a tribute to my work. Not for a moment did I glimpse the nightmare which

was to come. Nor the real reason why I had been invited to Berlin.

It was in August, four months later, that I awoke to the truth. The German military authorities had merely demonstrated once more their foresight and preparedness.

My invitation had specified that the bone mill should be the topic of my address, and I was requested to be prepared to demonstrate its use in detail, together with my technic in bone graft surgery. Those who were planning the war then in preparation, knew only too well to what degree engines of destruction and diabolical mutilation never before dreamed of, were to be employed. In that war, millions of bullet-and-shell-torn bodies, thousands and thousands of bones shattered or shot away, were to require scientific treatment; thousands of cases calling for bone reconstruction were to be encountered.

As statistics of the English army—later confirmed by our own—were to show, approximately sixty-five per cent of all military and surgical service was surgery of the spine and bones and joints; thirty per cent was medical service; only five per cent was abdominal and visceral surgery.

That was a gigantic task, for which the hand tools and instruments formerly available alone would have been appallingly inadequate.

The Germans realized that an army so organized that it had the means of returning even seriously wounded soldiers, with extensive loss of bone, to the front, was by that measure more efficient. When such wounded men reached into the millions; this item in the organization of the army became more and more important.

When it was learned that it might be possible to restore even large amounts of bone shot away or lost by infection, surgeons all along the military line, from the front to the base hospitals, refrained from the amputation of limbs, thus returning many soldiers to the front.

How much of this the High Command of the German army apprehended in 1914, I am unable to say. But as succeeding events proved their uncanny efficiency, it seems probable that they apprehended a very large measure of the philosophy of preparedness. Therefore, they started, even before the war was launched, to educate the profession in the new technic.

After the Congress, I was requested to give a course of instruction in the use of the bone mill. Though I have filled pro-

fessional chairs in a number of colleges and universities, no class has ever shown keener or more avid interest than did these German surgeons.

In Munich, I saw a huge hospital under construction. More German preparedness. Many of these hospitals were being built at that time at strategic points, and designed to take care of future military needs.

However, in Germany, as in other countries, there were surgeons who looked with suspicion on innovations. Following the German Orthopædic Surgical Congress, I visited the Sauerbruch Clinic in Berlin. We were shown through it by the Chief Surgeon, who paused beside the cot of a patient suffering from an ununited fracture of the thigh bone. I took down the chart which was hanging on the wall and studied it. It was very thick, showing that the patient had been in the hospital for months. The Chief Surgeon displayed some X-rays.

"What are you going to do with the patient?" I asked.

"Take off his leg or make a brace for him."

"Don't you ever resort to a bone graft operation?"

"Very rarely," he said, "and we would not think it advisable to do so in this case."

"If you were to perform a grafting operation," I asked, "how would you cut the bone?"

"With Lexer's Osteotome." (A chisel bevelled on both sides.)

"Why?"

"Simply because it has a wooden handle and that gives greater precision in cutting." (And this in utter disregard of the fact that in the course of use a malleted wooden handle shreds and so renders the tool to which it is attached uncertain in cutting effect under driving blows.)

"You know sculpturing?"

"Yes."

"Will you not grant that sculpture calls for the most precise chisel-cutting possible?"

"Certainly."

"Does a sculptor ever use wooden-handled tools?"

"No."

"And you still hold to the use of the Lexer Osteotome in cutting bone grafts?"

"Yes."

The bone mill encountered a measure of opposition that seems to be almost inherent in surgery. For surgery is a staid

profession in which ancient usage is sometimes a fetish, and it often shows itself to be tradition-bound. It is given to viewing innovations askance and distrusting progressive ideas.

The German Government, however, had seen in this procedure a new war tool, and shortly after the outbreak of the war, I was asked to return to Germany for the purpose of demonstrating in the various military hospitals the application of the bone mill and various reconstruction technics. I felt that I could not accept this invitation, and it was not until two years later—in July 1916—that I encountered the witches' brew of modern war when, at the request of the French War Office, I sailed for France to demonstrate reconstruction technic in various military hospitals.

On July 1, 1916, I left on the S.S. *St. Paul* with my assistant, the late Dr. A. J. Crane, of Waterbury, Connecticut, and my wife—who was allowed to accompany me on the understanding that she was to serve as a Red Cross nurse in the American-British hospital at Ris-Orangis.

The war took on a different quality for me from the moment I boarded the ship. In America it was remote, at sea it was at hand. The sides of the ship were painted with American flags, brilliantly illuminated, to point out to any lurking submarine that we were neutral. As night came on, I discovered a growing tendency to hope that the German eyesight was good and that the German navy was not given to being impulsive.

There was much talk on shipboard of neutrals. Among the passengers was Thomas Nelson Page, currently Ambassador to Italy, a brilliant conversationalist and so full of off-the-record information on world affairs that we gave him little opportunity to get away from the pervading topic of interest—would Italy, or would she not, come in on the side of the Allies? Then, as in the Second World War, she waited cautiously to see which way the cat would jump.

If politics make strange bedfellows, war calls forth equally unexpected alliances. It was borne home to me increasingly during the First World War that there was no natural association between the British and the French, they were too dissimilar in temperament.

War alliances are matters of expediency solely. One of the great mistakes of the propagandists seems to be their attempt to make them matters of sentiment. Though perhaps this is

necessary; for it would appear that nations fight for reasons of expediency, and peoples for reasons of sentiment.

On the eighth day out, we entered the submarine zone and learned that the ship's crew was more apprehensive of danger from floating mines than from submarines. One of our stewards, a brawny fellow, was a survivor of the *Lusitania* disaster. As we sighted the Irish Coast, he pointed out to us the spot where the S.S. *Arabic* had been sunk, and the site where the *Lusitania* had gone down in nineteen minutes. Unlike most seamen, the steward was an excellent swimmer, and he had managed to get on a flagpole, from which he was eventually picked up by a fishing boat.

On the ninth day, still flanked by mine sweepers, the S.S. *St. Paul* knifed her way through the shifting fog and nosed into Liverpool harbour.

Liverpool was in darkness because of air raids. There were few able men in evidence. Women and small boys, twelve or thirteen years old, had taken their place. Women ran the tramcars and cleaned the streets. At night women waited behind the darkened windows of the houses, in silent, darkened streets. Liverpool is frequently wreathed in fog and is a dreary place at best, but in time of war it was starkly sombre and sad.

The morning after our arrival, Sir Robert Jones, head of the British Orthopædic Division—an assignment which kept him travelling constantly between France and England—took Dr. Crane and me to our first British Military Hospital, at Alderhey. Originally, the building had been used for crippled children, but now was being used to rehabilitate Tommies—many of whom were returned to the trenches after only a short stay.

This military hospital cared for a thousand cases at a time. The wards were large, airy and clean, with a window at the head of each bed, the bottom of each window pane painted blue. The beds had snow-white pillows and counterpanes, and contrasted gaily with the folded red blankets at the foot of each bed. It was an attractive red, white and blue colour scheme. Every room was provided with bouquets of flowers, pianos, victrolas, and everything necessary for the patients' comfort and happiness. As I walked around I took particular note of every detail for I didn't want to miss any phase of British military medical service which might prove useful elsewhere.

The disabled Tommies, who could not return to the trenches

again, were placed on the pension lists by the hospital, and discharged when they were healed.

Between Liverpool and London, there was little evidence of war. The countryside was as glorious as it had been the year before, the fields and hedges as green. But here and there, men stood guard at tunnels, and over half the men were in uniform. An advertisement in *The Times* read:

> HELP WANTED—Healthy and Strong Men need not apply. They know where to apply.

Coming out of a theatre that first evening in London, we found at least a hundred pencils of light probing the night in search of Zeppelins. The glare in the sky was in strange contrast to the darkened and noiseless streets and houses. Only now and then would the unnatural silence be broken by a whistle calling a taxi.

It was curious to observe the psychological effect on the English of the German air raids. They did not for a moment weaken the English morale as they were designed to do. As a matter of fact, they created a determination and a unity of spirit in England such as nothing else could have accomplished.

We visited several military hospitals and then, although my gout had begun to bother me and I had gone back and forth from police station to consult the officers of the Red Cross, and had been finger-printed and filled in forms by the dozen, I could not resist going for a ride in the country with my most intimate English friend, Mr. W. Rowley Bristow, the great orthopædic surgeon. We combined a little business with our pleasure for he was on the way to see a patient of his, a seventy-eight-year-old man who had just broken his neck, and lay with an incredible-looking harness on his head—with pulleys, sand bags and everything else the local doctor could think of.

It seems he had been the guest of an equally old gentleman who had just purchased a new automobile, and after a game of bowls they had gone for a ride. Although the chauffeur was along, the host insisted on driving, even though they had been celebrating something or other by taking a nip from a bottle from time to time.

They ended by having one too many drinks, and smashed the car in a ditch. Both were hurt, but fortunately, only one had a broken neck. However, X-rays showed that his chances for recovery were more than fair, and when I saw him, he was

as chipper as could be, and wanted to know when he could play another game of bowls.

That same day I saw another gallant Englishman, King George, who, with his Queen, was attending the Red Cross Temple Fête. The King had renounced his German name, Saxe-Coburg and Gotha, and proclaimed that henceforth the name should be Windsor. According to reports, this action greatly entertained the Kaiser who requested that the opera company perform for his amusement "The Merry Wives of Saxe-Coburg and Gotha".

After one of the German air raids, in which forty planes flew over London, the King, pointing from his palace window to the statue of Queen Victoria, remarked to the astonished General Pershing: "The Kaiser, God damn him, has even tried to destroy the statue of his own grandmother!"

The King, it is presumed, had not heard that the Kaiser, with his strangely mingled hatred and veneration for England, had ordered that no historical monument there should ever be bombed.

With Sir Robert Jones, we visited the beautifully equipped temporary pavilions of Roehampton Hospital which specialized in nothing but amputation cases—the worst mutilations of the war—five hundred men suffering from loss of legs, arms and eyes. From a surgeon's point of view there was more to learn in this enormous centre of amputation work than in any other institution I have ever visited—for nothing in civil life produces the quantity of mutilation that war does, and here under one roof were gathered together the surgically worst cases.

We made a tour of Queen Mary's Convalescent Hospital, and of Dover House, donated by J. Pierpont Morgan for the use of officers. Both of these institutions were devoted entirely to supplying artificial limbs. We saw a file of fifty men, stripped to the waist, march into the hall, come to right face and salute with military precision. A group of alert young men. But there was a difference. Briskly each man held out for inspection his new equipment: a hand, hook, knife and fork. Quietly each man demonstrated his proficiency in their use. Those who needed adjustment were sent back to their quarters for another day. Those who passed muster signed for their equipment and were sent to their homes.

A singularly happy place, among all this suffering, was the hospital for Blind Soldiers at St. Dunstans. The matron,

Frances Hughes, better known as "Sister Pat", conducted us through it.

Before becoming a hospital, it had been the private home of Lord Lounsbury, who rented it to Mr. Otto Kahn of New York for the period of the war and six months thereafter.

But at the time, this refuge for the blind was a place of light. Sir Arthur Pearson, himself blind, maintained the place. A thousand cases were cared for. Here we found a bright, attractive girl, Esther Cleveland, daughter of Grover Cleveland, tall and pretty, with blonde hair and blue eyes. She had volunteered to do unskilled work of any nature, and when I first saw her was making beds.

I have never seen happier men than the blind in these workshops. It is curious that blindness has, in general, so ennobling an effect upon human character. Take away light and colour, form and beauty, all the things we tend to regard as compensations for living, and something rare develops in the human heart. The patients sang, whistled, and chatted as they soled shoes, made baskets, wove rugs, did cabinet work, made hammocks, and wove shopping bags.

They liked chicken husbandry, and it was amazing to watch them working with poultry. By the texture of feathers, they could distinguish the type of fowl and know whether it were Barred Rock, Plymouth Rock, Leghorn, and so forth. They learned to write Braille, using special typewriters. What had once been a grim picture had been changed, through the right methods of education for self-support, into a happy one. And it was this picture which remained with me, to inspire me later in my work at U.S. General Hospital No. 3.

After indescribable going to and fro, we finally obtained visas from the French Embassy and were ready to leave for France. On the walls of the embassy were two placards. One read:

Si j'avance, suivez-moi,
Si je recule, tuez-moi,
Si je meurs, vengez-moi.

The other read:

Il est une chose pire pour un soldat que de perdre du sang, c'est de perdre du courage.

That was our introduction to wartime France.

IX

PARIS, LIKE LONDON, was without lights, only the occasional dull glow of a street light. Everything was shut up by ten o'clock, and after that there was practically no one on the streets save for the theatre people and the street-walkers, of whom there was always a plethora.

On our way home from the opera one night, Dr. Crane was walking a few steps ahead of us. Two of these women came up to him, and not discouraged by his rebuffs, grasped him, one by either arm, and attempted to march off with their hapless victim.

Dr. Crane's wail of distress to my wife sent the women scurrying off. The presence of a woman was the only protection from these creatures, who infested the Paris streets throughout the war.

There were other contrasts between wartime London and wartime Paris. In London there were few able-bodied men to be seen. In Paris there were numbers of men in various types of uniform whose military duties appeared to be of the vaguest kind, though the war spirit had changed greatly in the past two years.

Friends of ours, who had been there from the beginning of the war in 1914, said that in those first months the defeatist spirit had been overwhelming.

Losses in man-power had been huge and the people were discouraged. As the Germans neared Paris, practically everyone prepared to evacuate, taking their belongings with them. They were convinced that the Germans would take Paris and there were many who were ready to talk peace.

But England had rallied them and by 1916 they were in a mood to fight to the end, putting up a desperate and magnificent struggle.

We were also told that when the Germans were about to enter Paris, the French put placards on the doors of all the houses occupied by Americans, reading: "Do not harm these people. They are Americans."

The picturesque little village of Ris-Orangis lies cosily on the banks of the Seine about twenty-five kilometres from Paris, on the main road to Fontainebleau.

Before the ravages of war, Ris-Orangis had been a wind-kissed flower garden, riotous with colour. A passer-by, however, could see only the cold, grey walls which lined her two streets and hid the beautiful gardens sprawled out behind them. Even the war failed to rob Ris-Orangis of all her beauty. Her women continued to wear full skirts with tight basques, and wooden shoes with which to plough through the French mud.

It was in her quaint simplicity that one could recapture notes of tranquil, bygone days. Her peasants were simple, honest folk who unquestioningly adapted themselves to the ways of nature. They had three unconflicting loyalties: love of God, love of country, love of home.

It is difficult to imagine what the incursion of the horrors of modern warfare meant to them. Modernity in any form had no part in their lives. The moving picture, the aeroplane, the automobile, the telephone did not enter their lives. They lived as their forefathers had done. The peasant is the world's greatest conservative. The only change he accepts unquestioningly is change of season. Politics do not affect him. Whoever may hold the reins of power, he has the soil, and he clings to it with unfaltering tenacity. City populations may wax and wane, war may sweep over a country and drive thousands before it. But the peasant remains, rooted to his land. When its peasants join the ranks of the dispossessed, a country is lost indeed.

Into this peaceful village of Ris-Orangis, early in 1914, came two Alsatian schoolmasters, who asked to be shown the college of the Marist fathers. The old monastery, deserted by the Marist monks at the time of the schism between Church and State, sat benignly upon a heavily wooded hill, just off la Grande Rue, overlooking the Seine.

"An ideal location for a school," remarked one of the Alsatians to the other as they admired the beautiful drives, arched with copper beeches and oaks, and vistas of blue skies stretching out endlessly before them.

His comrade agreed, a spark of real interest in his eyes, as he took note of the great grey stone building and its adjacent chapel set in this convenient, healthy spot.

A few days later they leased the property, and the stone walls of the monastery soon resounded with activity as the musty old building was being made habitable by the installa-

tion of a heating system, plumbing, and electric wiring. Materials arrived, and the villagers watched developments with interest and pride.

While the schoolmasters were busy with their renovating, another stranger in town rented an old mill, down the river Seine, for a distillery. Like the schoolmasters, he spoke Alsatian French, and the three soon became friends.

By this time, the fourth floor of the old monastery had been converted into a spacious dormitory and Ris-Orangis knew that its new school would soon be opened. Instead, however, with the first battle of the Marne, consternation reigned in the village as Germany began her drive on Paris.

The men of Ris-Orangis rushed to the aid of their country, but the Alsatian schoolmasters stayed, promising the worried fathers that they would look out for their children, and praying with the women that the German drive might fail.

Days of terrible anxiety followed, as the guns boomed nearer and nearer. Then, one morning, the awful rumbling ceased. The women rushed to the school on the hill to share the good news that the Germans had been repulsed.

Strangely enough, the schoolmasters did not appear. The excited peasants, searching for them in every room of the building, discovered amazing things. Signs of hasty departure, scattered leaflets in German, the new plumbing almost totally destroyed, dangling electric wires—and beyond, in a large wing that was supposed to be the dormitory, the remains of a fairly complete hospital, where army cots, bandages, and surgical dressings filling two large rooms, told the story.

The Alsatian "schoolmasters", secret agents of the German government, were gone, having deserted the now useless base hospital, which had been prepared in anticipation of the human wreckage which would necessarily have accompanied Germany's triumphal entry into Paris.

The aroused women ran from the silent but eloquent rooms, down to the old mill, in search of the "distiller". He too had vanished.

While Ris-Orangis was still heatedly discussing the strange events of the past weeks, a little group of people from three countries was being drawn together by a common ambition which was to have a great effect on Ris-Orangis.

Two Quakers from Sussex, Mr. and Mrs. J. Rickett, Lady Johnstone, wife of the British Minister to the Hague, and

Madame Bermont, a Parisian, were pleading with the Service de Santé for permission to establish a hospital somewhere near Paris.

They were finally given permission to take over either an empty cinema house in Paris or the deserted monastery midway between Paris and Fontainebleau. Upon investigating the latter, they were delighted to find that, owing to the thoroughness of the Germans in their recent occupation, they could recondition it with little expense and transform it into a hospital.

The strange history of the monastery turned another colourful page, and the erstwhile quarters of the German Red Cross became the Franco-British Army hospital to whose surgical staff I was assigned by the French War Office. The understanding was that it was to serve as headquarters from which I was to go, with my operating team, to various French military hospitals, demonstrating the bone graft methods.

The orderlies at this hospital, both British and French, were men who had been rejected by the army because they were physically unfit for military service. In spite of this, they encountered daily jibes and insults, both from civilians and from the wounded, for failing to do their duty in the trenches. Without attempting to justify themselves, these harassed, hard-pressed men continued to perform quiet, tender, and efficient service.

One of New York's best-known surgeons, Dr. Joseph A. Blake, was *Médecin-chef* at this hospital. He had been busy at the hospital base in Neuilly from the beginning of the war, performing magnificent work, and using his great talents in a manner which petty gossips had prevented him from doing at home.

Dr. Blake's crime, in the eyes of these malicious scandalmongers, was that he had married the former Mrs. Clarence Mackay, the once beautiful, vivacious, fashionable Kitty Duer, who had signed away a fortune to marry him. As a result of this romance, his New York practice had been hurt, and busybodies saw to it that he never returned to the pinnacle of his profession—a criminally stupid loss.

Like Alcibiades the Just, Dr. Blake found himself condemned by people who did not even know him. One day Alcibiades encountered in the streets of Athens an ignorant man who could neither read nor write, and who was doubly anxious,

therefore, that his opinions should be recorded. He asked the great Athenian to write the word "Alcibiades" on an egg which he handed him.

In those days, if one man desired the exile of another, he wrote his name upon an egg and cast it into a vacant lot. At a certain time, the eggs would be collected and counted. If an overwhelming majority desired that a certain person be exiled, the individual was promptly notified.

"Friend," said Alcibiades to the ignorant beggar, "how has this man injured you?"

"He hasn't injured me," replied the beggar. "I'm just tired of hearing him called 'Alcibiades the Just'."

And that may have been the case with Dr. Blake. He was a remarkable surgeon.

Three days before our arrival at Ris-Orangis, a consignment of sixty-five wounded had come in from La Chappelle, and the 210 beds of V.R. 76 were full.

The first thing that met my eyes on visiting the wards with Dr. Joseph Blake, was an array of wooden beams and frames, reaching from each bed part way to the ceiling, with weights and pulleys of every description. It was like stepping into a building under construction. Suspended in this forest of soft pine were hundreds of arms and legs, broken by gunshot wounds, or otherwise.

Some had gaping shrapnel wounds, others were riddled with machine-gun bullets, while some suffered from both. Over eighty per cent of the patients at Ris-Orangis had serious fractures. The fracture appliances were known as Balkan frames, and because of their name it was a joke that "the hospital had gone over to the Balkans". Little known before the war, these appliances had suddenly come into great demand owing to the peculiar complications which surround war injuries, particularly those which become infected.

The filthy condition of these poor men, as they came from the Front, is unimaginable to anyone unacquainted with war times and war zones. They had been in the trenches for days or weeks, with no opportunity to bathe or to change their clothing. They had been picked up, exhausted and covered with vermin. Not only were pieces of filthy clothing carried into their wounds by some penetrating missile, but the French battlefield, tilled for centuries, teemed with virulent bacteria.

One of the patients at Ris-Orangis had been wounded in both arms by a shell explosion in the Argonne drive. As he lay in a foxhole on the battlefield, with his arms crossed, the shell fragments drove his watch through his left wrist, and carried his toothbrush and comb from a breast pocket into the right arm, shattering the bone. This man ultimately made a very good recovery.

Many times soldiers had to give themselves first aid on the battlefields, and after the agony of waiting for the barrage to cease, sometimes as long as twelve hours, they were picked up by stretcher-bearers, who dodged barbed wires and enemy snipers, and finally carried the wounded to the casualty clearing station. The stretcher-bearers often had to command the wounded not to cry out with pain, lest the noise help the snipers to locate them.

To the shock of grim battle, and the agony of shrapnel wound, add a rough ride over muddy, rutted roads, and there you have a picture of the barbarous conditions that prevail in war.

At the casualty clearing station, the cases were "sorted" as to the severity and nature of the wound, the most critical ones being sent at once to the nearest evacuation hospital, or surgical tents, which each army moved as rapidly as possible from place to place as the line of advance changed.

The remaining wounded were placed in ambulance trains, which, before the entrance of the United States into the war, were for the most part cattle cars, *Huit chevaux, quarante hommes*, "forty and eight", and were sent to the evacuation base hospital which handled their type of case.

One of the strangest cases at Ris-Orangis was that of a soldier who, for two days, survived 169 wounds, only to die of cirrhosis of the liver.

Nearly every war fracture was "compound, comminuted", that is, the bone had not only been broken, but it was shattered in many places, if not completely blown away.

In these cases, it was necessary to remove fragments of shell, pieces of clothing, and splinters of dead bone. This was done by debridement, or other cleansing of the wound, which usually entailed further loss of soft parts overlying the fractured bone. The flesh from the outer portion of a man's thigh might be almost entirely blown away, but a sufficient amount of bone left, even though broken, might make it worth while to attempt

to save his leg. Such cases were so desperate that our first thought was to save the man's life, then, if possible, his leg.

Dr. Blake frequently stated that with a compound, comminuted fracture, danger of infection by the deadly tetanus and gas bacilli made the usual plaster, or other coaptation splints absolutely impractical and unsafe. "One does not," he said, "apply plaster over exposed bones, or shut in dangerous infection. Daily observation of the wound is necessary."

In the Second World War we started out with the opposite dictum—both in England and America, the Orr type of treatment for bone casualties is favoured. This involves first the cleansing of the wound by debridement (cutting out) or some other method, and then packing it with gauze impregnated with vaseline, after which a large dressing is applied, and on top of this a plaster of Paris splint.

On going from bed to bed at Ris-Orangis, I found inserted in a large number of wounds several tubes, with little stopcocks on them. This was my first introduction to the Carrel-Dakin method of sterilizing infected wounds. A few weeks later, I was to have the privilege of going to Compiègne and studying it with Dr. Carrel himself in his own hospital.

X

IT WAS DURING THAT SUMMER of 1916 that the Crown Prince, commanding the flower of the German army, launched an attack against Verdun, which for pure, diabolical cruelty and implacable ferocity had never been equalled in the annals of war. In this titanic struggle, millions of shells and mines were unloosed. In a single day, 55,000 French soldiers were mowed down, and within four months the Germans sacrificed 400,000 men.

This wholesale slaughtering of the world's youngsters filled all the available hospitals with crushed, mutilated victims, whom we were expected to patch up and, if possible, return to active service.

Perhaps it is as well that a surgeon in a military hospital is too overworked to have time to think. To use all the skill and ingenuity you possess to heal a shattered body so that it may

be useful again to stop more bullets, does not bear thinking of. And in the military hospitals of France there was no time for thought.

Military Hospital V.R. 76, at Ris-Orangis, buzzed incessantly with activity; and activity was a psychological necessity.

A great writer once came very near the interpretation of the madness that seizes nations and peoples, especially in times of war. "If thou wouldst bear the burdens of life," he said, "and stand up beneath the belabourings of Fate, then be thou drunk —on wine, love, ambition, hope, virtue, beauty, or poetry—or what you will, but be thou drunk. And if on the morrow thou wakest and findst thyself on the steps of a palace, or the green grass of a moat, or the recesses of thy chamber, ask of the clock that ticks, or the bird that flies, or the wind that sweeps by, or the waves that roll, or the cloud that floats, ask of all that lives and flies, what is the hour? And these things will say to thee, it is the hour to be drunk, and drunk without cease on wine, love, ambition, hope, beauty, or poetry—or what you will, but be thou drunk without cease."

Even with the bombs rumbling in the distance, like a continuous thunder, activity kept our minds nailed to our work. They say a man can get used to hanging, and in time we got used to that bombardment which started regularly at four o'clock in the morning. After a while it became almost a normal accompaniment to our work, and we ceased to have that hideous awareness that every blast carried death in its wake. It is difficult to describe the noise produced by that curtain of fire. No single gun can be heard firing; it is a terrible, steady roar on an almost unbearable scale.

Curiously enough, the only time I was really bowled over by the sound of exploding shells was after my return to America when a munition plant was sabotaged. That terrific racket went on for twenty-four hours until it seemed that all the munitions in the world must have gone up in smoke.

Mrs. Albee was assigned to Red Cross canteen work and to work in the bandage room, adjacent to the hospital. Here the butcher's wife and the lady from the château worked side by side with other village women who came in to spend a few hours after having prepared their simple meals, and closed their shops to help remake bandages. One doughty mother of seven soldiers in the army came in every day. A feeling of great comradeship flooded those hours of service.

That is another anomaly of war, that the greatest instrument of destruction known to man, whose incentive is hatred and whose tools are death, should inspire a unity of spirit, a sense of common purpose, a noble self-abnegation which man achieves under no other circumstances. It is the great paradox that men will die unhesitatingly and magnificently for mediocre causes. A quarter of this passion, this faith, employed constructively before the event might shape our blundering world very close to a utopia.

Unhappily, this self-abnegation was not always accompanied by efficiency. Many bandages sent from the United States had to be remade to meet war emergencies. More fervour than efficiency had gone into their making. This was true too of knitted articles, which were gratefully received by the boys in the trenches, but which occasionally caused great merriment. Even the terrors of war failed to dampen the humour of the recipients who tried to wear some of these well-meant knitted articles. One soldier, finding the name and address of the donor of his pair of knitted woollen socks, expressed his appreciation to the lady thus:

Dear Miss,
I thank you for the sox,
Some fit!
I used one for a hammock,
Another for a mitt.
Some day I hope to meet you
When I have done my bit . . .
But in the meantime, tell me
Where in the H——
Did you learn how to knit?

Time and again, after zigzagging crazily over war-ravaged roads, we would tear into St. Georges Station, about ten miles from Ris-Orangis, to meet a fresh load of wounded soldiers.

Above us the whirr of aeroplanes indicated that French Aces were leaving the huge army aerodrome and speeding towards the Front.

On the station platform, doctors, nurses, and canteen workers from Champrosay, Juilly, Corbeil, Villiers-sur-Marne, and Viry-Chatillon, neighbouring hospitals, were waiting to help sort the wounded and take their quota.

The ambulance train, carrying the wounded, would chug clumsily into the station, and then there would ensue a period of switching, moments of great agony for the wounded, before the engine could manœuvre its cars into favourable unloading position.

There were usually ten cattle cars, each carrying eight wounded men. Later, with America's entrance into the war, transportation facilities for the wounded were much improved.

The injured men were removed from the straw pallets on the car, and were then carried on stretchers by the orderlies to be sorted out on the freight station platform. How did they bear it, these men fresh from the Somme—with legs blown off, faces mutilated, skulls fractured, arms dangling limply?

Yet they never complained, except to murmur occasionally: "*Doucement, mon dieu, doucement,*" to the stretcher-bearers.

As the canteen workers offered them cool drinks and cigarettes, the smokes almost always got the preference, and suffering faces gradually relaxed into wan, weary smiles. The wounded were then hastily catalogued as to type of injury and rushed off to the designated hospital.

At Ris-Orangis we had three groups of doctors, nurses, and canteen workers—labouring day and night in eight-hour shifts. The patients were usually alive with cooties, and had to be washed and deloused before dressing or operation could be performed. After this process, the most urgent cases were rushed into the operating room, while others were put into Balkan frames, and the Carrel-Dakin treatment applied. With fresh contingents of wounded pouring in, this procedure was an endless one.

The French and British governments furnished the hospitals with cigarettes by the yard. These were long white "ropes" made from the trimmings of tobacco at cigar factories. From these the wounded could cut their own smokes and lapse into contented reverie.

Mrs. Joseph Blake, wife of the *Médecin-chef*, went tirelessly from bed to bed in the wards, reading and writing letters for the wounded and the illiterate. She kept records of the relatives of each patient, and in the case of death, broke the news as gently as possible to the families. She won the gratitude and admiration not only of the soldiers, but of all of us.

At Ris-Orangis I met another splendid and unselfish woman. One day a technician in the bacteriological laboratory, a Miss

Mary Davies, called on me. Miss Davies was a highly educated woman who, though she was not a doctor, had, since the beginning of the war, been experimenting under the Robert Walton-Goelet Research fund, in a determined effort to find a potent germicide with which to combat the gas bacillus.

Miss Davies believed that, if the clothing could in some way not only be sterilized but, for an extended time, fortified against contamination by living bacteria such as the gas bacillus as well as other types of infection, many lives would be saved.

She had, therefore, for some time been carrying on experiments, consisting of implanting in the muscles of animals bits of fabric taken from the filthy uniforms of wounded soldiers fresh from the trenches. Into another group of animals she was implanting bits from uniforms which had first been laundered in the usual way and then immersed in one of the creosols, a coal-tar product, a very active germicide which would not only penetrate the fabric and kill any existing bacteria, but remain in the fabric active as an anti-bacterial agent or germicide long after the soldier had returned to the trenches.

The differences in the reaction of the animal tissue was striking. The untreated fabric caused infection and abscesses so virulent that the life of the animal was endangered, whereas the treated fabric caused practically no reaction.

Miss Davies, therefore, recommended that the French army should issue a general order calling for the chemical treatment of all uniforms as a preventive of infection following injury.

The wisdom of this young woman's conclusions was apparent. But because she felt that the experiments on animals alone would not be sufficient to convince the War Department, she wished to confirm her findings on human subjects. Her sincerity was evidenced by the fact that she offered to submit herself and a friend who was also interested in the undertaking, as the human subjects for experiment.

As she was not a doctor, she had come to me, believing that if I would conduct the experiments or sponsor them, there would be no difficulty in assuring publication of the results, which would, she hoped, lead to a general germicidal treatment of uniforms before men wore them into the trenches.

Unfortunately, I was not to be at Ris-Orangis long enough to make this feasible, and Miss Davies never got authority from the War Department to give her apparently sound theory

a trial. I thoroughly believe, however, that some such method will be adopted in future wars, the soldier's uniform being sterilized and impregnated with chemicals to keep it so. If it is the entrance of soiled fabric into wounds which causes these terrible, fatal infections, such a procedure would be only common sense.

It is interesting to note that in the Russo-Japanese war, the Japanese soldiers were required to take a bath and put on freshly laundered clothing from the skin out before going into the field of battle.

Now and then we tried to break the strain by having picnics. On one occasion we stumbled into a trench built by the French in the fall of 1914. It was completely hidden from the road by tall grass, and camouflaged with brush and small limbs of trees so that, although nearly six feet deep and about three and a half feet wide, it was entirely invisible.

We climbed down into the trenches and walked from them to the dugouts. These dugouts had beams overhead and rough sleeping bunks on the sides. Standing on the bottom of the trench, one could not see out; but from raised ground, on one side, it was possible to see just over the edge without unduly exposing the head to the firing of the enemy. All along this road were huge piles of broken stones, ready for use as bases for the French seventy-fives.

One evening, just before visiting Dr. Alexis Carrel at Compiègne, I was summoned to Paris to operate on a lad with a very serious ununited fracture of both bones of his left leg at L'Hôpital Marie Lannelogne. It was the type of injury which tempts many a surgeon to amputate. The fragments were badly out of place with a great deal of shattering and loss of bone. I pulled the principal fragments into position, and then, with my electric twin saw, cut a bone graft four inches long from the upper fragment of the tibia, and slid it into the lower fragment, thus spanning the nonunion and hiatus caused by loss of bone.

The graft was immobilized in place with kangaroo tendons which I had brought with me from America; the smaller fragments of the bone were put into as nearly normal position as possible to stimulate bone growth, then the plaster of Paris was applied. I am thankful to say that this boy's shattered leg was not only saved, but ultimately restored to good function.

The great strength of kangaroo tendons is evidenced by the fact that the kangaroo uses its tail to propel it in running, and that it serves as a third leg of a tripod when he boxes. A single kangaroo tail may be separated into a hundred strands of various sizes, which can be easily stripped apart and sterilized.

Kangaroo tendons, as a fixative agent for bone, have the following advantages: They are much stronger even than catgut, silk, or silver wire. They are absorbable, but not too rapidly so. They remain in bone for upwards of forty days, and then begin to disappear. They can be tied in a firm, tough, non-slipping knot. They do not stretch, as silkworm gut does. Finally, kangaroo tendon is comparatively easy to sterilize and is not at all irritating to the tissues.

Compiègne is a pleasant little village sprawled on the banks of the River Oise, about two hours' ride north of Paris. It was on the bridge of Oise that Jeanne d'Arc made her last gallant fight and was captured. Her spirit still dominates the town, and she lives on in many a local legend. Her name is commemorated in the great tower and the street of Jeanne d'Arc.

Being so near the Front, we expected to see Compiègne shorn of its beauty. We were amazed, however, to find that it was completely unharmed. The villagers later explained that the reason for this was that the Crown Prince had planned to live in the historic palace, whose tapestried walls looked down on the romantic adventures of Louis XIV, Marie Antoinette, and Napoleon I.

Our hotel at Compiègne had seen many exciting days. We were told that on August 23, 1914, General French of the British Army had quartered there, and five days later, a few hours after he had left, German officers were occupying the very beds in which we slept. The officers remained seventeen days, drank all the champagne in the hotel cellar, and wrecked the elevator. But aside from a few "souvenirs" which they took away, the town was relatively unharmed.

However, when General Pétain of the French Army headquartered at the palace in 1918, the Germans turned their guns on the town and shattered many buildings.

It was in Mrs. Depew's château-hospital that Dr. Carrel was waging his battle against wound infection, and this was

no easy matter at the best for the town was alternatively occupied by French and German troops, depending on the line of battle.

I was most anxious to see Dr. Carrel again. At Ris-Orangis the staff had been most enthusiastic about Dr. Carrel's method of treating infected wounds, and I wished to learn his technic in every detail.

Carrel had devised a method of carrying an effective germicide (Dakin solution) into every recess of an infected wound; and practically every wound which resulted from high explosives was at least potentially infective. It was his dream to eliminate from military surgery the dreadful suppurating wounds which had been so common in the Civil War.

Tuffier, the noted French surgeon, had found, at the Maison Blanche Hospital in Paris, that nearly seventy per cent of the amputations done were undertaken not because of the extent of the wound, but because of the virulency of infection, and he was enthusiastic about the Carrel-Dakin method.

Pozzi of Paris had presented several papers on its efficiency before the Academie de Médecin, but these had been met with levity on the part of the ultra-conservative members.

I found Dr. Carrel working tirelessly in the hospital wards by day, and in his laboratory at night. His patients, fresh from the Front (only a few miles away) with extensive wounds, were in much better condition, however, than the patients of Ris-Orangis, who had to travel much further before infection could be stemmed.

At Compiègne, great care was taken in dressing the wounds. If a patient had several wounds, fresh forceps were used for each wound, to avoid the danger of cross-infection.

The virulent bacteria which impregnated the soldiers' uniforms, were classified as anærobia, and ærobia. The former flourished without free oxygen, and the latter required oxygen to keep them alive.

Efficient treatment of infection from anærobic bacteria (tetanus and gas bacilli) consisted of opening the wounds to expose the bacilli to air, free drainage, and immediate administration of a prophylactic dose of anti-tetanic serum. If this was not done, death from ballooning of the tissues within thirty-six hours was certain, for the rapidly inflating gas carried gas-producing bacilli further into the tissues, until the whole body filled up with extremely toxic poison.

In October 1914, the Medical Department of the Allied Armies gave every soldier a shot of anti-tetanic serum, and under the direction of Dr. Roux of the Pasteur Institute, 160,000 doses of this serum were prepared. As a result, lock-jaw, which had claimed nine out of every thousand troops in September 1914, afflicted but one in every two thousand in October 1916.

In developing a chemical to kill these dangerous bacteria, great difficulty was encountered, as a chemical powerful enough to do that might, at the same time, destroy the human tissues which harboured them.

Realizing the need for such a chemical, Henry H. Dakin, an English chemist from Leeds University, devoted many months in 1914 and 1915 to the development of a solution which would lay bare bacteria in the deeper recesses of the wound, and at the same time not harm the wound tissues.

He evolved the hypochlorite solution known as "Dakin's Solution", composed of chlorinated lime, sodium bicarbonate, boric acid and water. In contact with the wound it would dissolve away the exudate and discharge of the wound, and give off a nascent, or fresh chlorine, which would then penetrate every recess and kill the virulent bacteria.

After Dakin had persisted until he had found a desired strength which would neither irritate the wound nor burn it, Dr. Carrel devised a formidable-looking apparatus, with tubes, flasks, pinch-cocks, and glass connectors, which instilled the powerful germicide into all parts of the wound.

In freshly lacerated wounds, tissue fragments and foreign bodies were carefully removed by the surgeon, the wound explored and cleansed, and all parts made accessible to infiltration by the antiseptic solution.

To insure the proper concentration of the solution, the pinch-cock on the rubber conducting-tube was opened from one-half second to three seconds every two hours, both day and night, in order to soak the dressings and fill the wound. Sterile gauze compresses and tampons, moistened with Dakin's solution, were then inserted in such a way as to cover the entire wound surface and hold the tubes in place. Vaseline compresses were placed over the skin at the margins of the wound to prevent irritation.

"From the month of September 1915," Dr. Carrel told me, "it has been possible to do away with practically all suppurat-

ing (pus-exuding) wounds in hospitals. By means of the irrigations, ugly wounds can be made red and glistening with healthy granulations and the bacterial count grows lower and lower.

"However, my method has met with so much opposition from certain individuals at the head of the medical profession in France that it has been applied scarcely anywhere outside of Compiègne and La Penne, where Dr. De Page, a noted Belgian surgeon, is using it and is most enthusiastic."

Dr. Carrel had voiced the universal cry of all those who have pioneered. He had devoted his days and nights to devising means of saving lives and limbs, but members of his own profession were condemning him without fair and accurate trial of his method. Even in those days of crying need, petty jealousies flouted the efforts of the humanitarian.

The pioneer's greatest stumbling-block is jealousy. When the Almighty passed out jealousy, he gave most of it to the medical profession. This is not always the case, of course, nor does it account altogether for the caution displayed in accepting new ideas. There are strong and sound reasons for such caution, such as the fear of coming to hasty conclusions, and the danger of charlatanry. There is so much yet unsolved in medicine, so much unproved. It does not have the comforting concreteness of other fields, such, for instance, as the law, in which the rules are neatly entered on the statute books.

Occasionally, but more rarely, failure to accept new ideas is a form of self-preservation on the part of men who are unable to adapt themselves to new theories, new methods, new technics.

Lister was scoffed at, and only by persistent effort against opposition was he able to give to an ungrateful world the benefits of antiseptic surgery. Even in America, the older surgeons were slow to adopt it. Dr. William Keen told me that as a young man he had been severely reprimanded for attempting to use the Listerian method.

The unnecessary suffering, and loss of limbs, disturbed Dr. Carrel. The libellous and stupid opposition of members of the medical profession dissuaded younger surgeons from resorting to this method. And those who were loudest in its condemnation were those who had failed to learn and carry out the details meticulously and consequently did not get favourable results.

However, Dr. Carrel refused to be downed, and pushed ahead until, in 1917, the merits of the Carrel-Dakin method were generally recognized, so that Dr. Keen wrote: "Every surgeon in the various military and naval forces, and also those in civil life who have to do with industrial and other accidental wounds, should know this technic by heart, and practise it with exactness. They will be rewarded by a most gratifying success."

Working side by side with Dr. Carrel was his wife, who kept records of cases and methods. She was then preparing the book, which came out in 1917, describing the Carrel-Dakin method.

Among Dr. Carrel's staff was an expert mathematician, who could predict to a fairly accurate degree just when the healing of a wound would take place. He would place a plantarscope on the wound, over thin, sterilized, prepared paper, and the marked curves would indicate the progress of healing. In this way he found a close relationship between the healing time and the degree of infection of the wound. This interested me, as it suggested a possible way of measuring return of function following joint injuries. This same method was later worked out by one of my staff at United States Army General Hospital No. 3.

During our visit with Dr. Carrel, we decided to look in on my friend Dr. Henry Lyle of New York, who was stationed at the field hospital at Château D'Annel. With carnets in our pockets from the French War Office, Dr. Crane and I anticipated no difficulty, but Dr. Carrel shook his head upon inspecting our passes.

"We are so near the Front," he said, "that all train connections between Compiègne and Longeuil Annel have been stopped. And you can't possibly go on foot."

"But why not drive?" we asked, knowing that a car was the most privileged of all conveyances in wartime, and could go practically anywhere.

Dr. Carrel smiled. "Your permits," he said, "read *Par chemin de fer ou à pied*, by rail or afoot."

But Dr. Carrel had an army chauffeur, an ingenious fellow, Pierre Magnier, who in civil life had been one of the finest actors on the French stage. When our predicament was explained to him, his fertile mind set to work and evolved a plan.

Driven by Pierre Magnier, we approached the sentry posted at the entrance to the zone of the armies near Longeuil Annel, and although the fellow signalled frantically for us to stop, our chauffeur slowed down just long enough for him to see two army passes pressed against the window of the automobile by a couple of half-visible occupants, and as Pierre's gesticulations indicated some tremendous emergency, we cruised by him at a terrific speed before he could shake the dust out of his eyes. The sentry, however, had noticed the official seal of the car, and reported the matter to headquarters.

It looked as though we would have to walk back, but the invaluable Pierre put his thinking cap on while Dr. Crane and I visited with Dr. Lyle.

The château at Longeuil Annel had belonged to the nephew of Chauncey Depew. When the Germans, under General von Kluck, occupied the village in the latter part of August 1914, they had placed a sentry at the gateway of the park, and told Mrs. Depew that if any German wounded came there, she would have to take care of them. Mrs. Depew replied proudly that she would have done this in any case. Shortly afterwards, she converted the château into a hospital for the Allies.

It was only three miles from the Front, and there were no other casualty clearing stations, so the château-hospital received a great many patients directly from the trenches. There were fifty-six beds, a small efficient staff. It was completely modernized. Work went on at the château, day and night, in three eight-hour shifts, as at Ris-Orangis. Serious wounds, not likely to prove fatal, were dressed and tagged for another destination.

As we passed through the wards, Dr. Lyle pointed out a patient who wore the most harrowing expression I have ever seen. He had lain on the battlefield for thirty-six hours between two dead comrades, the stretcher-bearers being unable to reach him until the German barrage had ceased. He had received fourteen wounds, and at last had to feign death in order to escape being shot. He eventually crawled to safety, and no doubt later recovered, but he represented then one of those terrible cases of shock to the nervous system that afterwards filled our insane asylums.

The tension induced by the constant bombardment, and the unbearable strain of trench warfare produced strange nervous disorders in the soldiers, sometimes causing an apparent

paralysis of one side of the body; sometimes a shaking of the head or a rolling of the eye.

We saw two small boys who had found an unexploded German bomb, and trying to find out what was in it, lost most of their arms and legs, so that between the two of them they hadn't enough fingers, arms, or legs for one.

I inquired about the incessant wailing and howling of the dogs at d'Annel, and learned that half-starved dogs were released from time to time in the dugouts to kill off the rats which were making the poilu's life miserable by their multiplication. There was a standing order from Headquarters for hungry dogs and ferrets.

When the French guns, located in the rear, shot over the château-hospital, it sounded like a fast express train going over one's head. During a brief lull in bombardment, we took a look at the trenches, which were well-made, with floors of brush, and a good attempt at drainage. Beside these trenches stretched the broad green lawns of the château with its beautiful winding driveway, and stately forest in the background. It seemed like a mirage.

After exchanging our felicitations, we were reminded about our predicament of returning home. But Pierre, our trustworthy chauffeur, suggested that we ride in the automobile until just before coming in the range of the sentry's vision, where we could get out and walk. He would go on in the automobile and wait for us around the next bend.

The sentry was waiting for us, and we could not help but discern a very belligerent attitude. We mustered our most carefree manner and expressions of wide-eyed innocence. We looked, if I do say so, like men with the best of consciences.

As we presented our carnets, he glared at us accusingly. Observing a good coating of French dust on our shoes, he said nothing, but I think he was greatly disappointed at being foiled of his earnest desire to clap us in irons.

Wishing him the top of the day, we walked another dusty kilometre or so, and there, around a curve awaiting us, was our faithful and clever Pierre, the actor-chauffeur.

XI

DURING MY FOUR MONTHS' STAY in France, I visited over forty hospitals. It was a great paradox that the First World War, which brought into use, through the efforts of science, new and hideous methods for the destruction of human life, at the same time helped to develop technics for rebuilding shattered bodies which were new to medical science and which restored to normal life—at least in some degree—men who otherwise would either have died or have been horribly maimed.

While credit for this work in reconstructing human bodies must go to physicians and surgeons in every country, much of it belongs to the American medical men who, during the First World War, came into their own. Before that, they had gone to Europe as pupils. Now the European doctors came to them —to learn. Particularly in the fields of sanitation and surgery, the American contributions to the war were incalculable. It was the first war in which more men died from wounds than from disease. The lack of sanitation which had, in the past, cost so many lives in camp, was largely eliminated by American methods.

Richard Strong abolished typhus in Serbia. Harvey Cushing brought his vast knowledge of brain surgery to the American Hospital in Paris. Richard Harte did magnificent work in plastic surgery at the same institution, these men gave their services without compensatory payment.

In the First World War alone the use of the bone graft concept saved enough limbs to fill a large building, restoring to active life men who otherwise would have been permanently crippled.

One curious effect of widespread knowledge of the bone graft was that it frequently saved the limbs of men who never had a bone graft operation. In the past, any extensive loss of bone from gun-shot wounds had been treated automatically by amputation. Now, however, doctors who knew of this method of restoring bone hesitated to amputate. Perhaps, they thought, this man can have a bone graft later and so regain use of his arm or leg.

As it happened, however, there were cases in which the shattered fragments of bone in the patient's leg reformed in the

course of time until the bone was strong enough to endure the stress put upon it, and no graft was necessary.

St. Cloud, almost a suburb of Paris, lies slumbering on pleasant hillsides, and for centuries has gazed placidly at the restless Seine lapping her foothills. Known all over the world for beautiful porcelain, St. Cloud is one of those chameleon towns that can shed her artistic garb and put on a military one without losing her own intrinsic charm.

It was fitting that the great Canadian Hospital should be established at historic St. Cloud, where the spirit of that self-styled "Child of Destiny", Napoleon Bonaparte, could look down from his palace upon a sea of portable huts and tents, dotting the verdant hillsides like mushroom plants. This was war on a scale which must have embarrassed that wager of wars, destruction such as he had never contemplated, an attempt at world domination which made his own ambitions paltry.

While we were visiting St. Cloud, the wounded poured in from the rapidly shifting battlefields. Spurred by an acute need for more beds, Lavalle University Hospital, adjoining the Canadian Hospital, speeded up work on the thousand-bed project then under construction. The Canadians stood staunchly by their British brethren, and the hospital at St. Cloud was only one of the many maintained by them. Canada sent doctors and nurses by the hundreds, and her laboratory on wheels, at Le Touquet, was among the wonders of the war.

Every great drive brought its burden of wounded, and surgical teams worked continually, devising new methods of operation. As I toured from one hospital to another, I was more and more aware of the crying need for trained surgeons.

From St. Cloud we went to Lycée Pasteur, a French school which had been in the process of construction at the outbreak of the war. Through the efforts of Ambassador Herrick, Robert Bacon (his predecessor), the Vanderbilts, Morgans, and other prominent Americans, Lycée Pasteur had been converted, in eighteen days, from an unfinished, windowless, rubbish-filled structure, to an American War Hospital, known as Ambulance A, ready for occupancy before the Germans reached the Marne.

Ambulance A had 650 beds, 500 of which were filled at the time of our visit. The X-ray rooms and surgical amphitheatre were the last word in equipment. The speed with which Lycée

Pasteur was transformed into an American War Hospital wrung warm praise from the London *Times*.

"The organization of the hospital at Neuilly," it said, "was remarkable. Upon this plan all the great war hospitals were afterwards conducted. Indeed it is true to a great extent that the Americans led the way in the great new movement towards the perfect military hospital which the war instituted."

I was called on to do an unusually large number of bone grafts in restoring portions of the jaw. In the early days of trench warfare, the French soldiers failed to understand the menace of the machine gun. They seemed to think they could pop their heads up over a trench and move quickly enough to dodge the hail of machine-gun bullets. By the time they found out that this was the wrong idea, head-wound cases were filling the hospitals of France. If the men were hit higher up, of course, they were usually beyond medical help, but the others were in horrible condition.

Most of the jaw cases were turned over to me. Of all bone restoration surgery, it is the most difficult. The jaw bone is as hard as ivory. It will not break or split. If you take a chisel and hit it with a hammer, there is no anvil stability. The jaw simply recedes. Some of the men literally had their faces shot away. It was our job to repair them, not only so that the victims would no longer be horrifying to look at, but also to restore, as far as possible, the functions of their faces.

Hundreds of soldiers who would otherwise have been too revolting to appear on the street, were restored to something like their old appearance by papier-mâché noses; rubber ears, coloured like flesh and almost as pliable; jaws made out of ribs, tibia or pelvic bone.

Some of these patients were pitiable to look upon. The whole side of their face would be blown away. But out of such wounds, which taxed the surgeon's ingenuity, were born the tremendous advances in plastic surgery.

Medical science, side by side with nature, reconstructed these unfortunates so that they did not need to hide themselves from public stares of mingled pity and horror.

One jaw case at the Hotel Pantheon, in charge of Dr. Sorrel, was so badly shattered that there was a gap of more than two inches between the left fragment and the tip of the other fragment at the centre of the chin.

Dr. Sorrel had already done the necessary, preliminary

plastic work on the soft parts, so that the case was ready for bone graft. I took a U-shaped graft from the pelvic bone for the purpose of replacing loss of jaw substance, and by carefully mortising the ends of this graft into grooves in the jaw fragments, which had been prepared by the motor-driven twin saw with cabinet-maker's exactness, we were able to restore the contour of the patient's face. The surgeon, the plastic surgeon, and the dentist co-operated in the reconstruction of the face.

Facial reconstruction amounts essentially to sculpturing with live tissues for material. Therefore, when transplanting bone and soft tissues for repair of the nose, cheek, or jaw, one must combine mechanical dexterity with artistic feeling for the desired cosmetic result.

Many of these patients had to be bolstered up by blood transfusions. Almost all of them suffered a terrific loss of blood while crawling to aid across No Man's Land, and later lost more blood in hæmorrhages on the way to the field and base hospitals, in ambulance or cattle cars.

One of the most brilliant operations I saw in Paris was one performed by Dr. Moreston, the noted plastic surgeon. At the Rothschild Hospital where he operated, three hundred beds were distributed in three pavilions, one of which was devoted entirely to plastic work on the face.

I saw Dr. Moreston mould a new nose and eyebrow for a French boy. By grafting a piece of rib, he formed a bridge for the nose and covered it with a flap of skin and soft parts brought down from the forehead. All this work was done under local anæsthetic. Afterwards, in the wards, I saw the end results of the plastic facial surgery, which was truly remarkable.

In such work, the sculptor was of great assistance to the surgeon. By making a cast of the wounded man's face from a good photograph, taken before he was wounded, the surgeon was usually able to reconstruct the badly mutilated features in such a way that his relatives would recognize the patient. Such an accomplishment was one of the great human profits of war which benefit civilians to-day. By this means, ears, noses, mouths, were reconstructed and disfigurements removed so that the patient could resume something approaching normal life.

Eyes could not be replaced with seeing eyes. The restoration of noses that would smell, ears that would hear, mouths and jaws that could eat and talk, was the limit of the medical man's ability.

Of course, there were often scars left as a result of these operations, but a scarred face is a small matter compared with a gaping hole where a nose or a mouth has been.

Man's ability to repair, it would seem, must always lag a little behind his ability to destroy. But a tremendous advance, at any rate, was made in our knowledge of what could be done in reconstructing the human face. The psychological effect on a man who must go through life, an object of horror to himself as well as to others, is beyond description. It is, in a lesser degree, difficult to adjust himself to a new and different face which does not greatly resemble him. It has a terrible effect on his mind and spirit, because he tends to lose the sense of his own familiar personality. It is a fairly common experience for the maladjusted person to feel like a stranger to his world. It must be unmitigated hell to feel like a stranger to yourself.

At last our permits for the war zone arrived, and we lost no time in starting on our seven-hour journey towards the Somme, where the drive was raging. Practically everyone on the train was a soldier. We passed camp after camp of cavalry, artillery, and transport trains. Moving regiments appeared in every direction.

At Amiens, just thirty-five kilometres from the Front, English hospital trains began to pass us. The river was covered with hospital barges carrying the wounded quietly down the stream without the jolting of trains or ambulances.

Within two miles of the Front you could not only hear, you could feel the vibrations of the firing. Near the Front, the camps were camouflaged to look like trees. One railroad engine that passed us had been covered with canvas painted like woods and foliage to deceive the enemy.

In order to throw German aeroplanes off the track of munition supplies and movements, a forest of trees was painted on a canvas, which was stretched over the main road where the munition supply was moving; and about a mile away, another canvas was stretched, painted to look like a road, with holes through which natural foliage was allowed to protrude at the "roadside".

The army vans moved cautiously along the rear road under the protection of the canvas trees, while the enemy planes, as the artists had hoped, directed bombardments towards the

canvas road, a mile away. Later, at Châlons-sur-Marne, I travelled over a similarly camouflaged road.

Calais, which two years before had been the playground of the rich, where European society gathered to frolic, had now been transformed into an army base for wounded soldiers. The great casino was filled with the wounded, as well as the bathing houses. Where once the baccarat wheels had spun, the surgeons now gambled with death. Ambulance trains rolled in, day and night, and the number of the wounded rose to tens of thousands.

At Boulogne the great casino, as well as the palaces and monasteries had been converted into hospitals. All were overflowing.

At Etaples, we passed a mobilization camp, busy with drill, bayonet practice, and barricades. Passing a huge British camp, we saw an army burial, touching in its simplicity—just the priest, a few comrades, and that was all.

At Etaples we drove to see the famous Canadian General Hospital. Surrounding a perfect sea of tents were beautiful flower gardens in full bloom. Mile after mile, there stretched before our eyes thousands upon thousands of tents and huts, and under them lay 20,000 wounded men. Pharaoh's hosts, camped on the deserts of Egypt, could not have seemed more overwhelming in numbers than this tent city in the fields of France.

Besides the Canadian General Hospital, there was a British General Hospital, and a few miles away, at Camils, was the Harvard Unit No. 22. Among them, they cared for a total of 70,000 wounded. For whom could there be a victory when the youth of the world lay stricken?

At dusk, rain or shine, the British troops engaged in sham battles in which real bombs were used. Occasionally, men were wounded or even killed in these battles, as a result of holding bombs or hand grenades too long. But, in the long run, such intensive training saved lives by sending well-equipped men into the trenches.

One tale of German atrocity came to me here, at first-hand from the victim himself.

Dr. Calot had an assistant, the left side of whose face was paralysed. It seemed that he had been captured by a German captain who, not satisfied with taking a prisoner, deliberately shot him in the head. The bullet entered his skull, back of one ear, and came out on the other side under the eye, dazing him so that he spun around and fell. Just as the German was about

to shoot him again, one of his subordinates knocked the revolver out of his hand, shouting, "brute!"

When the young assistant was able to move—he was carefully nursed in a German hospital—he was placed in front of the German regiment as it advanced upon the Allies.

Knowing that his only possible chance for escape lay in making a dash for the French lines, the assistant did so, and although a French sentry, not recognizing his nationality, shot at him; he missed. The young man reached the lines in safety.

His wound had healed and there had been no infection. This only goes to show that a bullet at high velocity will do much less harm than a slower, rough-edged missile, such as a flying piece of bomb. Furthermore, because the wound was in the face, no bits of soiled uniform had carried infection into the wound.

Returning from the hospital, we hoped to proceed to Belgium to Dr. de Page's hospital. However, a great disappointment was in store for us. Monsieur Didier of the Belgian Red Cross greeted us with news that "something important was doing", and it was impossible for anyone to get through to Belgium. More than this, he was not permitted to say. Later we learned that it was indeed "important". It was the great German offensive on the Somme.

In a single night over 200,000 gas shells fell. It was as real a hell as there can ever be. About this same time, 9,000 men on the Italian front, billeted in a low valley, were killed overnight by gas, and with them every living animal. This was a crowning success for the Prussians, who had spent fifteen years in perfecting the gas with which they hoped to win the war.

Daily, village after village was ravaged, and its inhabitants either slaughtered or so scattered that their names were struck off the list of communes. Helpless human hulks staggered back to their villages, only to find them deserted and pillaged, their wives and children lost.

XII

DR. THIERRY DE MARTEL, one of the famous Parisian surgeons, had asked me to make a demonstration visit to the war hospital at Châlons-sur-Marne, which lay in the heart of the war zone.

Here, he said, his colleague, Major Hitz-Boyer, Chief Surgeon of the hospital, had lined up several cases of wounded soldiers needing bone graft and reconstruction operations. Would I please operate on them?

Dr. de Martel left me with the understanding that he would not only arrange for our visit to the Front hospital, but would escort me there himself. For days, I waited to hear from him. But no word came. Finally I learned that on the day following our conversation his only son had been blown to bits at the Front, and Dr. de Martel was in a state of collapse.

When the Germans took Paris in the Second World War, Dr. de Martel, rather than face internment, committed suicide. This is another tragic example of the irreparable losses civilization has sustained through the hideous and ignorant outbreak of prejudice and war. For Dr. de Martel was one of the truly great doctors. He gave his energy and his fine abilities without stint to those who needed them. His death in the face of the advancing hosts who sought to destroy men of his stamp is a blot which the world must strive hard to wipe out.

While I was waiting for arrangements to be made for me to go to the Front, Captain Pariseau, a Canadian officer, decided, quite erroneously, that I was in need of entertainment, and hustled me over to Bar-le-Duc. Here he induced a French Ace to take me over the enemy lines in a war plane. Before I knew what was happening, I was strapped in the machine gunner's seat, in front of the pilot.

As we zoomed up into the air, I clutched the machine-gun for all I was worth. The French Ace had apparently made up his mind to entertain me if he had to kill me to do it. He looped the loop, he did a tail-spin, flat-spin, barrel roll, falling leaf and reverse. When I thought it was all over, and began to hope timidly that we might, after all, come down to the blessed, solid earth intact, he tapped me on the shoulder and pointed downwards. I closed my eyes tightly and then peeked cautiously over the side. Far below, I saw the remains of a plane which had been shattered a day or two before. I have never seen a less encouraging sight.

After we had soared up again, he tapped me and pointed to a man cutting wheat in the field below. Then he opened up and swooped down so close that the reaper flattened himself out on the ground in fright. Having made an Immelman turn, he zoomed up again.

After this workout, the flight over the lines was comparatively tame. I was prepared for anything, even to being shot down. It's amazing how long a man can live without breathing. I know I drew my first breath when I was unstrapped at Bar-le-Duc.

Shrouded in inky blackness, we arrived by train at Châlons-sur-Marne an hour past midnight. As petrol was being conserved for ambulances, there were no taxis, and we stumbled in darkness along unfamiliar, narrow, cobble-stone streets, taking turns at carrying the heavy case containing my electric bone mill outfit and our luggage.

At last, we discerned something that looked like a field hospital, and the ghostly silence of the black night was shattered by the raucous hospital doorbell, as we rang it.

The night watchman who admitted us was an elderly man with a cultured voice and gracious manner. The field hospital, it appeared, had been a French college, and our night watchman had been its President. Too old to go to the Front, and devoted to the college and the village, he had offered his services to his government and the hospital as a night watchman.

After I had left my bone mill with the resident surgeon and given instructions as to how the operations scheduled for the next day should be prepared for, the watchman-president insisted on taking us to Major Hitz-Boyer's house, in spite of our protests over the lateness of the hour.

In response to our ring, Major Hitz-Boyer appeared in his lounging robe on the balcony. Upon learning our identity he threw kisses of greeting at us. We arranged for a clinic and six bone graft operations at three o'clock the next afternoon.

Then we hurried to the hotel, provisionally reserved for us by Major Hitz-Boyer. We needed some sleep before our heavy day. But upon reaching the hotel, we found that the divine Sarah Bernhardt had arrived to entertain the soldiers at the Front. At the moment, she was occupying our room, while her troupe filled all the other available space.

Questioning the divinity even of a Bernhardt, we turned back into the dark streets, and about three o'clock in the morning, with the help of the night watchman, we found another lodging-place. Persuading the hotel porter to sell us his night lunch of hard bread and light wine, we devoured it, and tumbled wearily into bed.

The second battle of the Somme had been raging for several weeks. In a determined effort to restore the morale of the French Army, the General Staff had started a return offensive, in preparation for which they built a huge casualty clearing station, known as a *triage*, with a capacity of 3,500 beds.

At four o'clock in the morning, a few hours after the clearing station was completed, the artillery barrage started. By sundown, every bed in the hospital was filled, and the grounds outside the institution were littered with the wounded.

It was out of these tremendous emergencies that some of the greatest surgical advances were born.

We had driven to this *triage* at a good speed, but now, as we set out for the second-line trenches, our chauffeur slowed down. We drove behind a camouflage of evergreen trees, built to confuse the Germans as to the true location of the road.

As we approached the trenches, we barely crawled along, and the chauffeur said he hoped *Monsieur le docteur* would not object to driving very slowly. If we raised much dust, he explained, the Germans might think an important artillery unit was approaching, and start firing at us.

I assured him earnestly that he was on no account to hurry for my sake.

That morning, the Germans had been bombing a narrow-gauge railroad and station on our route. Sheared-off stumps of trees jutted here and there, and as we alighted, we stepped into shell holes only a few hours old.

In this area, tactics to equal the Trojan Horse deception were employed. If a large tree was shattered in the daytime, at night it would be completely hewn down, and a tin tree, skilfully painted, concealing a sentry, would be put in its place. At sundown, a dead horse on the field would be replaced by a tin one, with a look-out man inside. The guns were covered with green nets, or painted to look like houses and trees.

In the second-line trenches, each dugout had two exits. Experience had shown that a single exit might be completely closed by a shell and bury the men alive. Guns were stationed at well-camouflaged openings in the trenches, and immediately after one was fired, the disturbed and burned ground around it was covered with fresh dirt, so that enemy airmen could not locate the spot.

Terrible destruction lay all around us. What had once been beautiful forests and farms now stood naked and desolate, with

here and there a few remaining charred stumps etched against the burning August sun. The ominous stillness was broken now and then by a sniper's shot.

The six cases of gunshot wounds which I had been summoned to operate on had been in the hospital long enough for the infection to clear up and the soft part of the wounds to heal.

They brought into the operating room the first lad, who had had a large portion of his chin and jaw blown away. Dr. Hitz-Boyer had already grafted skin and flesh to span the hideous gap, and I was able to restore the lost portion of the lower jaw.

The second patient was a typical French peasant from the Pyrenees—dark, keen, and excitable. Knowing that a considerable portion of his shin bone had been blown out, he was sure that his leg would have to be amputated.

For the peasant, it seemed almost easier to die than to be crippled in such a way that he could no longer work his land. His relief and gratitude at learning he need not lose his leg were overwhelming.

On the next table lay a man who, but for the war, might still have been a Paris Apache. He had fallen from a gun carriage and fractured two vertebræ. This necessitated the inlaying into his spine of a strong tibial bone graft approximately six inches long.

The fourth patient was a huge Norman with a badly shattered right arm. He was a blacksmith by trade. With a dangling arm, life would have been bitter for this uneducated giant, but a successful transplant from the smaller bone (fibula) of the lower leg restored the upper part of his arm bone and gave him reasonable hope of restored arm power.

For the other two cases, I had to advise delay in operation, for in one the soft parts had not sufficiently healed to allow bone reconstruction work, and in the other a preliminary operation was necessary to replace the extensive scar which overlay the area of the missing bone.

I was later privileged to visit field hospitals in the war zone. Here five or six emergency cases were usually operated on side by side. The surgeon would say: "It is very nasty, son, but I will do my best to save your arm."

And the game reply would be: "Leave it to you, Doc."

During these crowded hours, I had no chance to communicate with Mrs. Albee at Ris-Orangis, for there were no telephone connections. But I knew her courage and good sense in emergencies, and I felt sure that not hearing from me, she would have left for Paris. Taking the night train to Paris, I arrived in time to meet the Boulogne train, and my confidence, as usual, was rewarded. There was Mrs. Albee with all our baggage.

At Boulogne, we boarded the *Lafayette* and headed homewards. German submarines were on a rampage, and from four o'clock Sunday morning until noon on Monday we were in the submarine zone. The atmosphere was tense. Life-boats were swung, ready to be lowered; rope ladders hung from the sides of the boat; life belts were conspicuously near at hand. It was only when we saw the sailors return the life-boats to their usual positions that the tenseness dissolved.

The crossing was extremely rough, but we were absorbed in exchanging experiences with returning medical groups. One thing was apparent—America was bound to enter the war. If only our surgeons could realize the grimness of the new type of warfare with high explosive shells, gas, and aeroplanes, we might go into battle medically and surgically prepared. Headlines of casualties in action would never bring home to our people the appalling realities which I had seen.

I resolved to do my best to acquaint our American people with the necessity of preparedness, and save them the awful price that European countries had paid for experience. The going was harder than I had anticipated, and it was only because we had a man of vision, General Gorgas, at the head of the United States Medical Corps, that we were prepared when the hour struck.

While I had been instituting my bone graft and reconstruction methods in the military hospitals of France, they were already in wide use in the German and Austro-Hungarian armies, as well as in the British army under the direction of General Jones.

I was not, however, aware that my method had found its way to Imperial Russia during the great war. Knowledge of this fact did not reach me until after the Armistice. At this time a certain Dr. Downes called upon me in New York City to thank me for the service I had unknowingly rendered him.

It seemed that in the early part of the war, Dr. Downes became imbued with the idea of making a professional tour to Russia. Unable to finance the journey himself, he appealed to Mr. George Gould, to finance this expedition for the purpose of demonstrating to the Russian military medical profession American surgical instruments, which should be of great use to them during the war.

With true American generosity, Mr. Gould sponsored the expedition, and soon Dr. Downes was *en route* to Russia with two surgical nurses, and a supply of surgical bone instruments of American design, among them the bone mill.

Arriving at what was then St. Petersburg, Dr. Downes was chagrined at the utter indifference of the Russians. All his efforts to interest the Surgeon General of the Imperial Russian Army in the American surgical instruments failed.

It was like smashing his way through a granite boulder, but in a last effort, he succeeded in getting the ears of some of the influential officers, and interested them in the possibilities of the bone mill's use in military surgery as a device that would save the limbs of many wounded.

The medical officers viewed the whole affair with scepticism and freely expressed their doubts of this "experimentation" on wounded soldiers. However, Dr. Downes offered to demonstrate on wood, if necessary, to show them what the bone mill could do.

At last, with great reluctance, a court audience was arranged for Dr. Downes in one of the Palace chambers. This demonstration was attended by the Czarina, some of her Court friends, and the higher officers of the Medical Corps of the Russian Army.

The demonstration was a success and immediately afterwards a representative of the Surgeon General of the Russian Army invited him to operate on a Russian soldier, who had lost part of the humerus as the result of a gunshot wound.

It was a difficult situation, but with the help of his two American surgical nurses, and the assistance of the Hospital Surgeon, Dr. Downes performed the operation successfully.

By this the resistance was completely broken down, and Dr. Downes was given all the work he could handle until his return to the United States.

Oddly enough, within a very short time, I was to hear this same story told almost verbatim by Professor Emory, my old

teacher of Political Economy at Bowdoin College, who later held the same chair at Yale. It was at the Annual Banquet of the Bowdoin College alumni, at Boston, where we both were after-dinner speakers. Professor Emory related that just before the First World War, and after his resignation as Chairman of the National Tariff Commission in Washington, he went to Russia as a representative of the Guaranty Trust Company. His representation proved short-lived, for with the Muscovite Eagle's declaration of war, his work for the Guaranty Trust Company ceased, and he found himself with a great deal of leisure on his hands.

During this leisure period, and some time after the outbreak of war, a Russian merchant friend invited him to go on a trip through the Arctic Ocean on a steamer carrying military supplies to the Russian Army in East Russia. The merchant had secured his contract late in the summer, when ominous ice floes were already accumulating, a reminder of the fact that once the Arctic froze over in November, it would not thaw out until late spring. Yet this consignment of supplies was desperately needed. It had to get through! To prevent any avoidable delay which might result in his ship wintering in the ice fields, the merchant had decided to accompany his cargo—and he wanted company.

Professor Emory said the first part of the trip passed uneventfully, later on ice floes barred their way; ice draped their decks, masts and funnels. To while away the time, and because nothing else could be done, conversation flourished. And so it was that Professor Emory learned the story of Dr. Downes' experience in Russia, and of the American invention which the Russian merchant acclaimed as a god-send to Russian war surgery. It was a little like listening to my own funeral oration.

XIII

On the wings of 1917, America declared war on Germany. On April 21st, President Woodrow Wilson declared: "We have no selfish ends to serve. We desire no conquest, no dominion. We seek no material compensation for the sacrifice we shall freely make. We are but one of the champions of mankind."

In 1917, there were about 140 army hospitals scattered all over the country, equipped only for chronic ailments of peace-time duty. Yet in 1918–19 a quarter of a million wounded returned to our shores, and we were ready for them.

It was our singular good fortune to have had at the head of the United States Medical Corps, in time of need, a man of strong courage and vision—Surgeon General William C. Gorgas. With characteristic perspicacity, he devoted the entire summer of 1916 to advising the military affairs Committees of both the House and the Senate on the drafting of the Army Bill. He urged reorganization and expansion of the Medical Corps, and saw to it that when the Council of National Defence was established, its Advisory Commission included—for the first time—an outstanding medical representative, the late Dr. Franklin H. Martin.

With the aid of the American College of Surgeons and the American Medical Association, General Gorgas appointed reserve officers from the 140,000 physicians in the United States.

The Surgeon General's next move was to make a survey of hospitals. It was most disconcerting to find that there were only 9,530 available beds in the entire 140 army hospitals, most of which were equipped to handle only minor ailments.

Congress appropriated funds for military hospital construction, and the first of these general hospitals to be constructed by the Government was the United States General Hospital No. 3 at Colonia, New Jersey, of which I was Chief Surgeon and Director, under the auspices of Surgeon General Gorgas and Colonel Jefferson R. Kean of the Red Cross.

On the rolling hillsides of New Jersey, twenty miles from the port of New York, with the main line of the Pennsylvania Railroad only a few rods away, lay the beautiful estate of my friend Charles D. Freeman.

It happened that I received orders from Washington to report to Indianapolis. On the train to New York, I met Mr. Freeman and mentioned my assignment.

"But why Indianapolis?" he objected. "A hospital is needed here to help the wounded boys as soon as they land."

"But," I pointed out, "there isn't any hospital here."

"Build one. Let them take my land and home, if they haven't anything better. I will give you power of attorney over my estate to use as you see fit for such a purpose."

Next day, I reported at Washington and learned that my

assignment to Indianapolis was an error. I took the opportunity of laying Mr. Freeman's proposition before General Gorgas. He received the idea most cordially, and advised me to make formal application for Army Reconstruction Hospital No. 3.

Although applications for U.S. Reconstruction Hospitals No. 1 and No. 2—the former at Washington, D.C. and the latter at Boston—had gone through, U.S. General Hospital No. 3 was destined to be the only reconstruction hospital of the three to be built during the entire war period. Hospitals No. 1 and No. 2 never materialized. The seeds of their inspiration had fallen on the stony soil of local objections, red tape, and lack of initiative.

On June 7, 1917, I mailed my application and request for the construction of U.S. General Hospital No. 3 to Colonel H. P. Birmingham of the War Department, and then boarded the train to investigate conditions in Montreal and Toronto.

There, I found the hospitals swamped. In fact, Toronto had been forced to place some of its first contingent of wounded in church pews because of lack of room. This emphasized the crying need for a large army hospital near the chief port of entry, and I backed up my application with a detailed report of my conviction.

June 13, 1917

Colonel H. P. Birmingham,
War Department,
Washington, D.C.

My dear Colonel Birmingham:

I have just returned from Canada, after making a careful study of the provisions for the care of the returned invalided Canadian soldiers, as exemplified in the system finally established for the purpose of ascertaining how we may best attend the surgical, vocational, and re-educational needs of our wounded. Since we feel that most of the difficulties encountered by the Canadian commission were due to the fact that they were caught unprepared, that, for example, several hundred were sent to Toronto without any previous provision for their needs—I believe that we ought to profit, if possible, by their mistakes and unpreparedness and act accordingly.

The establishment of a sort of medical and surgical "clearing house" hospital, at port of entry seems imperative. Here the

cases may be sorted out on the basis of their surgical or medical requirements and sent to the respective military hospitals for routine care.

The need of a purely Orthopædic Hospital is apparent when we consider that from seventy per cent to ninety per cent of the returned wounded have orthopædic lesions coming under the following heads:

(Classification of Orthopædic conditions as recognized by the Canadian Government.)

A. Derangements and disabilities of joints, simple and grave, including ankylosis.

B. Deformities and disabilities of feet, such as hallus rigidus, hallus valgus, hammer toes, metatarsalgia, painful heels, flat and claw feet.

C. Malunited and ununited fractures.

D. Injuries to ligaments, muscles, and tendons.

E. Cases requiring tendon transplantation or other measures for irreparable destruction.

F. Nerve injuries complicated by fracture or stiffness of joint.

G. Certain complicated gunshot injuries to joints.

H. Cases requiring surgical appliances.

The above table is the index to the sort of cases which the Canadian Government requires shall be entirely committed to the care of the Orthopædic Surgeon in the Military Orthopædic Hospitals.

The patients are best cared for in units of at least five hundred men. A most important feature of a unit such as this is that it should include under the government supervision, a factory for the manufacture of braces, artificial limbs, and so forth, which are made, fitted, and adjusted under the same group of surgeons who are treating the stumps which are to receive the artificial limbs.

It is extremely wise to keep the ambulatory patient mentally and physically occupied and as early as possible to prepare him for his return to the front or to civil life. This hastens his convalescence, and courses are so arranged as to lead to the vocation he is most adapted to pursue after his discharge. The decision as to what vocation he is to be re-educated for, is a most important one, and a vocational bureau working in connection with the hospital may arrange courses of which the following are examples:

1. Care and operation of automobile.
2. General Course in Electricity.
3. Machine Shop Practice.
4. Telegraphy, traffic orders, train rules.
5. Testing of Cement and Steel.
6. Cabinet-making, Wood-turning, Construction Carpentry.
7. Commercial course, Bookkeeping, Typewriting, Shorthand.
8. Courses for those wishing Civil Service Preparation.
9. Power machine operating.
10. Shoemaking and repairing.
11. Drafting (architectural and mechanical).
12. Plumbing and steam fitting.
13. Pottery Making.
14. Painting and Decorating.
15. Lettering.
16. Designing and Illustrating.
17. Clay Modelling.
18. Steam and Gas Engines.
19. Short Course and Chemical Analysis.
20. Assaying and Milling (for former miners especially).
21. Poultry farming.
22. Flower Growing (two men only).
23. Sanitary Inspection.
24. Other Courses to be added later.

In this way, the patients occupy their convalescence to the best advantage and more quickly and easily merge into civil life.

A distinctly different phase of effort is therapeutic re-education. Therapeutic re-education used in conjunction with regular hospital care attempts to restore as nearly as possible to normal certain types of physical and mental disability. Hydrotherapy, electricity, and massage are adjuncts to regular hospital treatment; but special apparatus and training by individual instructors to encourage physical movements or mental processes, interfered with through injury or shock, are also required. Such work can also be carried on during Orthopædic Convalescence under the direction of a psychologist appointed for the hospital.

We believe that at the Freeman estate, Colonia, New Jersey, such an Orthopædic Hospital, with the above-mentioned ortho-

pædic vocational and re-educational facilities, can be established in working order in eight weeks, with accommodations for from 500 to 1,000 men.

These three hundred acres are of easy access to New Jersey by the Pennsylvania Railroad, and are subject to the disposal of the Government as described in my letter of June 7th.

Trusting that the above recommendation may meet with your approval, and assuring you of my earnest desire to co-operate in any such endeavour, I am

Very truly yours,

FRED H. ALBEE.

As I read this recommendation twenty-three years after I wrote it, I realize that there is practically nothing in it which I would change in the light of subsequent experience.

The morning after I mailed the letter, the first contingent of the A.E.F. sailed for France from New York Harbour. Scarcely had the steamer put out from the wharf, when it crashed unexpectedly into another boat, and was wrecked.

The impact was so violent that the steamer sank almost immediately. The boys aboard ship lost practically everything. Much to the chagrin and humiliation of the first contingent, they were fished out of the sea, later they were re-shipped on another vessel.

The youth of the country looked confident and gay that summer's day, back in June 1917, as they prepared to leave for France. I can see them now. Like a ghostly company, they rise up once more and pass in review. Thousands of stalwart, smart, khaki-clad figures, marching down Fifth Avenue to the tune of stirring military rhythms, before cheering crowds. But to me, as I looked for my youngest brother, who was in the first contingent, every thrilling drum-beat swelled into overtones of stark tragedy.

The crowd saw only one side of the medal—the noble, impregnable side. They knew only that America's best was taking the torch of democracy three thousand miles, charged with an assurance of victory.

To those of us who were seasoned by warfare, the reverse of the medal was apparent. Within a few weeks those lads who were gaily marching down Fifth Avenue, heads high and chests swelling, would be lying on their bellies in French infected mud—wounded, mutilated, some cut down. Instead of music,

they would be crawling to the staccato accompaniment of a rain of bullets, a cloudburst of bombs, the roar of the big Berthas.

In my mind's eye, I could see the casualty clearing station at Châlons-sur-Marne, with the hospital full and the grounds overflowing with the waiting wounded.

I could see the staff at Ris-Orangis, operating day and night in a brave attempt to keep down the number of "wings and peggies". And in the wards at Compiègne, Dr. Carrel carrying on his ceaseless campaign against infection.

There was only one consolation. Ahead of these proud youths had gone one thousand American surgeons. For, chalked up to the everlasting credit of the medical profession, the first American uniforms in the trenches bore the caduceus wand—the spread wings and serpent of the Medical Corps.

Limitations and objections, characteristic of military departments, were inevitable in regard to accepting Mr. Freeman's unselfish offer of his estate. But he insisted that the Government take his land and home because of his inability, on account of age, to bear arms in the service of his country.

So two weeks after the formal offer had been made, Mr. Freeman received word of acceptance from Newton D. Baker, Secretary of War. In order to be within the scope of army regulations, two hundred acres were finally leased from Mr. Freeman, by the Government, at the annual rental of one dollar per year.

Money to build U.S. General Hospital No. 3 at Colonia, New Jersey, was appropriated by Congress. In the process of evolution, it was finally decided by the War Department that from an economic and operative standpoint, it would be better to have a large general hospital with two thousand beds, in place of the originally planned reconstruction unit with five hundred beds.

No surgeon in the United States Army ever had the authority that Surgeon General Gorgas conferred upon me at that time. So far as I know, I was the only civilian surgeon, during the First World War, who stepped into the army and organized a general army hospital.

Given *carte blanche* by the Secretary of War, Surgeon General Gorgas, Colonel Russell, and the Red Cross, through Colonel J. R. Kean, I went to work to appoint a staff and drew up plans for the hospital in which I considered not only

facilities for the medical and surgical programme, but also provisions for psychological rehabilitation of the wounded.

These tentative plans were then turned over to the Quartermaster's Department where they were completed.

Invaluable aid was rendered in the accomplishment of these plans by the architects, Crow, Lewis & Wickenhoeffer, who gave me their services gratis.

Many important features of the hospital, such as the operating pavilion, which contained a hospital filtering plant to filter and sterilize all water used in the operating rooms; the general laboratory as well as pathological and bacteriological departments; and my own special research laboratory, were formulated by these architects at my suggestion.

In that research laboratory, by the way, I intended to do animal research. Now the State of New Jersey has always been anti-vivisectionist. My friends, knowing my intention, said: "You cannot do animal research here."

"Why not?" I demanded.

"No one ever has done animal research work in New Jersey."

"But this isn't New Jersey; this is Federal property," I pointed out, "and I'll do as I damn well please." That was probably the only animal research performed in any army hospital in this country during the First World War.

The construction of the hospital was begun in February, 1918, under the supervision of Major B. Ellicott, Q.M.C., assisted by Captain Fred A. Smith, Q.M.C. Within two months all the storehouses, garages, and eighteen one-story wards were finished.

Early in April 1918, Commanding Officer Lieutenant-Colonel A. P. Upshur, arrived at the Post. The Quartermaster and Medical Property Officers were established there at about the same time.

Enlisted men in a detachment of the Quartermasters Corps arrived late in April, and were followed by the advance guard of the Medical Detachment in May. During June, members of the medical and surgical staffs arrived, the nurses reported at the hospital, the organization of the many departments was begun, and the hospital was prepared to receive patients, the first of whom were admitted on July 5, 1918.

In the beginning the hospital was modest enough, but in the end it swelled to gigantic proportions. There emerged 110 buildings, scattered over 200 acres; approximately 2,000 avail-

able beds; a swimming pool fifty by a hundred feet; a half-million dollar central heating plant, which consumed sixty-five tons of coal a day. There were five kitchens and mess halls.

There were also:

An X-ray department; orthopædic service department; general surgery; orthopædic workshop; artificial limb manufacturing service; neurological and anæsthetic departments; eye, ear, nose and throat department; huge laundry plant; a fire department costing $26,000; a telephone service with eighty extensions.

Three and a half million dollars went into the construction of General Hospital No. 3, and it was said to be, at the time, the most complete hospital in the country, as well as the largest orthopædic military surgical service in the United States.

Realizing that I would need a research laboratory, I told Colonel Russell, who said: "Ask the Surgeon General for it. He will, I am sure, grant you anything you want within reason." He did.

While construction of the hospital was progressing, I was requested to organize and start the first military graduate school in bone and joint surgery in the United States Army, which I did at the New York Post Graduate Medical School and Hospital.

This school of war surgery grew so popular that the Surgeon General issued an order that it be divided. Half of the surgeon's time was to be spent at the Harvard Medical School under Major Lovett, who was to give the non-operative side of bone and joint surgery, and the other half was to be spent with me for instruction in operative work.

The reconstruction hospitals in Europe, particularly the English hospitals, had been performing one of the most valuable jobs in war relief work. They had set themselves the task not only of curing but of "reconstructing" men suffering from bone injuries, or with arms and legs missing, teaching them the trades which would prevent them from becoming an economic burden.

This was the plan which General Gorgas intended to put into effect in the American reconstruction hospitals.

"The whole conception of governmental and national responsibility in caring for the wounded," General Gorgas said, "has undergone a radical change. . . . Instead of the old idea that responsibility ended with the return of the soldier to private

life with his wounds healed and such pension as he might be given, it is now considered that it is the duty of the Government to equip and re-educate the wounded man, after healing his wounds, and to return him to civil life, ready to be as useful to himself and his country as possible. . . . Workshops will be provided at the hospitals, but arrangements will also be made with outside industries whereby more elaborate methods of training may be carried on. An employment bureau will be established to place men so trained in different parts of the United States. . . .

"Arrangements have been made by the Department of Military Orthopædics to care for soldiers, so far as orthopædics (the prevention of deformity) is concerned, continuously until they are returned either to active service or civil life."

These boys returning from the Front, in other words, needed much more than medical care as we had known it in the past. They had to be taught how to walk with artificial legs, how to work with artificial arms, how to talk and eat with manufactured jaws.

An inevitable result of the advance of medical science to war experience was that it was helping to prolong the war itself. There could only be one bright spot in this deplorable result—that in the long run, humanity would benefit from the knowledge surgeons had gained in time of war.

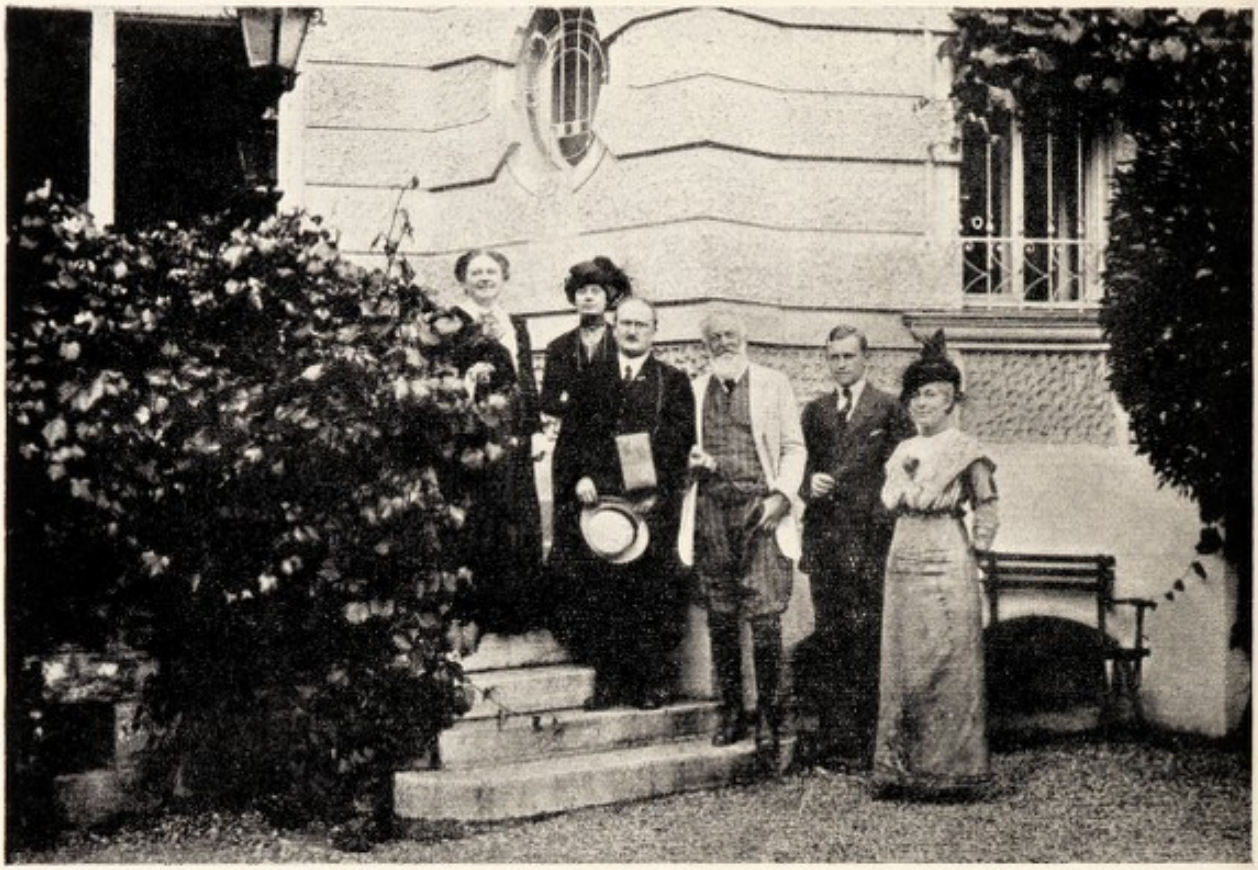
Germany would have broken down much faster if her surgeons had not been able to rehabilitate so many wounded men and send them back to the Front to fight again. This applied to England, as well, which of 1,350 men in a hospital, returned 1,000 to the trenches in fighting shape.

While Dover Road at Colonia, New Jersey, was humming with incessant work, miles of pipe line, carloads of lumber pouring in, and U.S. General Hospital No. 3 was nearing completion, I received another assignment.

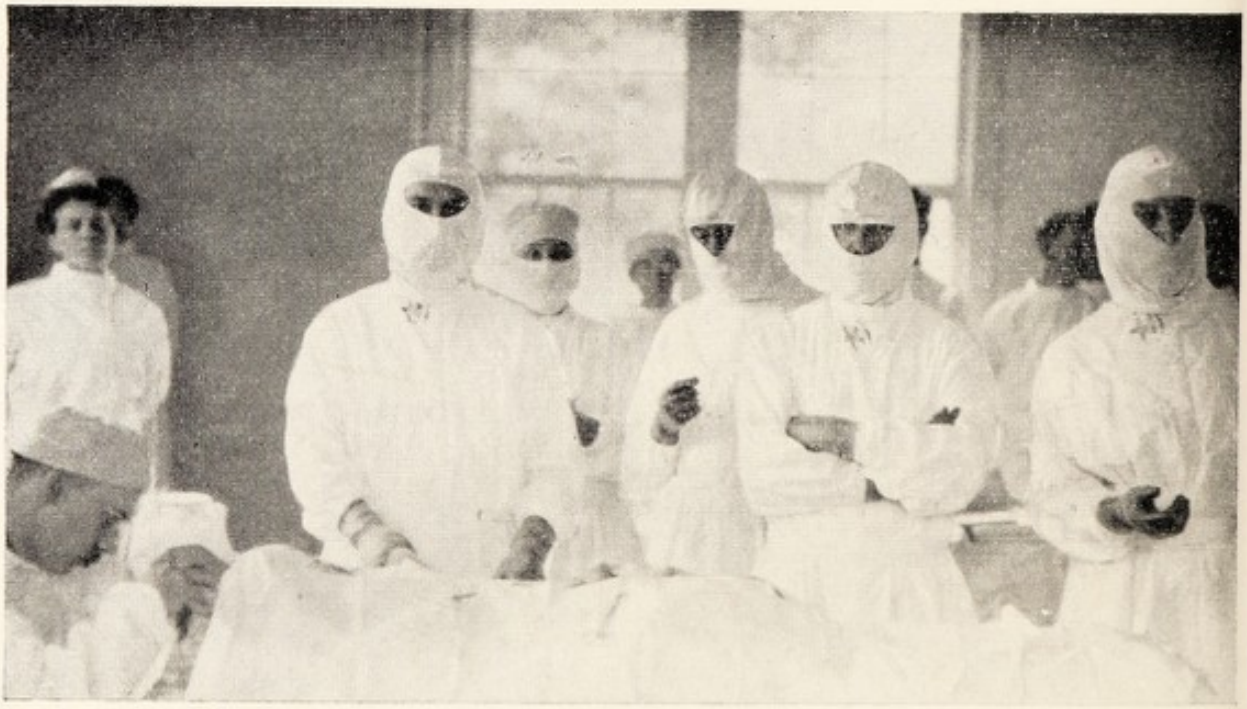
It arrived in the form of an order, giving me a choice either of taking charge of a surgical service at Camp Devens in Massachusetts or going to Fort Oglethorpe for military training.

I arrived at Oglethorpe with Captain Weigel, who was later to become my adjutant at U.S. General Hospital No. 3, and the two of us began military training, starting with the classical routine of picking up cigarette butts, and so forth.

The reason for my preference for this training was that, as



Dr. and Mrs. Albee at the home of Dr. Adolph Lorenz in the Alps in 1913. Reading from left to right: Mrs. Adolph Lorenz, Mrs. Albee, Dr. Albee, Professor Lorenz, Professor Lorenz's son (now a doctor), and Mrs. Lord, wife of Dr. Lord, the well-known orthopædic surgeon of Omaha, Nebraska



Dr. Albee, as staff surgeon, performing the first operation (a bone graft for tuberculosis of the spine) at U.S. General Hospital, Colonia, N.J., in 1918. Miss Swenson, Superintendent of Nurses at left, Captain Trowbridge (now a very successful surgeon of Oak Park, Illinois) giving the anæsthetic; Captain van Rentsaleer (formerly Professor of Surgery, George Washington University) extreme right

an army officer I would be expected to know something about military usage and understand the routine. I would be required to have at least a bowing acquaintance with the rules regarding the proper salutes, and other mysteries of army life, and the only way to acquire it was to be a rookie.

While I was taking this military training, there was a little fellow named Smyth who was a hopeless case as an army man. He was so short that the order to double-quick left him far behind. His abbreviated legs worked like pistons, but it was impossible for him to keep up.

Smyth, however, was a philosopher. He didn't attempt the impossible. When he heard the double-quick order, he would hop violently for a moment, and then lie down cosily along the roadside until we came back to a more reasonable tempo.

I can't recall that anything was done about it. Smyth was too amusing to deserve discipline.

XIV

On June 3, 1918, we opened the U.S. General Hospital No. 3. Our first patient, Private Charles Blalock, from Company D, 14th Machine Gun Battalion, arrived on July 5, 1918. (Tuberculosis of spine, later bone grafted.) His arrival caused more commotion than that of hundreds of patients later on, and Miss Swenson, the Superintendent of Nurses, and her assistant met him at the train.

The first overseas contingent, seventeen wounded, all from Château Thierry, arrived on August 1, 1918.

We felt rewarded for our efforts when, instead of birds chirping to each other on the Jersey hillsides, we saw six hundred men bathed, bandaged, fed, and under good treatment.

Major General Shanks, then Commander of the Port of Hoboken, together with a thousand officers, and six thousand enlisted men, worked day and night removing the wounded, as they disembarked, and sent them to the proper hospitals.

When asked about the method of handling returning soldiers, he summed it up with the terse phrase: "Debarked, Deloused, Delighted." There was just one question: "How many more hospitals before we get home?"

As the wounded settled down in their spotless cots, the ugly memories of death, blood, vermin-infested trenches, mud, rain, and chilly wintry winds began to fade from their minds, and peace crept into their souls once more.

Eleven acute surgical wards were filled to overflowing. By October, the number grew into the thousand mark, and winter found us ministering to nearly 2,000 wounded daily. In the fifteen months between July 1918 and October 1919, over 6,000 wounded came to Colonia. I am proud to say that the majority of these were returned to active civilian life.

In the space of slightly more than a year, according to records in Washington, D.C., I was privileged to perform approximately half of all the bone graft operations done in the First World War.

A magnificent spirit of helpfulness pervaded our hospital corps from the top down to the ambulance drivers, who were a group of splendid fellows. In the fifteen months that they carried 6,000 patients, there was not a single accident.

An amusing incident occurred, however, in the case of a pert, loquacious young woman who drove an ambulance. Among other instructions, she was told that if she handled a case with a fractured leg, she was to strap her puttee about it to prevent it from moving, providing proper splintage was not available. In due course, such a patient came her way, and the vivacious young lady promptly used her puttee as ordered. The only trouble was that, in her excitement, or possibly because she was chattering away as usual, she put it on the wrong leg!

With the advent of the terrible flu epidemic in September, our duties swelled. This imposed a stupendous task upon the medical officers at Hoboken. They were not only compelled to delouse returning troops, but to deflu embarking troops. As 50,000 men embarked daily, operations were carried out on a gigantic scale.

Some of the wounds of the lads returning were appalling, and the grit and gameness they displayed remain seared in my memory.

There was "Les" of the Red Star Division of the 127th Infantry who had been sent down the Marne River to Paris in an old canal boat with a fractured, infected shoulder which was in horrible shape.

And Tommy Matthews, who had lied about his age in order

to get in the army—he was only sixteen—and had been blown out of his tank. His wound was shocking.

There was Pat Tangney of the Engineer Corps, who had been shot through both legs, his right knee cap completely shattered. It took five operations to build him a new knee so that he could walk again.

Lieutenant Gilmore of the Marines had been hit in the spine by two machine-gun bullets. The wounds of entrance of these two machine-gun bullets were three inches apart. Undoubtedly, these bullets struck within a fraction of a minute, and during that time, Lieutenant Gilmore rotated a sufficient amount so that both bullets came out of the same wound in the back, damaging the spinal cord. He was fortunate in not being completely paralysed; only one leg was partially affected.

The uncommonness of the wounds of entrance of these two bullets reminds me of extraordinarily freakish cases we had at U.S. General Hospital No. 3.

One soldier was apparently standing sideways to the line of fire, and a machine-gun bullet clipped the lower portion of the septum of the nose, not touching or damaging the wings of the nose on either side.

One of the worst wounds of the hard palate that came to my attention was that of a young lieutenant. The roof of his mouth had been torn off by a machine-gun bullet, leaving a huge hole through his hard palate which made him talk exactly like a person with a cleft palate. Such wounds taxed the surgeon's ingenuity.

Only once afterwards did I come across a worse wound of this character, and that was in civil practice when a boy of twenty-one was brought to me. He had shot away the greater part of his chin, and right lower jaw while deer-hunting in the Maine woods. He had only one molar tooth remaining. What was left of the lower lip was severely contracted. He had to be fed by a tube.

An expert prosthetic dentist was called in for consultation and we proceeded to make a sliding graft of skin and soft parts of the neck to restore the shot-away soft parts of the face. A month later, after circulation in the graft of soft parts had been established, a U-shaped bone graft from the pelvic bone was cut and inserted to replace the missing part of the jaw. After the graft had been morticed into the jaw fragments and securely fastened with kangaroo tendon it was trimmed with the motor

saw to make the profile resemble as closely as possible a photograph of the young man taken before the accident.

Six months later the bone graft was thoroughly consolidated, and more detailed plastic work for cosmetic purposes was undertaken on the face and the patient referred to the dentist for artificial teeth.

A year after the first operation the patient came back to have the contraction about his mouth relieved. Seeing him today one would never suspect he had been the victim of such a terrible accident.

Among the others was Allen Bryant, a handsome young Southerner who had lost both hands, and Sunny Osterberg, only eighteen, who was minus both legs just below the hips. Both of these boys thoroughly overcame their handicap by sheer force of will, and Sunny is now running a successful automobile agency in New Jersey.

These two lads soon became the most popular in the hospital not only because of their gameness, but because of their thoughtfulness of others.

Breaking the news to the home folks was very difficult for some, but this is the way Sunny Osterberg told his parents that he had lost both legs above the knees. This letter was published in *The Literary Digest*:

"Yes, Mother and Dad,

"I know it doesn't read very good, but I wish you could see me. You would never dream I had both legs off. So cheer up. What I have said in regard to my condition is straight, and in time no one will know I have lost a limb or two. Now I don't want you to sit down and mourn, but to know the truth and thank God I am alive. I do, for of thirty-two boys who were struck by an aero bomb, five lost their legs, and of the five I am the only one alive.

"From the time you are born,
Till you ride in the hearse,
There is nothing so bad
But it might have been worse."

On Armistice Day, Sunny wanted to go to New York to see the parade, but Army Regulations forbade it. The Sergeant, however, felt that a man without legs ought to have some

privileges, and set out with him, regardless of rules. Nobody stopped him. When they got to New York, the Sergeant broke another army regulation by going into a Fifth Avenue restaurant. As he entered, carrying Sunny pick-a-back, everyone in the restaurant stood.

Sunny's stumps finally healed and he was fitted with "peggies". The last time I saw him, he was driving a Cadillac down Lincoln Highway.

With the arrival of the overseas patients, Captain Weigel, my adjutant, and I went about the wards, examining the gaping wounds, and one of my first orders was the general institution of the Carrel-Dakin treatment. Anticipating the great need for this method, I had selected Captain B. Barnett, an experienced surgeon and practical chemist, and had sent him to the Rockefeller Institute for a short, intensive course in this treatment and placed him in charge of all Carrel-Dakin service.

The older men on the staff felt that they had had a great deal of satisfactory experience with tried methods, and were sceptical of the Carrel-Dakin process. They were not, however, familiar with modern warfare wounds, especially the type inflicted by shrapnel and hand grenades. These leave huge lacerated wounds with deep crevices and pockets where infection grows like a fungus. I gave each man permission to use his own particular method. The only proviso I made was that bacteriological counts should be made in their individual wards, and records kept for comparison.

This proved to be an interesting clinical experiment. Each ward surgeon strove to get the best-looking wound, and the lowest bacterial count. It did not take long, however, for these surgeons to throw up the sponge and admit that the Carrel-Dakin treatment was the most effective.

To the uncomplaining small laboratory staff belongs much credit for this work. They bore the brunt of the experiment, for it devolved upon them to make the bacteriological counts and cultures. This was in addition to all their other work, which included Wassermann and blood tests.

In the fifteen months the laboratory staff made 9,896 bacteriological counts; took 1,500 wound cultures; prepared 10,260 litres of Carrel-Dakin solution besides vaccines and inoculations.

In addition to the Carrel-Dakin method for destruction of bacteria another method had been suggested in England

during the war, known as bacteriophage, involving the use of a beneficial parasite which destroys the enemy organism in wounds. D'Herelle introduced this bacteriophage method in 1918 when dysentery and cholera pervaded some of our fighting forces and it was found to be most effective.

One of the most serious fracture cases to reach Colonia was a young Captain. He had been carrying a three-inch shell when for some unknown reason it exploded and completely destroyed his hand and right wrist. It blew away the skin, muscles, and soft tissues of his thigh down to the bone, all the way from the hip to the knee, and shattered the whole shaft of the femur in dozens of pieces.

A wire had been put through the lower end of his thigh bone, and he had been placed in a Balkan frame, with a pull upon the wire overcoming shortening. By the time he arrived at Colonia, he had an enormous discharging wound in his thigh, and infection threatened his life.

I removed the wire and slowly sterilized the whole side of the thigh by the Carrel-Dakin method. It was many weeks before the wound was relatively sterile, and since it was too large to heal over, skin was taken from the leg of a man just amputated, and grafted over the wound. Ultimately, the extensive loss of thigh bone was restored by a bone graft.

Because of the fine balance demanded by nature, no evil ever befalls the race without bringing with it some good. We in the medical profession had to put our shoulder to the wheel of life in an effort to restore and reconstruct the human wrecks left by the First World War. To what extent we succeeded in doing this, may be illustrated by various cases.

There was a veteran who had been a barber. He came out of the war with what is known as "dangle arm", a condition in which the entire head of the humerus and the upper portion of the shaft had been shattered into tiny splinters, leaving the arm frail and useless. In previous wars, such an arm would have been amputated. In his case, as in many others, we took the upper half of the fibula from the leg, and transplanted it into the arm. The head of the bone and its upper end served as the ball of the shoulder. And I doubt if those whom he shaves to-day have any idea that a leg bone serves as the framework of his arm.

Then there were many "drop wrist" cases. This condition

is caused when the musculo-spiral nerve, which controls certain movements of the wrist, is caught and damaged between fragments of the broken bone, thus impairing the flexion of the fingers.

One case was that of a young aviator who, while operating his plane near Montdidier, at an elevation of 4,000 feet, had been shot through the left arm, the whole lower third of his upper arm shattered into pieces. He managed to land safely with one hand, and then fainted from loss of blood. He was taken to the American Field Hospital No. 12 where the fracture was set, apparently imprisoning the musculo-spiral nerve between the bony fragments, for when he arrived at U.S. General Hospital No. 3 his wrist was dropped, and he could flex his fingers only slightly.

Before we could determine at what point the nerve was caught, or whether it was advisable to release the nerve, a most unexpected denouement took place. A fire broke out in the Officers' Quarters, and in his haste to get out of the ward, this patient completely forgot his weak arm and loaded it with clothing. The immediate result was a refracture. Less than twenty-four hours later, the ward surgeon reported to me that the patient had recovered complete motion and function of his wrist, hand, and fingers. The new fracture had released the nerve from the bone callus and we were saved a very delicate operation. It did not take the refracture long to heal and the outcome was very satisfactory.

Quite a different type of case, and a very pathetic one, was that of a young Belgian musician who was caught in our draft. He was a well-known violinist who had devoted his whole life to music. A bullet had severed the musculo-spiral nerve on the left side. As a result, his hand was paralysed and he could no longer finger the strings. His whole future seemed wrecked. A terrible despondency seized him, in which state of mind he contemplated suicide.

We waited for regeneration of the nerve to take place. This failing, we operated, and found that the distance between the severed ends was about three inches, and although considerable stretching will be tolerated, this was too much. At operation, by bending the elbow and displacing the nerve, it was loosened sufficiently so that the ends of the severed nerves could be brought closely enough together to be joined by the delicate technic of nerve suture.

A year after the operation, he was able to move his fingers so that he could once more play the violin. During his entire treatment, a very capable reconstruction aide, who was assigned to massage and exercise his arm daily, had been most helpful in rehabilitating him both mentally and physically—one was almost as important as the other. Later, the government gave him lessons under one of the finest violinists in New York City, and he rapidly recovered his ability to manipulate the strings. Two years later, he made a concert tour of Europe.

Illustrating the efforts made by the surgeons in the First World War to save limbs, and the terrific odds under which they were forced to perform life-saving operations, Lieutenant C. told me his own story:

"I went over with the American Engineers in September 1917. In the spring of 1918, hearing the whirr of approaching shells at Rouen, I dropped to the ground; but before I had quite flattened one knee, a shell fragment hit it and scooped a large hole in the knee-cap.

"I was given first-aid by a comrade, and as soon as the stretcher-bearers could reach me, I was rushed to Base Hospital No. 9 at Rouen, the Lakeside Unit from Cleveland, Ohio, headed by Dr. Crile. Here, for several days they tried to save the leg by applying Carrel-Dakin treatment to the knee wound which was highly infected. This proving impossible, as the infection was spreading so rapidly up the thigh as to endanger life amputation of the British Guillotine type was performed. In any event, the knee would probably have been useless owing to the extensive amount of bone shot away.

"As I was wheeled into the operating room, fully conscious, I saw that the five other tables were all occupied. Oh, yes, they operated on six of us at once.

"As I came in, another groaning stretcher was carried out. That man's leg, still bleeding, gaped at me from a pail at the foot of the table on which they laid me. Next to me, they were hoisting the leg of a comrade by a pulley, and the surgeon at that table lifted his knife to amputate just as the merciful ether took me under.

"A few weeks after the amputation, they attempted to fill in the great gap in the soft parts over my hip which the shell wound, plus the infection, had left.

"At first, they made grafts from other men's legs, amputated

within the hour. The grafts would not take. They finally took a graft from my own good leg, which they had, heretofore, hesitated to do on account of my weakened condition. This "took" but even my good leg was apparently infected, as it took six months for the area from which the graft was taken, to heal. That thigh still has a great deal of scar tissue and is very sensitive.

"Meanwhile, the whole end of the stump sloughed, and most painful and unsuccessful treatments were given with a 150-watt light bulb, to draw the infection out of the stump.

"During the light treatment, the nurse had to strip off every day the crusted material which formed as a result of the heat. This process was so painful that I used to call the piece that came off at the end of the bone, the *Croix de Guerre*.

"One day, in this picking-off process, the knot that tied an important artery was pulled away, and I had what nearly proved to be a fatal hæmorrhage.

"I left Rouen for Southampton in July 1918. I had been serving with the British Fifth Army. Crossing the Channel was pretty rough, but they put us in 'cradles' instead of bunks, and this contributed to our comfort. These cradles were suspended on an axle, so that when the boat pitched or rolled, the cradle stayed flat, which prevented a great deal of pain.

"At various steps in my treatment, bricks were attached to one end of a rope which hung over the foot of the bed, and the other end was attached to the stump to prevent retraction of the soft parts; but in spite of this, the bone remained very near the surface at the end of the stump.

"From Southampton, I was sent to Portsmouth where it was decided to re-amputate. A few days later, the bone broke right through the stitches, and the whole works was exposed again.

"From there, I was sent home on the *Mauretania* to Walter Reed Hospital. Here, a third amputation was performed on my leg, and following this, I had an internal hæmorrhage in the stump, which made a fourth operation necessary. Once more, I was put in the seriously ill ward. By this time, I was getting pretty discouraged and my one idea was to get home."

At U.S. General Hospital No. 3, this man's stump, by meticulous Carrel-Dakin treatment, was finally induced to heal, and while convalescing, he responded to a request from the New York Liberty Loan Committee for patients to help with the drive. He proved such an able speaker, and brought in so

many subscriptions, that he attracted the attention of one of the senior officers of one of America's largest motor companies, and was asked, upon discharge, to take a position with their company. He started on a very small salary. To-day, he is assistant to the President of the Company, which shows what can be done in spite of such a physical handicap.

There were, at U.S. General Hospital No. 3, 1,335 amputations. During the months of January and February, 1919, there were 750 amputation cases in our wards at one time. This is more than five surgeons with huge metropolitan practices would see in a lifetime.

To avoid too much introspection on the part of the boys, and to reinforce their sporting spirit with practical knowledge of those who had to cope with physical handicaps, we brought into service at the hospital several men from civil life. There was Michael Dowling, from Minnesota, who had lost both legs, one arm, and the fingers of the other hand in a blizzard when just a boy. An orphan with no means, he was "on the town". A farmer was found who was willing to board him for two dollars a week. But Michael had two priceless qualities—pluck and ambition. He argued with the authorities that he might live many years, and even at the rate of two dollars a week, he would cost the community a great deal of money. He pleaded for an education, and justified his reasoning by becoming an able lawyer, and eventually a judge.

Michael Dowling did a lot towards putting fresh heart into our "wings" and "peggies".

"I have found," he told the boys, "that you do not need hands and feet, but you do need courage and character. You must play the game through like a thoroughbred.

"You fellows know how it is in a handicap race. A handicap is put on the horse that has proved himself, so that he may not beat the others too easily. But the horse with the handicap is the one to bet on.

"You fellows are handicapped, but we know you can win the fight. It may prove to be God's greatest blessing, for few men begin to think until they find themselves up against a brick wall."

Missing fingers can in many instances be replaced or lengthened by reconstruction surgery. A striking illustration

of this was a patient at Colonia who had all his fingers and a part of the palm of his hand shot away. Only the thumb remained intact, and the hand was quite useless, because there was nothing against which the thumb could oppose itself. By a three-step operation, we managed to give him a stable forefinger, and by the combined action of this synthetic finger and his thumb, he was able to do most of the routine things of daily life.

How was this finger provided? It was built by transplanting skin and subcutaneous tissue from the upper abdomen and bone from the shin.

From the upper abdomen, a rectangular flap of skin and underlying fat was cut on three sides, leaving one end attached to its base. The two long sides were sewn edge to edge, making a fleshy tube of proper size for the contemplated finger. The skin and subcutaneous tissues of the palm were then opened near the position of the index finger, and the detached end of the tube-like graft sewn to them.

The arm was placed in a plaster of Paris splint across the front of the body to allow the circulation to develop from the abdominal wall so as to nourish the new finger until normal blood supply from the hand was established at the other end.

Adequate circulation is a prime requisite in successful transplantation. Without it, the graft will die, just as a plant will die from want of water and nourishment.

At the end of three weeks, when we were sure that sufficient blood was flowing from the hand into the boneless finger, we cut away the end which was still attached to the abdomen, and tied the profusely bleeding vessels at the end of the finger. Then with the electric saw, a piece of bone of the desired size was taken from the tibia (shin bone) and shaped with a motor-driven dowel shaper, or lathe, to serve as the skeleton of the newly made digit. This bone graft was then inserted into the new boneless finger in the position of the shot-away index finger, and mortised into the carpus.

It requires approximately one year for the nerves to extend along such a digit to its tip, thus supplying the sensation of touch, pain, and so forth.

This patient, Private Wahl, who was operated on at Colonia, in October, 1918, sent me word a few weeks ago—twenty-two years after his operation—that he was farming in California and was daily using his hand with the synthetic finger in doing heavy farm work.

XV

THE RECONSTRUCTION of shattered bodies was only one of our jobs at U.S. General Hospital No. 3. Equally important was the work of rehabilitating shattered minds and nerves and morale. Out of the attempts to solve the great number of psychic disturbances resulting from war experience came improved understanding of human emotions and their effect upon the mind.

The extent to which wartime service had brought about a mental disequilibrium was brought home to me, of course, long before the establishment of U.S. Hospital No. 3. In France I had already observed the horrifying mental conditions induced by shell-shock. But during my brief stay at Fort Oglethorpe I had seen a situation for which I was completely unprepared—the widespread existence of a mental condition, which bore every resemblance to shell-shock, in soldiers who not only had never been in the trenches, but who had never even left this country!

At Fort Oglethorpe and elsewhere, military hospitals had been planned with so many beds allotted to surgical cases, so many to medical cases, and so forth. But, as time went on, it was discovered that more and more space had to be allotted to nervous or mental cases, to the boys whose nervous systems were so unstable they could not withstand the shock of being drafted into the army and became demented.

What caused this situation? There were several basic reasons for it. One was civilized man's variation of primitive man's reaction to his environment—a fear of fear. A second reason was—to our shame be it said—a lowered physical and hence nervous resistance due to poor living conditions and inadequate food. A third was the existence among us of many borderline cases, those people whose deviations from the norm is so slight that it can be detected only under stress, and who are unable to face a complete upheaval in their lives.

In this category might be placed the great number of soldiers who found themselves abruptly torn from their familiar environments and plunged into a world to which they were utter strangers. They lost their sense of security, of their own individuality, of their personal freedom. It was the sense of being held like a vice by the conscription which broke them—the

destruction of their own individualism by a force which seemed inexorable and inescapable to them. An apprehension of having to kill or be killed in reversal to all the ethical foundations of modern life.

This same response to abnormal conditions has made itself felt in England under the pressure of constant bombings, with the notable difference that it is the civilians who have been subjected to shell-shock, rather than the fighting troops; it is the noncombatant, and particularly the child, who is the victim of nervous diseases. According to recent reports, young children, like the shell-shocked troops of the First World War, must be taught again to walk and talk. The seeds of mental instability, the seeds of future wars are being sown in the hapless young to bear fruit perhaps in another generation.

At Fort Oglethorpe, which abounded in these "shell-shock" cases of men who had never gone overseas, there was one soldier in particular whom I remember. I ought to remember him. For days on end I followed his adventures as one follows a serial story. For this patient, who was generally known as "Buddy", was turned over to the care of a meticulous little sergeant who, in civilian life, had been a lawyer, and had a passion for setting things down neatly on paper. Day by day, and eventually almost hour by hour, he recorded, in report, and later in telegrams, his experiences with his charge.

Buddy was a Kentucky mountaineer who had never, until the draft caught him, been away from his farm. He was slow-moving and slow-thinking. He was accustomed to the plodding and even tempo of the seasons. Beyond his farm and his hills he knew nothing of the world. It was no concern of his. The issues involved in the war had no meaning for him. Europe was no more remote and foreign than New Jersey. He had a young wife whom he had recently married, and, if he thought about it at all, Buddy was well content with life.

Then the draft engulfed him. He was torn away from his wife and his farm and his familiar hills, and plunged into the strict regulations of an army camp. Everything was incredibly strange to him. He was hopelessly lost, mindlessly obeying orders he did not comprehend for reasons which baffled him. And Buddy, as a result, in short order became a mental case. An attempt was made to cure him, but the authorities at Fort Oglethorpe decided that nothing could be done. Buddy must be discharged from the army and sent back to his farm.

In his bemused condition, however, he was manifestly unable to take care of himself, and that is where the report-writing sergeant came into the case. He was assigned to escort Buddy safely back to his Kentucky farm.

From there on the story reached us in the form of telegrams which appeared to be sent from almost every station along the line. All went well until midnight, when Buddy got restless and told the sergeant he was going "to wash his hands". Time passed and he did not come back. The worried sergeant went to the lavatory. The door was locked. He hammered on it but there was no answer. Eventually, the conductor broke down the door. The window in the lavatory was wide open and Buddy was gone.

The sergeant's harried telegram stated that at the next station he left the train and walked back, fearing at any moment that he would stumble on the soldier's mangled body. There was a faint light from the moon but nowhere could he find any trace of his charge.

Then, all at once, he saw a moving shadow, and Buddy rushed to him, saying: "My God, sergeant, where have you been? I've been looking for you all night."

With his charge firmly in tow, the sergeant boarded the next train, which happened to be filled by a company of rookies. As it happened, they all piled off at the station where the sergeant and the mental case were to get off.

In the attendant confusion, the sergeant got off alone, and when he reached the platform he looked around him in vain. Buddy was gone!

After a fruitless search of the town, he decided that the only thing he could do was to break the news to Buddy's wife. His next telegram told us rather pathetically that he had to pawn his watch to raise the taxi fare to the farm. The sergeant was a martyr to duty.

It was early morning when the taxi bumped and clattered to a halt at the farm. And there, on the front porch, holding his young wife in his arms, was Buddy!

Neuro-surgery, like orthopædics, received a tremendous stimulus from the war. In 1914, the United States had, so far as I know, few outstanding surgeons in its small cities who devoted all their time to neuro-surgery. U.S. General Hospital No. 3 was extremely fortunate in having a man like

Major K. Winfield Ney in charge of its neuro-surgical service.

I recall one man at U.S. General Hospital No. 3, who seemed to be suffering from mental shock. He would sit for hours, drawing engines and writing "Kaiser" on the tender, going over and over the wheels with his pencil—whether preparing them to run over the Kaiser or not, I cannot say.

One of the neurologists suggested that as a child he might have been afraid of locomotives, in the war he was afraid of the Kaiser, and the two fears were associated in his disturbed mind.

He caused us no end of trouble, first, by writing to the Government that he was being abused, and then by sending out to Nebraska for his mother, to come and save him "before he was starved to death".

We were shocked into realization of what the man was doing when an inspection officer arrived from Washington to inquire why the patient was being abused. The officer found him sitting peacefully in the sun room, drawing engines, and showing no evidence of starvation or abuse.

A few weeks later, his mother arrived, worn out from the trip, and full of anxiety for her son. She arrived without funds, having borrowed from kind-hearted neighbours in order to be able to make the trip at all. She was terribly chagrined and unhappy when she found that the hospital was really doing everything it could for her son, but relieved to know that the abuse was entirely in his own imagination.

More baffling to treat were the "functional disorders". In these cases, the anatomy remains unchanged, but function has ceased in some parts of the body. Paralysis has set in, and, nine times out of ten, it is just as real to the patient as though there were an actual organic cause.

One of our boys had been found wandering in "No Man's Land" after a battle, blind and speechless. For a whole year, he was kept in hospitals in England, and then sent on to Walter Reed Hospital in Washington. From there he was transferred to U.S. General Hospital No. 3, where we noticed that, although he was totally blind, he never bumped into anything. This aroused our suspicion that the blindness was purely functional, particularly as an optical examination revealed no eye defect.

At the time this boy arrived at Colonia, our neurological department was particularly busy, and the patient came under

the care of Captain Schwindlein, a man of forceful personality, who told him repeatedly that, without doubt, Major Ney could cure him. Hope is a potent factor in any recovery. The patient was told that other men around him had been paralysed, and were now getting better.

Examination revealed that there was no real paralysis of the vocal chords, because they responded normally to certain tests. The patient was told this, and by persistent suggestion was made to say, "Ah," the first sound he had made in eighteen months. He was then told that the following day he would be given a treatment, and that within fifteen minutes he would talk.

During the twenty-four hours preceding the treatment, the nurses were instructed to question the patient as to what hopes he had been given by "The Chief", and then to assure him that no such positive statement was ever given out by the Major unless he knew it would happen. Next day, the treatment was given, and within ten minutes, the patient repeated his name after the doctor. From this, he was gradually led into a conversation, and with the return of his vocal power, there was a simultaneous restoration of vision.

The boy was not a malingerer. He had been the victim of such terrific fright or horror on the battlefield that his nervous system succumbed functionally.

Another "functional" type was a boy from the lower East Side in New York City who had been terribly afraid of war and the trenches. Almost immediately, upon being drafted, there developed so strong a defence mechanism in his mind that a simple accident, such as spraining his ankle while playing football, sent him into definite hysteria.

Owing to the crowded conditions in the camp hospital, he was placed in a ward with several cases of leg paralysis from spinal injuries. Within a few days, purely from mental suggestion, this boy developed paralysis of the right leg, and had to use a crutch to get around.

He then met several patients suffering from "crutch paralysis" of the arm, caused from leaning too much weight on the crutch, and in a short time he caught this affliction also.

Fate hastened this boy's recovery in a most unusual way. A fire broke out in the officers' quarters, the flames awakened him. He leaped from his bed in terror, seized a helpless paralytic in the next bed, and rushed from the ward, carrying his friend to safety. Extreme emotion, the fear of death by fire, restored his

motor function after months during which he sincerely believed he could not move one side of his body.

These cases must be handled most carefully. Any careless suggestion that the patient is faking will serve only to prolong the disability. It is so real to him that such an insinuation offends his sense of justice, and he will, therefore, set out to show the reality of his disability in order to prove his own integrity.

One of the most valuable members of our medical staff was Major Emil Altman, Chief of the Neuro-psychiatric Service, later a member of the New York Board of Education. I had known Major Altman at the Post-Graduate Hospital in New York City, where he had been on the staff since 1895. Major Altman performed a splendid and invaluable service, in the face of his own disappointment and chagrin. Twice, his orders for overseas service had been revoked, because he had been born in Hungary. This occurred in spite of the fact that he had lived in this country since he was eleven years of age, and that two of his nephews were serving at the Front with the American Expeditionary Force.

Instead of being embittered, Major Altman threw himself wholeheartedly into the roving commission of psychiatric examiner to which he was assigned. Before coming to U.S. General Hospital No. 3, he had worked at ten different mobilization camps and prisons, where he organized psychiatric services.

Major Altman was a sturdy believer in the application of common sense. There was an army regulation that no soldier could be court-martialled until he had been examined by a neuro-psychiatrist. This gave the Major an intimate acquaintance with the guardhouse, which was usually in charge of a Second Lieutenant. Often enough, these young officers, inflated by recent promotion from positions of little importance, had a great deal more consideration for their own "brief authority" than for the penned-up youngsters who, after an evening's whoopee on a pass, found themselves in the guardhouse.

Soon after his arrival, Major Altman went to Colonel Upshur, the Commandant of the hospital, and said: "Colonel, I am going to burn the guardhouse."

The astounded Colonel demanded an explanation. Major Altman pointed out that the guardhouse was in a filthy condition and that no man in it could be expected to keep his self-respect.

"Oh, yes," the Colonel said, "I've heard about you. They tell me that as soon as a prisoner gets in the guardhouse, he says, 'Send for Major Altman; he'll get me out'."

The Major talked to the Colonel for some time, pointing out that men were human beings, and few of these boys were regular army men. They had been yanked suddenly out of civilian life to fight for their country. Some of them had never been away from home before, and they could not be expected to behave like West Pointers.

The discussion ended by Major Altman asking Colonel Upshur to take a nice, sunny ward and make a prison out of it. The Colonel looked at him as though he thought the Major had gone balmy.

"Why," he said, "the men would run away!"

But Major Altman assured him they would not.

Colonel Upshur, being an open-minded man, finally agreed to try the experiment, though he did not believe in it. From that time on, our guardhouse troubles ceased. No one broke jail.

Major Altman's fearlessness in giving suggestions which he believed to be sound, even though contrary to military precedent, appeared on other occasions. When necessary, his placidity would give way to a sternness that bordered on ruthlessness.

I remember one patient, an aviator, who at a certain hour every night would shout, "We're off."

Then he would go through all the phases of the air flight in which he had been injured and his pilot killed.

Major Altman watched him through several of these battles. Then, one night, as soon as the patient got his plane into action, the Major ran his finger down the man's throat and cut off his wind until he stopped fighting.

The next night at the hour when the flight usually started, the aviator asked the ward corpsman if Major Altman was around. When the reply was in the affirmative, the nightly flight did not take place. In a few days, the psychosis was broken.

The Major believed that this boy, who had loved his pilot, his plane, and his country, felt an overwhelming sense of failure because the plane had been brought down and his comrade killed, and this feeling drove him out every night to fight the thing over. But when the stronger fear of strangling to death with the Major's finger down his throat was super-

imposed, the instinct of self-preservation conquered the other unhealthy emotion.

The fire in the officers' quarters, which had an unexpected effect on many patients, was a tragic thing. A one-story building housed all the commissioned officers. During its erection, the Quartermaster's Department had announced that it would be made with a wooden framework, but that the main part of the building would be constructed of material which looked something like beaver-board and was said to be semi-fireproof.

The large Assembly Room looked barren upon completion. Although a fireplace had been requisitioned, it was ruled out by the Quartermaster's Department. The officers canvassed among themselves, however, and acquired sufficient funds to purchase material for the erection of a chimney and a fireplace of rather spacious dimensions.

A corporal, who served as an orderly, volunteered his services to do the masonry work, claiming that he had had much experience in that line of work before he went into the army.

The officers enjoyed their fireplace, and it was pleasant to drop in at the Assembly, on any wintry night, and find a large group collected about a roaring open fire.

One evening, about two weeks after the erection of the fireplace, Mrs. Albee and I returned from New York around midnight. We had scarcely gone to bed when we heard the shrieking blast of the hospital fire siren. Leaping up, I ran to the window.

The whole building of the Officers' Quarters was in flames, blazing like a gigantic gasoline pot. The officers were scattered about the premises, giving a panicky recital of their narrow escapes from the seething cauldron. They had been awakened by a burst of flames driving their bedroom doors open. Practically all of them escaped by plunging head foremost through their windows, whether open or not.

Many had various degrees of burns, but the one who disturbed me most was Lieutenant King. King had come to me about two weeks before, saying that he had been striving to train himself for surgery. He had put in four years of interneship and residency in various capacities, and he considered that he was well-grounded in the art of surgery; but he had not had an opportunity to "use his hands" sufficiently at the operating

table. With that, I shall always remember, he opened and closed his hands.

"Colonel, can't you possibly give me an opportunity to assist at the operating table?" he asked me.

I assured him that I would do everything possible to bring this about.

Of the several officers injured, I learned that Lieutenant King had been the most seriously burned. I was taken to him in one of the dressing-rooms. His face and chest were badly burned. It was possible that some of his fingers would have to be amputated. During the next week he was observed carefully, and at length it was decided that it would not be necessary to amputate any of his fingers. They were so badly burned, however, that it was apparent Lieutenant King's ambition of developing his hands at the surgical operating table would never be realized. Several years after this, he told me that it was practically impossible for him to do much of anything with his hands, and he could do nothing in the way of surgery.

The morning after the fire, a search of the ruins exposed Captain Fred Towle's charred body beside his bed. He had not even been able to get to the door or the window of his room. Captain Warren T. Walker's body was found at his door, which opened into the corridor.

A request came from Washington for a Committee to investigate the cause of the fire. I served as the chairman, and many hours of testimony were taken. It was a revelation to me that such a variety of testimony was obtainable under such conditions. Various witnesses stated that the fire had started in every conceivable location. One witness was positive that it was an incendiary fire, and that he saw it start on the veranda. Others located it here and there. There was no uniformity of testimony sufficient to determine just where the fire did start.

Inspection of the ruins, however, disclosed significant facts. The chimney was still standing, and there the glaring indiscretion of the well-meaning corporal was disclosed. He had built it around a wooden beam, which had, of course, caught fire.

The next important discovery was that the "fireproof" material, sold to the Government by a chiselling contractor, was in reality fabricated material, held in place by means of pine battings about one and a half inches wide and one-third of an inch thick. In spite of all the water that had been poured upon

the burning structure, the semi-fireproof material had completely disappeared in the flames, leaving the pine batting, ordinarily considered to be as inflammable as guncotton, projecting as much as three or four feet, without other structure around it. Those pine battings, which make the nicest kindling wood, had not burned, because of the amount of water poured upon them, whereas the so-called semi-fireproof material was destroyed. The whole building was demolished.

I wonder sometimes if the contractor's enjoyment of his profits was ever dimmed by the memory of those charred bodies.

XVI

"WHY, SISTER," said a handsome young giant from the Kentucky mountains to a hospital reconstruction aide, "I can't even read or write!"

The aide had suggested that he train for an office position which would not require much walking, as he had lost a leg.

Within a few minutes, five other men gathered around this boy's bed, confessing that they, too, were illiterate. This was too much for the aide, who was a college woman, and she went in search of Major Johnson. Right then and there a beginner's class in reading, writing, and English was organized.

Foreseeing the grave human and economic problems that the physically handicapped veteran was going to present as soon as he returned to civil life, Congress, on June 27, 1918, passed a bill known as the Smith-Sears Vocational Rehabilitation Act. Two million dollars were appropriated to help train the disabled soldier or sailor as an independent and self-respecting unit.

U.S. General Hospital No. 3 was extremely fortunate in having the highly resourceful Major Franklin W. Johnson, then on leave from Teacher's College at Columbia University, and now President of Colby College, and Captain Amphor to organize the educational department.

A man's past experience was never scrapped at Colonia, and if he could not be retrained in an allied field, if possible he was educated by the Government. In April 1918 we had nearly 2,000 patients, their educational backgrounds ranging from illiteracy to college degrees, which gives a bird's-eye view of

the stupendous task that confronted us. It is safe to say that during 1918–1919, over 100,000 men received the benefits of educational courses.

Study was not confined to elementary subjects. Algebra, arithmetic, bookkeeping, elementary science, chemistry, advanced English, geometry, left-handed penmanship, salesmanship, advertising, shop mechanics, spelling, typewriting, were offered to patients who had left school or college to join the A.E.F.

One-handed typing had a large enrolment and was taught by a one-armed superintendent of schools from Pennsylvania, a Mr. Potter. A soldier with both legs off taught English for months, while waiting for his stumps to heal. His artificial legs were fitted in the schoolroom, and his students could not dwell on their own troubles in the face of pluck like that.

Where did all this education lead? Usually to a better job than the soldier had held before he entered the army.

As a result of education, many aliens who had enlisted to support their land of opportunity became American citizens before they left the hospital—in accordance with a law which went into effect at that time. One of the most popular classes offered by the hospital was the one in Americanism, which prepared aliens for citizenship. At regular intervals, Judge Peter F. Daly of New Brunswick, New Jersey, would come to Colonia to conduct the ceremony of induction. Daly was a forceful, inspiring speaker, and both the patients and staff flocked to hear him.

As often as possible, work was combined with fun. Our staff used psychology in ways that were unique in hospital life and work in those days. Finding that there were quite a few boys who had literary ability, Major Johnson suggested that the hospital edit a newspaper, which became a live part of the educational department, accomplishing its share in convalescence. Oddly enough, it was an illiterate patient who gave it its name, *Over Here*.

Lieutenant William Emmett Conway, the editor, had had considerable journalistic experience before the war, contributing to *Vanity Fair* and other publications. The drawings of two talented cartoonists, Hirscher and McNamara, added much life to the paper. The latter, an industrious young surgeon who helped me in my animal research, still keeps up his drawing as a hobby.

All the printing on *Over Here* was done in the Curative Workshop, where we had a most complete print shop, including a linotype machine. The patients showed great interest in learning how to run this, and Major Johnson organized a class to study the various processes of printing. A circulation of 3,000 copies furnished plenty of work, both in assembling the material and in setting it. In addition to *Over Here*, all hospital announcements and programmes were printed by the patients. Thus the production of *Over Here* served a dual role—that of a curative workshop, as well as a vocational school.

The print shop equipment, unfortunately, was being put to other uses, without our knowledge. It was not until the spring of 1919 that we discovered the foreman had used it to make a counterfeit plate of one of the Liberty Loan bond issues. It seems he had bribed a sergeant in Colonel Upshur's office to lend him the government seal and so was able to put several counterfeit bonds into circulation. He was eventually discovered, tried, and sent to Leavenworth.

During the sometimes prolonged process of convalescence, it is necessary to keep a patient's mind off himself. In order to do this, some occupation must be found for his hands and his mind.

It was my good fortune to know a woman who was able to find the answer to this perplexing problem. Mrs. G. Wheeler Jones of New York, an interior decorator and toy maker, with a shop on Madison Avenue, had acquired a reputation for devising toys which appealed to the mechanical instincts of the adult. Before she entered the toy-making business, she had been a teacher; and from her father, who had been an officer in the Civil War, she had heard a great deal about the tedium of hospital life.

When I asked Mrs. Jones to organize our "Occupational Therapy" department, she threw her whole heart into the work. Soon after her arrival, the wards began to look like miniature automobile and aeroplane factories. But the materials were different—empty talcum powder cans, typewriter ribbon reels, bits of paper, cardboard and beads. Later, as the patients developed greater skill, all kinds of conventional materials were added.

At first there was a good deal of antagonism on the part of the head nurses towards the occupational therapy workers. Before long they realized that this activity made the patients

forget their troubles. The boys who had been morose and troublesome while idle, became docile and tractable after an hour's work with the paintbrush, jig-saw, silver novelties or beaded necklace. They took their Carrel-Dakin dressings and irrigations without protest. Their minds had found a new interest.

Mrs. Jones emphasized the importance of making the patient proud of his first piece of work. In school, if a child's arithmetic problems do not come out right, he often gets discouraged and sulky. The same is true of the hospitalized soldier, and to a more extreme degree, because he may be in a rebellious state of mind. Perhaps he didn't want to weave a bead chain—the simplest means of accomplishing new physical co-ordination and morale—in the first place. Now if he fails, he has a good excuse for giving the whole thing up. Or, if his long hospitalization has resulted in an inferiority complex—as it often does—failure heightens his conviction that he is no longer any good to himself or to others.

It is, therefore, most important that the first piece of bedside work assigned be so simple in construction that its successful completion would be certain. In spite of himself, the morose patient is elated at his success, and an interest in making something more difficult is born. This insures an eventual establishment of the work habit, and has a strong psychological value in treatment.

One big Swedish patient lingers in my mind. All attempts to interest him had failed. To be sure, he had reason enough to be gloomy. Before the draft took him, he had been an auto mechanic in a factory. He had a large family and was absolutely without education. His right hand had been amputated and he stubbornly refused to try anything. He had lain in the trenches for fourteen hours before the stretcher-bearers found him and all his hospital experience in France had been harrowing.

Everyone despaired of helping him until one morning an aide brought in a toy camel with movable joints which another patient had made. Big Tim brightened up at once. It wasn't the toy which interested him, but its mechanism. Of his own accord, he asked if he could be taught to make one like it for the baby at home, and from then on he worked steadily, gradually devising more complicated toys of his own. One was an "action toy", composed of road machine, wheel barrows,

and dumps, all arranged so that they worked on a circuit, and constructed from the ends of shaving tubes and talcum-powder cans. Empty typewriter reels made the wheels of the road machine. This was one case where simplicity of project did not appeal, but complexity did. Tim's dejection vanished and he asked to be allowed to go to the workshop.

In order to make him employable, however, it was necessary to give him an education. But Big Tim was accustomed to looking on schools as highbrow, and it was very difficult to get him to leave the Curative Workshop for study.

Eventually, an aide suggested that if he would learn to read and write, he could write his own letters to his wife, instead of having it done for him. This argument was effective, where everything else had failed.

Clay modelling was another popular occupation. There was a young Italian whose hands had been so badly shattered—he had caught a hand grenade and saved the lives of five comrades —that he could not even feed himself when he came to Colonia. The metacarpals of his right hand were all fractured, and also both forearms. Scar tissue, and disuse while the fractures were healing, had left the fingers practically rigid.

As soon as X-rays showed union of the fractures, he was taught clay modelling. The moulding of the clay brought stress in every direction on fingers and wrist, but because of his interest, he forgot the pain in his absorption in what he was modelling. This patient made large bowls which so impressed an Evanston woman who visited our wards, that she sent us an electrically-driven potter's wheel, making it possible for the men to turn out much finer pottery than before.

Many of the boys found themselves through their handicaps. A mechanic who had lost his right hand was feeling pretty blue because he could never go back to his old job. One day he attracted the attention of Mrs. Jones, the chief reconstruction aide, by the eagerness with which he watched the boy in the next cot do a pastel. Gradually, Mrs. Jones drew from him the admission that he had always wanted to be an artist, but the necessity of helping to support younger brothers and sisters had made him an auto mechanic. When Major Johnson told him that if he wanted to learn to paint badly enough, he could do it with his left hand, and the Government would provide for his training, the boy's face became radiant.

Up to the time when we discovered his love of art, we had

been unable to arouse his interest in any form of re-education. He had even refused to learn to write with his left hand. But when we said, "Paint," it was a different story. Time proved that he had real talent, and I am told that to-day he has many commissions.

In the routine of rehabilitating farm boys, too, we discovered several misfits. One was a boy from the Kentucky mountains who was an amputation case. He was the youngest of a large family of boys, and all his life had worked on his father's farm, making a bare living. He hated getting up early in the morning to do farm chores and milk cows. If it had not been for the war, he would probably have gone on as a dissatisfied farmer for the rest of his life.

It was soon discovered that this youngster too was interested in painting, and while his stump was healing, footstools were brought to his bedside for him to decorate. He took delight in this, and showed such good taste in colour and design, that we suggested he enter the poster contest then being run by the Liberty Loan. As a result of the talent displayed in his poster, arrangements were made for him to study. The last time Colonel Upshur saw this lad, he was working in the studio of a well-known interior decorator on Madison Avenue in New York, happy as could be and earning two hundred dollars a month.

It occurs to me that I have made all this sound painless and easy, as though, after a few kind words from a reconstruction aide, a disgruntled soldier saw the error of his ways and became adjusted to his lot.

That wasn't the truth—it wasn't within miles of the truth. While the surgeon and the nurse and the reconstruction aide did everything in their power to help, in the final analysis it was the character of the patient which carried him through that bitter period of readjustment to life with a handicap.

One of the most remarkable cases of rehabilitation I know is that of Ralph Grimm, as plucky a man as ever passed through the hospital at Colonia. With both legs off, he isn't even a "peggy" for his stumps were too short for the application of artificial limbs. Yet, since his discharge, he has not only built up a successful jewellery business, but won the love of a splendid woman who met him while he was a patient, and has had much to do with his successful rehabilitation.

His letter came to me last summer, when he was "working day and night to get ready for a trip into the White Mountains to sell his hand-made silver novelties at the different hotels."

"My wife and I," he wrote, "and some others, are in a cottage on Forest Lake, near Littleton—we spend a day at each of the different hotels, where I have made some very good sales. For exercise, I swim and paddle a canoe on the lake, and I have enjoyed some very good fishing." (Remember, he has no legs.)

"You ask about my experience in the war. It was the fourth of November, 1918. The 3rd Battalion, 355th Infantry, 89th Division, was advancing in the last Meuse-Argonne drive in skirmish formation. We had started at daylight, and it was now nine o'clock. We had taken the town of Beaufort, and were advancing up a narrow valley with high hills on each side. We passed the buildings of a French farm, and went on for about a mile. The enemy had been firing at us with light machine-guns, and, as we approached, they would pick up their guns and run back. The country was fairly open, but there were always enough bushes so that they could keep hidden. A German battery was also firing shrapnel at us, but so far, we had not had many casualties.

"We reached a place where the valley narrowed, and here the enemy had massed their machine-guns to stop us. I was scout for the 3rd Platoon of I. Company, which was in support. With two others, I was about fifty yards ahead of the platoon and about the same distance in the rear of the advance platoon. There was a slight rise in the ground between us and the German machine-guns, and as the leading platoon reached the top of this rise, they were met by the fire of at least a dozen machine-guns.

"We halted and while we were waiting for orders, the German battery changed to high explosive shells, and started a rapid fire on the slope where we were now digging. I was lying with the upper part of my body in a hole I had dug, but my legs were out on top of the ground. Three shells lit close enough to throw dirt on me, and then I felt a pain in my legs and rolled over. My left leg had entirely disappeared and my right was split the whole length. I had not heard a sound, but lay on the edge of a shell hole, the centre of which was where my left knee had been. From the shell hole and the appear-

ance of my wounds, it was plain that I had received a direct hit from a 77 mm. or 3-inch shell. The ground was soft and most of the force of the explosion had gone into the ground.

"I expected to bleed to death in a few minutes, but I saw that the blood squirting from an artery in the stump of my left leg suddenly stopped, and I thought that was strange. Later, I found that the heat of the explosion had seared the stump and kept me from losing much blood. My right leg did not bleed much, although it was laid open from hip to ankle, and the wounds were filled with dirt, clothing, and iron.

"I looked around and saw a pair of pliers that had been in my hip pocket lying on the opposite side of the shell hole. Later, in the hospital, when I had nothing else to do, I would try to figure just what freak of the explosion had sent them across that shell hole.

"The shelling ceased soon after I was hit, and one of the other scouts came over to look at me. He went away, and came back with stretcher-bearers, and I was carried back to the French farm we had passed. Here some enterprising surgeon had established a first-aid post, and I was given A.T.S. and morphine. This surgeon wrote his name on the ticket that was given and asked to be notified as to how I came out, but the ticket was lost in the ambulance.

"About noon, ambulances came up and I was taken back. When the ambulance stopped, I was taken out and told that my case could not be handled there, and that I must be sent further back. That ambulance ride was in the dark and it was a rough one. When I asked the driver if they could go easier, they told me that they had to take to the back roads because troops and supplies were being sent up to the front on the main roads. I knew that I was losing blood from my right leg.

"About midnight—I was taken from the ambulance and carried into a dark ward and the stretcher was laid on a cot. I heard the surgeon say: 'I don't want this man to have any more shock.'

"In a short time, I was carried into the operating room. I was still conscious and answered all their questions. At first, they intended to try to save my right leg, but a major told them that he saw signs of gas infection and that if they were wise, they would amputate at once. They told me this, and said if I wished they would try to save the leg, but that it was hopeless and that it would have to come off in two or three days any-

way. So I told them to do what they thought best, but not to make any mistakes.

"They called it a guillotine amputation, and it took eighteen minutes. The surgeons were Lieutenants Foote and Meleney, from somewhere on Long Island, and the hospital was Mobile Operating No. 4.

"I woke up before daylight and knew that both legs were gone. I was in that hospital about two weeks and was then sent to a Base Hospital at Mars sur Allier near Nevers. In December, I was operated on in an attempt to close the stumps, but the bones were not covered.

"In January, I got awful sick and had a temperature and very high pulse. The ward surgeon had gone on leave, and the nurse got another who probed a hole in my stump that was discharging. He found metal, and when he failed to get it out with a pair of forceps, he said he would give me gas and take it out the next day. The metal proved to be the jaw of the pliers which I had seen on the shell hole when I was wounded, and that explained how the pliers had gotten across the shell hole. A piece of steel had struck them, driving part of them into me, and throwing the other part across the shell hole.

"In February, I was sent to a Base Hospital near Nantes. Here, I had another operation and my stumps were successfully closed. There was only about two inches of bone left in each leg. This operation was the last, and I have never had any trouble from my wounds since.

"In March, I was sent to Brest, and home on the *George Washington*. On landing, I was sent at once to Colonia Hospital, U.S. General Hospital No. 3, and in June my wounds were entirely healed. When the Colonia Hospital closed, I was sent to the Walter Reed Hospital, where I tried to learn to use artificial legs. I gave the things a thorough tryout, but my stumps were so short I could not do anything with them.

"After I was discharged, I found I could take Vocational training in the schools and shops at Walter Reed Hospital, and I studied jewellery, silver-smithing, and art metal work. Miss Alberta Montgomery and Miss Sarah Gaut were the instructors, and I was able to sell the things I made, so that I could afford to buy material and try new things. I always liked to work with tools and silver and copper are splendid mediums to work with and offer almost unlimited opportunities for practice in design. I now have my own business in Washington."

While men like Ralph Grimm live, I feel that we are all a little richer in the knowledge that such magnificent spirit exists.

XVII

THE CURATIVE WORKSHOP at U.S. General Hospital No. 3 was one of the first to be established in the United States. But I had seen the wonderful results at Shepherd's Bush Curative Workshop in England where it had been sponsored by ex-king Manoël of Portugal, and I had been eager to try it out in America. It is significant that this workshop was located in what had formerly been an almshouse. For the purpose of the Curative Workshop is to prepare a man, not only to help cure himself but to support himself.

It had taken a great deal of argument to convince the English Government that definite steps must be taken to rehabilitate their wounded soldiers. At that time there was little public interest in reconstruction and orthopædic surgery, and the British people by national inclination want to be sure of their ground before accepting innovations. When Sir Robert Jones was eventually put in charge of this work, there were many people who were convinced that little good could be expected from it. There are some illuminating comments on this attitude in Goldthwait's *The Division of Orthopædic Surgery in the A.E.F.*:

"Previous to the war, there had been very little place for the orthopædic surgeon in Great Britain, and Sir Robert's position was not highly thought of, he being treated much as the osteopath has been treated in our country until comparatively recently. In our country, previous to the war, the orthopædic surgeon was being tolerated more or less, but was not cordially welcomed by the general surgeon; it was not many years removed from the old so-called 'strap-and-buckle days', the term that was used in the early days of the orthopædic work."

When, at Oxford, Goldthwait hotly remarked that it would be better to let the soldiers die than to let them live in their present maimed and helpless condition, he was mentioned with some amusement in the newspapers as "a breezy American".

None the less, the idea was growing that some definite measures must be taken. During his visit to England, Goldthwait learned that there were in Great Britain over 600,000

men who had been more or less mutilated by the war. At least half a dozen high officials in various branches of government told him, he says, that each of those wounded men "represented a centre of unrest, and that unless something could be done to improve their condition, or at least to have them feel that the government had done its best for them, these individuals would become centres of revolution, and that no empire or nation could survive that. This at once led the British to try to do something to restore their usefulness, and to give a type of care to the wounded different from the ordinary first surgical care."

After my visit to Shepherd's Bush, I was thoroughly convinced that a workshop served as a bridge from prolonged hospitalization back to an active life and employment. Many men, unless a plank is thrown to them, will get stuck in the quagmire of post-operative, or post-hospital depression. A surgeon who is unaware of the defeatist sense, the inferiority complex that has developed in a patient, is apt to hand him the coveted discharge with the words: "You are all right now. In a week or two, go back to work. The more you use it, the better your arm will function."

For a few men of unusual stamina, such an admonition might suffice. But in most cases, the men would still be at home a month or two later, thinking in despair of the days before the war when they were earning good weekly wages which they might never be able to equal again.

Such men need a plank. And the most effective one I know is work, planned with due consideration of physical and mental capabilities, but under actual industrial conditions, where patients are paid each week on production basis. The Curative Workshop provided just this.

Work is a valuable curative agent. If affects both mind and body at the same time. The patient's mind is imbued with a stimulus to activity, and is taken completely off himself. Without knowing it, he helps to restore his crippled hands and feet by the operation of machines. That is why artificial exercise cannot hold a candle to tools and raw materials placed at the patient's disposal. A sense of accomplishment is a mighty factor in rehabilitation. The healthy psychic effect of getting back into an atmosphere of work and wage-earning is remarkable.

Work, it has always seemed to me, is man's greatest blessing. Work and its attendant sense of achievement, of accomplishment is the most completely satisfactory experience in human

life. The day that is engulfed to the very edges in work is a good day. Perhaps it is the most enduring form of happiness. But, of course, I mean congenial work. Any other kind is meaningless drudgery. But if the work suits the man, and he suits it, he is a creature to be envied.

Leisure is good, too, if it is a refreshment and a preparation for further labours. But leisure as a reward, an end in itself, a climax of living, a prize for a busy life—never! Of course, there have always been people who make a career of leisure, and others who envy them. But I pity them. They must be miserable creatures.

How successful we eventually were with our Curative Workshop was indicated by the fact that for five successive months U.S. General Hospital No. 3 rated first on the record of curative shop work at all United States Army Reconstructional Hospitals. The Surgeon General sent Colonel Billings to Colonia to discover the reason for this. The Colonel was so impressed that he tried to induce Major Johnson to go to Walter Reed Hospital in Washington. The Major declined, but we did lose him later on to an important administrative position in the Surgeon General's office, which was a high tribute to his ability and to the staff that had worked with him in the building up of the best hospital educational department in the country. So our sense of personal loss was combined with a feeling of pride when we had to say good-bye to him.

I realized in starting the Curative Workshop that it was a ticklish proposition. It was a completely new thing in this country, and if it failed, I would come under a cloud of criticism from all sides. The successful outcome of the whole project depended upon the wise selection of the first patients and the co-operation of their ward surgeon.

After studying the matter, I decided on Ward No. 5, because there were boys with extensive injuries who could be greatly benefited by shop work, and because the ward surgeon seemed the most sympathetic towards the idea.

Major Johnson and I went to the ward together, and selected as our first candidate a red-headed Irishman, who had been in a very ugly temper ever since his arrival from France.

The ward surgeon promptly objected, on the grounds that the man was a crank and a faultfinder, never satisfied, and entirely unsuited for work in the shop.

But this was exactly the type of man we wanted. It was more than likely that Red's mental attitude was the result of a very severe injury he had sustained. He had plenty to be disgruntled over, and his state of mind was the result of too much introspection. Hence, the need of work to jar him out of it. So I stuck to my selection, and went to work getting together material either from philanthropic friends and other sources, or by requisition from the government.

A few weeks later, as we entered the workshop, Red burst out enthusiastically.

"Why, this is a regular place!"

My theory had won. With rapidly mounting interest, Red passed from one type of machine to another. He paused longest in front of the wood-working machines, and we found that he had been a carpenter before enlistment. With a badly injured leg, his days of climbing scaffoldings were over, so we suggested that he learn cabinet-making.

This gloomy Irishman became so enthusiastic over his woodwork that his grouch vanished. This, and the fact that he began urging other men off the sun porch into the shop, helped to start our curative workshop rolling in fine shape. Red had thought his life ruined, but when he got into the workshop and realized that he could produce something, he got his first ray of hope.

Lying in bed, with nurses taking care of them, and all sorts of welfare organizations pampering them, the soldiers lost their morale and ambition. But, as soon as they were put where machines and work benches surrounded them, their whole attitude changed. Before long, they requested that the shop be kept open on Sundays.

Whenever possible, we used machines driven by hand or foot instead of motor. Machines run by foot-power brought stiff knees and ankles into play. In cases of serious contractures of finger and palm, the handles of tools were specially built and modelled, with gutta-percha, so that the patient could grasp them. The pressure of working a plane or auger gradually loosened up contractures, and as function increased, the amount of gutta-percha was gradually decreased. Eventually, the patient could use the regular wooden handle.

James Pollock, a reconstruction aide from Brooklyn, instructed eighty men in mechanical and architectural drawing, most of them becoming expert draughtsmen. Through his

connections with the Red Cross Institute for Crippled and Disabled Soldiers, by whom he had been formerly employed, and his personal touch with a large number of manufacturing concerns, he was able to place quite a number of men in very good jobs.

Telegraphy was also taught. One of our ablest telegraphic pupils was Samuel Dana, a full-blooded Indian who, before his enlistment had attained distinction as a star football player on the Carlisle University team.

Fortunately, the Curative Workshop escaped the fire at Colonia with little damage. Had it not been so, I do not think that Major Johnson and I would have had the heart to go out into the highways and byways as we had done before, to solicit donations of machinery and equipment. Through our joint efforts, some fifty thousand dollars' worth of machines had been collected. This included a Mergenthaler linotype, tractor, an acetylene-welding outfit, garden tools, wireless apparatus, carpenter's lathes, automobile parts for repair shops, and a Landis shoe-stitching machine which brought joy to Italian patients who wished to improve their art of cobbling.

The Colonia hospital owed much to public-spirited civilians who contributed generously in countless ways to the welfare of the boys and the hospital itself. Mrs. Louis Ballard, director of the Sewaren public library, even furnished money to have reproductions made in clay and wax of my reconstruction operations, to be used for teaching and demonstration purposes.

Many of the boys helped to make their own artificial legs. In fact, the making of artificial limbs furnished an important part of the work in the Curative Workshop. This not only helped to remove some of the odium of wearing an artificial limb, but had a salutary psychological effect—the boys felt they were actually having a hand in their own reconstruction.

When the day finally arrived for a man to receive his "provisional" leg, which was worn during the shrinkage process, these gallant fellows made comedy the sustaining element. Invariably, the wearer gave his new leg a pet name. When he was going for a long ride, far from the sight of watchful nurses or surgeons, he was likely to unstrap it and lay it on the floor of the car. Or, just before stretching himself out on the grass by the roadside, he would hang his leg on a nearby tree and chuckle over the gasps of passing automobilists.

Civilians for miles around took the boys on recreation rides; and amputated men, who were waiting for their artificial limbs, were always given preference.

One day, four of the boys were being driven to Plainfield, New Jersey. Three of them had lost both legs, and the fourth had only one. A few miles from the hospital, the driver detected the odour of smoke, and stopped to investigate. A cigarette had ignited the carpet in the tonneau and the four men were making a brave attempt to stamp out the fire with the one leg in the crowd.

As soon as the artificial leg had been fitted, the first thing to do was to acquire balance. And dancing was one of the best ways to do it. The "amputation dances" held at Colonia were always well attended, and the male wallflowers were few. The first such dance held in the Red Cross House heightened my admiration for the boys. Lieutenant Barry had reserved the floor exclusively for men who were learning to wear artificial legs. The morning afterwards the hospital paper ran a column on Sergeant B's reaction to his first dance on an artificial leg:

"Yes, it took courage to step out upon that polished ballroom floor . . . I, who four weeks before, had been on crutches, was going to attempt my first dance on an artificial leg. I say it took courage, but I want to say a word for the consummate nerve of the girl who coaxed me to try it with her—that was real patriotism!

"The music was a jazz one-step. I felt full of pep, glided off with my left foot, then with my right—no, wait! It should have been gliding, but it refused. I felt my right leg lift a weight, swing it forward, and drop it on the floor again. Where was the pep in that leg? There wasn't any. I felt that there was something hanging on there, and when I placed my weight on it, I knew that it must be under me, for I did not fall. Was I keeping time? Yes, I must be, because my left foot came down on the right beat.

"Was that 'peg' kicking the lady, or resting on her toes? She answered 'no', when questioned. Did the people about notice that stick of wood hanging on me? No, I didn't seem to be attracting any particular attention.

"Well, perhaps then it didn't look as peculiar as it felt. On the wall was a large looking-glass, and there was my reflection. I looked like a normal human being. All these questions were going through my head, but gradually I began to gain con-

fidence and relaxed my grip on the young lady enough so she could breathe.

"Why, really, it wasn't half bad. Of course, that 'E-Z Fit' didn't have any pep in it, but there was plenty to spare in the good leg, and anyhow wasn't the girl a pippin, and didn't I have my arm around her, and wasn't I privileged to hold her just a little tighter than the fellow with two legs?

"Now, you peg-legs, profit by my experience; don't sit and watch the other fellow dance—do it. It is like going under a cold shower—hard to start, but great after the first shock, and sure does put the old ginger in you. But take my advice, when you pick your partners, pick 'em big, because the smaller they are, the harder you are likely to fall."

One of the unanticipated effects of the amputation dance was that men who were waiting the completion of their new legs clamoured next morning for more speed, and the orthopædic shop worked overtime to oblige them so they could attend the next dance.

On "Welcome Home Day" at Perth Amboy (June 30, 1919), the "Victory All-Star Vaudeville—8 Big Feature Acts" from U.S. General Hospital No. 3 packed the Majestic Theatre both afternoon and evening. It was managed by one of our patients who had been an actor in civil life.

The number which will be remembered by those who saw it was the exhibition drill. It opened with a bugle call by Corporal Jimmie Palmquist, in a wheel-chair. Then, as though from a great distance, could be heard the even tread of approaching troops. The "one, two, three, four" grew louder and louder. When the men finally marched on to the stage, every one of the sixteen was on crutches.

They drilled around the stage, doing squads right and left, circling, squatting, and never a man out of step. Finally they went through the manual of arms—the right crutch serving as a gun. The crutches descended to the floor as though they were one instead of sixteen; and the manual was executed with snap and precision.

The audience cheered again and again. The men retired from the stage for a few minutes, and when they re-appeared the audience received a distinct shock. Each man was walking on two legs—the crutches had disappeared. During the interim, the men had donned their new artificial legs, and proceeded to show their skill in using them. This time they went

through the same formations, and did it almost as quickly and well as though they had never undergone an amputation.

In the spring of 1919, when we had nearly 2,000 boys in our wards, a general order from the Surgeon General's office was sent to every army hospital to dismiss half its professional staff.

This sounded like a death knell for many men. At Colonia there were some of the most difficult reconstruction cases from overseas, men who needed constant supervision, and hundreds with large granulating wounds. Their very existence was at stake.

I went at once to our Commandant, and said: "This order cannot be complied with."

"It must be," he replied. "Every other hospital has received the same order and is complying."

"What is going to happen to these boys?" I questioned. "It is more important that they go home rehabilitated than that an ill-advised order go through. Here we have been working tirelessly for months to put these men on their feet, so that they can go back home and carry on. Our staff has never been too large. Cut it in half, and what will happen?"

After a moment's hesitation, the Commandant, a Colonel, said: "I will write a letter to Headquarters."

"A letter!" I exclaimed. "Why, this order takes effect in a few days, and with all the official red tape in Washington, a letter may not even reach the officer who has authority to take action until too late. Once the order is effective, and must be complied with, we will be helpless. Every officer is anxious to get home, and once they are ordered from the post, they can never be brought back. There is nothing to do but for you to go to Washington."

The Colonel went. Next day he returned, saying he was sorry, he had done his best, but to no avail. The Colonel was a regular army man, trained to comply, but I am a poor complier. So far as U.S. General Hospital No. 3 was concerned, I was determined that this order should not go through. Next morning, therefore, I took the train for Washington.

Immediately upon my arrival, I sought out the officer who was controlling such orders. Before I had half-stated my errand, he interrupted impatiently: "Oh, that matter is all attended to. Your Commandant was here yesterday. We can make no exceptions. The order must be complied with."

If half of the professional staff at General Hospital No. 3

were given their discharge, I told him, it would do incalculable harm to the patients set adrift before they were able to take care of themselves. It would lead to an investigation and might even create public criticism.

Some hospitals, from which a large number of patients had already been sent home, might be able to comply with such an order, but the situation at Colonia was entirely different and demanded a different ruling. Hundreds of major operative cases had been segregated and sent there because of extensive loss of bone and the necessity of bone graft operations. In fact, most of such cases had been sent to U.S. General Hospital No. 3. In a large percentage of these cases, the soft parts had not yet healed sufficiently to allow the bone-restoration operations to be done. Therefore, we still had an exceptionally large number of serious cases necessitating a large surgical staff.

The Colonel was irritated, but he could not deny the truth of my statements.

"Go back to Colonia," he said at last, "and dispense with as many of your staff as you can, and it will be all right."

The next issue of *Over Here* carried an editorial on the importance of the enlisted medical officer staying by the wounded when everyone else was shouting for discharge. And—may I pay this tribute to my staff?—from then on until the middle of October, when the hospital closed, they stood by, almost to a man. I do not believe there was a more co-operative staff in the whole medical corps, and I still treasure the association of those strenuous months.

The final order to close the hospital came early in October, and this time it was possible to comply. Those sixteen months showed me, as nothing else before or since, the magnanimity of human nature under terrific stress; the remarkable possibilities of reconstruction surgery in warfare with automatic power-driven tools; the curative power of well-selected and directed manual and mental work in restoring function.

To-day, only a flag pole rises from the waving grass, like a solitary sentinel, guarding the spot where the foundations of rehabilitation were laid in the State of New Jersey. But I still love to drive by the empty fields where once stood the great hospital which held the richest experience of my life.

In 1917, while our national participation in the First World War was still in its infancy—and right in the midst of my own

military work—Charles R. Macauley, the famous war cartoonist of the *New York World*, conceived the idea of writing a scenario to be called "Whom the Gods Would Destroy" which was to educate all the world as to the iniquities and ambitions of Prussian militarism. For some time Macauley had been carrying on a one-man campaign against the Kaiser and all his works, with such unforgettably graphic depictions as the Kaiser leading the flower of his nation towards a victory which becomes a heap of skulls. Macauley believed a motion picture development of this same theme would prove of inestimable human service in promoting the cause of a future and lasting peace.

Macauley and some of his friends got in touch with ex-President Taft, Herbert Houston, George F. Allison, Hamilton Holt, Walter B. Clark, and Walter Measday, and organized a company to be called the Charles R. Macauley Photoplays, Inc.

Mr. Clark, a Bowdoin classmate and fellow football player, came to me. Because of the horrors I had already seen in my rehabilitation work among the veterans, the project had a particular appeal. I invested several thousand dollars in the venture, and was made one of the vice-presidents of the company.

It was agreed that Macauley should write the scenario. He was placed on a salary, and together with his family—and a whole library of reference books—was sent up to the Adirondacks to commune with the Muses, and give birth to the epic. But the Muses evidently were not in a communing mood, for as Macauley wrote us on numerous occasions, he just couldn't "get it out of himself". Eventually, however, after months—and much pushing, which was intended to be helpful, but possibly was just the opposite—the author announced the completion of the scenario.

A director was engaged at a thousand dollars a week, the cast was assembled, and Macauley, his family and the whole company was sent to Hollywood to make the film.

With the starting of production, bills that looked like the national debt began to roll in. Then, when about half the picture had been shot, it was discovered that the scenario required more work done on it—it was not really finished. To add to the difficulties, an epidemic of Hollywood "blonde trouble" broke out all around. This so delayed production that the war was practically over when the film was finished and ready for distribution. With the signing of the Armistice, the

public developed a complete apathy towards any war subject, and thus "Whom the Gods Would Destroy" died.

We tried to recoup our losses with other ventures, but when the majority proved to be failures, we quietly folded up, and crept away from Hollywood.

To-day there are hundreds of thousands of dollars' worth of our films in storage. They are very nice films, but no one ever sees them.

At this same time, I became interested in another enterprise of a very different character, and one with a far happier ending than the movie venture I have just described.

For years, Rahway, New Jersey had struggled on without a hospital of its own. The doctors were forced to take their patients to Newark or Elizabeth where, as they were not on the staff of the hospitals, they found it increasingly difficult for them to procure admission for their patients.

One night a committee came to me, saying that they were desirous of purchasing a building which would be suitable for a hospital, but they needed funds for it. Would I help them?

I said that I would and a discussion of plans was launched.

"But, of course," remarked one of the committee abruptly, "Dr. X will not be allowed to bring his patients to this hospital."

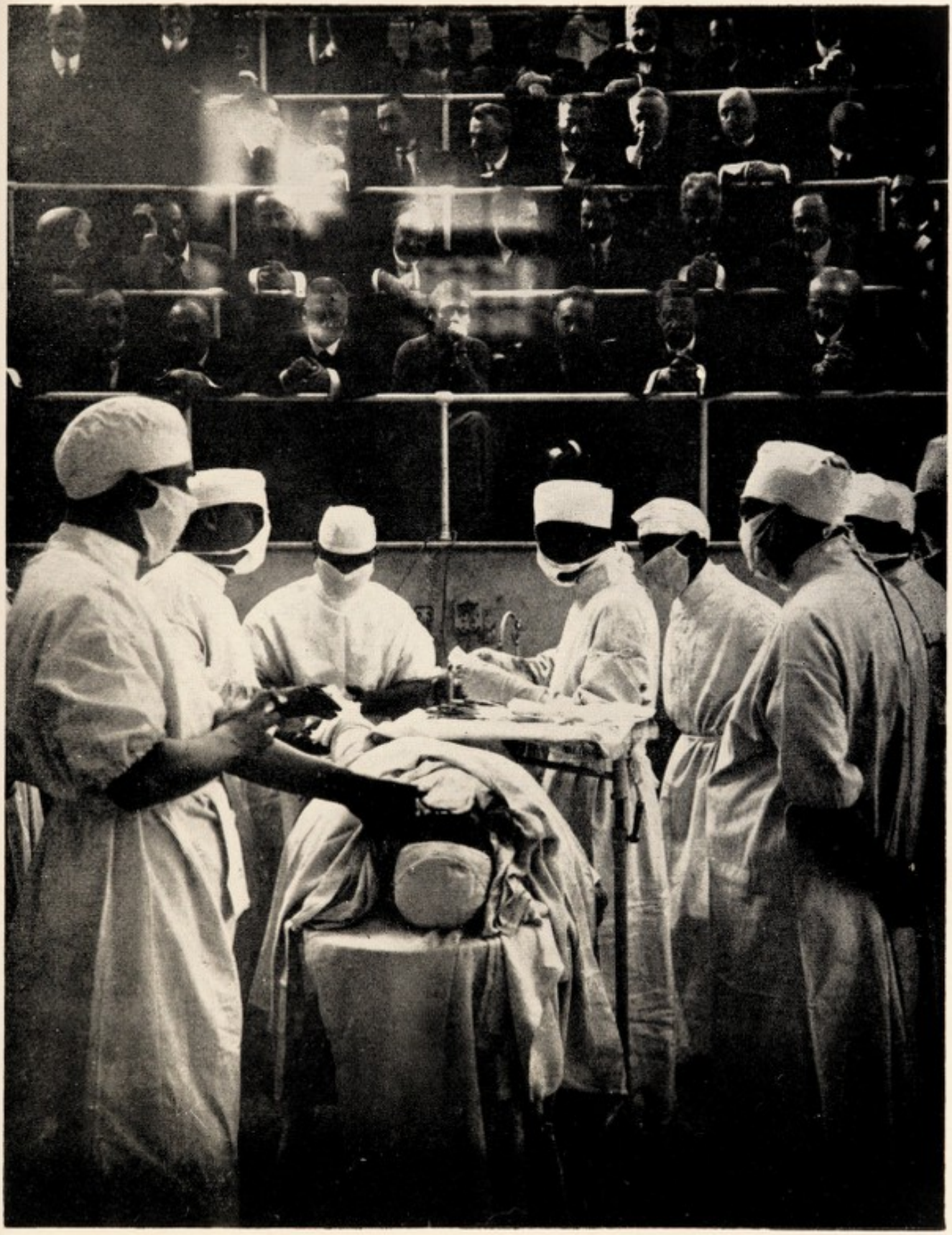
Now Rahway is a small town, too small to harbour resentments, professional squabbles, and spite; too small for dissension; certainly too small for discrimination against an accredited doctor.

"Unless this hospital is for the use of all the doctors of Rahway, I am through," I told them bluntly. "It isn't the doctor, it is the patient you injure by an action of that kind."

After a little humming and hawing, one of the committee went to the telephone and asked Dr. X to join us for the rest of the discussion.

The hospital thus planned went forward, was organized, and was open to every physician in Rahway. It proved to be so successful that two years later we purchased an adjoining building which became the hospital annexe.

From the beginning it was called the Rahway Memorial Hospital. Some years later it was taken over by public-spirited citizens from the doctors who had operated it exclusively. A half-million dollars was subscribed and the citizens erected the present beautiful edifice which is a credit to Rahway and the people who built it.



Dr. Fred H. Albee performing the opening operation of the 1919 Congress of the Italian Orthopædic Surgical Association, Rizzoli Institute, Bologna University, Bologna, Italy. The operator is standing at the foot of the table, and his first assistant, Professor Vittorio Putti, is at his left

PART THREE THE HUMAN SCRAP HEAP

XVIII

On the day that U.S. General Hospital No. 3 closed its doors, I was summoned to Washington to the Surgeon General's office. Here I was asked to attend the Inter-Allied Conference on Rehabilitation in Rome, both as the official representative of the United States government, and of the United States Medical Corps.

So in October of that year, 1919, Mrs. Albee and I sailed on the *Mauretania*.

Rome was at its most festive. The reception given to the conference delegates was about the most elaborate I have ever witnessed. And shades of Julius Caesar, and the days when we struggled to learn that Rome was built on seven hills! We were received on Capitoline Hill by the Mayor of Rome; and on Palatine Hill by the King of Italy, who stood, dressed in a Colonel's uniform, alone with his body guard at the very top. Each official delegate of his individual country was escorted, with a guard on each side, up the steps of the Palatine Hill to the presence of the King. The officers of the King's Royal Guard, stationed on the successive platforms *en route*, gained in splendour from one platform to the next, until at the top they quite outshone the King himself, with their waving plumes, gorgeous braids, glittering buttons and magnificent swords.

On another occasion, this very elegance of a guard led to the most embarrassing experience in a colleague's life. A famous orthopædic surgeon from the West, was attending his first elaborate reception in Italy, at which he had heard a very high dignitary was also to be present. As the reception progressed and no one introduced the high dignitary, he decided to do a little looking around on his own. At the far end of the room, standing near the door, he saw a most magnificently garbed person, with enough plumage for two kings. "Ah!" said my colleague. "This is my opportunity." And with an enthusiasm designed to melt even such evident aloofness as that of the high dignitary, he rushed forward with outstretched hand, say-

ing: "Sir, this is indeed a great honour." Only a surgeon's strong heart probably kept him from fainting when the guard put him straight; and needless to say, he has never been allowed to forget his *faux pas*, which has served ever since to forewarn all other members of the profession.

On this occasion, fortunately, no such untoward event marred the proceedings, and everything went along smoothly in the midst of the great pomp.

From all over the world, surgeons and scientists, ranking army officers, educators, and employers had been summoned to this Inter-Allied Conference to consider the problem of rehabilitating the wounded of the First World War.

This was in fact the first great rehabilitation meeting in the world, with representatives from China, Japan, Montenegro, Serbia, Greece, Italy, Great Britain and her colonies, France, America and many other countries in attendance. For the first time the coined word "Rehabilitation" was used in an international sense.

Each nation set forth its experience in dealing with the wounded and salvaging the injured. Papers were read on every phase of this many-sided problem, and a whole section of the Congress was devoted to reconstruction surgery. Practical demonstrations were given of work done in curative workshops and vocational schools.

The President of the Congress, Colonel Riccado Galeazzi of Milan, Italy, was an inspiring leader and visualized practical plans, not only for the restoration of the Italian *mutilati*, but of his injured civilian brothers as well.

In that fall of 1919, lights were again burning in Europe, but it was still digging out from under the ruins of war. After the Conference, where we had been discussing ways and means of rehabilitating men who had been disabled in action, the indescribably lovely, peaceful Italian countryside was like a dream, so remote it seemed from violence and bloodshed. Italy had escaped the brunt of the fighting, and the unmarred splendour of her beauty was something to hold in the heart, to recall when the memories of war were too painful.

Directly after the Rome Conference, the Italian National Orthopædic Association asked me to open their Congress with an operation at the University of Bologna. I was doubly interested in doing this. First, professionally, of course, and especially so when I found that Professor Putti, Professor of

Orthopædic Surgery at the University was honouring me by serving as my assistant during the operation. But aside from this, I had a purely personal reason—a long-standing curiosity mixed with affection, which dated back to my college days, for it was here in the University of Bologna that my fraternity, Kappa Sigma, was founded in 1400, and to this day its ritual is rich in the language of early Bologna.

When it came time to sail for home, I discovered that practically the entire A.E.F. was trying to get passage. I was given reservations on the *President Grant* which was to sail from Cherbourg in about a week. Meanwhile, I learned, some members of the A.E.F. wanted to pay a final farewell visit to the French battlefields. I was invited to join them, and we entrained at Paris for Château-Thierry.

We visited every battlefield from Château-Thierry to Verdun and the Argonne Forest—the other side of the coin from the peaceful-looking Italian countryside I had so recently left—a devastated land, with gutted wrecks of houses, and no tree standing. It did not seem like a land in which men had lived—only a land in which men had died, in fear and agony and horror. We saw the town of Arras, where 40,000 people had had their homes, completely destroyed by shell-fire. We saw many little towns, or rather the sites of little towns, of which nothing at all remained.

These, I reminded myself, were the French provincial version of our little towns, with their church, their butcher and baker, their leisurely small concerns. These the people whose familiar world had vanished in shot and smoke and the staccato drumming of machine-guns. Little people.

The town of Lens, which had once boasted 35,000 inhabitants, was completely destroyed; and under a rubbish heap, which was all that was left of the cathedral, lay 900 still unrecovered bodies of people who had been buried alive.

We went through Vimy Ridge and No Man's Land, a waste space of shell holes, where men had blasted at one another for four years; and we stumbled over human bones and boots with men's feet still in them.

We found people living in caves, starving, without coal, and winter coming on. And these, we remembered grimly, were the victors!

Finally, we reached Romagne where I saw a field of 65,000 white crosses, marking the graves of American boys.

I came back to the United States with one overwhelming conviction. The war must pay back its debt to humanity by the alleviation of suffering for mankind in general.

We had learned much during the war, under the strong, relentless pressure of necessity. We had found new methods of patching up mutilated bodies, and restoring handicapped men to their rightful place in society.

The next step was to apply what we had learned in healing and restoring that vast, anonymous army which was made up of crippled or handicapped civilians.

It came about like this.

The Commissioner of Labour for the State of New Jersey, Colonel Louis T. Bryant, was a man of great vision, with an international reputation as a humanitarian. He was responsible for many valuable labour laws. Now the time had come when he wanted to find some way to help workers who had been injured in industry, to make New Jersey "the State without an industrial scrap heap".

Colonel Bryant had long been interested in the work we were doing at Colonia in rehabilitating men, and he believed that a similar method of rehabilitation, based on the fundamentals of physical reconstruction, should be adopted by the state for the benefit of its industrial casualties.

As it happened, Colonel Bryant's conviction was shared by Arthur G. Whitney, a state senator, and together the two men approached Walter E. Edge, who was then Governor of New Jersey.

From the American Embassy in Paris, in 1931, while he was French Ambassador, Walter Edge wrote, with great generosity, something of that story:

"A great French statesman, M. André Tardieu, considering in his *France and America*, the engrossing problem of post-war reconstruction, marvels at the individual American's faith in the preventive, practical, and economic importance to society of aid and rehabilitation. In fact, he goes one step farther: he contrasts this quality favourably with the attitude of other peoples who content themselves with the curative effort of the State in the guise of Providence. . . .

"Anyone who has followed, even casually, the magnificent strides made by surgery and sociology in the second and third decades of the twentieth century, can easily apply M. Tardieu's compliment, addressed to American character in general to

Dr. Albee's specific achievement. His trail-blazing record of surgical redemption on the battlefields of France in 1916 is, for instance, one of the remarkable mileposts of modern remedial progress. The account of his tireless work of reconstruction among the maimed and helpless at U.S. General Hospital No. 3, Colonia, New Jersey, after America's entry into the war, of his devotion since the Armistice (both as surgeon and member of the N.J. Commission of Rehabilitation) to the cause of the physically handicapped, is the genesis of one of the most stirring contemporary humanitarian movements. . . .

"I still recall with awe my first visit to Colonia in the spring of 1918. The magnitude of the problem—the heartrending nature of the task—which the surgeons of the rehabilitation centre had to cope with and the intrepid courage and skill with which they were handling it, impressed me in a way which the passage of time cannot efface. . . .

"But what perhaps struck me most during my visit to Colonia was a remark made by Dr. Albee as we passed from a curative workshop to an experimental laboratory. 'Human injury,' he declared with emphasis, 'will not end with the Armistice. In an age governed by speed and mass production, the grinding pistons of our industrial civilization will take a higher annual toll than the war.' In other words, should the lessons of the war learned at Colonia and other reconstruction centres be applied to the problems arising from social and economic injury, the lives lost from 1914 to 1918 would soon be made up by a reduction to a minimum of permanently handicapped men of the type who through no fault of their own become a public charge and an economic loss to the community.

"From this thought, launched in the stimulating atmosphere of a great reconstructional hospital, to the passage and signing of the Rehabilitation Act of New Jersey—the first comprehensive Rehabilitation Act to be passed in the United States—was a logical progression. Having served as Chairman of the Economy and Efficiency Commission of New Jersey, and having been instrumental in securing the passage of the Workman's Compensation Bill in 1911, I was naturally deeply concerned with the problem arising from accidents in their duty and accordingly returned to my legislature determined to assure to the victims of our machine age the same advantages that a grateful nation was then lavishing on the wounded of the war. To the great credit of the enterprising and far-sighted citizens

of my state, the Act was passed and in April, 1919, I had the privilege of appointing the first New Jersey Commission of Rehabilitation and Dr. Albee as its Chairman. . . . By outlining a programme whereby men and women will become assets instead of burdens to the community, Dr. Albee has struck a smashing blow for social and political order in a world which is surfeited with the subversive and the unassimilated."

Because the knowledge gained in the care of 6,000 patients in eighteen months at Colonia had given me an unparalleled chance to ascertain how far-reaching in value was the effect of rehabilitation, I was given the opportunity to help draft the law—passed on April 10, 1919, by the State Legislature—which brought the New Jersey State Rehabilitation Commission into being.

During the World War only 4,000 Americans required limb amputation. And yet 30,000 industrial workers required such operations *annually*!

Frederic G. Elton, district director of the New York State Rehabilitation Bureau, which followed the New Jersey Commission, pointed out graphically the distressing state of affairs in the *Rehabilitation Review*, which we edited jointly for almost ten years.

"If there has resulted," Mr. Elton wrote, "from the devastation and sacrifice of human happiness and life during the World War anything beneficial to humanity, it is the realization of the necessity of conserving the human resources of the country. . . .

"The staggering loss of 227,000,000 days of labour, and $66,000,000 annually as a result of industrial accidents that result in partial and complete permanent disabilities, is the situation which has to be reckoned with economically and socially. It is estimated that in industrial accidents alone, there are 2,500,000 temporary and permanent disabilities a year."

The idea that society should not tolerate this condition, that its industrial cripples, as well as its war cripples, constituted a problem which must be solved, was a new one. In that same review, C. A. Prosser sketched the historic background of the social concept of rehabilitation.

"Since the dawn of recorded history," he pointed out, "the human race as a whole has advanced through a series of attitudes towards those afflicted by disease or misfortune. These

changing points of view can be roughly described as a succession of ages, some of them covering many centuries. The titles that might well be given these eras will serve here to describe the corresponding stages at which the world has arrived in dealing with the unfortunate; particularly, the lame, the halt, and the blind: The age of cruelty and elimination, the age of indifference and neglect, the age of pity and pauperism, the age of charity and individual responsibility, the age of social responsibility and experiment, and the age of constructive treatment of the dependent and the handicapped.

"All of these attitudes still linger in the world. The savage tribes of the dark places have never evolved beyond the first age. Some barbaric people are still in the second. Some civilized nations have attained the fourth. All self-determining democracies recognize their social responsibility, within limits, at least, for the dependent and the handicapped. The United States has the honour of being the first to see the redemption of the disabled as a wise venture in human conservation and to begin the handling of it in a constructive way. This seeing and doing of things for the nation's handicapped constitutes the Rehabilitation Movement."

In that word "rehabilitation" we included all the factors involved in rehabilitating the whole man, physically and mentally, economically and socially.

"By rehabilitation," I explained at that time, "is meant not only the latest methods of orthopædic surgery and surgical reconstruction of the injured, but also training of the injured member to perform the utmost function of which it is capable; the teaching of the patient skill in work other than that which he has been doing, in case the injury incapacitated him from his previous occupation; the application of the latest psychological methods to improve his morale, and finally a study of industry for the purpose of ascertaining those occupations which are suited to the cripple and fitting the patient to make himself useful in such work when the position has been found for him. It includes also such subjects as mechanical devices and artificial limbs, the relation of the cripple to compensation laws, the prevention of accidents through safety devices, and many other subjects which bear on the relation of the cripple to society."

I have never found it easy to wait for things to happen. It

is probably a result of that early training on a Maine farm. There we had to make things happen.

While the slow machinery of law was clearing the way for the New Jersey Rehabilitation Commission, Frederic Elton and I established in New York City a Curative Workshop, based on the principles of the workshop at the Colonia Hospital. Give a handicapped man sympathetic help, tools which are made with an eye to his deformities, the appearance of normal working conditions with the help of secluded surroundings and a friendly foreman, and he can help himself towards physical, mental, and moral rehabilitation. It had proved its value in war time; it should be equally valuable in times of peace. It was and is!

There is great satisfaction in taking a poor fellow who can scarcely raise his hand, or move his foot, surgically reconstruct him, place him in the curative workshop, and then carry him through to employment. For instance, there was such satisfaction in the case of John Harlan.

I first saw John at Blackwell Island Hospital, when I was called in by Dr. Dawbaum to determine whether anything could be done to relieve the complete paralysis which had forced him to give up work.

I found him suffering from tuberculosis of the spine, which had resulted in the involvement of the spinal cord and its membranes, and consequent paralysis. Harlan had a devoted sister, and I explained to both of them that I would operate if John would not give up hope for a year of being able to walk.

John had been helpless so long that he was anxious to take the chance, and accordingly I operated, inserting a bone graft from his tibia.

Ten months after the operation, his sister came to my office and told me dejectedly that John was not moving a toe.

I reminded her of what I had told them before the operation —not to give up hope for a year. She went away, very doubtful and anxious. But, just before the year was up, she came again to my office, this time radiant with joy, and said that John was moving his feet considerably.

From then on he made rapid progress, and fourteen months after the operation, he walked into my office, the proudest man I have ever seen. Although still weak, he had obtained leave from the hospital to come and show me how well he was getting on.

After that, he returned to the care of the Blackwell Island physicians, and I lost sight of him for about ten years. That is one of the tragedies of a surgical consultant's life in a huge city like New York. It is impossible to follow intimately and personally all the cases on which one operates.

It was in 1909 that I first knew John Harlan. Just about ten years later, Mr. Elton and I opened the Rehabilitation Workshop of East 41st Street, in New York City, and installed, so far as I know, the first curative workshop for civilians in the United States. The day it opened I went around to see Mr. Elton.

Among the men at work, I noticed one who looked familiar, but not being sure of myself, I passed on. The next day when I dropped in at the shop, this man came up to me and said: "Doctor, you didn't know me yesterday. I'm John Harlan."

He told me one of the most pathetic stories I have ever heard, illustrating what I mean by the curative workshop bridging the way back to permanent employment.

This man had been overjoyed at the ability to walk after years of paralysis. But because of his extremely weak condition before the operation, he was, naturally, still far from being strong when he was discharged from the Blackwell Island Hospital. Because neither he nor his family had money, he could not stay at home until his resistance was built up. He was forced to find a job long before he was fit to hold it. And the work he obtained was far too heavy for him at that convalescent period. The first thing he knew, he found himself back in the hospital. For ten years, he struggled with this vicious circle of hospitalization.

Each time he tried to break into industry, a job became harder to get because of his past record of inability to carry on. Employment managers told him that he looked too weak, and he ended by walking the streets almost in despair.

Then, one day, he saw a poster advertising the opening of the curative workshop.

"I knew," he told me, "that was my last chance. So I came in."

Before he had been stricken with tuberculosis, he had apparently been a keen workman, for he did not have to be told how to go about things. But about ten days after the shop opened, the foreman came to me and said that John looked so emaciated and pale, he did not believe he could carry on.

I told him to go the limit in giving this man a chance. That Saturday night, John received the first real pay envelope he had had in ten years, and the foreman reported that he had never seen anyone so happy.

Within the next few weeks, John rapidly gained in strength and efficiency, and became a valuable member of the shop. I shall always believe that first pay envelope, and the knowledge that he was not going to be turned out because he looked ill, accounted for his gain. His work progressed so satisfactorily that he was later made foreman of the shop, a position for which his own battle against odds ably fitted him.

After he had held this position about two years, he came to me hesitantly, saying that he was very grateful to me and to the shop for what we had done for him, and that if I said so, he would stay there the rest of his life, but he had been offered a position as chief shipping clerk in a large organization at a much bigger salary.

I told him this was the best news he could have given me, as the ambition of the shop was to pass our workmen back into normal industry as fast as it could be done, and every case thus passed on was a triumph. So John went back into competitive industry with no fear of breaking down. The last I heard of him, he was still drawing a good salary. Had he not found his way into the Curative Workshop, he would to-day be a discouraged invalid, living on charity.

Charity is one of the loveliest of virtues, but no one likes to be its object. It is more pleasant, as it is more blessed, to give than to receive. The average person wants to be independent, self-respecting, able to stand on his own feet. Nearly everyone strives to be a self-supporting member of society. This is just as true of the cripple and the handicapped person, who longs for some place in which he too can perform a useful task and carry his share of the economic burden.

I have described John's case at length because it illustrates the difficulties of handicapped men in these days when the increasing demands of unions for higher wages lead to greater exactions on the part of the employers. Who wants to employ a man who has had tuberculosis of the spine and may become paralysed again during employment? No one, unless that man has first made good in a curative workshop under the guidance of a competent foreman.

The curative workshop is a plank thrown to drowning men,

giving them a chance to come back to employment. In fact, more than eighty-five per cent of these industrial wrecks and lame ducks are put back on their feet again and restored to full earning power and self-respect.

There is a need for a curative workshop in every industrial centre in the country, and one can only hope that the time is near at hand when they will be in existence wherever they are needed.

XIX

With the passage of the New Jersey Rehabilitation Act, I was appointed Chairman of the Commission, a position which I have held for twenty-three years. A beautiful silver service, presented to me by the Commission on the occasion of my twenty-second anniversary, is a permanent reminder of the sterling qualities of the magnificent men with whom I have worked so closely in this work of rehabilitating the driftwood of a state, and restoring men and women to their rightful place in society.

It is largely because of the calibre of these devoted men that Colonel Bryant's dream has come true, and New Jersey is known to-day as the state without a human scrap heap. Governments from all over the world have sent delegates to America to study our system of rehabilitation, which speaks well for the effectiveness of this new type of social service.

The Civilian Rehabilitation Act of New Jersey provided for the appointment of a Rehabilitation Commission to consist ex-officio of the State Commissioners of Education, of Labour, and of Institutions and Agencies, plus a member representing industry, another representing labour, and lastly a member at large.

The members of the original commission were the late Colonel L. T. Bryant, Commissioner of Labour; Mr. Burdett Lewis, Commissioner of Education; the late Mr. Peter Campbell, representing employers; Mr. Gregory Adlon, representing industrial labour; and myself as chairman, representing the general public.

The Rehabilitation Commissioners were to serve without

remuneration, and to have *carte blanche* control of all matters relating to rehabilitation.

The first task of the new Commission was to find a Director of Rehabilitation. This was complicated by the fact that it required a man of outstanding civilian rehabilitation experience, and, as we had only $5,000 appropriation the first year, we could offer no adequate salary. With the small sum at our disposal, it was necessary to make every penny count. In order to get things under way, therefore, Colonel Bryant offered to undertake the directorship, without salary, in addition to his other heavy duties.

New Jersey was the first State to enact a comprehensive rehabilitation law, and that enactment antedated the first federal legislation on the subject by six months. The federal bill provided for matching funds with the States in rehabilitation work, and, stimulated by this encouragement, by 1938 every State in the Union had passed a rehabilitation law of some sort.

In the course of administration of these Acts of Congress, every State in the Union has received Federal aid, dollar for dollar, for rehabilitation work, vocational training (adults and minors), and surgical restoration of persons under the age of employability, or about sixteen years of age. For those of sixteen years and older, however, or during the employable age, the government has thus far refused to allow the matching of funds for surgical restoration.

New Jersey has operated along somewhat different lines, those already laid down at Colonia. Where other governmental agencies, federal and state, re-educate the handicapped person so that he can find employment along some line in which his handicap will not prove a stumbling block, the New Jersey motto has been:

NEVER TRAIN AROUND A DISABILITY THAT CAN BE REMOVED.

That has been my plan and I have fought for it from the beginning of rehabilitation work in 1919. Physically disabled persons are better served through physical restoration than by any programme which contemplates training around a removable disability.

In other words, our work falls into three main categories:

1. Physical reconstruction; that is, repair of the injury to the maximum attainable. This depends on the medical profession.
2. Vocational rehabilitation; that is, vocational counselling and vocational education. This depends on education.
3. Job restoration; that is, employment. This depends on industry.

In the beginning, the plan was to care for workers injured in industry, but it expanded to include handicapped persons in four classifications:

1. Workers injured in industry.
2. Sufferers from such diseases as infantile paralysis, tuberculosis, and so forth.
3. Victims of public accidents.
4. Those with congenital deformities.

Our first step was to establish State Clinics, which would serve as clearing houses, for the physically handicapped. Here competent staffs would analyse each case to determine whether the handicap could be removed by surgical reconstruction, before any retraining programme was outlined.

Although Colonel Bryant and I were most enthusiastic over vocational training for certain cases, we were unable in the beginning, because of inadequate appropriations, to foster this feature of the work without seriously neglecting what was so obviously needed in a great number of cases—physical and psychological reconstruction. The other members of the Commission, who at first opposed establishing State Clinic "clearing houses", were soon won over.

We divided the State into six districts, each of which contained an important industrial city (Newark, Trenton, Camden, Paterson, Jersey City, and Atlantic City). With these industrial centres as geographical bases from which to work, the Commission established a rehabilitation clinic in each of the cities. The most experienced and competent surgeon available in each district was elected as Chief of each clinic on part time. Here the medical and surgical talent of the State was made available for every physically handicapped adult or child who could not get it elsewhere. No other State in the Union has this medical facility available within its own organization.

From the beginning, the Commission has found the struggle to put surgical reconstruction into rehabilitation one of the odds it has been up against. This has been largely due to the action of the federal government in placing rehabilitation under its educational services. In a way, this has been unfortunate, because the educators are naturally interested primarily in spending the funds on education. In practice, it has meant that a boy with, for instance, an ununited fracture of the arm, will be re-educated at considerable cost of time and money, to do a type of work to which he is not accustomed.

Our method, on the other hand, is to operate on the arm, and restore its function, so that the boy can go back to the job he originally had.

As an example, some time ago, a young man twenty years old, who had spent his entire life in a wheel chair and bed, was referred to the New Jersey Rehabilitation Commission. Upon physical examination, Dr. Henry H. Kessler, Director of the Newark Clinic, and I agreed that an operation, a bone graft fusion for tuberculosis of the right hip, would make him ambulatory.

The young man was sceptical at first, but finally consented and the operation was performed with successful results. A year after the operation, he was able to walk with the aid of crutches and entered Junior College to prepare as a laboratory technician. An employment training programme was initiated which later resulted in his employment as an assistant to a laboratory technician at a salary of fifty dollars a month, plus maintenance. Upon the recommendation of his employer, he is now a student at a New Jersey college at a cost of one hundred and fifty-nine dollars to the Commission. He is able to pay an additional hundred dollars of the expenses himself.

While the State Clinics were being established, Colonel Bryant's assistant, Mr. Joseph Spitz, went abroad to observe the rehabilitation methods in France, Belgium, and England. He saw at least 100,000 disabled service men in the process of getting back to active lives.

Mr. Spitz had lost an only son in the war, and as a result he brought to rehabilitation his increased sympathy and devotion. To this was added his practical knowledge of employment problems gained through ten years' experience as superintendent in a large New Jersey factory.

In the beginning, Mr. Spitz and his assistants interviewed

between 4,000 and 5,000 handicapped people a year. But experience showed the wisdom of concentrating on more serious cases and eliminating others.

The co-operation of medical profession, hospitals, employment bureaus, philanthropic and lay organizations had to be gained next in order to further the work and avoid misunderstandings.

At first, there was considerable clash with agencies that had for years been dealing with handicapped citizens requiring charitable assistance, but in time this ill-feeling was minimized. A foundation was laid for the closest co-operation between all those activities—public, professional, and philanthropic—which have a bearing on the restoration of the handicapped to a place in the industrial scheme.

New Jersey owes much of the success of its rehabilitation commission to its freedom from the uncertainties of party affiliation. If the personnel had changed with every change in the political colour of the state government, one commission would have done little but repeat or correct the errors of its predecessors, and progress would have been well-nigh impossible.

We began with the fact that neither in our State nor in any other were sufficient funds being provided to meet all requirements under such a scheme. We reasoned that it was much sounder economically and, indeed, much more humane, to aim at restoring the injured man, through medical and surgical means, to the job which he had himself chosen as most suitable and most agreeable. If this was not possible, then he was to be restored physically and mentally, as completely as possible, and re-educated for other employment.

The reason for this is, of course, obvious. The chances are that a man's original training and choice of an occupation have been determined by the fact that the work was congenial to him and he had a certain degree of ability for it. To retrain him along other lines, instead of doing all in one's power to cure his disability and restore him to his own niche, is to place another square peg in a round hole.

Congeniality of employment is more than a guarantee of greater efficiency on the job. Talent or ability which is not put to use is wasted. And the world cannot afford to waste ability by misdirecting it. More important than all that, however, is the fact that our whole concept of rehabilitation is based on a

synchronized curing of mind and body, and congenial employment is at the very core of harmonious living.

One day the vocational guidance teacher of a New Jersey high school came to see Mr. Spitz. There was a boy in his school, he said, so crippled that his knee touched the floor when he walked. But he had a fine voice. Did Mr. Spitz think it could be trained?

Mr. Spitz did not. People go to hear music, he said, because they want to enjoy it, not for heart-throbs.

"Let's not train around that boy's handicap," he urged. "Send him in to us and let us see whether something cannot be done to remove it."

So we examined the boy and I operated on him. We studied his aptitudes and sent him to an engineering college. To-day he has a good laboratory job.

Now Mr. Spitz is not the kind of man who regards the people who come to him as cases. Each one remains a poignant human problem to him. So it was in this case. For he was not satisfied with solving the boy's difficulty and seeing that he was provided with an education. No, Mr. Spitz went to the graduation exercises. "And do you know," he told me later, "when those boys marched out for their diplomas, upright, and straight and normal, I could not tell which one was my boy. He walked like the rest!"

It is not an easy job to direct rehabilitation when a man devotes to it not only his time and his energy, but his imagination and his devotion as well. In the evenings and on holidays, for a little relaxation, Joseph Spitz goes walking through the parks, with an eye out, as he confesses sheepishly when cornered, for crippled boys. But when he finds them on these busman's holidays of his, he is apt to wait for an evening or two before he screws up his courage to talk to them and suggest they call on him at the Rehabilitation commission. For Joseph Spitz is very shy.

He turns over the pages of his records of salvaged lives as gloatingly as misers finger their gold. Some years ago, a New Jersey boy was discharged from a New York hospital with a spinal lesion and sent to the Commission. The medical commission examined him and suggested that he wear Hessian braces with crutches and provided him with the braces. In a year he was able to walk with two canes instead of crutches and eventually with one cane.

The boy had been in high school so he was sent to a preparatory school for an intensive education and then to an engineering college, where he took a course in chemical engineering, followed by a course in pedagogy. He is now an assistant professor. The boy who came to us, helpless, disabled, and without a nickel, to-day has a three-thousand-dollar power boat, his own car, and an attractive home. And Mr. Spitz fingers his reports and smiles.

Before long, the importance of rehabilitation was widely recognized, and doctors and laymen alike were increasingly aware of the social and economic value of restoring function so that injured workmen could be returned to a place in competitive industry.

In 1923, Dr. Secord of Ontario declared:

"The building of tendons, the making of eyelids, restoration of faces and grafting of bones are now being used to return to society as useful and competent citizens those who have been injured in industrial accidents. . . . Up to two or three years ago, we considered our duty done when we had eliminated infection and had cut away the diseased or injured part, even though we left the functions impaired. Now we recognize that we must not only remove the disease but that we must restore as nearly as possible the functions of that part of the body upon which we operated. It is not enough that we can build tendons out of silk or scar tissue, but we must give the fingers or limbs movement and strength."

In other words, it is not enough to patch up the cripple or the handicapped person. The doctor has to follow through. Twenty-three years in rehabilitation have convinced me of the necessity of the surgeon following his physically handicapped cases all the way through for surgical reconstruction, and its immediate convalescent period, to vocational therapy, vocational education, and finally placement in productive employment.

For successful rehabilitation is measured by permanent employment. That is the ultimate measuring rod. Nothing of enduring value has been accomplished unless the cripple is restored to his place as a self-supporting member of society.

There was a man who came to me some years ago. He had been born with just a stump of a left arm and only two fingers on the right hand. His family threw him out, rather than have

the burden of his support, and he had lived in parks or any place that would afford shelter.

In order to make this man employable, it was necessary to enable him to use his right hand. This I did by constructing a synthetic thumb by shaping a rectangular piece of skin and underlying tissue from the abdomen and attaching it to the hand where a thumb should be. Having fashioned a hand that would work, the next step was to find employment in which the patient could put it to use. As it happened, he was interested in chicken husbandry, and we succeeded in getting him a job. He soon became very proficient at using his right arm, which developed great strength.

As it happened, the year the Rehabilitation Commission started its work in New Jersey, the State Brotherhood of Elks elected to its presidency a man destined to become an outstanding leader in the work of searching out and caring for crippled children, Mr. Joseph Buch, of Trenton, New Jersey, later the Grand Exalted Ruler of the National Fraternity of the Elks.

Shortly after he took office, the usual "outing for crippled children" was given, and the great number of unfortunate children so impressed Mr. Buch that he at once decided to concentrate the philanthropic efforts of the Elks, during his term of office, on this problem. Soon afterwards, he paid a visit to the Rehabilitation Clinic in Trenton to learn what medicine and surgery could do for crippled children.

Nothing could have been more fortunate for the development of the rehabilitation work in the State than Mr. Buch's stimulation of interest in so large a brotherhood as the Elks, at the time we were struggling with a small appropriation. The Elks' volunteer help has been inestimable in many ways.

Philanthropic societies, indeed, have done heroic work in finding crippled children and bringing them to us for rehabilitation.

In 1926, a bill creating a Temporary Children's Commission was passed in New Jersey, and signed by Governor A. Harry Moore. The new Commission was instructed to report upon the number, distribution, and condition of crippled children throughout the State; the existing facilities, the legal provisions for promoting their treatment, education, and general welfare; and to recommend means to meet their needs more adequately.

Its membership included representatives from leading men's philanthropic organizations—the Elks, Shriners, Rotarians, Kiwanis—representatives from the State Senate and the State Assembly, and a director of the State Board of Health.

The Commission's first undertaking was a state-wide search for crippled children, and, to New Jersey's amazement, 12,000 were found up to the age of eighteen.

Twelve thousand crippled children! It was only by local distribution that such a stupendous task could be handled adequately. And because the Elks had been conducting the work so efficiently for nearly seven years, the Temporary children's Commission recommended their continuance in leadership. Consequently, the names of the children were divided, according to the various Elks' jurisdiction, while the Kiwanis and Rotary, the Shriners and other clubs continued to co-operate.

While it may seem unnecessary for the Rehabilitation Commission to go in search of its cripples, it is a continual surprise to discover how little people seem to be aware of the services which are created for their benefit. Often, too, they do not come forward either because they are afraid or because they are hopeless.

For this reason, we have found that, while State aid is invaluable, the assistance of philanthropic societies is also of great importance. It frequently requires a personal interest in certain families to discover their handicapped members.

A striking example of this was the case of Mr. Quinn of the printing firm of Quinn-Bodin of Rahway, New Jersey. He had, for some time, been in charge of searching out crippled children in New Jersey before he became aware of the fact that he had had such a case practically under his nose the whole time, the child of his own chauffeur, who had been hobbling around with congenital dislocation of the hip. The child's parents had been convinced by their doctor that nothing could be done, and they had accepted that cheerless verdict without attempting anything further. At Mr. Quinn's insistence, they brought the child to us for treatment.

Careful psychology is necessary in dealing with these children because of their extreme sensitivity. I have seen a boy, born without hands, push his mother away as she started to button his suit, with an emphatic: "No, I'll do it myself."

Tears of injured pride stood in his eyes, but a few minutes

later those same eyes shone with conquest as he finished the job with his pitiful little stumps.

A friend of my wife's had a chauffeur whose son had been stricken with infantile paralysis. The muscles of the right shoulder were so affected that the boy could not handle himself at the table, could not hold a knife and fork, or feed himself without assistance. As he reached his teens, the boy developed a severe inferiority complex. He ran away to hide when visitors came and refused to sit at the table because it humiliated him to have someone cut his meat for him.

I did a bone graft reconstruction on the shoulder so that the muscles from the neck and chest to the shoulder were brought into vicarious function. The boy was almost completely restored and promptly got over his self-consciousness and sense of inferiority. We surveyed him carefully as to his intelligence, education, and adaptability, and decided that he had some artistic bent. So we gave him instruction and training as an art jeweller, and he is now employed, satisfied with his work, and completely adjusted.

Money invested in rehabilitation of injured children means human profit for a lifetime. Looked at from the most selfish viewpoint, it saves the State and society a tremendous economic burden.

It has been estimated that it costs, on an average, three hundred dollars to rehabilitate one individual, so that he can go back to remunerative employment. The cost of maintaining this same person in a charitable institution is five hundred dollars a year. Suppose he lives a minimum of forty years! The deduction is obvious.

Within the past twenty years, approximately 8,000 people have been rehabilitated. About $3,000,000 was spent for rehabilitation. The earning power, per person, of this rehabilitated group increased from little or nothing to approximately $1,000 each, or aggregately $11,000,000 a year. Three times, almost four times, the Government's investment in them!

It seems to me that, apart from any humanitarian angle, apart from any purely decent and self-respecting angle, rehabilitation has not only justified itself; it has proved that it is economically necessary to the community. It has proved, in dollars and cents, that it pays to conserve our human resources.

XX

In the industrial building in Newark, we have a curative workshop, similar to the one we had at U.S. General Hospital No. 3, and the one which Mr. Elton and I established in New York, soon after the First World War. It is an integral part of the New Jersey Rehabilitation Service.

The Sunshine League, a philanthropic society, founded the first curative workshop at Newark. The first six months showed such good results that a second appropriation was made and at the end of the first year, the State, convinced of the soundness of the plan, took the shop over. Mr. J. C. Kupper was appointed to organize the shop.

You might meet Mr. Kupper many times before you discovered that his right arm had been affected by infantile paralysis. By keeping that hand in his pocket he very deftly conceals his defect. This very disability establishes an immediate bond of sympathy between him and the boys who come into his shop to work.

"I know how a man with a handicap feels," Mr. Kupper said recently. "I know something of what he thinks about when he is alone at night. Because of my arm, I grew up with a feeling of social indifference tinged with rebellion. Gradually, I conquered it. But I am still sensitive about my handicap.

"About a year before I took over this shop," he went on, "I applied for a position as draughtsman for a certain engineering company. I took with me blue prints of steel piers and other construction work I had drawn for a previous employer, and excellent letters of recommendation. On the basis of these drawings, I was given the job. As the interview drew to a close, the employment manager offered me a smoke. When I lit it, I saw a queer expression go over his face. He had noticed my paralysed arm for the first time. From that moment he began to feel his way out of the contract. He did not see how I could do draughtsmanship with only one good arm. And because he didn't see how, he would not believe the evidence before his eyes.

"The years and will-power I had expended in finding out how, and doing it, were nothing in the face of his prejudice.

No handicapped person wants to be taken on to do a job he cannot do as well as the next man; but when he can do it as well, or better, should the fact that he has struggled to overcome a handicap militate against him?"

Because Mr Kupper knows from personal experience the problems that will confront the handicapped, he is extremely successful in laying out work for the boys who come under his care. All sorts of furniture is made in the shop, from bookracks to consoles and fine cabinet work.

The chief purpose of the shop is to help in curing the individual. The mind and the body have a reaction upon each other, and we learned at Colonia that when the mind and body can synchronize on some activity, the result is helpful to both. The workshop, therefore, serves a dual purpose. It engages the mind, and it brings into play muscles which must be exercised if they are to regain normal function. It serves a third purpose as well, for Mr. Kupper watches with apparent casualness the responses of the men in the workshop. He studies their aptitudes and abilities. He is quick to observe a slight dawning interest in some particular type of work and to see that it falls to the lot of a man to handle work that does interest him. He weighs intelligence and adaptability so that he can be prepared to recommend the type of job for which his men are best fitted, when the time comes to return them to industry.

One should never be oblivious to the effect of morale on physical recovery. The critical time is the early days of convalescence. The patient, after being an active, normal participant in the activities and joys of life, finds himself thrown abruptly into a new and unexpected environment. He is uncertain of the extent and significance of his injury, and apprehensive of its effect on his activities, his earning power, and his responsibilities to his dependents. Not least of the disturbing influences is his realization that he is dependent either on his savings, his friends, or the state. Depletion of morale is certain, although it may not always be evident or lasting.

In order to keep his mind off himself and to show him that he is not helpless, vocational therapy should be instituted at the earliest moment. This is where the workshop has shown its greatest value.

Let me cite the story of a boy who had been committed to the reformatory. It was discovered that he had a physical deformity which could be corrected. He came under the eye

of the Rehabilitation Commission through its many affiliations. When physical reconstruction had been carried out successfully, vocational re-education was employed. As a result, this crippled boy was not only physically rehabilitated but spiritually regenerated.

For many years as Chairman of the Crippled Kiddies Committee of the Benevolent and Protective Order of the Elks of Rahway, N.J., I have been examining, treating, and operating on a large number of cases of all kinds, gratis. Because of this, on December 15th, 1937, at Rahway, N.J., the Elks gave a testimonial banquet in my honour.

The presentation to me of a life membership in the Benevolent Protective Order of the Elks inscribed upon $150 rolled into a gold plate was made by a frail child of twelve, Florence Peterson. The thought of the Committee in selecting this child to present the life membership to me was excellent, in that, when Florence first came to me, her arms hung uselessly at her sides, having been attacked by infantile paralysis some years before. I operated upon her arms, and the result was so successful that she was able for the first time to bring her hands to her face.

When the maximum physical reconstruction attainable has been achieved, three methods of vocational re-education are carried out: 1, school training, either in a public school, at a vocational training centre, or in a business college; 2, employment training, the applicant getting his training while working; 3, job restoration, the applicant being given the best placement in industry in the face of his disability. The applicant is allowed to choose one of these three methods. There is, of course, a residue for whom nothing can be done, whether on account of the hopelessness of the surgical condition or deficiency of mental capacity. Just as a surgeon who makes an incision to find the abdomen a mass of cancer, closes the wound and pronounces the case surgically inoperable, so there are cases which are socially inoperable, incapable, physically or mentally, of going into competitive employment. These hopeless cases must be sent for institutional care, but as the efficiency of the service rises, this group becomes smaller.

It is not, nor has it ever been our desire to demand special privileges for the crippled and handicapped. We expect them to hold their own in employment, and they do. We do fight

constantly, however, to see that they be given an equal opportunity. All we ask is that they may be given a chance to show what they can do.

Congressional enactments appropriated $4,000,000 for the fiscal year ending June 30, 1941, and $5,000,000 for each fiscal year thereafter to promote rehabilitation work. This is a stimulus in improving and extending rehabilitation work, but this, too, is not enough without the jobs. Given half a chance, it is astounding and inspiring to see what these handicapped people can accomplish.

A boy with a very unusual mental capacity, who was born with congenital malformation of hands and arms, to such a degree that he could not use them, came to my attention. I operated and was able to restore his arms so that he could write and do many things, but his handicapped physical condition was such that we despaired of hoping to train him for manual work. He was educated and trained, therefore, as a lawyer, and to-day he is a very successful practitioner of law.

Men like these are worth salvaging, not merely for their own good, but for *our* good. Somewhere in business there must be a place for them.

In a New Jersey hospital, I found a man whose feet were paralysed because of an old fracture of the lower end of the spine. He was one of the human scrap heap, without family or friends. Year in and year out, he had been kept in the hospital because his feet were completely useless. It was hard to convince this man, who knew nothing but helplessness and dependence, that we could put him on his feet and make him economically self-reliant. It was long since he had thought of himself in terms of hope or an active life. But I was able to do stabilizing operations on his feet so that he could walk, and the Rehabilitation Commission then took the responsibility of getting him back to employment. An employer was found who was willing to give him an opportunity and thus another life was salvaged.

Suppose, however, that we had failed to live up to our promises? It is a catastrophe to go to a person who is inured to his lot as a helpless cripple, raise his hopes, and then dash them because of the impossibility of obtaining employment for him.

Restored to health and physical wholeness, as far as possible;

educated and trained by schools and agencies for special work, the cripple too often finds himself faced with closed doors to employment.

It is one thing to rehabilitate, but—we have learned from painful experience—it is another thing to get the job. Our industries must open their doors to the men who have lost one limb.

The goal of rehabilitation is re-employment. John L. Lee, supervisor of vocational rehabilitation in Massachusetts, declared: ". . . unless the people injured in industry and otherwise could be re-educated *and returned to society on a self-supporting basis* (the italics are mine), all these disabled people would become 'marginal labourers'. They would be barred from employment because of their disabled condition and we would have, as a result, a constantly and rapidly growing number of people dependent, together with their families, on society. In proportion, then, as we can re-educate and restore these disabled people to society, they become self-supporting and we solve, to that extent, our problem of dependency in this country."

Industrial compensation does not compensate. It is only a temporary financial award, and an attempt to relieve by the payment of money. Charity does not restore, but only prolongs the days of idleness. The economic and humane obligation of society is fulfilled only when it is made possible for the disabled person again to engage in a regular job, as far as it is humanly possible.

Medicine and surgery are doing what they can, but it is not enough. Vocational training and guidance are employed. But they, too, are not enough. Industry must do its share in completing the work of rehabilitation.

"The demands of business," Albert Frederich Stephens Jr. pointed out, "have been for the present and not for the future. Industry throughout the country was fast consuming and draining the natural resources of the nation prior to the World War. Did industry make the first move for conservation? Did industry take the leading steps to put back something for the future? Was it industry that first paid heed to its waste products? The answer to all these questions is emphatically NO! It was Government, and it took a tremendous war to force through not only the conservation of natural resources and the use of waste products, but it has remained for Govern-

ment to turn finally and last of all to the human wastage as a major factor in production.

"Industry to-day pays many thousands of dollars on the salvage of waste materials, and in this the Bureau of Standards at Washington co-operates. Industry, unfortunately, however, has not yet been shown by the Government that there is money in human salvage, and being selfish, it must be shown."

Unless employers take an open-minded attitude towards handicapped men, we may reach the day when the Government will compel industry to assimilate a certain percentage of such men. In the German Reich, after the World War, each industrial plant was required by law to employ physically handicapped persons as ten per cent of its force.

This is not the solution we would like to see, not only for business but for the cripple. When employment for the handicapped is enforced by the Government, there is resentment on both sides. It is stultifying to a man's self-respect to know that he is hired because the law says he must be, and not because he can turn out an A 1 job.

What we want to do, what we have done in many cases, is to prove to employers that if these people are placed in the proper position, they will furnish a mental attitude, a loyalty, an alertness, a keenness to serve, which are worth far more than a hand. Qualities of persistence, ambition, loyalty, and willingness to do more than is required of them are typical of cripples. And these qualities cannot be bought.

Attempts have already been made to place cripples in industry and their success will lead inevitably to more placement. Some years ago, Henry Ford, who believed that the handicapped could be used satisfactorily in industry if their disabilities were analysed and they were given work which required only such muscles as functioned properly, had over 9,000 cripples in his factory on full salary. These included men without legs, and some without hands. He did not discriminate against the deaf. When he replaced men with good eyes by those totally blinded, in a certain department, he discovered that the blind men did twice the work of those who were normal!

"In many ways," Henry S. Curtis remarked in the *Rehabilitation Review*, "the handicapped person is likely to be a superior employee. It is not easy for him to get a job, consequently he is anxious not to lose it. He is likely to be on time and faithful

in his work. He will not strike unless he has more than ordinary reason for doing it. As he does not have as many outside calls or recreations as the others, he is likely to put his whole heart into what he is doing.

"There is one serious difficulty in the situation, however, and that is the fear of employers that the crippled or handicapped individual means for them an excess of liability."

But is this necessarily the case? A few years ago a large utility company in New Jersey agreed to make a test, for both social and economic reasons, of handicapped workers. The company hired 652 normal and 652 handicapped workers and, for the sake of the experiment, matched normal with handicapped workers on similar work. The results were enlightening:

(*a*) There were 7 per cent more absences on account of sickness in the normal than in the handicapped group.

(*b*) There were 5.6 per cent more accidents among the normal than the handicapped group.

(*c*) At the end of the trial period there were more of the handicapped than the normal employees still on the payroll.

Philanthropic societies have been of incalculable value in finding jobs for the handicapped. They vie with each other in their efforts at placement and their attempts to educate the employer are counteracting the selfish reaction to compensation laws. The interest developed in a particular case inevitably leads to a determination to follow it through to economic as well as physical rehabilitation. That is why I would prefer to see the problem of restoration to industry accomplished through philanthropic rather than legal means. It is better to hire through conviction than through compulsion. It is better to persuade the employer that the qualities which the cripple brings with him compensate for his handicap.

In New Jersey we have a group of handicapped youngsters in their teens, who call themselves the Junior Optimists. When they get a job, they hold it.

There is Ben, for instance; both legs were crippled by infantile paralysis, and he had a very bad spinal curvature. He finished school before the age limit was taken out of the Rehabilitation Law, and drifted along without getting sound vocational advice. He walked with an extremely awkward gait, he couldn't make much speed with his twisted legs, and

employment managers at various factories shook their heads and gave him a pitying look.

Finally, he came to Joseph Spitz, who discovered that he had real talent for mathematics. Expert calculations don't take legs—they take brains. Would he like to study higher mathematics? Was he willing to start at a salary smaller than he would get for manual labour in a factory, if it led somewhere? To-day, that boy is head statistician for a large New Jersey power company. He is only twenty-five and he has five people working under him. That is what ambition, brains and optimism have done.

Both Elks and Kiwanis are asking members to put forth a real effort not to discriminate against the physically handicapped, provided his ability for the job in question is equal to that of the normal applicant.

When this effort at placement is successful, employers are requested to keep the Kiwanis committee informed of the progress of the handicapped person. In the event that the employee does not measure up to the required standard, the employer communicates with the committee, who withdraws the physically handicapped employee instead of having him suffer discharge.

As a result of these efforts, the physically handicapped person in New Jersey, who has been rehabilitated, has as good a chance of getting a job as the normal person. Much of the credit for that record goes to J. J. Toohey, Jr., Commissioner of Labour in New Jersey and Director of Rehabilitation; to Joseph Spitz; to Victor Bleeker, and the other men whose enthusiasm and devotion are daily turning the handicapped into useful citizens.

Slowly, the results of rehabilitation are beginning to show all over the country. Much has been done, but there is so much left to do. These people are our people. But for the grace of God, they are you and I. The job will not be done until society at large realizes that the only right, fair, decent thing to do is to give them a chance.



Four of the most prominent orthopædic surgeons in the world. Left to right : Sir Robert Jones, Dr. Royal Whitman, Dr. Albee, and Mr. Ernest Hey Groves, attending the conjoint meeting of the British and the American Orthopædic Associations, London, July 4th, 1929. Mr. Hey Groves was President of the British Orthopædic Association and Dr. Albee of the American Orthopædic Association

XXI

JEAN LAHOR once remarked: "It is well that artists and men of science incessantly bring together the bonds of sympathy between nations that politicians are incessantly trying to separate."

Heart trouble, diabetes, tuberculosis, cancer, are universal ills. They are mankind's common heritage of pain. No national barrier can shut them out, nature does not take into account political boundaries, disease has no racial prejudice.

The knowledge of men of science must be disseminated to all peoples, for the common good, else it serves no purpose. War has nothing to do with science. Politics has nothing to do with science. The hatred of man for man, engendered by tyrants and grasping politicians and unscrupulous governments and blind prejudice, has nothing to do with science. For science itself is passionless. To misuse it, to shackle it, to distort it, is an unforgivable sin against civilization. The knowledge we gain so slowly, at such an infinite cost of time and patience and effort, must be pooled.

In the overwhelming majority of cases, men of science are of one mind in regard to this, but during times of war there are always a few, here and there, who, swayed by personal bitterness and political whirlwinds, confuse the scientist with his government, and would shut their door to men who, like themselves, have devoted their lives to pushing back a little further the curtain of ignorance. Whenever this has happened, mankind as a whole has suffered.

All this is a prologue to the fact that, in 1928, as President-elect of the American Orthopædic Association, I suggested that we reinstate the Honorary Fellows of the Central Empires whom we had struck from our rolls during the war. When the war started in 1914, the Germans and Austrians had notified all of us who were honorary fellows in their national organization that we no longer held these fellowships. Foolishly, as I believed then and still do, we in this country promptly retaliated by notifying the honorary fellows of enemy countries that they no longer held such honours in our organizations.

All of this spiteful and petty activity on the part of medical men who, at the height of their political animosity, continued to use each other's contributions for the benefit of the wounded, was remarkably similar to that of small boys, making faces at one another over a neutral fence.

After the war, it seemed to me high time that we in America should take the lead in re-establishing a friendly relationship with our Central European colleagues, but the suggestion was received with a good deal of apathy.

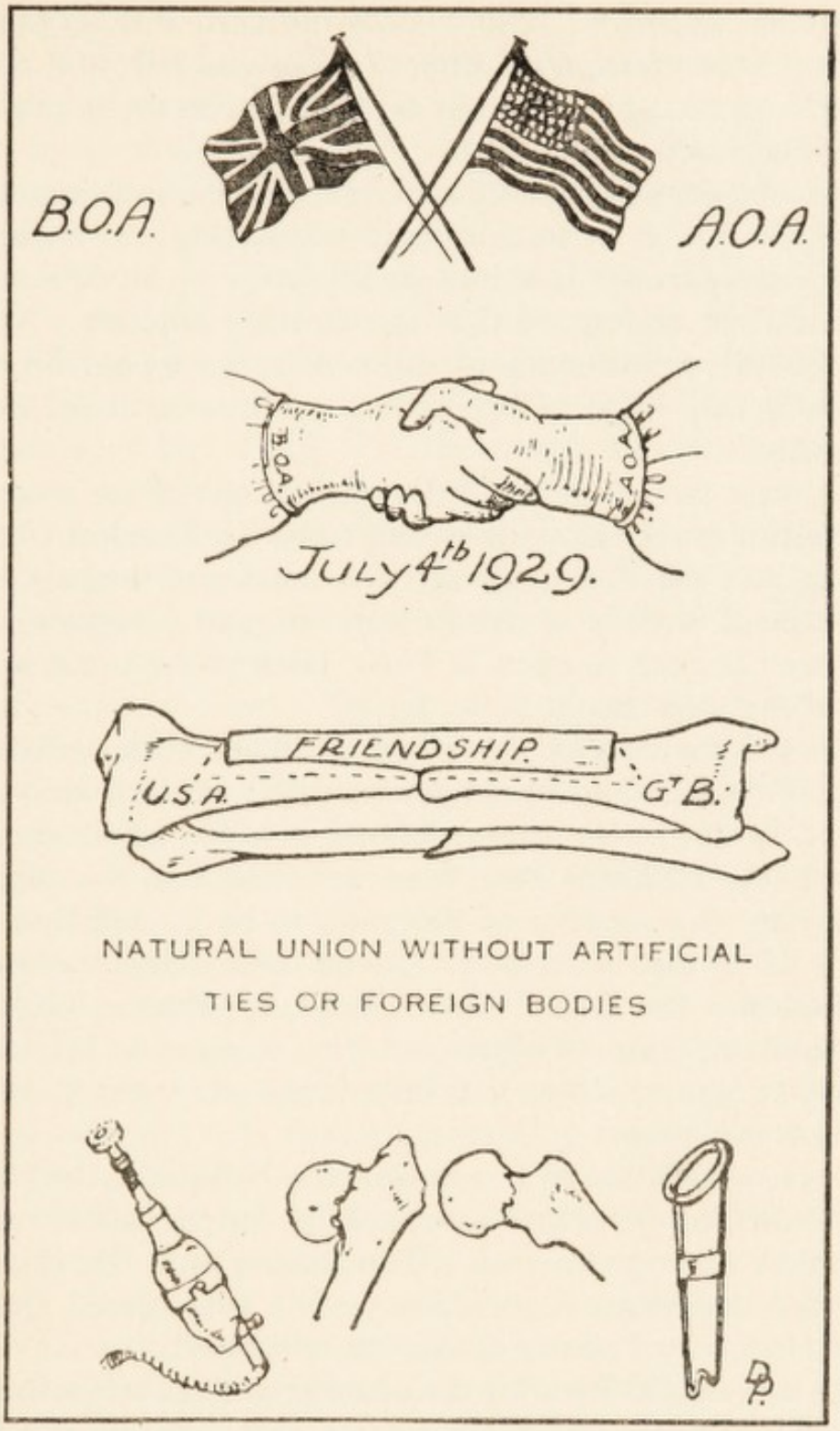
At that time, the American Orthopædic Association was the oldest orthopædic association in America, with a limited fellowship and great influence on orthopædics both in America and in Europe. The other outstanding association was the British Orthopædic Association. The *Journal of Bone and Joint Surgery* served as the official organ both of the British and the American societies. As it happened, these two organizations had never had a conjoint meeting, and it seemed to me logical and desirable that they should do so.

We therefore made the suggestion and as a result a most stimulating meeting was held in London. A number of Continental surgeons attended as well, making it the first international meeting in orthopædic surgery that had ever taken place. It met, on the suggestion of the English orthopædists, on July 4, 1929.

There was so much enthusiasm about the conjoint meeting that after it was over, Dr. Murk Jensen (Holland), Dr. Vittorio Putti (Italy), Dr. Harry Platt (England), Dr. Joel Goldthwait (U.S.A.), Dr. E. G. Brackett (U.S.A.), Dr. Starr (Canada), and Sir Robert Jones (England) came to me, saying that, as I was chiefly responsible for the First International Orthopædic meeting, they wanted me to organize an International Society of Orthopædic Surgery. When the late Dr. Vittorio Putti, one of the most eminent orthopædic surgeons in the world, head of the Rizzoli Institute of Bologna, Italy, promised to assist me, I agreed to make the attempt.

Knowing that Professor Julius Doelinger, president of the great International Association of Medicine and Surgery, which met in 1909 in Budapest, had been the leader in previous attempts to establish an international orthopædic association, I decided to go to Budapest and have a conference with him.

I found Professor Doelinger gracious and willing to discuss



Drawing for the cover of the menu card at the banquet in Dr. Albee's honour on the occasion of the only conjoint meeting of the British and the American Orthopædic Associations. It symbolizes the friendship of Great Britain and America. England chose to have this meeting start on July 4th. Below is indicated an un-united fracture of the tibia (shin bone); one fragment the United States, the other, Great Britain, united by the Albee inlay bone graft. Below is shown the Albee Bone Mill, the means of uniting an un-united fracture of the hip and discarding the brace.

his abortive attempts. The trouble, he said, was simply this: On several occasions, committees had assembled from all over the world, speaking many languages, discussing many problems, consuming much time.

These meetings invariably took place in the evening, and as there was a babble of tongues, and translating was a slow and cumbersome process, it would finally grow so late that someone would rise and move that the meeting adjourn. No provision for the continuance of the conference would be made, nor would any hope of organizing an International Society materialize.

With these facts in mind, I disengaged one of my secretaries from routine work, after returning from the London Conjoint meeting, and decided to launch the matter of organizing the International Society at the French Surgical Congress, which I had been invited to open in Paris, later in the same year, as many of the men would be on hand.

I selected the hall in the Hotel Crillon, Paris, where the League of Nations had its inception, as the appropriately international spot for the International Society of Orthopædic Surgery. As Professor Putti was not available, the plans for determining the number of delegates to be invited from each country fell to me. I decided to invite three delegates from the large nations—the United States, England, France, Germany, Italy—and one from all other countries, to meet on Wednesday evening, at eight o'clock, and invitations were sent in accordance with this plan.

It was my ambition to re-establish the Fellows in the Central Empire who had been thrown out of the American Orthopædic Association during the war. The matter was therefore put before the American Association and it was agreed that the former Honorary Fellows should be reinstated.

Upon arriving in Paris for the opening of the French Surgical Congress, however, where the matter of organizing the International Society of Orthopædic Surgery was to be started, I was chagrined to receive a cable from Dr. Brackett saying that the Secretary of the American Orthopædic Association had neglected to notify the men of the belligerent nations of their reinstatement. Things seemed to have reached an *impasse* before they even started, but in my brief case there was some official stationery of the London meeting. I sat down and wrote a letter to every one of these men, notifying them of their

reinstatement, dating the letters as of July—the time of the conjoint meeting in London—and signing them as President of the American Orthopædic Association.

This had the desired effect. Immediately courteous replies came from the German and Austrian surgeons, all of whom came to the organizing meeting.

Here were men, speaking every language of the globe. It had been decided that the official languages of the society should be five—English, French, German, Italian, and Spanish. Two of Europe's most versatile linguists—Dr. Jensen of Holland, and Dr. Putti of Italy—each of whom spoke six languages, agreed to give their assistance.

As Professor Doelinger had warned me, much discussion ensued: arguments as to who should be eligible for membership, debates as to whether traumatic surgeons should be admitted, and so forth.

Men talked in every tongue and raised all sorts of questions. They talked about the future before they got started. They fought about what the organization should do before they had an organization. This sort of thing went on until long after midnight. Then someone arose and offered a motion for adjournment.

That was what I was waiting for.

As presiding officer, I reminded them, I was bound by no constitution or by-laws, and I refused to recognize this motion from the floor. Not only that, but I would recognize only one of three motions: one, that a nominating committee should be elected from the floor to bring in a slate of officers; two, that we elect from the floor a slate of officers; and three, that we elect from the floor an organizing committee and bestow upon it every prerogative to organize the International Society. When that was done, they could adjourn.

This somewhat high-handed recommendation was unanimously accepted. Professor Jensen, Professor Putti, and I were voted upon as the Committee. We met next morning at the Hotel Crillon and proceeded to designate the officers.

Sir Robert Jones was selected as President; Dr. Mathieu of Brussels, as Treasurer; and Dr. Delchef of Brussels, as Secretary. This choice was activated by the fact that the International Society of General Surgery had made its headquarters at Brussels, and had accumulated a group of translators, and other invaluable assistance necessary for conducting such

meetings. Our next meeting-place was designated as Paris, the following autumn.

Before the war the membership of this organization reached the high peak of over eight hundred prominent surgeons from every country on the face of the globe, representing all nations and races.

In 1936, the International Society of Orthopædic Surgery held its congress in Rome and Bologna, that most interesting of all university cities. The University of Bologna is the oldest in the world, having been founded in 1088. It was not, unhappily, in an atmosphere of ancient scholarship that we met, but in a new world of clicking heels and stiff-armed salutes, of men who moved like automatons and thought like robots. Mussolini not only had succeeded in making the trains run on time. He had a whole nation moving like the less interesting parts of a well-oiled machine—and I am not speaking merely of castor oil.

One of my assistants, Dr. Robert L. Preston, accompanied me on this trip. Being a frugal bachelor, he had selected his clothes very carefully, with an eye to economy. Upon arriving in Bologna, he put on a very dark blue shirt, largely for the purpose of cutting down on his laundry. This shirt was so dark a blue that it looked black. Preston was a sprightly young man, and he wore his dubious blue shirt with an air. He was constantly being mistaken for an officer of the Black Shirts. Wherever he went, men popped up in his face, clicked their heels, and saluted, until at length, in self-defence, he was forced to return to his hotel and put on a shirt of a less militant hue.

On the day of our arrival, it was noised about that Professor Putti of Bologna had suggested the name of the society be changed to "International Society of Orthopædic Surgery and Traumatology", thus including fractures of bones.

There was a unanimous agreement as to the wisdom of such a change, and a delegation of twelve or fourteen from Germany readily acquiesced. However, when the vote came up on the subject, some three days later, it was a surprise to discover that these German delegates had received orders from the Hitler Government to vote against the change.

It was a well-known fact, by this time, that Hitler's government had interfered in many ways with educational curricula

and that the Fuehrer had been particularly didactic in emasculating everything worthwhile in the orthopædic speciality. He had left it a mere skeleton, permitting only the application of braces, plastic splints, and physiotherapy, particularly forbidding the surgery of injuries (traumatology) to be classed as orthopædic, as it is in most parts of the world. As all the universities and hospitals were directly under the dictates of the German government, complete control of the speciality of orthopædic surgery, as well as all others, was in effect.

This meant, of course, that orthopædic surgery, as we know it in this country, could hardly survive in Germany. The effect of the totalitarian attitude, indeed, was to deprive the scientist of his own integrity, and consequently of his value to himself and to society. This was a heavy price to pay in order that one man might play the role of God with a small moustache, a part for which he seemed dismally miscast.

Before leaving Rome, a number of us were each given a bronze medallion of Mussolini, which we were told not to fail to wear on the lapel of our coats, as it was to be our only passport of admission. We were then taken to the Palazza Venezia where we were ushered into a large audience hall. Here we were to have an audience with Mussolini. While waiting, I came sharply to the realization that I had in the right-hand pocket of my coat a simplex pocket moving picture camera. This was particularly startling as every camera, cane, umbrella, even one poor man's ear trumpet, had been taken away upon entrance. I had completely forgotten my pocket camera. I visualized one of the secret service agents coming over, putting his hand on my coat pocket, and insisting that the innocent simplex was a revolver.

I could feel beads of perspiration rolling down my temples as I recalled that the year before—the last time a surgical congress had been granted an audience with Mussolini—a woman later proved insane, had snatched a revolver from her purse and shot a piece off Mussolini's nose. Whether or not her insanity was based on this act alone I could not learn.

After waiting for some time, the door opened and in came Mussolini.

I knew from newspaper photographs that his stature was not large, but I was surprised that he was so small. I knew he carried his chin extremely high, but I didn't think it was possible to carry it as high as he did. I knew he carried his

shoulders back with what we, in the profession, term extreme lordosis, but I never would have believed that a man could stand quite as over-erect as he did.

With great deliberation, he strutted into the room, for all the world like a penguin, and began to address us slowly in French, in an unexpectedly soft voice.

I do not remember the polite platitudes he uttered, I remember only the absurd pomp of that small man, trying hard to be bigger than he was. Most of the tyrants, throughout history, I recalled, had been small men. All of them had tried to be bigger than nature allowed. Perhaps if they had been endowed with six inches more of height, they would never have felt they had to dominate their fellow-men in order to be noticed. Like Cleopatra's nose, a few inches, more or less, might have changed the face of the world.

In the summer of 1939, preparations were being made for the Fourth Congress of the International Society of Orthopædic Surgery and Traumatology, in Berlin.

Accompanying Mrs. Albee and me from New York were Professor Putti and Professor Alberto Inclan, Professor of Orthopædic Surgery in Havana, Cuba.

Because of the war scare in Europe, the first-class passenger list had dropped to eighteen; second class to two hundred, and third class to four hundred.

We sailed on the *S.S. Hamburg*. We were no sooner out of port than we were aware of the brooding war spirit which we had encountered twenty-five years before. The ocean was no longer a highway between continents. It was once more a treacherous path, strewn with mines, with lurking submarines, with waiting enemies.

We had not, it was apparent, learned much that was useful to us in a quarter of a century. Looking back, it was difficult to see how we had managed to make such a mess of things. We had meant well. We had been men of good will, for the most part. We hated war. We did not want it. We knew that it was the most destructive force in life. And somehow we had let it happen again. While we had been busy with our own affairs, the seeds of war, engendered by the Versailles peace, fertilized by unappeased hatreds, and unscrupulous men, and dishonest or weak or incompetent politicians, had been allowed to grow in the rich soil of hunger and idleness. Those of us

who had been mature at the time of the First World War, who had seen at first hand its horror and its suffering and its devastation, who had witnessed the disillusioning madness of its aftermath in the mad twenties and the stricken thirties, all must share the burden of guilt for permitting it to happen again. It was a poor heritage we had given our sons, who came of age only to face another war our negligence had made possible.

"You will find life-belts under your pillows," the steward told us lugubriously.

On the second night, the portholes were closed, with black curtains over them, and we were asked to keep only one light burning.

On the third morning, coming on deck, we observed that the yellow funnels, with the black, white, and red colours of the Hamburg-American line, had been painted red, with heavy black around the top, indicating a French liner. The ship was constantly changing her course. All our radios were taken away, and no radiograms could be sent or received. The moment any smoke was observed on the horizon, indicating a steamer, it was a signal for our ship to steer in the opposite direction.

The Captain told us that he was receiving nautical orders by code. We asked what port we were heading for, and he answered: "We are heading for Europe."

We knew we were 182 miles off the course. The crew were forbidden to talk, and no one knew whether war had been declared or not. Our course, eventually, was southward, to such a degree that it was noised about among the passengers that we were to land at the Azores instead of Europe.

We circled and zigzagged across the Atlantic, while the Captain walked the deck, shaking his head, as though talking to himself, and snapping his fingers as he walked. He was jittery. Undoubtedly, he was under sealed orders from Berlin to destroy the ship in case of threatened capture.

"I have been Captain twenty-five years," he said to me one day, "and I have many friends all over the world. I hope that we do not get into war."

A few mornings later, upon going on deck, we found the funnels painted the Holland-American colours, and the steamship travelling in a northerly direction. It was then noised about that we were going to land at Iceland.

The seventh day at sea was bright and beautiful. We knew then that we were heading towards Heligoland, but no other information was available. That evening at dinner the Captain told us we had narrowly escaped capture by a squadron of English warships, the day before, as we passed Scotland. But we had lost them in the fog.

That night the funnels of the ship were repainted in the German colours and at midnight we arrived opposite Heligoland, and drew up not far from a German mine-laying boat. We circled all around Heligoland and did not stop at Cuxhaven, as usual, to take a train there for Hamburg, but went up the narrow Elbe River directly to Hamburg.

Arriving at customs at Hamburg, we had our only amusing experience. Dr. Inclan had brought along a great many Cuban cigars, but upon learning that he could take in only ten, he asked us to take twenty cigars in for him.

"How many?" the customs officer asked me.

"Twenty," I answered. "Ten for my wife and ten for me."

The German inspector had a sense of humour and Dr. Inclan got his cigars through.

We arrived in Berlin in total darkness. The lights were out once more in Europe. A new Dark Ages had crept over the Continent. Country after country had been swallowed up in a blackout. When the lights would burn again, when the blackout, like some pestilential fog, would rise again, God only knew.

Dr. Putti was fortunate in locating a very old man who acted as our porter. Since there were no taxis available, the old man went off and returned with a cabriolet, a small three-wheeled truck. He put all our luggage on the floor and then we crawled in and sat upon the luggage. Arriving at our hotel, we learned in amazement that our reservations had been cancelled by Dr. Hohman, President of the International Congress. This was just too much.

I immediately telephoned to Dr. Eckhardt, Secretary of the Medical Congress, and he informed me that, the Friday before, he had conferred with Dr. Delchef of Brussels, and they had decided to postpone the Congress until May 1940. It had simply not occurred to them to notify the Americans.

After dinner, we began thinking of means of getting home.

"Don't wait!" the manager of the hotel told us. "This is no place for you people. Go while you can!"

But it was not as easy as all that. The next morning we

learned that British bombers had flown over Berlin during the night. The streets were flooded with thousands of leaflets, informing the Germans that England would fight to the finish, that her nerves were "tough", her resources inexhaustible, that the English "do not give in", and that "England always keeps her pledges".

In 1916 conditions had been grim, but there was not the horror of war, not the apprehension which was visible in this one. The German people could not believe that war had been declared. The vast majority of them did not want it. They were sunk in gloom. I had observed that on the steamer going over, though none of the Germans dared to commit themselves on Hitler.

I had noticed that same paralysis of fear even in America. A few years before, a German professor from the University of Berlin visited me in New York. In the smoking car of the train we encountered another German, who had just returned from Germany. He attacked Hitler hotly and outspokenly, while the professor maintained absolute silence. The only comment he made was after the other German had left.

"That man is taking a terrible chance," he remarked. "What a pity! He does not know what he is doing to his family."

Terror is a tremendous cudgel. Only those who have seen its hideous effects know the extent of its power.

We asked our hotel manager how to get back to America.

"By way of Sweden," he said. "Go to Sassnitz, Germany."

We asked if we could get reservations on the train-ferry sailing from Sassnitz, and he inquired for us. It was impossible to get through to Sassnitz by telephone. The German ferry had made its last trip, but the Swedish ferry might still be running. The hotel manager recommended our taking the train, and making a seven-hour trip to find out whether the last Swedish steamer had put out to sea. If it had sailed, he advised us to return to Berlin, and try to get to Sweden by way of Denmark.

There was only one thing to do, and that was to hazard the trip with the hope that we might catch the Swedish ferry.

We said good-bye to Dr. Putti and left for Sassnitz. Leaving Berlin, we noticed on the top of all the big, flat-roofed buildings, anti-aircraft machine-guns, and small groups of men with field glasses, on the lookout for aeroplanes. The men were dressed in gun-metal suits and the guns were camouflaged with gardens of flowers.

Arriving at Sassnitz, we breathed a sigh of relief. The Swedish steamer was still at the docks. At length we sailed on the *Drottingholm* from Gottenborg, Sweden, a small steamer of 10,000 tons, usually carrying about 700 people, now loaded to a capacity of 975. We understood that she was built in England in 1905, sunk during the First World War, raised, and in 1919 sold to Sweden. This was to be her next to last trip before she was made into a freighter.

The sight of the New York skyline, as we finally reached home, meant more to me than it ever had before. Not because of its spectacular beauty. Not because of the vast, clear sweep of the buildings, reaching into the sky. But because, in all the windows, lights were burning, uncovered, unafraid.

XXII

PAN-AMERICAN RELATIONS have become the theme of the hour. It has always been obvious that close, friendly co-operation should exist among the peoples of the western hemisphere, and it has now become of great moment that they should do so. But we have been rather stupid in our attempts to develop better relations. On the whole, we have been too commercial about it.

The trouble, in part, has been the tendency of government officials and businessmen to pour money into the South American republics. They accept it, of course—who doesn't? But we cannot buy good will. Far more has been done to establish mutual trust and confidence by the Rockefeller Foundation, which has sent members of its staff to South and Central America to help eradicate tropical diseases and assist with problems of health.

Much can be done by the medical profession. It is the most influential of all the professions in Latin America. On several occasions I have found doctors who have become presidents of republics, indicating the extent to which medical men take a part in the political activities in these countries.

Faith and confidence between North and South America can be extended by bringing together the intellectuals of the two hemispheres: doctors, scientists, engineers, writers, and students. For years Latin America sent its young men to

Europe to complete their education, to acquire their culture, to shape their ideas. To-day, they are sending them to the United States to learn our methods in nearly every field of science.

It seemed obvious to me, from the beginning, that the first and most important step in stimulating better feeling between the medical profession in this country and that of the Latin American countries would be to organize a Pan-American Medical Association.

A group of ten American surgeons had constituted themselves a committee on Pan-American relations, but they had done nothing but hold committee meetings.

When they asked me to be chairman, I asked, "What have you fellows done? If I am chairman, we are going to do something."

Committee meetings, in my experience, are one of the best substitutes I know of for doing things. They give all the satisfaction of achievement and they peter out in talk. I have never believed much in talk except as a means of accomplishing something.

So we got busy organizing. I disengaged one of my secretaries from all my professional work and put her on the task of aiding me with this Congress, which was to meet on December 30, 1928. At first, correspondence with the leaders of the medical profession in Cuba failed to arouse much enthusiasm. The Latin Americans have always been inclined to suspect that we have an axe to grind. But, fortunately, a former pupil of mine, Dr. Alberto Inclan of the University of Havana, was in New York. I explained to him that our purpose in trying to found a Pan-American Medical Association was purely to establish a better feeling between the physicians of the various countries and asked him to aid me in stimulating professional interest in Cuba in regard to the organization of such an association. Upon his return to Cuba, I began to get immediate responses from prominent men there, saying that they would be willing to do everything they could to help me.

As a result, we organized a tremendous meeting in Cuba. At that time, Machado was president, and the government entered into the affair with great enthusiasm. One of the features of the meeting, indeed, was a special train trip, arranged by President Machado, which took us the whole length of the Island.

Just previous to this, as it happened, President-elect Hoover had made an extensive good-will trip to Latin America and was called back hurriedly to America, cutting out his visit to Cuba. As a result, all the oratory that had been prepared for Hoover, fell to our share. Our plan had been to discuss medical problems only, but with the President-elect's visit abandoned, I as President of the Pan-American Association was requested, at Santiago de Cuba, to inspect the military establishments, and, on each occasion, I responded to a great deal of Cuban oratory.

To cap the festivities, both Dr. Will Mayo and myself received the Carlos B. Finley decoration.

No American doctor can fail to pay warm tribute to the amazing Mayo brothers, to their personal qualities, their contributions to medicine, and their magnificent ability to get things done.

It is the fashion now to speak of the "bewildered intellectuals", which really means, I think, the growing tendency to talk and talk about what ought to be done and then not to do anything about it. The Mayos were not like that. They did not find talk an easy and comfortable substitute for action.

I recall once visiting Dr. Charles Mayo's home. He took me up to an observation tower back of the house, which he had made from a silo and which was typical of his ingenuity. We sat there, looking over the country and down on a pond in front of the house. Dr. Mayo said that he had had a brook there, but neither electricity nor water. He wanted to dam the brook and produce electricity for his house and farm. So he sent for a man who had a big reputation for building dams.

The engineer came to look over the dam site, bringing with him a retinue of associates. Dr. Mayo, in a pained tone, said that they stayed for days and days. At length the engineer and his staff took their departure. Dr. Mayo then waited for the report. Much to his surprise, he finally received a letter saying that, because of conditions at the proposed dam site, it was impossible to build a dam. Dr. Mayo was understandably annoyed. Later, when he received a thumping bill for this invaluable advice, he was still more annoyed.

The following year, after the harvest was over, he told his hands he was going to build a dam. And with the help of these

untrained farm hands, he did so. There, before us, were the results: a dynamo, a pump, a pond, electricity, and running water. Yes, the Mayos got things done! Luck—that favourite word of the incompetent? Well, I suppose it is all in the point of view.

The physicians in Central and South America, as I have pointed out, are often the most travelled and cultured men in the community, and the reins of government are frequently placed in their hands. But they suffer the incomparable disadvantage of isolation. Compared with their situation, travel and communion with one's fellow-physicians in America is easy. In some of these southern countries, mountains and other adverse geographical conditions make road building and railroad construction so difficult that travel is arduous, expensive, and slow.

Only a physician can realize how these men welcome a visit by a group of fellow physicians, particularly from another land, and how eager they are for the refreshment of new thought and new methods.

It was with these ideas in mind that a group of us planned a flying clinic to Central America and the northern part of South America in 1930. The immediate object of our trip was to expand the Pan-American Medical Association, and eventually to unify medical knowledge between these countries and the United States. We started a journal to which articles are contributed in Spanish and English. It was the medium of intercourse between our two races. The Pan-American Medical Association is an important medical bond, perhaps destined to be the strongest bond between the two races. Its purposes are not only educational, investigative, and humanitarian, but the Association can, as no other agency, bring about good will and fellowship, which may be considered, in the light of present events, an important object of our international policy.

Our party, on this flying clinic over the Lindbergh Circle, consisted of Dr. William Sharpe of New York; Dr. Anthony H. Kegal, Commissioner of Health, from Chicago; Dr. George Hawley of Bridgeport, Connecticut; Dr. Charles Murray Gratz of New York; and myself.

We had the choice of spending six months by ordinary means of travel, or covering the entire field in seventeen days of flying. Not only the necessity for economy in time, but the risks of

ordinary travel determined our choice of the aeroplane. It is decidedly unsafe for a northerner, unaccustomed to the climate and the diseases of the tropics, to undertake a six months' visit there.

We set out from Miami in two chartered Sikorsky twin-motored amphibian planes for Havana. Here we were looking down over the seas of the Spanish Main. Below us, perhaps, lay the bones of pirates and the decaying boxes of "pieces of eight". Within our range of vision were the changing colours of the sea.

At first, the water was very shallow, and from our height, the different colours of the algæ in the pockets of the ocean bed gave the sea a mosaic appearance as they showed through the smooth green of the water. As the ocean became deeper, the colour became more constant and only a giant sea-turtle swimming on the surface provided any variety until we could see the surf of the Cuban shore, advancing, not like waves of foam, but like ever-changing patterns in a snow drift.

In Havana, we were welcomed by the President, Dr. Fernandez, who authorized us to found chapters of the organization wherever we went. Sometimes this was done when we arrived at a clinic or banquet; at other times, we announced our plans and completed them on our return journey.

It was smooth flying to Yucatan, the south-eastern projection of Mexico. Over the land we bumped when we flew low, and we were more comfortable, in our minds as well as our bodies, when we were so high that trees were toothpicks, frayed out at the top, and men unrecognizable unless they moved. The smoothness of flight is like the smoothness of a motor trip. It depends on the terrain. Forests and mountains disturb the smoothness of the air just as obstacles affect comfort on a highway.

In Yucatan we were in a land of endless forests. We flew low to look at Lindbergh's moss-covered historic ruins of the Maya civilization. Not a river or a brook did we see; not a break in the forest, except for an occasional shack in a small clearing, with an excavation containing a little muddy water.

It was primeval country.

Our first night, after two strides across the Gulf of Mexico from Miami, was spent at Mérida, where we saw 10,000 windmills, most of them made in Chicago, of all places, driving as many individual water pumps, fed not by a community-built

reservoir, but by one built by nature under the city. Much of the state of Yucatan has a stratum of water-bearing rock close to the top soil.

Next morning, after stopping at Belize, the capital of British Honduras, we made a losing tussle with a norther which had been raging in the mountains for four days. As we scaled from the Atlantic side to a ceiling of 16,000 feet, we saw the storm clouds raging like a rolling sea below us.

They caught many colours and lights and shadows from the sun. Sometimes the reflection of the sun itself came back to us in a great misty halo. We were alone with the skimming shadows of our planes in a mystic world.

The plane ahead of us was well in the lead, running towards a wall of clouds that seemed to rise thousands of feet above us. Presently, we began to sway in a jerky fashion. The plane ahead veered sharply to the left and we followed suit. Still the great wall was ahead of us, until, at length, we saw a jagged circle of blue beneath us. The other plane was making for it and we raced on, lest it close. Down we dived, our engines roaring, till we saw the blue sea and the surf on the shore. But as we settled on our pontoons in the water, we learned to our consternation that this was not the Pacific. We were back again on the Atlantic side. Another attempt and we sailed right into the sun, over mountains and clouds, to our destination, San Lorenzo, on the Pacific side of Honduras.

Here we found only a pasture, surrounded by a mahogany fence, for an airport landing field. This was 1930, when aviation was in its infancy, complete dormancy had existed everywhere until Lindbergh's phenomenal crossing of the Atlantic a little over two years before, and his trip over our same route one year before, had stirred the imagination of men and led to a new interest in the possibilities of air travel. One of our greatest difficulties on this whole journey was the curious crowds that came tumbling over our improvised landing fields as we landed and took off.

We were still five and a half hours from Tegucigalpa, by way of a dusty tortuous mountain trail that passes for a road. Tegucigalpa is the only capital in the Western hemisphere without a railroad. Our planes were too large to land on the small field at Tegucigalpa, surrounded by mountains in the rarefied air at that high elevation, so the Government of Honduras and the United Fruit Company kindly—we can say

that now it is over—put Bellanca Fokker planes at our disposal. We stepped out of our two 850 horse-power twin-motored Sikorskys, with the small amount of luggage to which we had been rigidly limited, and gazed at the 190 horse-power single-motored craft.

Nobody seemed anxious to be the first passenger. Someone suggested half-heartedly that we draw lots.

Then the pilot stepped up. "All aboard!" he called briskly.

I had nothing against a Bellanca or Fokker, at least not then. However, the party went in two trips, and I was content to wait for the second one. Presently the plane returned and in a few minutes we were 7,000 feet in the air. We made the flight in record time.

At Tegucigalpa a banquet was waiting for us, presided over by the President of Honduras, Dr. Clindres, a physician whose kindliness and genial wit made us forget the fatigue of the day.

On the journey back to San Lorenzo, next morning, I complimented our pilot in the Ballanca Fokker for our swift trip.

"Well, you see," he explained, "we had scarcely taken off when I noticed the oil pressure was at zero, from a leak somewhere. So it was up to me to hurry!"

From Guatemala City we flew to San Salvador, and then to Managua, the capital of Nicaragua.

We had heard a good deal about the unpleasantness aroused by the presence of the Marines, but we found them doing a kind of work to which nobody could object. They were protecting the water supply, and it is worth protecting. It comes from an old volcanic crater and is beautifully soft and pure.

The curse of Nicaragua, after the abolition of yellow fever, was malaria. Unfortunately, that has yet to be abolished, but it has been controlled by several methods. The mosquito, which carried the malaria germ, must be destroyed as quickly as possible. It must be attacked in its breeding ground, stagnant water. It is, of course, impossible to drain all the swamps, ponds, lakes, even if it were desirable. At one time, the water was sprayed with oil, so that the mosquito larvæ could not breathe, and died before they could develop into mosquitoes. Now these ponds are sprayed with Paris green. This work is carried out by the Marines, who fly over swamps in aeroplanes, and drop poison which the propeller disperses in a fine powder over the desired area.

The second method of attacking malaria is medical. If there were no patients with acute, or chronic malaria, mosquitoes would never become infected. Or, if all malaria patients could be kept from being bitten, the disease would die out. There are two reasons why this method is very difficult. Malaria is carried by patients after the acute attack, and they cannot always be protected from mosquitoes. Then, too, monkeys carry malaria germs in their blood, and there are quite a number of monkeys in Nicaragua.

The greatest problem is the treatment of the human carrier. If the malaria germ has not been destroyed in the blood of the patient in a comparatively short time, it passes into a sexual form. Ordinarily, the germ multiplies in the human blood by splitting up into a number of spores, each of which grows into a new individual in a few days. These spores are asexual.

The sexual process is carried out by the sexual forms, known as gametes, which are formed later on. But the sexual process itself cannot occur except in a special mosquito. Hence, the mosquito must be infected by the gametes formed in the human blood. Thus, part of the life cycle of a malarial germ is spent in the human blood, and part in the stomach and tissues of the mosquito. It is now believed that quinine, if it does not kill the germs, favours the formation of the gametes, against which it is not effective.

In recent years, plasmochene, another drug, has been discovered, which is said to be effective in destroying the gametes.

If every infected person could be treated with quinine and then with plasmochene before another mosquito sucked his blood, malaria would be destroyed in a very short time. Such results cannot be attained in Nicaragua at present, but the attempt to reduce the mortality rate has met with striking success.

Of course, I do not mean to say that the ground gained is to be measured in terms of mortality rate alone. A malaria-ridden race is handicapped physically, mentally, and probably spiritually, and cannot compete with a race that is free from the disease. The question of malaria enters into the whole industrial, social, and political fabric of Nicaragua. I venture to predict that the country will be entirely remade when malaria is overcome.

After days of travelling, we went to Panama City, where the

Congress of the Pan-American Medical Association was being held.

The sight of the Canal moved us, not only because this was a great feat of engineering, but because it stands as a tribute to modern medicine. We were proud as Americans and proud as physicians. Man's handiwork has not detracted from the beauty of the scenic effect. The great lake and the locks lying in the low hills present a scene of grandeur in themselves. The scarred hillsides, where the great slides occurred, reminded us of nature's relentlessness, and how she returned to battle even after having seemingly lost. Now she seems content to let the great oceans mix.

The Panama meeting lasted from January 30th to February 3rd. It was attended by doctors from most of the Latin-American countries and from our own.

The day after the meeting, we left on our South American trip. First we flew to Cristobal, refuelling at Cartagena at noon, and had two hours to see this very old Spanish town, with its ancient houses, narrow streets, and old fort.

We ended our day's journey at Barranquilla in the middle of the afternoon. We had our conference, and, as usual, I showed movies and organized the local chapter of the Pan-American Medical Association, spending the night in Dr. Kupfer's splendid clinic.

In Barranquilla, we saw further evidence of the necessity of aeroplanes. Formerly the trip to Bogota, the capital of Colombia, took a week by boat and train. Now it takes thirty-six hours by air and railroad.

There was no landing field at Caracas, the capital of Venezuela. In fact, we were told that the President was not in favour of aeroplanes. This was no great drawback to us, because Venezuela had a motor road between the airport and Caracas which was the best road we saw outside of the Canal Zone. The road has been paved, not only to facilitate traffic, but to reduce the incidence of hookworm disease. This worm is contained in infected excreta, and abounds in ordinary dirt roads. It develops in moist soil and water. The peasants, travelling barefoot, are readily infected. Since more roads have been built of concrete, the disease has diminished considerably.

Our motor trip to Caracas in the mountains made a delightful last stage of our journey, for Caracas was the furthermost point of our itinerary.

President Gomez of Venezuela was then seventy-two years old, and had seventy-four sons, the daughters not having been counted, we were told. Venezuela is a strange country in some ways. It is not backward, but the laws in regard to marriage and legitimacy are unique. Only a minority of adults are married, and seventy per cent of the children are illegitimate. The father and mother can legitimatize a child, if they apply jointly. The women band together to help the unwed mother by supporting her and her child until she can do so herself. This is a striking antithesis of the Anglo-Saxon woman's attitude towards her erring sister, and another example of the fact that our morals, which at times we are prone to regard as deeply rooted in our natures, are a simple matter of geography.

When we stop to consider that mosquitoes can influence politics, that geography can effect a basic change in our morals, many of our most firmly held beliefs seem to be subject to some revision.

It was a great trip, studded with wonderful memories. Our road was clear. We had only to hold out our hands and they were eagerly grasped by our fellows to the south, without misgivings or the shadow of suspicion. Sunlit seas, gloomy jungles, mountain peaks, vomiting volcanoes—all crowd back into my mind as I write this. And something more too. I remember seeing a medical school with one hundred and fifty students and hardly a single microscope. Cut off from the world, they are making a valiant effort to do good work, without adequate training, without adequate touch with the profession and its advancement. We can do much to help them, and we have only made a beginning.

In 1932, I received a request from President Gomez of Venezuela to operate on his son Florenzio. At a great palatial reception, surrounded by high officers of the Medical Corps, Army, and Navy, the President, wearing the uniform of a General, received me. After all this ceremony, I was finally allowed to examine the patient.

Much to my discomfiture, the President, together with his assistants and retinue, accompanied me to the sick room. In a vast chamber, on a huge canopied bed, I finally made out the form of my patient.

Knowing before I saw the patient that General Gomez was a

dictator, I suspected that if I were to make any headway with him I should have to take on the demeanour of a medical dictator. This, if I do say so, I did with considerable success, and the old President was extremely tractable to my suggestions.

As a result of the operation, the President conferred upon me the Order of Libertador, the Grade of Commander, an award created in honour of Simon Bolivar for having expelled from South America the Spanish overlords. This was particularly interesting to me because, some years before, King Alfonso of Spain had decorated me with the Queen Isabella Catholica Order, created by the Queen for the purpose of rewarding her warriors for conquering Venezuela and South America.

The original significance of these two hostile orders had vanished in the course of time, and they were at length bestowed for a work of reconstruction rather than one of destruction. I suppose there is a moral in this, but what it is I am not sure, unless that if we can only wait long enough, the sinews of war will be used for peace.

Early in the spring of 1936, I accepted an invitation from the Chilean Government to go to Santiago de Chile as its guest to lecture to students, and demonstrate my work before the medical profession of Chile. My signature to the acceptance of this invitation had hardly dried before I received similar invitations from practically every country in Central and South America, as well as Puerto Rico, Trinidad, Jamaica, and Panama.

My engagements for the summer allowed for an absence of a little over a month, so I arranged a South American itinerary that would enable me to fulfil long-standing promises to many cities *en route*.

In applying for my passport and other necessary credentials required for entrance into the South American Republics, I was introduced to an amusing yet very just and common-sense custom. The general routine for entering a foreign country usually requires only a passport, properly visaed, but not so in South America. The customs officials wish to make sure that neither disease nor criminals enter their country. Therefore they required me to present, in addition to my passport, a health certificate and a police certificate, which appears below.



Dr. Fred H. Albee using the Albee Bone Mill while performing a very delicate bone graft operation in Rio de Janeiro, 1936, while on a flying trip by invitation through South America

City of Venice,
Venice, Florida
June 12, 1936

To Whom It May Concern:

This is to certify that Dr. Fred H. Albee is a resident of Sarasota County, Florida, and that to our knowledge he has not been arrested or in jail during the past five years.

(signed) JAMES T. BLALOCK
Mayor.

I completed this tour of the South American countries in thirty-three days, flying 14,000 miles completely around South America, down the east and up the west coast. This included clinics, operations, and lectures before the medical societies of San Juan, Puerto Rico, Trinidad, Brazil, Uruguay, Paraguay, Argentina, Chile, Peru, Ecuador, Colombia, and the Panama Canal Zone.

My curiosity in regard to the manifold aspects of the climates and civilizations of the Latin-American Republics has been great, but I have never had the time at my disposal to carry out my desire to delve into its charm and resources. This trip afforded me at least the opportunity of visiting most of the principal places of interest. Although I have been in South America and Mexico many times, I have never ceased to be amazed at the rapid growth and successful pioneering of the airways which have contributed so much to the development of good will between the Americas.

Six years before, the flying clinic, sponsored by the Pan-American Medical Association, had organized association chapters in each country. On that trip, eleven Pan-American chapters had been established, including chapters in Yucatan and Mexico.

On this trip, I found a decidedly increased interest in bone surgery and rehabilitation. And while the work of rehabilitation and vocational guidance has not yet reached the stage it has in North America, Latin America is progressing intelligently and rapidly.

I was extremely gratified to see progressive and outstanding work being done in public health and social welfare. Children's hospitals, clinics, open-air schools—sanatoria for after-care of children with rickets, tuberculosis, and abnormalities of all kinds—were well-organized.

I found everyone intensely interested in our pioneer rehabilitation work in New Jersey, and I am hopeful that in the near future a similar service may be inaugurated in the Argentine. Requests were made to have the New Jersey State Rehabilitation films sent to them for educational purposes, not only for the medical profession, but also for the public, so as to interest the latter in providing means for the employment of these new, helpful agencies for human betterment.

The medical profession, as well as the social workers, are eager for information and literature. It will be interesting to watch the growth of rehabilitation and preventive medicine below the equator in the next decade.

Certain moments of that trip stand out in my memory—the annual automobile race in Rio de Janeiro, for instance, a killing ordeal up and down the hairpin curves of a mountain speedway. There was a French woman driver in the lead until someone, whether to break her lead or by accident, hurled a bale of cotton on to the track in front of her speeding car. There was a splintering crash, a thin cry, and then the screams of the injured and dying as the dead woman's car catapulted into the stands. The United Press asked me to take the pictures of that hideous accident to Buenos Aires that night and I found them staring at me next day from my morning paper.

It was in Buenos Aires that I encountered the ox grill. On my arrival I was asked where I would like to dine and what I would like to eat. Perhaps, it was suggested, I would like some spaghetti. I was going to Rome later, I said, and the spaghetti could wait until then. I wanted the most characteristic dish of the country. After a moment's rumination, the vote was cast for a mixed grill.

Now there are mixed grills and mixed grills. But this was one to end mixed grills. It was made of every conceivable part of the ox and served on a plate as large as a grazing field. There was sirloin and tenderloin, a piece of the small intestine, very crisp and delicious. But when I faced a large piece of colon filled with blood I had to call a halt.

In the Argentine my partner in a golf foursome turned out to be the friend of a former patient of mine, the famous polo player, Alfredo Harrington. Harrington and his renowned Hurlingham team, having just completed a tour of the United States, where they beat the best we had to offer, were engaged

in the international championships at Buenos Aires, when, in the course of a match Harrington's pony and another collided and went down, pinning Harrington's right leg beneath them. My golf partner, who, it turned out, was President of the Hurlingham Club and was present at the spill, related how even as they pulled Harrington out and he realized his right leg was badly crushed, his chief worry was: "Will I ever be able to play polo again?"

Five years later, after he had been treated in Buenos Aires and elsewhere without beneficial results, and had come to me, his first question after my examination was: "Will I ever be able to play polo again?"

My examination had shown that there were four inches gone from his shin bone, and pus from a deep infection caused by wire used in a previous operation was pouring down his leg. Still I could see a possibility. He was essentially a fine, healthy specimen. "Perhaps," I answered.

After overcoming the infection, we restored the bone by a bone graft from his other tibia. The result was most gratifying; but the healing process was necessarily a prolonged one. All through his convalescence his one plea was his old one: "Will I ever be able to play polo again?"

Two years after my operation, and just before Christmas, I received a letter from Harrington, enclosing X-rays of his leg. He had written: "I am herewith sending you a Christmas present in the form of X-rays, which, according to my surgical advisers, show wonderful results."

After examining the X-rays I cabled back: "Your marvellous Christmas present received and much appreciated. I am hereby forwarding my Christmas present to you. You may begin playing polo."

Never, I think, have I understood all the meaning, all the potentialities, all the magic of the expression "Pan-America", as I do since another journey I have just completed through the countries of our neighbours to the south. Never have I been so deeply aware of the strong and indissoluble bond that exists between our peoples, of the partnership and the friendship which unites us.

This memorable trip was initiated by a request from the University of Buenos Aires that they be permitted to name their operating room for me, and that I attend the dedication ceremonies. Such an honour to a North American citizen gave

me great pleasure. The invitation was followed by others, and by the time I was ready to set out plans were made to stop at Port-of-Spain, Trinidad, Rio de Janeiro, Buenos Aires, the University of Chile, of which I was honorary professor, and the University of San Marcos, oldest university in the Western Hemisphere, of which I was also honorary professor of surgery.

At Port-of-Spain a new chapter of the International College of Surgeons was formed while I presided as International President. In Brazil, through the courtesy of Mr. Oswaldo Aranha, the Foreign Minister, and former Ambassador to this country, I became the guest of the Brazilian Government. This was shortly before the sinking of three Brazilian steamers by the Nazis. I learned of the sinkings first on my arrival in Rio de Janeiro when Mr. Aranha took me aside at a dinner party, given in my honour, to tell me what had happened and to confide to me that it meant war. The following day war was declared on Germany. The excitement was beyond description. There could be no doubt in the minds of those who witnessed that demonstration that the people of the country were wholeheartedly behind their government. German and Italian signs were ripped from places of business and the swastika flag was burned on the steps of the Grand Opera House.

The eagerness which the people here as in other parts of South America showed in honouring an American surgeon was, I think, an evidence of their desire to extend the hand of friendship to us during these hideous days. The President of the University of Brazil presented me with a medal and a scroll and notified me that I had been made honorary professor of surgery at the University.

It was a matter of tremendous interest to me, when I reached the Argentine, to find so immense a majority of the people in favour of the United Nations. Some even went so far as to say that if the present government were not more careful, it might be overthrown. In Buenos Aires I was proud to witness the unveiling of a bronze tablet bearing the words: "Professor Fred H. Albee Operating Room." An American flag was used in the unveiling, and I was accorded the privilege of dedicating the room by being the first surgeon to operate in it.

About seven hours' ride from Buenos Aires, on the pampas over difficult roads, is the ranch of my former patient, Alfredo Harrington. Here I saw a type of demonstration new to me,

and more exciting than any I have witnessed in a long time. That was a private rodeo staged for our amusement, with wild horses and skilled riders which could hardly be duplicated anywhere else in the world.

The trip from Buenos Aires to Santiago, Chile, was one of the most thrilling of all my aeroplane trips. The plane was tossed about like a feather in the wind, it dropped at times the height of the tallest skyscraper, pitched like a wild steer, dropped again until most of the passengers were panic-stricken. The pilot said afterwards he flew unusually high so he could keep the plane off mountain peaks when it dropped.

Both in Chile and in Peru the growth of interest in international co-operation through the International College of Surgeons was marked. My journey ended with a brief visit to my former patient, President de la Guardia of Panama.

The trip impressed me with the fact that there is as strong a desire throughout Latin America as in the United States for better acquaintance and understanding. I have observed it in my own country in the tremendous increase of study of the Spanish and Portuguese languages, and in the Latin-American countries by the learning of English. Many men of my own profession whom I met on previous trips had been unable to speak a word of English; now I found them speaking it fluently and with the ease that comes of much practice. I returned with the knowledge that the bonds of friendship grow day by day stronger and more enduring between the Americas.

XXIII

One of my oldest and most intimate friends was Dr. Harlow Brooks, the famous clinician. For many years he had been telling me about his interest in the Indians in Arizona, and his conversation was tinged with colourful Indian folklore. He had spoken several times of the unusual work he was doing among the Indians at Ganado Mission, Arizona, and asked me to go out with him, but the time never seemed ripe. There was so much bone and joint tuberculosis among the Indians, he said, that it would offer a tremendous opportunity to do something for these unfortunate people. Then Dr. Brooks died.

About three weeks later, Dr. C. G. Salsbury, Chief Surgeon and Director of the Presbyterian Ganado Mission, and head of the Sage Memorial Hospital at Ganado, came to my New York office.

"I've come to make arrangements with you for your trip to Ganado Mission," he told me. "Dr. Brooks said, before his death, that you had promised to come."

I agreed at once and in a short time we set out for the West. As we neared the Indian mission, we began to see the isolated Indian hogans on the broad desert. They reminded me of Dr. Peters' story about purchasing a hogan from a neighbouring Indian.

This particular hogan had not been inhabited for several years, as its owner had died, and the Indians, who believe that the spirit continues to inhabit its former dwelling-place, refused to live in it. Consequently, Dr. Peters was able to buy the hogan for the small sum of four dollars and a half.

When the time came to move it over on to his own property, he wondered how it could be done. He did not think the Indian from whom he purchased it would help him, because of his conviction that the evil spirit was in the hogan. Much to his surprise, the Indian volunteered. When Dr. Peters asked him about the evil spirit, the Indian declared that when he had purchased the hogan, Dr. Peters had bought the evil spirit with it.

We finally arrived at Ganado Mission, which is about fifty-two miles from Gallup, New Mexico. Ganado is on the Navajo Indian Reservation, where about 50,000 Navajos, 10,000 Hopis, and a number of smaller tribes are gathered together.

The most interesting part of this whole project is the Sage Memorial hospital, which uses only Indian girls as nurse-trainees. These Indian nurses proved to be most efficient and acted both as nurses and interpreters between the mission, its doctors, and the Indians.

In later visits to Ganado, the Indians have come to have confidence in my recommendations, because of results I obtained at previous visits, and I rarely have any difficulty in persuading them to have operative work done.

Recently, however, I examined a very advanced acute tuberculous hip in a medicine man about forty-five years of age. The little nurse, who acted as my interpreter, could not make much headway in convincing him to have the operation.

Indians always deliberate at length before giving an answer to any question, and this one was very reluctant.

Dr. Salsbury happened to come through the ward and found me at a standstill. He immediately said:

"Send for a nurse who is specially competent as a liaison nurse-interpreter."

She came promptly and proved to be a very forceful person. She related to the medicine man my previous efforts, and told him the individuals I had operated on before for the same condition he had were doing well. At length the Indian nodded timorous consent.

I decided to operate on him next morning by transplanting two bone grafts from his shin bone into the hip. This would completely immobilize the joint and bring about a cure. I then turned to the little Indian nurse and asked:

"By the way, what is the name of this man?"

"Brave-man-ever-ready," she replied.

Each year they have a clinic at Ganado Mission, which extends over a period of one week, and many prominent men from the surrounding and distant States attend. Tuberculous joints are prevalent, as are ununited fractures and a moderate amount of infantile paralysis.

Following the clinics, they have a week of Chautauqua, consisting of lectures, which are made as practical as possible, as well as all varieties of competitive exhibits with awarding of prizes.

One evening during the Chautauqua, I was asked to give a moving picture lecture, in colour, on the prevention of tuberculosis of the joints. I hesitated, and asked Dr. Salsbury if the Indians could stand it. About 1,200 Indians were present in a canvas tent; following my first picture. Dr. Salsbury asked them if they would like to see a moving picture of an operation. It seemed that every Indian rose, indicating thereby that he was desirous of seeing it. I was fearful lest some of them might faint.

There were two white men present, engineers who took charge of the lighting of the tent, and the running off of the moving picture projector. Apparently the Indians were very much interested in my movie and not one of them showed any evidence of being overcome; it was one of the engineers who fainted and fell to the floor.

This reminds me that some years ago, I was requested by the Southwestern Medical Association in Oklahoma City to present a paper on the subject of bone carpentry, to be illustrated by moving pictures. The hall where I appeared was a large one and in those days I used the black and white 35 mm. film which necessitated an asbestos booth placed in the back of the hall.

The film, showing bone graft reconstruction, had hardly begun when the moving picture apparatus went dead. I hurried back to the asbestos booth just in time to see the operator of the projectorscope pick himself up from the floor and rub his eyes. The motion picture apparatus was an old one and had to be turned by hand. The operator had become so overcome with the operative scene he was projecting, that he had fainted.

At this same meeting, I noticed a man of middle age sitting in a front seat, taking notes and making drawings. When the lecture was over, he came forward and introduced himself to me, not as an embryo bone and joint surgeon, but as a boss carpenter who had travelled a hundred and fifty miles that morning in order to learn something about carpentry from a bone carpenter!

As the carpenter looks at the result of his toil, sometimes with a certain satisfaction, sometimes wondering to himself, "Could I have done better?", so the bone carpenter looks on his handiwork, occasionally finding it good, often wondering if something more might not have been done.

So from time to time I pause to look at the rows of plaster casts and photographs of various phases of operations I have performed.

Earlier in this book I began a rough enumeration of the various applications of the bone graft in reconstruction surgery. These variations are so tremendous that it is possible only to list them in a general way by types. I broke off with the use of the method to correct loss of bone from gunshot wounds.

After that, the bone graft was applied in lengthening legs shortened by infantile paralysis. Reconstruction surgery now removes much of the terror of infantile paralysis, not only by transplanting bones but by transplanting muscles. By a remarkable adjustment of nature, the brain cells can be re-educated so that a muscle which brought the hand to the foot to put on a

shoe, will, when transplanted, bring the hand to the face to eat, and one that bent the knee will straighten it.

Such remarkable results have been achieved by this means that children whose muscle balance was so disturbed that they were obliged to go about on all fours have been placed on their feet and made to walk with only slight impairment of gait.

There was an eight-year-old boy so crippled by paralysis that he had to crawl about the floor, dragging himself by his arms. After several operations, he could stand on crutches, and in time he discarded them and wore braces on his legs. Finally, he was able to give them up altogether and walk with a cane. To-day, he himself is a practising physician.

The next logical step in applying the bone graft was in the cure of deformities of the spine, curvature, malformations of the bone, and so forth. I recall one case of curvature in which the ribs had been displaced down into the pelvis. The ribs were pulled up into their normal position and a bone graft fixed into place between the top of the pelvis and the tenth rib as a prop.

Accidents and tumours affecting the skull came next. There was a doctor from the Pacific Coast who had been in an automobile accident. A hook caught under the orbital ridge and tore out his skull back into the hair so that the top of his head was open. The brain bulged through the hole, and the beating of his heart could be seen in his brain. It was, he remarked with considerable understatement, somewhat embarrassing. The brain was pushed back into position, a bone graft set in the skull to replace the missing bone, and the doctor was completely restored.

The cripples from war are tragic enough, but year in and year out, in peace as in war, in times of depression as in times of affluence, the cripples from paralysis and from industrial injuries go on.

Because of automobile accidents, lower jaw work is coming to be a major surgical operation. One of the worst cases I ever encountered was that of the brother of one of the Professors of the New York Post Graduate Medical School and Hospital. This young man had gone to his country home for a Fourth of July celebration, which was held out on the lawn of the old homestead. Over to one side was an old muzzle-loading, antique cannon, which was set off at the breech by a trail of powder, a relic from the days of the Revolution.

Mr. MacNeal planned to shoot off the cannon as the crown-

ing event of the celebration. Unaware that some boys had filled the cannon mouth with rocks, he lit the powder of the fuse, but he did not run far enough away—the cannon exploded and fragments of it carried away his whole chin and jaw to back of the last molar tooth on each side. He was rushed into the house and placed upon a bed. In this position he felt the blood run down his throat, and thought he would choke to death. It is a great wonder to me that he did not bleed to death as both of the facial arteries were carried away.

He was brought to me a few weeks later, his mouth completely open from the loss of chin and jaw, and his tongue resting on his Adam's apple and neck.

My first act was to replace the tongue in his mouth and close the front parts of the cheek and chin by a pedicle graft of skin and soft tissues from the shoulder. After three weeks, this connected and rounded out the parts of his chin very well.

The next step was to mould a curved bone graft from the side of his pelvis into a correctly shaped chin, and mortice that into the front ends of the jawbone stubs. The soft parts, which had been grafted in from the shoulder, were pulled over and covered this bone graft.

The result was splendid. So much so that after procuring false teeth, Mr. MacNeal, who had been very sensitive about his looks, was able to go back to the practice of law.

An actress who was a famous beauty was brought into the hospital, horribly disfigured by an automobile accident, her jaw shattered, her nose and cheekbones crushed in, her face cut to pieces. A curved piece of bone was taken from her pelvis and grafted to the shattered jaw. Her nose and cheekbones were pulled back into shape. Her face was restored to nearly its original shape. The bone graft was used here to rectify deformities of the nose and to change the contours of bones. By the time new skin had grown, she was able to return to the stage, unscarred.

A bone is moved at any joint by a muscle or muscles operating on a lever. In cases of paralysis, muscles are weakened and cannot work on a normal lever. My most recent experiments have been in elongating successfully the levers for increased muscular control of joint function.

Interesting facts have emerged, too, in regard to hip dislocation where the hip socket is too shallow. Now we simply build up or increase the depth of the hip socket by bone grafts.

Or, in cases where the hip has been dislocated for a long time and cannot be put back, even into a shallow socket, we can now build a socket on the side of the pelvis.

To sum it all up, I have evolved at least a hundred new operations based on the bone graft principle for the repair and reconstruction of the human body.

And the need for such operations grows, for doctors to-day are constantly facing, in emergency accident cases, conditions comparable to those of war. There are, indeed, more casualties from the automobile than there are from war. This condition appears to be an uncontrollable evil of modern civilization.

Some 10,000,000 people are hurt every year in the United States, many of them acquiring bone injuries. In one year, 36,000 people lost their lives and 1,255,000 were injured—10,600 permanently crippled—from automobile accidents alone.

A strange feature, which has been little realized, is that there are shock victims of motor accidents just as there are shell-shock victims of war. These cases become a mounting problem for neurologists and psychiatrists who must refit them for life in our mechanized civilization.

We have a tendency to speak rather smugly of our improved standard of living, of the mechanical slaves which each of us has at his disposal. But it is high time that we realized these mechanical slaves, like the genii of the bottle, are powerful enough to destroy us all if we do not learn how to master them.

Between twenty-five and thirty per cent of the traffic victims who survive accidents suffer spine and brain injuries. This is an appalling picture and it will not improve until the public becomes alive to the situation and takes steps to end it by reasonable, intelligent precautions.

Up to ten years ago, for instance, there was no law in the State of Florida, requiring operators' licences as a protection against incompetent drivers. The Governor was fully aware of the necessity for such a law, and at his request, in order to stimulate some interest in the gravity of the situation, I did some broadcasting on the subject of "Rescue, First Aid, and Transportation", trying, among other things, to point out that well-meaning but untrained first aid often does more harm than the original injury. This is particularly true of spinal injuries, where the rescue frequently causes more harm than the accident. For instance, if a person has sustained a broken spine in

an automobile crash, it is better to let him lie on the ground where he is for an hour or more, if necessary, rather than to move him and attempt to prop him up in a car.

I have seen several cases where a strong person excitedly yanked the injured from under an automobile by pulling frantically upon the arm, thus tearing the large nerve trunks under the arm pit and paralysing the arm.

A boy runs out from behind a truck, is hit by an approaching car and sustains a broken leg. Well-meaning bystanders cannot bear his weight, because something gives way, whereupon he falls to the ground with increasing pain. This friendly act may force the injured person to remain an invalid for many additional months, or even result in amputation of the leg, for the following reasons: when a bone is fractured two knife edges are created and if the person is helped to his feet or lifted improperly, those sharp edges will tear into the main blood vessels, nerves, and muscles in the vicinity. The kindly bystander again comes to the rescue, and picks the victim up in his arms, or perhaps two people carry him if he is heavy. As he is being carried to a taxi or car, with the foot of the fractured leg dangling and swinging back and forth, no one realizes what the sharp bone ends are doing. He is then folded into the back seat and his foot lifted up into a lap or on to the seat, and the ride begins. Over bumps, and around corners, they hurry the patient to the hospital, with additional injury steadily increasing.

In the speed craze of to-day, the spine seems to be increasingly vulnerable to injury. In the horse and buggy days, the backbone was relatively immune from injury. A fall from a tree, a cave-in down the mine, were accidents of rare occurrence compared to the risk of injury to which the motorist is exposed whenever he steps into his car.

Recently in a midwestern city a woman hurrying across the street was struck by a squad car speeding to the scene of a burglary. The policeman placed her carefully in the back seat of his car, and, to ease the pain of her injured leg, lifted it over the uninjured one. When he reached the hospital he found that the bone had pierced through the leg in two places. The result was the loss of the woman's leg.

On one occasion, while I was making my broadcasts on "Rescue, First Aid, and Transportation", I seem to have carried my enthusiasm too far, for I gave what I have since called

my "illustrated lecture". I had flown from New York to the University of Florida from whose radio station I delivered my broadcast. Immediately afterwards I got into an automobile and sat beside my brother, who was driving. On the back seat sat the Mayor of Venice, with my grips piled beside him. As it happened, a truck loaded with fish and ice came careening down the road. The driver had been at the wheel since the night before and he was sound asleep. He crashed into us, smashing our car to smithereens. The Mayor suffered concussion and my brother was badly cut by the shattered windshield. I hauled out the unconscious Mayor and my brother, administered first aid, and then commandeered a passing truck to get them to a hospital. This is what I call illustrating a lecture, but, as I said before, I consider it showed rather excessive zeal on my part, and I do not recommend it.

Some of the strangest freak accidents I have encountered occurred in prize fights, which have always been one of my great enthusiasms.

One day, while playing golf, Gene Tunney and I were discussing unexpected knockouts.

"Have you ever noticed," I asked, "that sometimes when you have landed rather a weak blow on your opponent's jaw, he slumps down and it is a knockout?"

"Yes, Doc," Gene said, "I've noticed that. Can you explain it?"

"Directly inside the angle of the jaw is located the carotid nerve ganglion. A quick, snappy blow on the jaw is very likely to irritate this ganglion and result in the dropping of the blood pressure. This has been confirmed by research upon animals. Lay bare this ganglion in a dog's neck, touch it with an electrode, and the blood pressure will drop instantly. This," I said, "accounts for many of the unexpected knockouts."

I did not see Mr. Tunney again until his second fight with Dempsey in Chicago. The fight took place, and the famous long count occurred.

Directly afterwards, I hurried to the Sherman Hotel, Tunney's headquarters, and as I appeared, he came to meet me.

"Doc," he said, "when I was on the canvas I could not think about anything but that damned ganglion of yours!"

On one occasion John Ringling invited me to be his guest at the fight between Jack Dempsey and the Argentine Bull from

the Pampas, Firpo. We witnessed that night the most thrilling fight of our lives.

Never before or since have I observed the excitement that was evident on the occasion of that prize fight. When Dempsey was knocked out of the ring, through the ropes, down upon those occupying the press seats below, the house went wild!

He was pushed back into the ring by some reporters, and then occurred the greatest spurt of action it has been my good fortune ever to witness in a prize ring. Dempsey knocked Firpo down each time as he rose, seven in all. He never returned to his corner, but stood over Firpo, waiting for him to get up.

The excitement was terrific. We stood on our benches. When the fight was over, I found that I had my own hat on my head, and clutched a strange straw hat in my hand. Whether it was thrown in the air by some excited spectator, and I caught it, I shall never know.

Strangest of all was the Carnera-Schaaf prize fight. As Carnera had been a patient of mine, and I was much interested in him, I was present at the ringside to witness this fight. I was watching very closely. Suddenly, Carnera hit Schaaf in the jaw with a blow right from his size 32 shoe. It was a knockout. Schaaf, however, instead of slumping on the floor, as is usually the case in a knockout, stiffened, his legs extending rigidly so that it was difficult for his seconds to get him to his corner, and quite impossible to seat him in his chair.

After the fight was over, I went with my assistant, Dr. R. L. Preston, to Carnera's dressing-room. We were erroneously directed, and before I knew it, we were standing beside the table on which Schaaf was stretched out. He was still unconscious.

The attending surgeon was standing by, and I said to him: "What have you here?"

He immediately replied: "A concussion of the brain."

"I don't agree with you. I believe it is a case of a fracture of the neck."

Schaaf was taken to the Polyclinic Hospital where a well-known neuro-surgeon operated on his brain, and, according to newspaper reports, found nothing. After his death an autopsy was performed by the Coroner's physician at Bellevue, and nothing in particular was found in the brain and its membranes. It has always been my belief that my snap-diagnosis was correct.

I encountered Jim Braddock when he was training for his big fight with Schmeling. He was very much in the limelight. In most fields of activity a man rises slowly, by easy degrees, to a position of eminence. A fighter, however, may find himself famous in twenty-four hours, and sometimes the constant sense of being in the public eye may daze him, and blind him to the realization that even his wonderful body can stand only so much.

Schmeling was right-handed, so Jim was training with sparring partners who were also right-handed and kept hammering away on his left arm, which, of course, is the principal defence against a smashing right. It wasn't long before Jim began having trouble with his left elbow. His family doctor X-rayed it and said: "We will have to call a surgeon."

The surgeon again X-rayed and declared: "Your elbow must be operated on." Jim and his trainer refused to believe it. They called on another consultant . . . then another . . . then another. Before they were convinced, they had called on seven consultants, each of whom insisted that an operation was necessary. Whereupon, the New York Boxing Commission, always alert to the need for justifying anything which the fans might interpret as an alibi, called, it is said, seven more. These, just to complicate matters, took the other side.

I was called in, in a sort of neutral capacity. I examined Jim Braddock, and discovered he had the same trouble in both elbows. He was jittery and toxic, and what he needed as much as anything, was medical care. He had been under too great a strain. I took him to Florida with me for thorough study, and found that the principal cause of his trouble was a bad focal infection consisting of pus in his sinuses. There was no need for an operation—but there was need for rest and physiotherapy treatment. After several weeks of both, I took him on a shark-fishing trip. To see him tussle with a 350-pound shark, no one would have believed there had ever been anything wrong with his arms, which soon were so completely well that he could go on with his fighting career.

XXIV

IT IS NOW MANY YEARS since I first fell under the charm of Florida. Its climate, its sunshine, its pleasant way of life, its fishing, all of these things have been an unending delight to one who originally discovered the secrets of nature the hard way, on a Maine farm.

I had travelled the world over, time after time, before I made my own personal discovery of Florida. Enthusiasts took me about the State, from one end to the other. I saw the Everglades and the coastline, the lush growth of trees and flowers, and the fish in the sea. And, much to my wife's amusement, the first fish I ever caught was a bone fish!

In fact, like most devoted fishermen, I have been more an object of amusement than admiration to my wife. One of the officials of the Eastern Airways told me one day: "I have been talking to Captain Eddie Rickenbacher about you. He'd like to have you as a member of the Eastern Airways Flying Fishermen Club. Can you qualify?"

"Of course," I said promptly. "I have all the data on a large tarpon I caught." I dictated all the details, the time, place, size, weight, and so forth, and in due course I received a framed certificate of membership. Now the tarpon, as it happened, had weighed 105 pounds and was seventy-two inches long. Through some mistake the report read seventy-two feet. Which is a whale of a fish.

Not long after, I received a second framed document from the Eastern Airways Flying Fishermen Club. This one read:

BEHOLD

THE FISHERMAN!

> He ariseth early in the morning, and disturbeth the whole household. Mighty are his preparations. He goeth forth, full of hope; and after the day is far spent he returneth smelling of strong drink, and the truth is not in him.

For some time friends had been taking me out in their boats, and pointing casually to shimmering spots in the water would

say: "Look, there's a school of fish." I couldn't always see the fish, but I could always see the shimmer, so one day when I was taking my wife out in a motor boat, I thought I'd do a little showing off.

"Look, there's a school of fish," I said, pointing to one of the characteristic shimmering spots. "Let's ride right through it." Too late I discovered it was an oyster bed on which the Albees, complete with motor boat, piled up, to the great entertainment of more seasoned Floridians.

But such minor mishaps did not dampen my enthusiasm, and in time, I decided to give vent to my long-standing and at present irresistible urge to bring into reality that portion of the dream I'd cherished when night after night I lay in my cold childhood bedroom, and dreamed of a wonderful city in which all rooms would be heated, and I, grown to manhood, would have a pair of prancing bays just like Dr. Card's.

Since I owned some thirty miles of water front along the coast of Florida, my site seemed ready-made. I called in a city planner, John Nolan of Boston, to carry out my plans, now mentally formulated as a model modern city. He produced elaborately coloured maps on which theatres, hotels, business sections, apartment houses, areas for detached bungalows, school sites, banks, recreation centres, and parks were all indicated, with a network of wide streets connecting them.

At that time, the Florida bubble of prosperity was about as distended as it could possibly be; and everything seemed most propitious. But my surgical practice had expanded, and when I had that section of Venice, now called Nokomis, satisfactorily started on its path of development, I found that much of my city-creation urge had been satisfied. When my wife pointed out that the building of a complete city, on top of my professional work would be too much of a strain for me, and urged me to sell my blue-printed city, I listened to her counsel, and recognizing its wisdom, let it be known that Venice could be bought.

Without placing it formally on the market, or listing it with an agent, I suddenly found myself with ten potential buyers. Of them the most substantial seemed to be the American Brotherhood of Locomotive Engineers, and there was every indication that they would develop the city just as I had planned it.

This brotherhood was the first, and, I believe, the richest of

all the Unions to engage in high finance, which was carried on almost exclusively by their Chief Engineer, Mr. Warren Stone. Through his manipulations, the Union had acquired controlling interest in thirty-five banks scattered over the United States from Boston to San Francisco, and had also established an underwriting service for stocks and bonds of elaborate dimensions, with private wires extending all over the country. The building of a city seemed well within their scope.

The members of the American Brotherhood of Locomotive Engineers were jubilant over the amount of money they had made in their various financial ventures. But their joy vanished, when on the death of Mr. Warren Stone, it was found that instead of fabulous assets, they had a host of liabilities—what they had believed to be profitable ventures, were at best well-meaning visionary schemes which had miscarried.

It was to recoup their losses that they took over the potential city of Venice, which they saw as a future gold-mine, and it is said that within a period of approximately two years they spent $40,000,000 building and establishing the foundations of a community: drainage canals, wells, sewers, roads, paved streets, hotels, golf courses, bank buildings, business blocks, apartments, bungalows, etc. The city sprang up almost overnight, and through its entire founding the Brotherhood paid me the courtesy of allowing me to be their unofficial consultant; a position which carried with it none of the headaches, but all of the pleasure of seeing a dream fulfilled.

Then, in 1927, the Florida bubble burst! The Florida boom collapsed, and the Brotherhood with their credit exhausted and no place to borrow more money, found themselves facing bankruptcy. When they stopped spending money, the artificially stimulated prosperity of the city ceased, and Venice became a ghost town.

As holder of a large percentage of the mortgages in Venice, I had much of the property back on my hands. What to do with it was my next problem.

For many years—and ever since Mrs. Albee and I had been coming to Florida, I had felt that here was the ideal place to start a health centre, to set up a hospital where the tubercular conditions of bones and joints which I was operating on in less favourable climates would have the best possible assistance from nature. In this region of Florida it has been estimated there are seven hundred hours more of sunshine each year than even in

the Rhone Valley in Switzerland, which for generations has been the mecca for tubercular cases. So in 1933, I made plans to develop Venice as a health centre, and my first step was to open the Florida Medical Centre.

In connection with this, the saddest experience of my life took place, when I was subjected to fire by members of my own profession.

I had approached the Seaboard Airline with the request that they extend the running of their crack one-night train, the "Orange Blossom", from New York to Venice, for the benefit of patients at the medical centre, instead of ending it at Tampa.

This request was followed by an inquiry on their part as to what the hospital would be, who would be behind it, and so forth, as they did not care to take so radical and expensive a step without first having facts and details to place before their Board. This information was given them and they decided in favour of my request to extend the train to Venice.

When the time approached for the first trip of this line, the Seaboard Airline Railroad referred to the Florida Medical Centre on the cover of their menu card, and the consultants of the Centre, including myself, were mentioned by name.

At once, the New York County Medical Society condemned me for advertising and exacted a penalty of suspension from the Society for a year.

Although it was not of paramount importance, the injustice of this attitude fired me to action. I obtained the services of a former attorney of this same Society, determined to fight the thing through. The matter came up before the Court for a review, and the Judge handed down a very strong opinion in my favour, as the Medical Society did not have a witness, or a letter or a statement of any kind to substantiate in any way their claims that I had had a part in the Seaboard Airline Railroad advertisement, or that I had had any knowledge of it.

Three of the railroad's high officials appeared in court and accepted full responsibility for this act, testifying that a copy of the menu card had never been submitted to me and that I did not know of its existence.

The Medical Society, however, continued its antagonistic attitude, and refused to accept the Court's ruling. Judge Collins then handed down a stern decision, ordering the Society to rescind all measures or resolutions passed against me, and restore my standing *status quo*.

As there was hesitancy and delay on the part of the Society in complying with this Court order, the Judge then ruled that all high officials of the organization, more than twenty in number, would be held in contempt of Court unless they complied with the orders of the Court within three days and rescinded all their measures against me. They complied.

An inevitable result of the action of the New York Medical Society and the Court decision was to arouse an enormous amount of newspaper comment. "The doctors," remarked one editorial with some amusement, "don't want Dr. Albee to have any publicity and they've been the cause of his getting a million dollars' worth." Other newspapers referred to "the acute nettle rash of ethics".

But while that is a misunderstanding long since cleared up, it seems to me that the problem of publicity—and its definition—in relation to medical practice deserves a word of comment. I have no quarrel with the view held by those who represent the profession that there shall be no advertising on the part of its members. It seems to me, however, that this attitude has been carried to absurd lengths when it comes to giving publicity to medical developments which affect the public welfare. I can recall, about 1911, when I was head of the Department of Orthopædic Surgery at Cornell University, Dr. Howard Kelly, one of the "Big Four" at Johns Hopkins, sent his assistant to me with instructions to make stereoscopic views of one of my bone graft operations, the stereoscope being a precursor of the motion picture in recording operative procedures. At that time, Dr. John A. Hartwell was extremely critical of me for permitting this to be done, as it was, he declared, highly "unethical".

To-day, of course, such an attitude no longer exists. The motion picture is recognized as an invaluable aid in describing operative technics, and recording unusual cases. It is free of language barriers. It carries its clear message to anyone without risk of misunderstandings. Its value is beyond calculation in any meeting of doctors of various countries and many languages.

Speech, which is supposed to be man's chief means of communication, as often proves a hopeless barrier, a disastrous stumbling block. But the motion picture has no nationality. It is a common tongue. The language barrier, which hampers verbal description, is absent in visualization. In the demonstra-

tion of surgical technic the motion picture takes precedence over every other method.

One of its incalculable advantages was brought home to me when a doctor from South Africa came to see me. He had a patient, he said, a twelve-year-old boy with a severe case of infantile paralysis. He had been unable to bring the child with him, but he had made a long movie showing the boy standing, sitting, moving, walking. Did I think that by a study of the movie I could determine what surgical reconstruction, if any, could be done on the child?

We went over the movie, time after time, on the projectorscope, and decided on the operations to be performed. It was possible to tell, for instance, what group of muscles had been paralysed and which ones must be transplanted to take their place; that the deformity of a foot needed a particular operation, and so forth.

Gradually, a healthy change is coming about in the profession's attitude in regard to giving the general public information as to what is being accomplished. But there is still a tendency to regard with suspicion, if not open hostility, any public comment. It is not unlike the excessive modesty of the old maid who, back in the eighties, asked her friends to address her letter to "Miss Smith", instead of to "Miss Gladys Smith", as it wasn't proper for the postman to know her first name.

One of the results of this studied campaign of silence on the part of the medical profession has been to lay the seed of quackery, which flourishes where there is ignorance. So long as people do not have reliable information from authentic sources as to what can be accomplished and what cannot, they will always be victimized by the quacks.

During my years as a surgeon, I have been the object of an unusual amount of publicity, and, as a result, I have given this subject a great deal of thought. In my case, I strongly suspect, some of my colleagues believe I court this publicity and even that I have, on occasion, sought it, although it has come about simply because the bone graft and associated operation, to which I have devoted a large part of my life, are in themselves spectacular and appeal to the popular imagination, making the kind of stories which reporters love.

So far as I have ever been able to discover, a reporter will get his story if he sets out to do so. The result is apt to be awkward for the surgeon. But though it adds nothing to his peace of

mind, I have come to wonder, in the face of often querulous comment on the part of some members of the profession, if the results of this unsought and unwanted publicity have been altogether bad. And I am forced to the conclusion that, on the whole, it has been of benefit to the public, whose well-being it is, after all, our function to serve.

Let me cite two instances in which the stirring of public imagination in regard to surgery has accomplished more in helping cripples than could have been accomplished in any other way.

The first has to do with the Sea Breeze Hospital of which I became chief surgeon. This hospital was one of several charities operated by the Association for the Improvement of the Condition of the Poor. A year or so before my association with the hospital, a huge publicity stunt had been put over by this organization, which distributed at least a million pictures of "Smiling Joe", a boy with acute hunchback who had been kept on a frame for two or three years. His case was so filled with human interest that the distribution of his picture and the stories of his case, as told by the newspapers, struck public imagination and resulted in the raising of a great deal of money for the Sea Breeze Hospital and other charities run by the Association for the Improvement of the Condition of the Poor.

All this is a prelude to the fact that, shortly after I became Chief Surgeon of the Sea Breeze Hospital, I began to perform bone graft operations on cases of hunchback and clubfoot.

At three o'clock one morning I was awakened by the incessant jangle of the telephone, and a newspaper reporter asked whether I would confirm a report of having performed such an operation. I had scarcely stumbled back to bed before another newspaper called to ask the same question.

Obviously, the story had emanated from the Association for the Improvement of the Condition of the Poor, acting on the theory that, if the story of "Smiling Joe" could bring so large a public response, the story of cures brought about in one-tenth the time, should prove even more effective.

The net result was that I became the object of a great deal of public comment, which was sometimes frowned upon by some members of the profession. But a more important result was that more cripples could receive the medical and surgical attention of which they were in such desperate need. It seems to me, then, that a tangible good outweighs an intangible shibboleth.

The second instance of the effect of public interest in medical work goes back to the inauguration of the Rehabilitation Commission in New Jersey, which stemmed directly from public interest in the work done at U.S. General Hospital No. 3, and which has been of help to thousands of handicapped people.

The point I am trying to make is that humanity has everything to gain by a wide dissemination of information in regard to advancements in medicine and surgery. Since that is the case, I believe the time is coming when the profession will no longer feel that it must remain, in a medieval sense, a "mystery" to the people as a whole. Knowledge is always good. Ignorance remains a dark spot in our civilization—worse than that, a danger spot.

The Florida Medical Centre was first organized as a private general hospital. But recently, because of its rapid expansion, it has been converted into a volunteer hospital, with a charter permitting all the functions of the hospital as well as making it a post-graduate medical teaching institution.

In the beginning, my own department was by far the largest in the hospital, but at present, the medical department is as large as the orthopædic. This has been brought about largely because of the development of the institution to make the most of mineralized and vitaminized foods in the restoration of health and the treatment of disease.

Increasingly we are coming to believe that vitamins play an enormous part in human health and in disease prevention. That there is growing interest in the possibilities of the subject is displayed by the fact that a short time ago, on the occasion of its fiftieth anniversary, the University of Chicago devoted its entire celebration to a symposium on vitamins.

It came as a shock to people in the United States to learn that from forty to sixty per cent of the young men examined for induction into the army under the Selective Service Act were rejected as physically or mentally unfit. Why is it that so large a percentage of the young men of the most enlightened, humanitarian country on earth prove unfit when they are subjected to tests? This is an appalling situation, one to which none of us can afford to close our eyes.

The National Youth Administration of New York City and Long Island examined 13,297 young men and women in eleven months with the following findings in regard to defects and

diseases: visual, 40 per cent; malnutrition, 14.3 per cent; cutaneous lesions, 11.5 per cent; diseases of the nose and throat, 8.5 per cent; heart, 5.5 per cent; high blood pressure, 4 per cent.

It seems highly possible that much of this condition can be traced to vitamin deficiency.

Not long ago I was looking over a farm in Illinois. The owner, standing beside me, remarked: "This land has been cropped for a hundred consecutive years." It has long been a pernicious practice in agriculture to select the spots which are easy to cultivate, such as valleys, where the water supply is good, and so forth, and then to crop it over and over, year in and year out.

Inevitably the minerals—and that means the vitamins—are depleted. There are sixteen minerals necessary to human life, but no attempt is being made to replenish the mineral content of the soil, except for the three fertilizing minerals: phosphate, potash, and nitrate (ammonia).

This widespread mineral exhaustion is accumulating to an alarming degree, and we are creeping towards a complete depletion of the soil. The condition is so prevalent that it is a grave question to-day whether most of the vegetables reaching our markets are not inadequate in mineral and vitamin content for human needs.

To what extent, then, may the physically and mentally and nervously unfit of this country owe their condition to vitamin deficiency, because the foods that are supposed to contain them, do not?

Vitaminization naturally has a greater effect on the treatment of medical than of surgical cases, but it has been found that certain vitamins are of the greatest aid in the treatment of surgical conditions, such as infections, particularly those of gastro-intestinal tracts, and bones and joints, including arthritis.

For instance, in practically all cases of infection of bones and joints and osteomyelitis, there has been found a great deficiency of Vitamin C.

In the course of the University of Chicago symposium, it was pointed out that a vitamin has been discovered whose deficiency produces epilepsy. If this is the case, it seems probable that a slighter degree of deficiency might easily undermine the mental and nervous stability of the individual.

In the light of these facts, it seems not only conceivable but

likely that the increasing number of nervous diseases and "breakdowns" which we explain away as being due to the accelerated tempo of modern times and the unaccustomed stress of our machine civilization, may have their roots in the depleted soil of our farms.

If so, and it is still largely a matter of conjecture and experimentation—for though we know a little, there is still much to learn—it is a hopeful sign. For while we can hardly prevent mental instability and nervous breakdowns and poor health by stopping the hands on the clock of progress, we can prevent them by seeing that the sixteen minerals necessary to human well-being are restored to the soil upon which foods are grown. It becomes a matter of education, of explaining the situation to the public, of arousing them to demand that this process of remineralization take place.

Unhappily, one cannot store up a supply of vitamins against the day when they will be needed, as a camel stores up water for his trek across the desert. They have to be replaced every day. They affect the whole body economy, and the replacement of body tissue. It is not enough, for instance, to perform a bone graft. It is necessary to make sure that the patient has sufficient vitamins to build bone within the inter-cellular substance.

Because pure science has proved that a vitamin deficiency can produce a poor physical condition—if not actual disease, as when the deficiency lasts over a prolonged period—commercial interests have been quick to exploit this condition far beyond the intrinsic merits of the products involved. And while vitamin pills—or vitaminized this and that—may provide a measure of aid, and may supplement properly selected foods containing the required vitamins, still by themselves alone pills or other vitamin panaceas are not adequate. The only answer is to go to the root of the trouble—the food actually taken into the body every day. For the food if properly produced, not only has vitamin content, but the vitamin associates which scientific research has informed us are in many instances as important as the vitamins themselves.

The far-reaching effects of vitamins on health are only beginning to be recognized. We know now that Vitamin A has a lot to do with eyesight and colour blindness. It seems probable that many of the boys rejected as unfit for service because of poor eyesight may owe their trouble, in part, at least, to a long

continued deficiency of Vitamin A in the soil in which their vegetables were grown.

Dr. Wendell H. Griffith of St. Louis University has reported a vitamin choline whose absence from food produced cirrhosis of the liver and hæmorrhages of the eye.

Dr. Vincent du Vigneaud of Cornell University Medical College announced that Biotin, the active substance in allantoin, whose healing influence causes the regrowth of damaged tissues, is identical with Vitamin H. As its price to-day is $63,800 a pound, it is fortunate that vitamins are effective in small doses.

A vitamin has been announced which restores grey hair to its original colour. It is even possible that a cure for syphilis will be found through diet. In May, 1941, Simon T. Ruskin and Myron Silverstein made a startling announcement in regard to Vitamin C. By combining a salt of cevitamic acid it was possible to make available for therapeutic purposes bismuth cevitamate which is soluble in water and absorbed from the tissues to a degree of 100 per cent in two hours after its injection without danger of toxicity. The only previous way of employing bismuth was in oil which absorbs about 45 to 50 per cent in 10 days. It is apparent that this therapeutic revelation evolved in the use of Vitamin C is a most important contribution in the treatment of syphilis.

It was because of the conviction that vitamin deficiency was at the root of many forms of mental, physical, and nervous ills to-day, that we have plunged into research on the problem at the Florida Medical Centre, in the hope that some method of alleviating the ills arising from present agricultural methods can be found.

The institution has been particularly organized to bring about the most that can be accomplished by a high degree of correlation. There is also a close co-operation between the medical department and the highly organized dietary department, as well as a bio-chemical laboratory in conjunction with the Centre's own farm of 6,400 acres, which is farmed scientifically, and where everything that can be raised in semi-tropical country is grown under conditions to bring about the maximum content of both minerals and vitamins.

The sixteen minerals necessary to human health are placed about the roots of all plants producing food for the Centre. The

mineralization not only of seeds and roots of trees, but of berry bushes and vegetables, and even the grass upon which the dairy and beef cattle graze, is carried on in a scientific manner.

Our dairy herd is kept constantly on the range, and never placed in stalls, even at night, throughout the year. They are out in the sunshine, grazing upon green mineralized grass, and the same sun that causes the incorporation of vitamins into the grass, produces vitamins in the sterols and fats of the cows' skin, which in turn is transmitted to the milk. It has been found that the milk of cows pasture-fed at all times has a greater vitamin content than the milk of stall-fed cows.

Of all the minerals, cobalt is one of the most interesting. It is kept in big bins on the range for the cows to lick. It has a two-fold purpose; first it prevents the cows from having coastal fever, and secondly it mineralizes their milk and meat for human consumption.

We raise all types of vegetables, milk, cream, butter, eggs, poultry, fruit, all of which are subjected to mineralization. Of course, the climate of Florida gives us a tremendous advantage in this research work, for even if we did nothing in particular about mineralization and vitaminization, we would still find that our food contained a high vitamin content there.

On the whole, we have come to the cheering conclusion that human health could be vastly improved simply by a widespread application of the knowledge we already have. And one is justified in hoping, at least, that as the minds of men are less hampered by a vitamin deficiency, they may be able to get us out of some of the mess we are in now.

XXV

I COME TO THE END of this book with something like bewilderment. It did not seem possible, when I began, to crowd the activities of a busy life within the confines of a book. I see now that I have not done so. The stuff of life is hard to recapture. For every incident I have recorded, a dozen have been passed over.

In the course of those busy years, which have bulged at the sides with activity, I have seen much of the world, crossing the Atlantic Ocean some fifty times, visiting nearly every country,

meeting the medical men in each and exchanging ideas with them. There have been times when the future seemed full of promise that men of science, men of good will, might meet together perpetually, pooling their knowledge, sharing their achievements for the benefit of mankind as a whole. To-day, that future has receded so far into the distance that it is only with the eyes of faith that one can discern it at all.

Not long ago I pulled out two drawers, one crammed with decorations from, it seemed, almost every country under the sun, the other containing a scant handful of letters. The decorations had been bestowed on me by governments and rulers, once eager to pay tribute to an American, now, once more, largely swallowed up in the dark maw of totalitarianism. We no longer know how it fares behind the Iron Curtain. There is no interchange of views and discoveries and research. There is only an ominous silence.

Men and women, I said long ago, aren't as nature made them. They are largely self-made, not in wealth or social position, but in the sizes of their muscles and skeletons.

How is it that a person weighing a hundred pounds may grow to weigh twice as much and still have a skeleton strong enough to support the weight? It is because the skeleton grows too. When a weak, thin-boned man makes up his mind to get strong, he can by exercise increase his muscles and his bones to an enormous extent. It is a fact that some of our "strong men" have started as weaklings.

In this development of man, the doctor has an important rôle. I am reminded again of Dr. Landoczy's statement in London in 1913 that the physician's prime purpose is "to make life longer and death softer." That still sums up the fundamentals, I think, but the physician and surgeon to-day has a basic relationship not only with his patient but with society.

As he comes more and more to see that he cannot stop with diagnosis and treatment, that he must follow through until the patient has regained his active place in the world, the doctor discovers that his work touches on wider and wider ranges of human activity.

We learned, for instance, in the process of rehabilitation, in restoring men not only to health but to earning capacity, that we were being led into the field of industry, that our interest



Dr. Albee lecturing to a group of doctors at the University of Buenos Aires, August 1942, during an extensive good-will trip to South America.

in the welfare of a patient and society's interest in him were a joint affair, interlocking, neither part complete without the other.

We have discovered that if syphilis can be cured by vitamin ingestion, if bones can be built by diet, medicine's interests extend far afield into the domain of agriculture and crop control. We have long been aware that in order to check contagious diseases and protect the public health, we need to keep an eye on sanitation and the water supply, and this has taken us actively into civic life.

No profession can any longer remain secluded within its own walls. All are interlacing, closely related parts of the vast structure of society.

But this does not mean, in my opinion, that a more efficient or a better relationship can be established by adopting the principles of socialized medicine. There are many reasons for this. The doctor's relationship with his patient is a personal one. No one has the influence on the patient and, through him, on his family, that is exerted by the priest, the minister, and the doctor. They teach him not only how to guard his health and the public health, but, in all the meanings of the term, how to live. The personal relationship, the trust, the confidence established between doctor and patient, have an overwhelming effect on cure.

I have seen socialized medicine in operation in Germany and Russia and Sweden. And while I feel that it is absolutely destructive of initiative, and I am opposed to it, I am very fearful that it is coming to America. I have watched it in operation and I do not think it has proven a success.

In Germany the socialized medicine doctor got the equivalent of five cents in American money per call, and had to make about a hundred calls a day to eke out a living.

From my observations, I believe the public will be the ones to suffer the most. Medicine will no longer be a profession, it will be made up, not of scientists, but of assorted clerks working for the politicians. The profession will be levelled down to mediocrity.

There has always been a tremendous incentive for a man to blaze the way as a free-lance surgeon. He knew that it was worth while to work to the top of his bent, doing research in the long night hours after his day's work was done. When he had established himself, he would be able to tell other surgeons

what he had learned, he would be able to travel the world over and learn from other men.

But how is he to distribute the information he has gained so laboriously, how is he to travel and learn, if he makes a hundred dollars a month as a government employee? The answer appears to be that progress in medicine would come to a standstill.

The menace is that many influential men, at the head of the medical schools, are to-day coming out in favour of socialized medicine. Some of these men sincerely believe in it. Some of them are influenced by the position of the medical school at many universities, where it is a kind of step-child. Whenever the University suffers a shrinkage of income—as they are doing to-day with philanthropy and charity dropping out—the medical department is the first to suffer a loss of funds, unless it is especially endowed.

I am glad that my lot has been cast among men of medicine. I have found them steadfast friends, delightful companions, superb mentors and guides, and an unceasing source of inspiration. A medical friend whose memory I prize, as I prized his friendship while he lived, is Dr. B. C. Darling, whom I met at Harvard.

Dr. Darling suffered from a generalized malignancy and knew he would never be able to recover. He continued, however, with unfaltering loyalty, to attend to his patients. When he grew so weak that he could not get back and forth from his home to his office, he had a bed set up in his office, and from there he interpreted to other medical men, reading X-rays and consulting with various doctors until he died.

That, it seems to me, is the way a man would choose to die, using his last energy to push back a little farther the curtain of ignorance, to stem the tide of human pain. His was a good death as his was a good life.

It is not death which concerns the doctor, it is life. It is not the ending, but the eternal beginnings. That is why, I think, I have always enjoyed teaching young men. As a rule, I have not kept my assistants very long. To act as assistant for too long a time is apt to be stultifying, to provide a crutch instead of a goad, and I am no believer in crutches. So when they have learned all they can, I say: "Now, get out and devote your time to your own interests."

These have been pleasant associations. One of my early assistants was Dr. E. P. Weigel who shared my World War experiences, took military training with me at Fort Oglethorpe and was my adjutant at U.S. General Hospital No. 3. He is now chief of staff of the Muhlenberg Hospital in Plainfield, New Jersey.

I have had fellows in my clinic from many parts of the world, among them Dr. Paul Martin of Switzerland, at one time champion long distance runner of the world.

On one of my trips to Brazil, I was asked to establish a fellowship of one year's duration, provided that the candidate be determined by competition, requiring that the President of the National Orthopædic and Traumatological Association serve as chairman. The same request was made in Argentina, and I agreed, if a similar method of selection was followed, to alternate yearly between Brazil and Argentina. Fellows have also come to me from Mexico, among them Alphonso Ortiz-Tirado, the singer. He found an unusual method of earning money for his medical career. I provided him with an introduction to the Keith-Albee Vaudeville Circuit, he sang all over the western hemisphere, earning enough money in vaudeville, concerts, and over the radio to build himself one of the finest orthopædic clinics in the world. On our last visit to Mexico, my wife and I were house guests in his home, which is built over that magnificent clinic.

Among my assistants have been Dr. G. Sarkany; Dr. Ellis W. Jones; Dr. Charles Murray Gratz; Dr. S. Oscar Fry; Dr. Walter Sheets, now in charge of orthopædic surgery at the Veterans Facility, St. Petersburg, Florida; Dr. George Anapol, now professor and head of the department of orthopædic surgery at the New York Post Graduate Medical School, Columbia University; and Dr. Robert L. Preston, now assistant professor in the same department at Columbia. My present assistants are Dr. Fred G. Dilger, Medical Director of the Newark Clinic of the Rehabilitation Commission of the State of New Jersey; and Dr. Michael Agolia.

Up to now I have had an overwhelmingly busy life, which means, on the whole, a happy and rewarding one. For crowded activity in your own chosen field is of all lots the most enviable. There has not been as much time as I should have liked to stop and think things over, to ponder on the state of the world. The

doctor must be a practical philosopher. He has little leisure to lament the stupidity of statesmen who are busy blowing up the young men and the old civilizations of the world. He is too busily engaged in patching up the wreckage.

Perhaps this is a bad thing. I don't know. Though when I see the results accomplished by the men who have thought profoundly, I wonder if we who act are not accomplishing almost as much. Somewhere in the course of the years, I have performed over thirty thousand operations, and at least seven thousand bone grafts. Once I remember performing twenty-five operations in the course of a single day at the University of Vermont.

That is why, I suppose, a doctor tends to be an optimist. He is busy and his work, after all, is constructive, not destructive. The fact that his patients have been injured by battle, or modern machinery, or criminal carelessness in driving, does not make the job of curing them less worthwhile.

I have loved the inventions of my time, electricity, the aeroplane, the motion picture, and I have made great use of them. They do not seem less wonderful to me because men have used them unworthily.

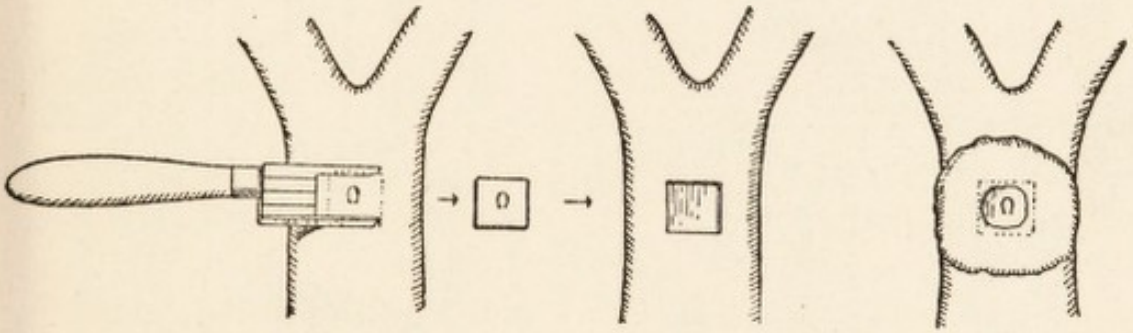
We have already most of the things we need to make us healthy and happy if we can only learn to use them intelligently. We have gone a little way in discovering the secrets of nature. We will go farther. This is just the beginning—not the end.

The lot of the doctor is like the lot of the English, as Winston Churchill has described it: Blood, sweat, and tears. But there is another element, the one that makes all the others possible—hope.

APPENDIX

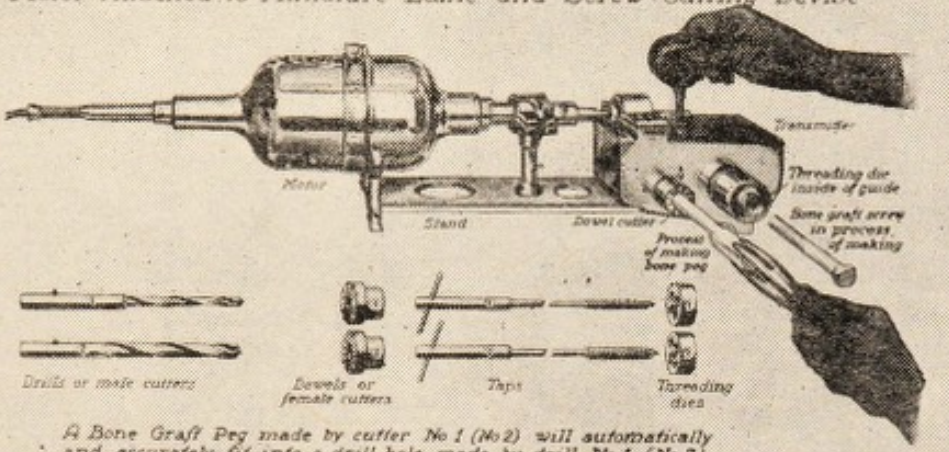
THE FOLLOWING illustrations indicate the wide variety of procedures for the reconstruction of the human body and their analogy to carpentry and machine shop work. The same precision of technique and of fit is essential and can be accomplished by means of the Albee Bone Mill under completely sterile conditions at the operating-table.

REMOVING GRAFT OF ORANGE TREE



Method of removing graft of orange tree, etc., consisting of bud with portion of bark and alburnum and fixing it in a gutter in the host. The double-bladed knife, like the twin motor-saw with bone, insures accuracy of fit and rapidity of technic. The paraffin dressing provides not only immobilization but allows access to light, which activates chlorophyl and builds tissue. From Albee, "Principles of the Treatment of Non-Union of Fractures", *Surg., Gynec. & Obst.*, September, 1930. By courtesy of *Surgery, Gynecology and Obstetrics.*

Motor Attached to Miniature Lathe and Screw Cutting Devise



A Bone Graft Peg made by cutter No 1 (No 2) will automatically and accurately fit into a drill hole made by drill No 1 (No 2)

Electrically Driven Circular Saws and Drills

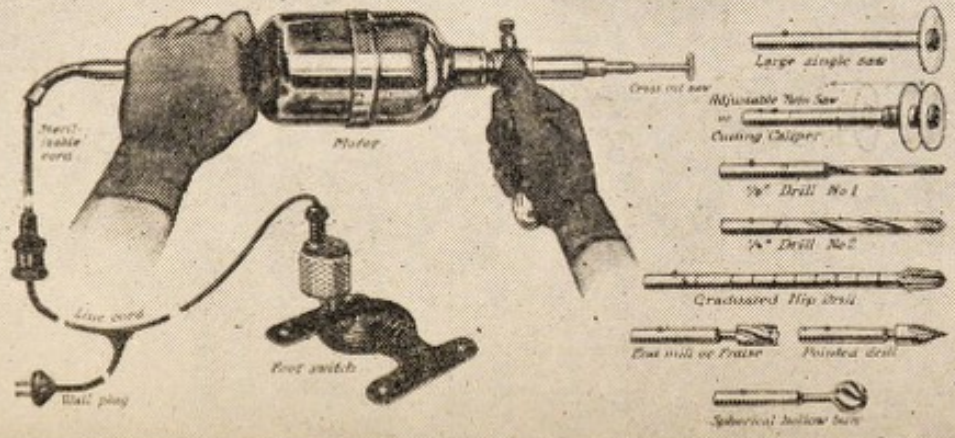
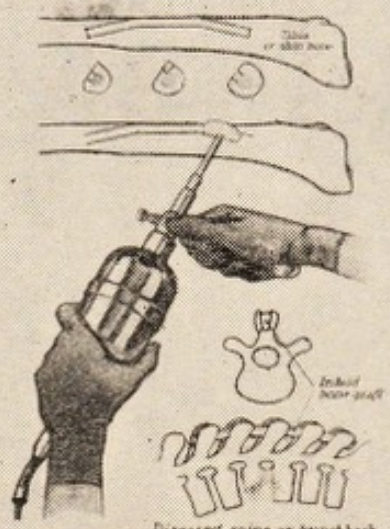
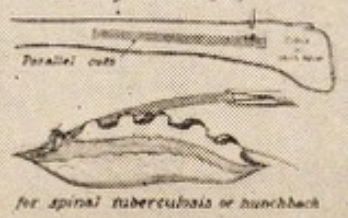


Diagram Showing Removal of Bone Graft from Tibia or Shin Bone for Insertion into Spine



Bundle of Reed Method
Bending a bone graft



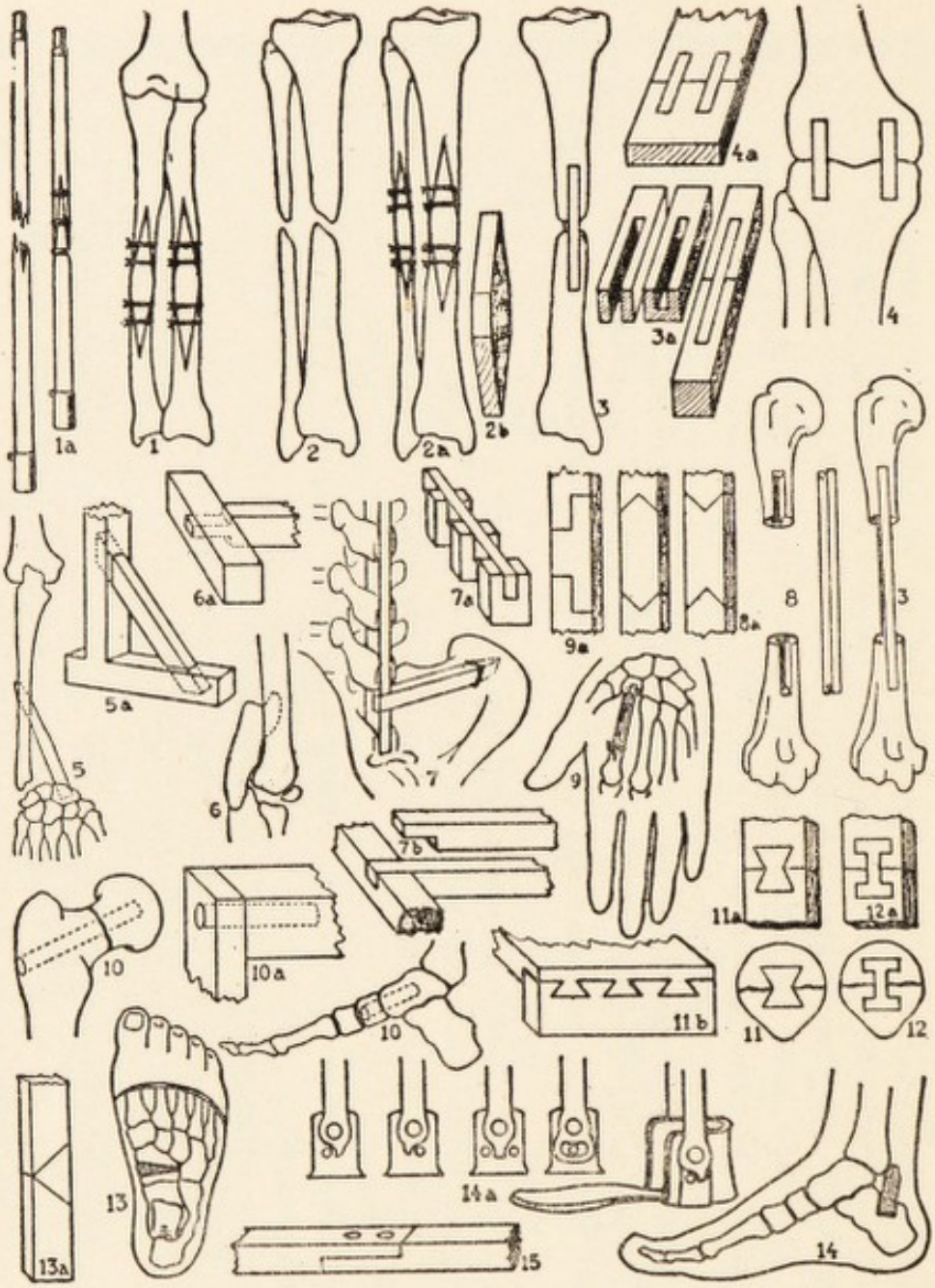
for spinal tuberculosis or hunchback

The Albee Bone Mill

Above is shown the Albee Bone Mill and a complete set of instruments—as complete as the carpenter's or cabinet maker's mill which permits the surgeon, under absolutely sterile conditions, to perform the necessary tasks of bone carpentry and cabinet making, with precision. The outfit consists of:

1. Rotary saws of different diameters.
2. Universally adjustable twin saws, or the cutting caliper.
3. Various types of reciprocal (oscillating) finger-type saws for deep work, circular osteotomy, scroll work or cutting of segments of any size of circle.
4. End mill cutters for enlarging gutters, mortices, etc., and for starting drill holes on oblique, hard or slippery bone surfaces.
5. Drills of various sizes and types, up to one-half inch for the neck of the femur.
6. Lathe for manufacture of living bone graft pegs and screws of different sizes.
7. Corresponding size drills for pegs or screws.
8. Different size taps, to cut threads on the inside of the drill holes.
9. Die cutters, to make threads upon bone graft pegs of different sizes.
10. Motor-driven oscillating chisels and files. This drawing also suggests a few examples of precision reconstruction bone work which the mill makes possible. *By courtesy of Kny-Scheerer Company.*

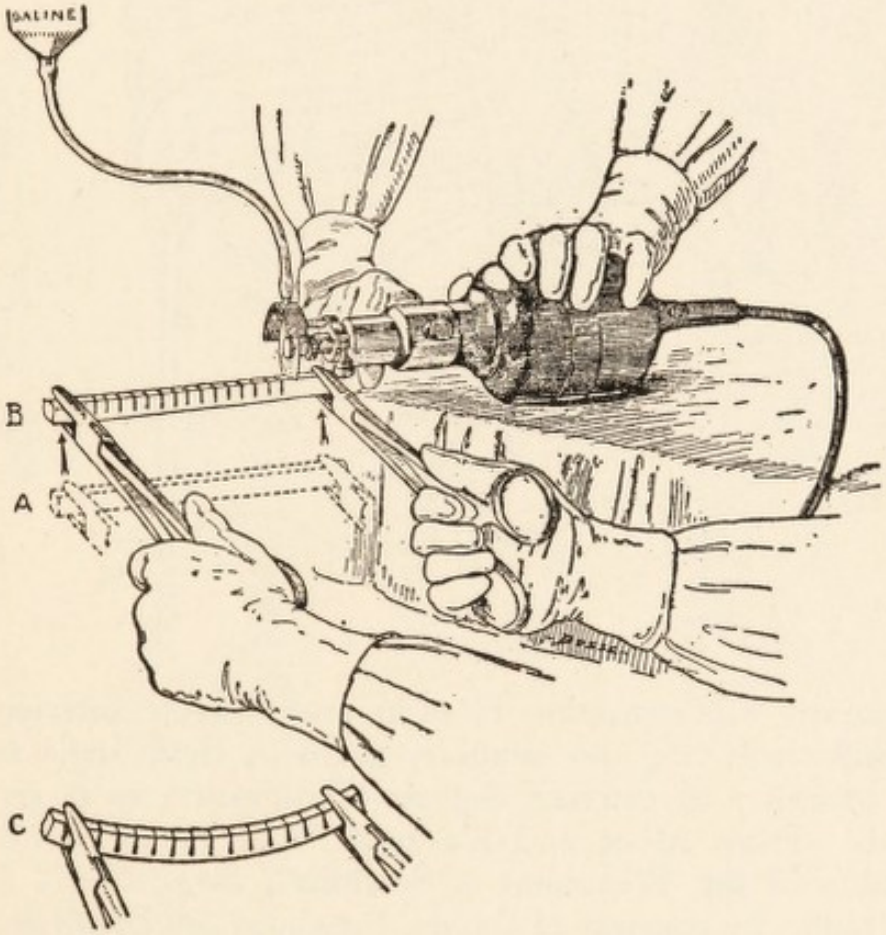
PRECISION JOINERY ELEMENTS



This drawing illustrates the precision joinery elements made possible by the electrically driven bone mill in bone surgery. The examples are self-evident analogies. Nos. 11 and 12 are keyed in members to hold in tension broken knee-caps which will not unite. No. 14 is a stop at the ankle joint itself, made of the patient's own bone, to prevent the foot from dropping, thus discarding metal brace, No. 14-a. No. 10 illustrates an un-united fracture of the hip with bone graft peg which has been shaped in the lathe component of the mill of an automatic size to the drill that made the hole for it. These automatic tools make a precision fit equal to a glass-stopper

fit possible under sterile conditions at the operating-table. The biological and mechanical demands of the problem require it. The carpentry prototype of this is illustrated by 10-a, where a wooden box or frame is secured at the corner by the same method. The bone surgeon must be a skilled mechanic before he can become proficient in this field. From Albee, "Bone Surgery with Machine Tools", *Scientific American*, April, 1936.

BENDING THE GRAFT



This is the method sometimes practised by the author for bending the graft. It is precisely the method used by the carpenter in bending a wooden board.

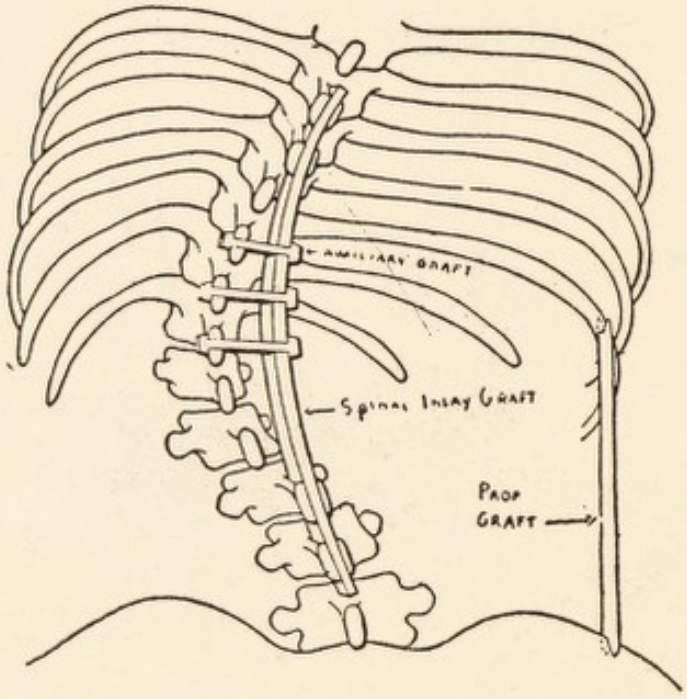
A, the manner of holding the graft while making the transverse saw-cuts to increase its flexibility.

B, transverse saw-cuts at equal intervals and over three-quarters through the diameter of the graft on its marrow surface.

C, testing for the desired amount of curve in the graft obtained by making the transverse saw-cuts before applying it to the curvature of the spine. Saline solution is fed to saw from bottle above through rubber tube—this favours the cutting of the saw and is

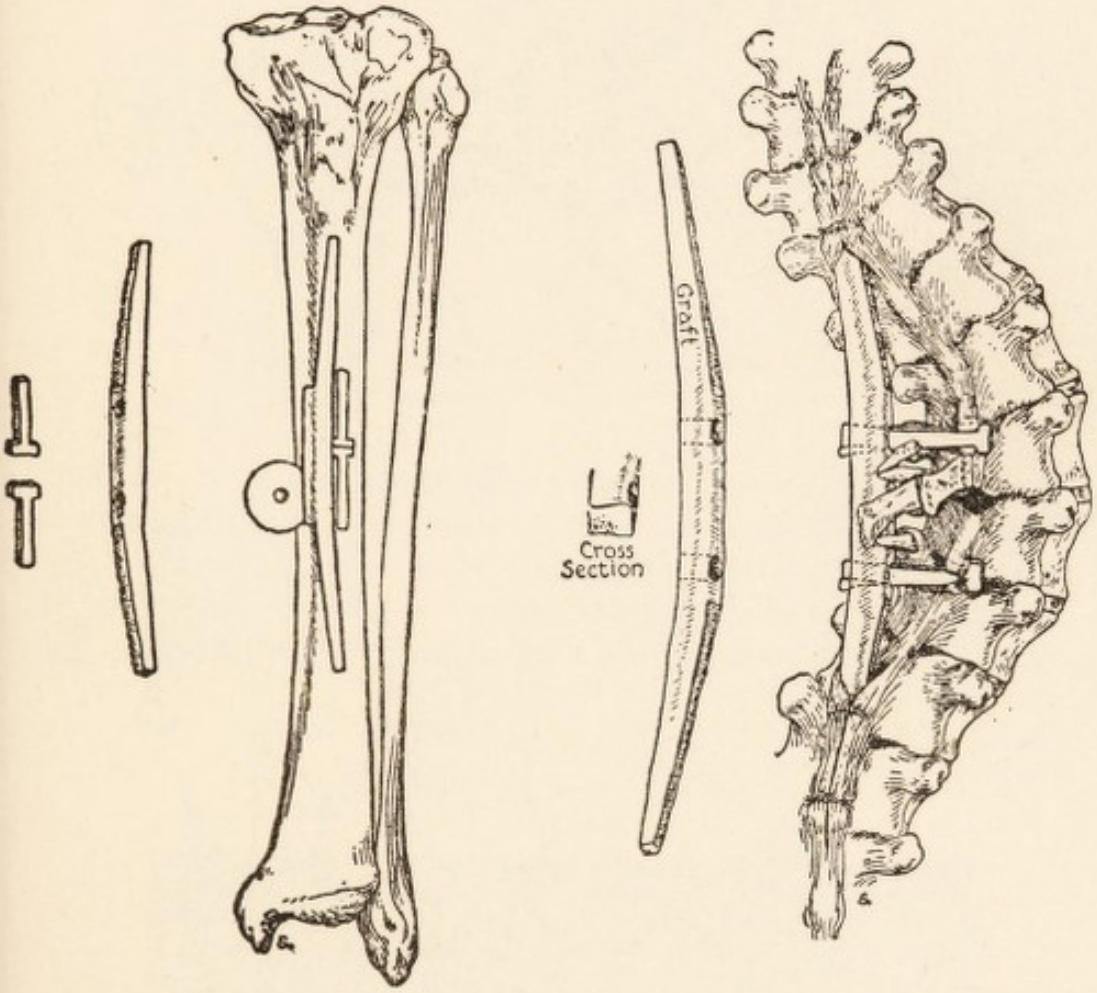
biologically beneficial to the graft. From Albee, *Orthopedic and Reconstruction Surgery*, W. B. Saunders Company.

THE PROP GRAFT



Schematic representation of prop graft. Note interlocking of graft and tenth rib, also auxiliary grafts at right angle to spinal graft, necessary in extreme degrees of curvature as it gives truss strength. From Albee and Kushner, "The Albee Spine Fusion Operation in the Treatment of Scoliosis", *Surg., Gynec. & Obst.*, April, 1938. By courtesy of *Surgery, Gynecology and Obstetrics.*

Source and Use of Bone Graft Material

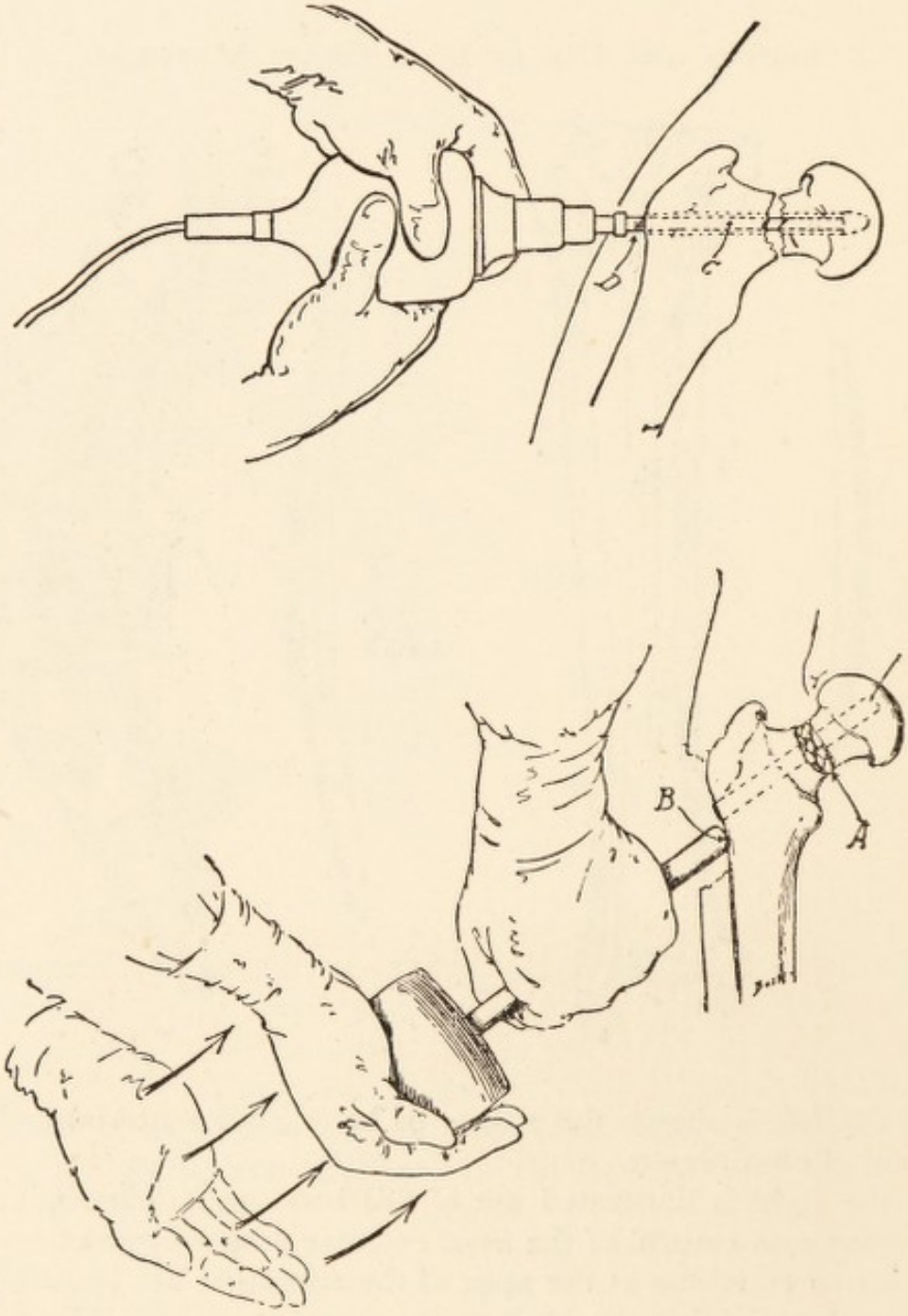


At the left is shown the source of bone graft material and the method of obtaining it.

At the right is illustrated use of this bone graft material in the correction and control of the most extreme cases of curvature.

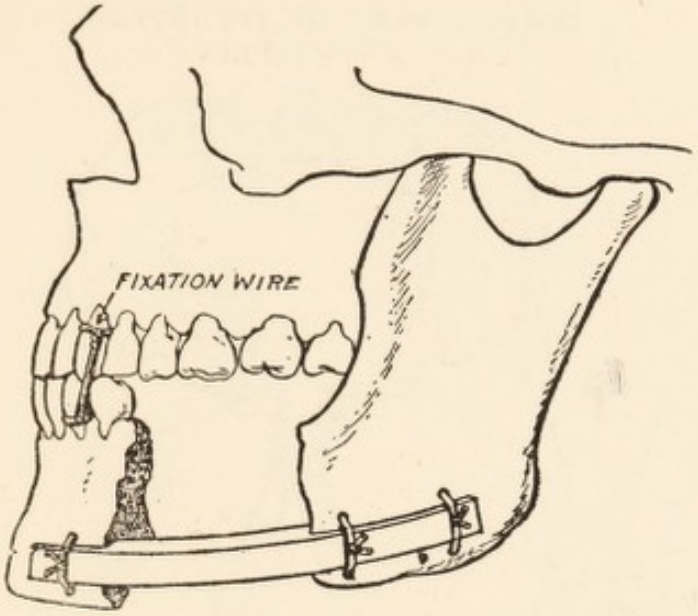
The two vertebrae at the apex of the curvature are immobilized by bone keys joining the graft to the vertebræ. From Albee, *Bone Graft Surgery in Disease, Injury and Deformity*, D. Appleton-Century Company.

DRILLING FOR TIBIAL GRAFT



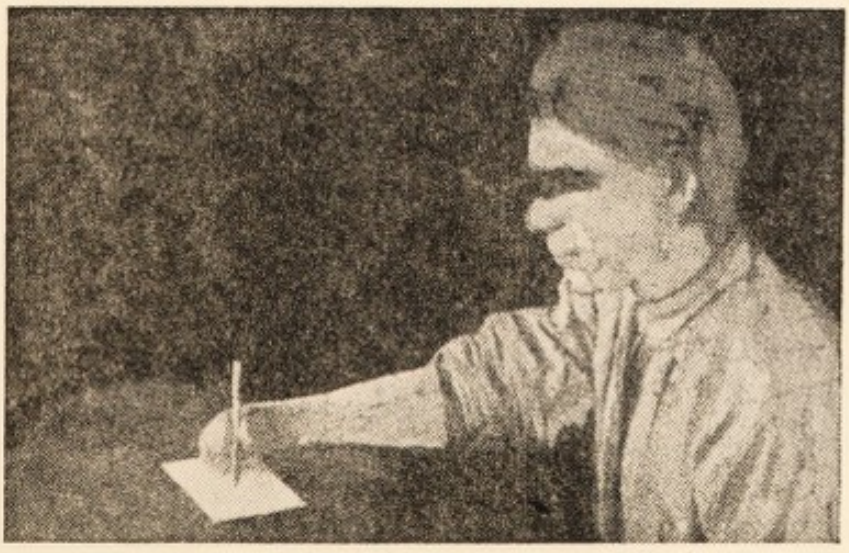
Bone Mill drilling an un-united fracture of the hip preparatory to the insertion of a tibial graft (below). The graft is shaped by another component part of the bone mill, namely, the lathe. As the drill and the lathe cutter are complements of each other, the fit will be a precision one. From Albee, *Injuries and Diseases of the Hip*, Hoeber.

RESTORATION OF JAW FRAGMENT



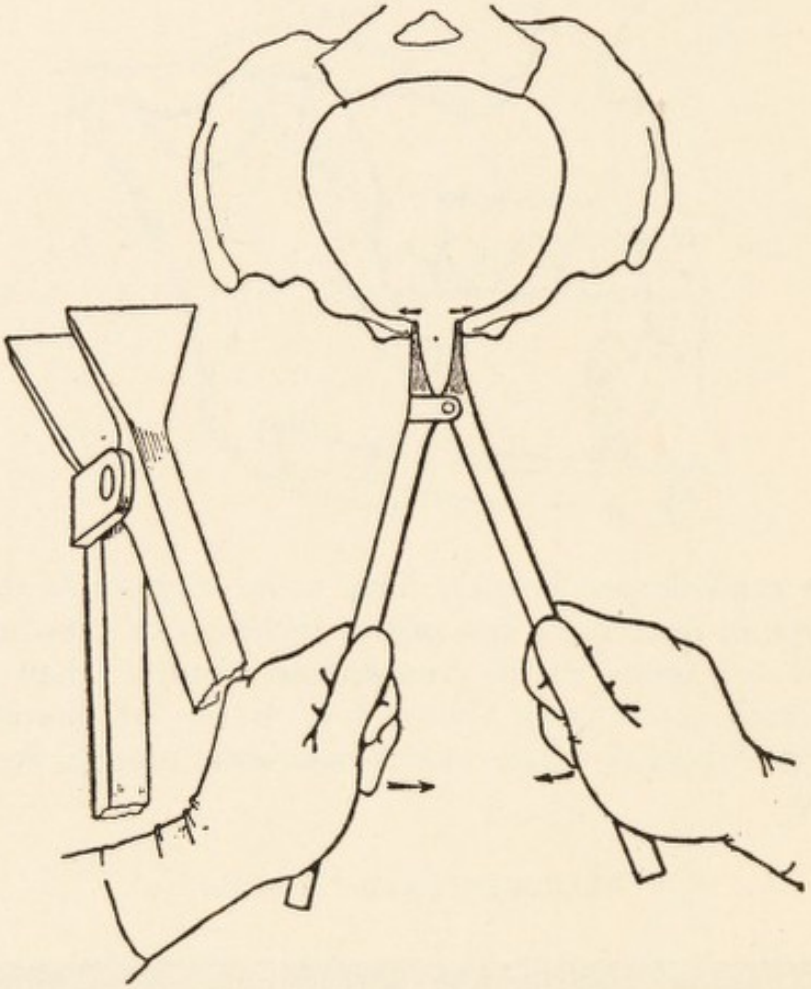
A bone graft shaped in inlay form to the contour of the jaw for the purpose of restoring a loss of two inches of its substance. This graft, although much less in cross-section diameter than the lower jaw, increased in size (as it always does) to the full diameter of the jaw. From Albee, *Orthopedic and Reconstruction Surgery*, Saunders.

MANUFACTURED "THUMB"

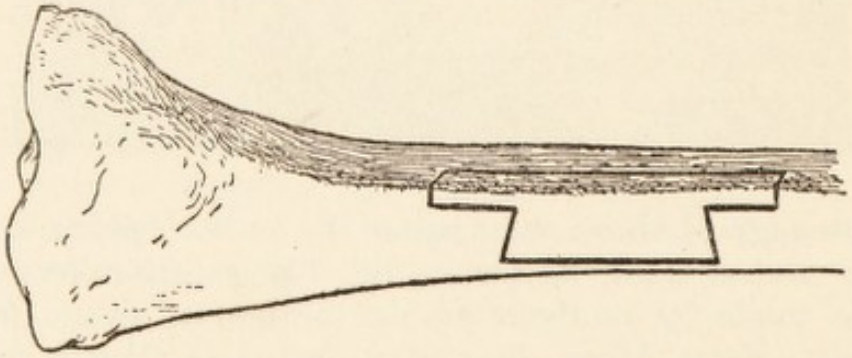


This photograph shows the result of the author's plastic operation upon the useless stump of the hand. The construction of a new digit was made by synthetic transplantation of tissues from the chest wall. From Albee, *Bone Graft Surgery in Disease, Injury and Deformity*, D. Appleton-Century Company.

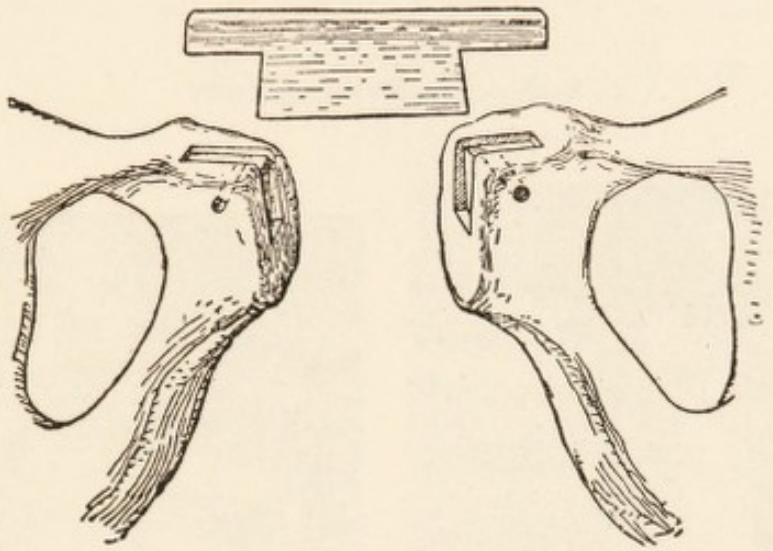
ENLARGEMENT OF THE PELVIS



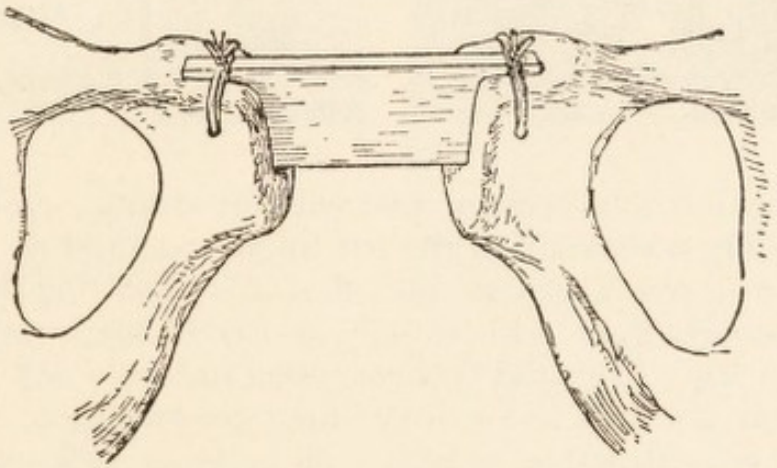
Enlargement of the pelvis by bone graft to increase the parturient or birth canal diameters presents no more difficult a mechanical problem than many done elsewhere in the body. Figure above shows clamp devised by Dr. Albee to spread the pelvis, and below the shape of graft obtained from tibia.



THE BED OF GRAFT



Note the drill holes for the insertion of heavy Kangaroo tendon; also the graft ready to be inlaid. By "Bone Graft".



Tibial graft inserted, with Kangaroo tendon sutures in place. The birth canal has been enlarged as much as 1¾ inches by this method. Illustrations on these two pages from Albee, "Enlargement of the Parturient Canal by Bone Graft," *Surg., Gynec. & Obst.*, June, 1928. By courtesy of *Surgery, Gynecology and Obstetrics.*

Surgical Restoration





This patient was an orphan child without means—age 6 years—born with only a remnant of the left thigh bone and no hip joint. The limb, as a result, was so short that it is noted the shoe comes opposite the right knee, with an ugly iron extension, nearly as long as the lower leg. The child was very keen mentally and becoming self-conscious, sensitive and morose about her condition.

Surgical reconstruction consisted of building a functional hip joint and elongating the limb so that an artificial foot was made. The restoration of function and morale was phenomenal, as shown in snapshots.

INDEX OF NAMES

Academie de Médecin, 100
Adlon, Gregory, 179
A.E.F., 124, 145, 150, 158, 171
Africa (South), 239
Agolia, Dr. Michael, 249
Ajax, S.S., 19
Albee Bone Mill, 28, 65, 66, 77, 80, 81, 199, 251, 252, 253
Albee, Blanche, 18
Carolyn, 18
Cleveland, 18
Ebenezer, 20
Fred H., Jr., 52
Freling Huysen, 18, 22, 23
Geraldine, 18
Louella, Ack., 52, 82, 94, 117, 147, 169, 204, 234, 235, 236
Margaret Parsons, 19
Marion, 18
Mary Charlotte, 18
Obediah, 19
Samuel, 20
Sewell, 19, 20
Stephen, 17, 18, 20, 32, 49
Sutton, 20
Albee Operating Room, Buenos Aires, 222
Albert Hall, 78
Alderhey, 83
Alfonso (King of Spain), 218
Allison, George F., 167
Alna (Maine), 17, 19
Alna Meeting House, 21
Altman, Major Emil, 145, 146
Ambulance A., 107
America, 78, 82, 94, 96, 102, 106, 108, 117, 119, 124, 125, 170, 198, 207, 216, 247
America, Central, 208, 211, 218
America, Latin, 208, 209, 210, 216, 219, 225
America, South, 29, 208, 211, 216, 218, 219, 222
American Brotherhood of Locomotive Engineers, 235, 236
College of Surgeons, 120
Engineers, 136
Field Hospital No. 12, 135
Hospital, Paris, 106
Medical Association, 120
Orthopædic Association, 40, 51, 54, 70, 197, 198, 199, 200, 201
Amiens, 110
Amphor, Captain, 149
Anapol, Dr. George, 249
Arabic, S.S., 83
Aranha, Mr. Oswaldo, 222
Arctic Ocean, 119
Argentina, 219, 220, 222, 249
Argonne, 92, 171
Arizona, 223
Armistice, 117, 132, 167
Army Bill, 120
Arras, 171
Assembly (State), 187
Association for the Improvement of the Condition of the Poor, 240
Atlantic City, N.J., 181
Atlantic Ocean, 205, 213, 245
Austria, 70, 197, 201
Averill, Mr. Emory, 27, 28

Bacon, Robert, 107
Baker, Newton D., 125
Balkan Confederation, 79
Balkan Frames, 91, 96
Balkans, 79
Ballard, Mrs. Louis, 162
Bar-Le-Duc, 113, 114
Barnett, Captain B., 133
Barranquilla, 216
Barry, Lieut., 163
Base Hospital No. 9, 136
Mars-sur-Allier, 157
Beach, Mr. H. H., 40
Beacon Hill, 39
Beebe, Dr. S. P., 11, 57, 58, 59, 63
Belgian Red Cross, 112
Belgium, 112, 182
Belize, 213
Bell, Sir Charles, 5
Bellanca (Fokker) Airplane, 214
Bellevue Hospital (N.Y.), 59, 232
Berlin (Germany), 70, 71, 79, 80, 81, 204, 205, 206, 207
Berlin University, 207
Bermont, Madame, 90
Bernhardt, Sarah, 114
Berry, Louella May, 52
Berry, Nathaniel, 52
Berry, William, 52
Billings, Colonel, 160
Birmingham, Col. H. P., 121
Blackwell Island Hospital, 176, 177
Blake, Dr. Joseph A., 90, 91, 93
Blake, Mrs. Joseph A., 90, 96
Blalock, Private Charles, 129
Blalock, Mayor James T., 219
Bleeker, Mr. Victor, 196
Board of Health, 187
Boehm, Professor, 70
Bogota, S.A., 216

Bolivar, Simon, 218
Bologna (Italy), 198, 202
Bologna University, 170, 202
Bonaparte, Napoleon, 107
Bone Graft Surgery in Disease, Injury and Deformity (Albee), 54, 257, 259
Bone and Joint Surgery (Journal of), 198
Bone Mill (Albee), 28, 65, 66, 77, 80, 81, 199, 251, 252, 253
Bone Surgery with Machine Tools (Albee), 255
Borland Automobile Company, 65
Boston (Massachusetts), 18, 119, 121, 235
Boston & Maine Railroad, 43
Boulogne, 111, 117
Bowdoin, 19, 30, 31, 32, 119, 167
Boyleston Street (Boston, Mass.), 33
Brackett, Dr. E. G., 198, 200
Braddock, Mr. James, 233
Braille, 86
Brazil, South America, 219, 222, 249
Brazil University, South America, 222
Brest, 157
Bristow, Mr. W. Rowley, 84
British General Hospital, Etaples, 111
  Guillotine, 136
  Honduras, 213
  Military Hospital, 83
  Orthopædic Association, 198, 199
  Orthopædic Division, 83
  Troops, 111
Brooklyn, N.Y., 161
Brooks, Dr. Harlow, 223, 224
Brussels (Belgium), 201
Bryant, Allen, 132
Bryant, Colonel Louis T., 172, 179, 180
Buch, Joseph G., 186
Budapest (Hungary), 70, 71, 72, 198
Buenos Aires (South America), 25, 220, 221, 222, 223
Buenos Aires University, 221

Cabot, Dr. Richard, 35, 36, 37, 38
Cabot, Mr. A. T., 40, 41
Caesarian Operation, 76
Calais, 111
Calot, Dr., 111
Camden, New Jersey, 181
Camils, 111
Camp Devens (Mass.), 128
Campbell, Mr. Peter, 179
Canada and Canadians, 107, 121, 198
Canadian General Hospital, Etaples, 111
Canadian Hospital, St. Cloud, 107
Canal Zone, Panama, 216, 219
Capitoline Hill, Rome, 169
Caracas, 216
Card, Dr. A. M., 26, 27, 28, 235
Carlisle University, 162
Carnera, Primo, 232
Carrel, Dr. Alexis, 56, 93, 98, 99, 100, 101, 102, 103, 125
Carrel-Dakin Treatment, 93, 96, 100, 101, 102, 103, 133, 136, 137, 151
Cartagena, 216
Central America, 208, 211, 218
Châlons-sur-Marne, 111, 112, 113, 125
Champrosay, 95
Château d'Annel, 103, 105
Château-Thierry, 129, 171
Chautauqua, 225
Cherbourg, 171
Cheyne, Sir Watson, 78
Chicago (Illinois), 65, 211, 212
Chicago University, 241, 242
Children's Commission, 186, 187
  Hospital (Boston, Mass.), 45
  Memorial Hospital, 65
Chile, South America, 218, 219, 223
Chile, University of, 222
Chilean Government, 218
China, 170
"Chinese Label," 74
Churchill, Winston, 250
Civil War, 100
Clark, Mr. Walter B., 167
Cleveland (Ohio), 136
Cleveland, Miss Esther, 86
  Mr. Grover, 86
Clindres, Dr., 214
Clinical Congress, 57
Colburn, Major Reuben, 21
Colby Hydrotherapy Institute, 37
Collins, Judge 237–8
Colombia (South America), 216, 219
Colonia (New Jersey), 120, 123, 125, 128, 130, 134, 139, 143, 149, 150, 153, 154, 157, 160, 162, 163, 165, 166, 172, 173, 174, 180, 190
Columbia University, 52, 249
Compiègne, 93, 98, 99, 100, 102, 103, 125
Conant, Mr. W. N., 40
Congress (United States), 120, 149
Connecticut, 211
Conway, Lieut. Wm. E., 150
Cooper, Sir Astley, 5
Corbeil, 95
Cornell University, 11, 57, 238, 244
Council of National Defence, 120
Crane, Dr. A. J., 82, 83, 87, 103, 104
Crile, Dr. George, 6, 136
Crillon Hotel, 200, 201
Cristobal, 216
Crow, Lewis and Wickenhoeffer, 126
Crown Prince (Germany), 71, 93, 99
Cuba, 204, 209, 210, 212
Curative Workshop (Colonia), 151, 153, 158, 159, 160, 162; (New York), 176, 177, 178; (Newark), 189–90

Cushing, Harvey, 106
Curtis, Henry S., 194
Cuxhaven, 206

d'Annel (Château), 103, 105
d'Arc, Jeanne, 99
Dakin, Henry H., 101
Dakin Solution, 100, 101
Daly, Judge Peter F., 150
Dana, Mr. Samuel, 162
Danube River, 71
Darling, Dr. B. C., 248
Davies, Miss Mary, 97
Davis, Mr. Ben, 22
Davis, Mr. J. Frank, 73, 74
Dawbaum, Dr., 176
de la Guardia, Pres. Ricardo, 223
Delchef, Dr. M., 200, 206
de Martel, Dr. Thierry, 112–3
Dempsey, Mr. Jack, 231, 232
Denmark, 207
Denniston, Miss Elinore, 11
de Page, Dr., 102, 112
Depew, Mrs. Chauncey, 99, 104
Depew, Mr. Chauncey, 104
Dept. of Military Orthopædics, 128
Devens, Camp, 128
Dexter, Dr. Franklin, 40, 49
D'Herelle, 134
Didier, Monsieur, 112
Dilger, Dr. Frederick G., 249
Doelinger, Dr. Julius, 72, 198, 201
Dover House, 85
Dover Road, 128
Dowling, Michael, 138
Downes, Dr., 117, 118, 119
Dresden (Maine), 19, 23
Drottingholm, S.S., 208
Druskin, Dr., 75
Duer, Miss Kitty, 90
Dunstan's, St., 85–6
du Vignaud, Dr. Vincent, 244

Eastern Airways Flying Fishermen Club, 234
Eckhardt, Dr., 206
Ecuador, South America, 219
Edge, Hon. Walter E., 172
Edgecomb (Maine), 19
Elbe River, 206
Elizabeth, N. J., 168
Elks (B.P.O.E.), 186, 187, 191, 196
Ellicot, Major B., 126
Elliott, Mr. J. W., 40
Elton, Mr. Frederick G., 174, 176, 177
Emory, Professor, 118, 119
England, 77, 78, 83, 84, 85, 87, 93, 128, 133, 158, 182, 198, 200, 207
Etaples, 111
Europe, 79, 106, 127, 206, 209
Everglades, 234
Ewing, Dr. James, 11, 57, 61

Fernandez, Dr., 212
Finley, Carlos B (Decoration), 210
Firpo, 232
First Int. Orthopædic Meeting, 198
First World War: see World War I
Fitz, Dr. G. W., 35, 37
Fitz, Prof. Regnall H., 38
Fitzgibbon, Dr., 77, 78
Florida, 17, 219, 229, 233, 234, 235, 236, 244, 245
Florida Medical Centre, 237, 241, 244
Florida, University of, 231
Fokker (Bellanca) Aeroplane, 214
Foote, Lieut., 157
Ford, Mr. Henry, 194
Fontainebleau, 87, 90
Fort Oglethorpe, 128, 140, 141, 249
France, 82, 83, 86–117, 124, 140, 170, 182, 200
France and America, Tardieu, 172
Franco-British Army Hospital, 90
Franklin, Mr. Benjamin, 14
Frauenthal, Dr. Henry W., 57
Freeman, Mr. Charles D., 120, 121, 125
French Aces, 95, 113
Army, 115
French, General, 99
French Surgical Congress, 200
War Office, 82, 90, 103
Front, 91, 95, 99, 100, 103, 104, 110, 113, 128
Fry, Dr. S. Oscar, 249
Fuehrer, The, 203

Galeazzi, Colonel Ricardo, 170
Gallup (New Mexico), 224
Galveston (Texas), 54
Ganado Mission, 223, 224, 225
Gardiner (Maine), 52
Garland, Dr. Roy, 40
Gaut, Miss Sarah, 157
George (King of England), 78, 85
George Washington, S.S., 157
Germany, 70, 71, 79, 80, 81, 82, 83, 84, 85, 87, 89, 90, 93, 104, 111, 112, 113, 115, 117, 119, 128, 197, 200, 201, 202, 203, 206–7, 222, 247
German Government, 82
Navy, 82
Orthopædic Surgical Congress, 79, 81
Red Cross, 90
Gibney, Dr. V. P., 48, 52
Gilmore, Lieut., 131
Goelet (Robert Walton-), 97
Goldthwaite, Dr. Joel, 158, 198
Gomez, President (Venezuela), 217, 218
Gomez, Florenzio, 217
Gorgas, General William C., 117, 120, 121, 125, 127, 128
Gottenborg, 208

Gould, Mr. George, 118
Grace Church (New York), 52
Grant, President, S.S., 171
Gratz, Dr. Charles Murray, 211, 249
Graves, Dr. Robert, 40
Great Britain, 158, 159, 170
Greece, 170
Griffiths, Dr. Wendell H., 244
Grimm, Mr. Ralph, 154–8
Gross, Samuel B., 5
Guardia, Pres. Ricardo de la, 223
Guaranty Trust Company, 119
Guatemala City, 214
Gulf of Mexico, 212

Hadra, Dr., 54
Hamburg, 206
Hamburg-American Line, 205
Hamburg, S.S., 204
Harlan, Mr. John, 176, 177, 178
Harrington, Mr. Alfredo, 220, 221, 222
Harris, Mr. Elijah, 21
Harte, Richard, 106
Hartford, Conn., 51
Hartwell, Dr. John A., 238
Harvard Unit No. 22, 111
Harvard University Medical School, 32, 35, 36, 37, 38, 40, 49, 51, 53, 127, 248
Havana, Cuba, 204, 212
Havana University, 209
Hawley, Dr. George, 211
Heligoland, 206
Herophilus, 5, 6
Herrick, Ambassador, 107
Hippocrates, 5
Hirscher, Mr. 150
Hitler, Adolf, 202, 207
Hitz-Boyer, Major, 113, 114, 116
Hoboken (New Jersey), 129, 130
Hohman, Dr., 206
Holland, 198
Hollywood, 167, 168
Holt, Mr. Hamilton, 167
Homans, Dr. John, 38, 39, 40
Honduras, 213, 214
Hoover, Mr. Herbert, 210
Hopi Indians, 224
Hospitals:
  Base Hospital No. 9, 136
  Base Hospital, Mars-sur-Allier, 157
  Bellevue, 59, 232
  Blackwell Island, 176, 177
  Canadian, St. Cloud, 107
  Lavalle University, 107
  Maison Blanche, 100
  Marie Lannelogne, 98
  Massachusetts General, 35, 37, 39, 40, 42, 44, 46, 47, 49
  Mobile Operating No. 4, 157
  Muhlenberg, 249
Hospitals—*cont.*:
  New York Post-Graduate, 47, 48, 49, 51, 52, 55, 59, 63, 76, 127, 145, 227, 249
  Polyclinic, 232
  Queen Mary's Convalescent, 85
  Rahway Memorial, 168
  Reed, Walter, 137, 143, 157, 160
  Roehampton, 85
  Roosevelt, 59
  Ruptured and Crippled, 48, 50, 52, 55
  Sage Memorial, 224
  Sea Breeze, 59
  St. Luke's, 65
  U.S. General No. 3, 60, 86, 103. 120, 121, 125–140, 142–151, 157, 158, 160–6, 169, 173, 241, 249
  U.S. Reconstruction Nos. 1, 2 and 3, 121
Houdlette, Charles G., 11, 23, 24, 25, 28
Houston, Herbert, 167
Hughes, Miss Frances, 86
Huguenots, 23
Hurlingham Club, 220, 221
Hussey, Mr. Alvin, 28, 29, 44

Illinois, 242
Inclan, Prof. Alberto, 204, 206, 209
Indianapolis, 120
Indians, Arizona, 223
Injuries and Diseases of the Hip (Albee), 258
Inter-Allied Conference on Rehabilitation, Rome, 1919, 169, 170
International Association of Medicine and Surgery, 70, 77, 79, 198
International College of Surgeons, 222, 223
International Society of General Surgery, 201
International Society of Orthopædic Surgery and Traumatology, 72, 198, 200, 201, 202, 204
Irish Coast, 83
Italian Front, 112
Italian National Orthopædic Association, 170
Italy, 82, 169, 170, 198, 200

Jamaica (B.W.I.), 218
Japan, 170
Japanese Soldiers, 98
Jeanne d'Arc, 99
Jensen, Dr. Murk, 198, 201
Jersey City (New Jersey), 181
Johns Hopkins Univ., 238
Johnson, Major F. W., 149, 150, 151, 153, 160, 162
Johnstone, Lady, 89
Jones, Dr. Ellis W., 249
Jones, General, 117

Jones, Mrs. G. Wheeler, 151, 152, 153
Jones, Sir Robert, 83, 85, 158, 198, 201
Journal of Bone and Joint Surgery, 198
Juilly, 95
Junior Optimists, 195

Kahn, Mr. Otto, 86
Kaiser, The, 70, 71, 85, 143, 167
Kangaroo tendon, 98, 99
Kappa Sigma Fraternity, 30, 171
Kean, Colonel Jefferson R., 120, 125
Keen, Dr. William, 102, 103
Kegal, Dr. Anthony H., 211
Keith-Albee Vaudeville Circuit, 249
Kelly, Dr. Howard, 238
Kennebec River, 18, 29
Kessler, Dr. Henry, 182
Kidner, Dr. F. C., 40
King, Lieut., 147–8
Kiwanis, 187, 196
Kny-Scheerer Corporation, 253
Kupfer, Dr., 216
Kupper, Mr. J. C., 189–90
Kushner, Dr. Alexander, 256

Labour Department (New Jersey), 172
La Chappelle, 91
"Ladder, The", 74
Lafayette, S.S., 117
Lahor, Jean, 197
Lake Constance, 70
Lakeside Unit, 136
Landoczy, Dr., 246
Lange, Professor Fritz, 54
Lannelogne, l'Hôpital Marie, 98
La Penne, 102
Latin America, 208, 209, 210, 216, 219, 223
Lavalle University Hospital, 107
Leavenworth, 151
Lee, Mr. John L., 193
Lee, "Pinky", 31, 32, 33
Leedingham, Miss, 76
Leeds University, 101
Lens, 171
Le Touquet, 107
Lewis, Mr. Burdett, 179
Lexer's Osteotome, 81
Leysin (Switzerland), 72
Liberty Loan, 137, 151, 154
Lincoln Academy, 28, 30
Lindbergh Circle, 211
Lindbergh, Colonel Charles A., 56, 212, 213
Lister, Lord, 5, 102
Liverpool, 83, 84
London (England), 77, 78, 79, 84, 85, 87, 198, 246
London *Times*, 79, 84, 108
Longeuil Annel, 103, 104, 105
Long Island, 241
Loomis Laboratory, 57, 59, 63
Lorenz, Dr. Adolph, 72
Lounsbury, Lord, 86
Louis XIV, 99
Lovett, Major, 127
Lycée Pasteur, 107–8
Lusitania, S.S., 83
Lyle, Dr. Henry, 103, 104

McDowell, Mr. Ephraim, 5
McGill University, 49
McNamara, Mr., 150

Macauley, Mr. Charles R., 167
Machado, President (Cuba), 209
Mackay, Mrs. Clarence, 90
MacMillan, Commander Donald B., 19
MacNeal, Mr., 227
Magnier, Pierre, 103, 104, 105
Maine (State of), 16, 17, 18, 19, 21, 29, 30, 31, 52, 176
Maison Blanche Hospital, Paris, 100
Malaria, 214, 215
Managua, 214
Manoël (ex-King of Portugal), 158
Marie Antoinette, 99
Marines, 214
Marne, 89, 107, 130
Martel, Dr. Thierry de, 112–3
Martin, Dr. Franklin H., 120
Martin, Dr. Paul, 249
Mary (Queen of England), 78, 85
Mary's (Queen) Convalescent Hospital, 85
Massachusetts, 193
Massachusetts Bay Company, 19
Massachusetts General Hospital, 35, 37, 39, 40, 42, 44, 46, 47, 49
Matthews, Tommy, 130
Matthieu, Dr., 201
Mauretania, S.S., 137, 169
Maya civilization, 212
Mayo, Dr. Charles, 210–11
Mayos, The, 6, 210–11
Mayo, Dr. William, 210
Measday, Mr Walter, 167
Medical Corps of the United States, 117, 120, 125, 169
Meleney, Lieut., 157
Mérida, 212
Methodist Church, 21
Mexico, 212, 219, 249
Mexico City, 76, 249
Miami (Florida), 212
Milan (Italy), 170
Military Hospital V. R. No. 76, 94
Minnesota, 138
Mobile Operating Hospital No. 4, 157
Montenegro, 170
Montgomery, Miss Alberta, 157
Montreal, Canada, 49, 121
Moore, Governor A. Harry, 186
Moreston, Dr., 109

Morgan, Mr. J. Pierpont, 85
Morgans, The, 107
Muhlenberg Hospital (Plainfield, New Jersey), 249
Mumford, Mr. J. G., 40
Munich, Germany, 81
Munsterberg, Hugo, 37
Murphy, Dr. J. B., 5, 72
Mussolini, Benito, 202, 203–4

Nantes, 157
Napoleon I, 99
Napoleon Bonaparte, 107
National Fraternity of Elks: see Elks
National Orthopædic and Traumatological Association, Brazil, 249
National Tariff Commission, 119
National Youth Administration of New York, 241
Navajo Indian Reservation, 224
Navajos, 224
Nazis, 222
Neuilly, 90, 108
Nevers, 157
Newark, N.J., Clinic, 168, 181, 182, 189–196, 249
New Brunswick (New Jersey), 150
Newcastle (Maine), 28
New Jersey (State of), 120, 124, 126, 129, 166, 172, 173, 179, 180, 181, 182, 183, 184, 185, 186, 187, 189, 192, 195, 196, 220, 249
New York Boxing Commission, 233
New York Central Railroad, 32
New York County Medical Society, 237, 238
New York Post-Graduate Medical School and Hospital, 47, 48, 49, 51, 52, 55, 59, 63, 76, 127, 145, 227, 249
New Testament, 22
New York World, 167
Ney, Major K. Winfield, 143, 144
Nicaragua, 214, 215
Nokomis, Florida, 235
Nolan, Mr. John, 235
No Man's Land, 171
Noonan, Morris, 50, 51, 70
North Pole, 19

Ocean, Arctic, 119
Atlantic, 205, 213, 245
Ogilvy, Dr. Charles, 47, 49, 50
Oglethorpe, Fort, 28, 140, 141, 249
Oise, River, 99
Oklahoma City, 226
Ollier, Professor, 55
Orr Treatment, 93
Orthopædic and Reconstruction Surgery (Albee), 256, 259
Ortiz-Tirado, Dr. Alfonso, 249
Osterberg, Sunny, 132
"Over Here", 150, 151, 166

Page, Dr. de, 102, 112
Page, Thomas Nelson, 82
Palatine Hill, Rome, 169
Palmquist, Jimmie, 164
Pan-American Medical Association, 209, 210, 211, 216, 219
Pan-American Relations, 208, 209, 221
Panama, 218, 223
Panama Canal, 216, 219
Panama City, 215
Pantheon, Hotel, 108
Paraguay, 219
Paré, Ambroise, 5, 6
Paris (France), 87, 89, 90, 98, 99, 109, 112, 113, 117, 171, 200, 201
Pariseau, Captain, 113
Parsons, Mr. Joseph, 19
Pasteur Institute, 101
Pasteur, Lycée, 107–8
Pat, Sister, 86
Paterson (New Jersey), 181
Pearson, Sir Arthur, 86
Pelvis, 75, 260
Penne, La, 102
Pennsylvania, 150
Pennsylvania College, 32
Pennsylvania Railroad, 120, 124
Pershing, General John J., 85
Perry, Admiral, 19
Peru (South America), 219, 223
Perth Amboy (New Jersey), 164
Pétain, General, 99
Peters, Dr., 224
Peterson, Miss Florence, 191
Peyronie of Montpellier, 5
Pittsburg (Pa.), 74
Pittston (Maine), 18, 19, 21, 52
Plainfield (New Jersey), 163, 249
Plastic Surgery, 108–10
Platt, Dr. Harry, 198
Pollock, Mr. James, 161
Polyclinic Hospital, 232
Poore, Dr. John R., 46, 48, 49
Porter, "Pa", 40
Port of Spain, 222
Pott's Disease, 52, 53, 68, 69
Pott, Sir Percivall, 53
Potter, Mr., 150
Pozzi, Dr., 100
President Grant, S.S., 171
Preston, Dr. Robert L., 202, 232, 249
Principles of the Treatment of Non-Union of Fracture (Albee), 251
Prosser, Mr. C. A., 174
Prussians, 112
Puerto Rico, 218, 219
Putnam, Dr. J. J., 37, 38
Putti, Prof. Vittorio, 170–1, 198, 200, 201, 202, 204, 206, 207
Pynchon, Mr. William, 19
Pyrenees, 116

Queen Mary (England), 78, 85
Queen Mary's Convalescent Hospital, 85
Queen Victoria, 85
Quinn, Mr., 187
Quinn-Bodin, 187

Rahway (New Jersey), 168, 191
Rahway Memorial Hospital, 168
Red Cross, 82, 84, 85, 94, 120, 125, 162, 163
Red Star Division, 130
Reed (Walter), Hospital, 137, 143, 157, 160
Rehabilitation Commission (New Jersey), 173, 174, 176, 179, 180, 181, 182–6, 187, 191, 192, 220, 241, 249
Rehabilitation Review, 194
Rhone Valley (Switzerland), 237
Richardson, Billy, 33
Richardson, Dr. Maurice H., 38, 39, 40, 49
Rickenbacker, Captain Eddie, 234
Rickett, Mr. and Mrs. J., 89
Ringling, John, 231
Rio De Janeiro (Brazil, S.A.), 220, 222
Ris Orangis, 82, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 100, 104, 117, 125
Rizzoli Institute (Bologna, Italy), 198
Rochampton Hospital, 85
Rockefeller Institute, 56, 57, 133, 208
Romagne, 171
Rome (Italy), 169, 202, 203, 220
Roosevelt Hospital, 59
Rotarians, The, 187
Rothschild Hospital, Paris, 109
Rouen, 136
Roux, Dr., 101
Royal Grand Opera House, Berlin, 70, 71
Ruptured and Crippled Hospital, 48, 50, 52, 55
Ruskin, Simon T., 244
Russell, Colonel, 125, 127
Russia (Imperial), 117, 118, 119
Russia (Soviet), 247
Russians, 118
Russian Army, 118, 119
Russian Czarina, 118
Russian Medical Corps, 118
Russo-Japanese War, 98

Sage Memorial Hospital, 224
Saint Cloud, 107
Dunstan's, 85–6
George's Station, 95
Louis University, 244
Luke's Hospital, 65
Paul, S.S., 82, 83
Petersburg, Russia, 118
Salsbury, Dr. C. G., 224, 225
San Antonio (Texas), 73
San Juan, 219
San Lorenzo, 213, 214
San Marcos, University of, 222
San Salvador, 214
Santé, Service de, 90
Santiago De Chile, 218, 223
Santiago De Cuba, 210
Sarasota County (Florida), 219
Sarkany, Dr. G., 249
Sassnitz, Germany, 207, 208
Sauerbruch Clinic, Berlin, 81
Schaaf, Ernie, 232
Schmeling, Max, 233
Schwindlein, Captain, 144
Scotland, 206
Seaboard Air Line Railway, 237
Sea Breeze Hospital, 59, 240
Seaman, Dr., 77
Second World War: see World War II
Secord, Dr., 185
Seine, 87, 88, 89, 107
Selective Service Act, 241
Senate (United States), 120, 187
Serbia, 106, 170
Sewaren (New Jersey), 162
Shanks, Major General, 129
Sharpe, Dr. William, 211
Sheepscot River, 18
Sheets, Dr. Walter, 249
Shepherd's Bush Curative Workshop, 158, 159
Sherman Hotel, Chicago, 231
Shriners, The, 187
Sikorsky (Airplane), 213
Silverstein, Myron, 244
Sims, Dr. J. Marion, 5
Sister Pat, 86
Smith, Captain Fred A., 126
Smith-Sears Vocational Rehabilitation Act, 149
Smyth, Mr., 129
Somme, 96, 110, 112, 115
Sorrel, Dr. E., 108
South Africa, 239
South America, 29, 208, 211, 216, 218, 219, 222
Southwestern Medical Association, 226
Spanish Main, 212
Spitz, Mr. Joseph, 182, 184, 185, 196
Starr, Dr., 198
Stephens, Albert Frederick, Jr., 193
Stone, Mr. Warren, 236
Strong, Richard, 106
Sunshine League, 189
Surgery, Gynæcology and Obstetrics, 251, 256, 261
Sweden, 207, 247
Swenson, Miss, 129
Switzerland, 237

SS. *Ajax*, 19
Arabic, 83
Drottingholm, 208
George Washington, 157
Hamburg, 204
Lafayette, 117
Lusitania, 83
Mauretania, 137, 169
President Grant, 171
St. Paul, 82, 83

Taft, President Howard, 167
Tampa (Florida), 237
Tangney, Pat, 131
Tardieu, M. André, 172
Taylor, Dr. Henry Ling, 47, 48, 49, 50, 63
Tegucegalpa, 213, 214
Thierry, Chateau, 129
Times, The, 79, 84, 108
Toohey, Mr. John J., Jr., 196
Toronto (Canada), 121
Towle, Captain Fred, 148
Trenton (New Jersey), 181, 186
Trinidad, 218, 219, 222
Tuffier, Dr., 100
Tunney, Mr. Gene, 231

United Fruit Company, 213
United Nations, 222
United Press, 220
United States, 120, 175, 198, 200, 209, 220, 223, 229, 241
United States Army, 125, 127
United States General Hospital No. 3, 60, 86, 103, 120, 121, 125–40, 142–51, 157, 158, 160–6, 169, 173, 241, 249
United States Medical Corps, 117, 120, 125, 169
United States Reconstruction Hospital Nos. 1, 2 and 3, 121
Universities:
Berlin, 207
Bologna, 170, 202
Brazil, 222
Buenos Aires, 221
Carlisle, 162
Chicago, 241, 242
Chile, 222
Columbia, 52, 249
Cornell, 11, 57, 238, 244
Florida, 231
Harvard, 32, 35, 36, 37, 38, 40, 49, 51, 53, 127, 253
Havana, 209
Lavalle Univ. Hospital, 107
McGill, 49
Vermont, 250
Yale, 119
Unter den Linden, 70
Upshur, Colonel A. P., 126, 145, 146, 151, 154
Uruguay, 219

Vanderbilts, The, 107
"Vanity Fair," 150
Venezia, Palazzo, 203
Venezuela, 216, 217
Venice, Florida, 219, 231, 235, 236, 237
Verdun, 93, 171
Vermont University, 250
Veterans Facility, 249
Vienna, 72
Victoria, Queen, 85
Vigneaud, Dr. Vincent du, 244
Villiers-sur-Marne, 95
Vimy Ridge, 171
Viry-Chatillon, 95
Vitamins, 241–5
Von Kluck, General, 104

Wahl, Private, 139
Walker, Captain Warren T., 148
Walter Reed Hospital, 137, 143, 157, 160
Walton-Goelet, Robert, 97
War Department, 97, 121, 125
Warren, Prof. J. Collins, 40, 42
Washington (D.C.), 120, 121, 130, 148, 157, 165, 169
Washington, George, 52
Washington, George (S.S.), 157
Waterbury, Connecticut, 46, 47, 48, 49, 50, 82
Waterbury Medical Society, 46
Waterbury Police Force, 51
Weigel, Dr. Elmer P., 60, 128, 133, 249
Wesley, John, 21
Westbrook (Maine), 31
White, Mr., 30
Whitney, Arthur G., 172
Whittier, Professor, 31, 32, 33
William IV, 20
Wiscasset (Maine), 18, 19, 20
Wilson, President Woodrow, 119
Windsor Castle, 78
Winthrop, Mr. John, 19
Wolff's Law, 62
World War I, 13, 16, 60, 78, 82, 106, 125, 126, 130, 134, 136, 141, 166, 170, 205, 208, 249
World War II, 13, 16, 82, 93, 113, 141

Yale University, 119
Yucatan, 212, 213, 219

Zeppelin, Count, 70, 71

To the Reader

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