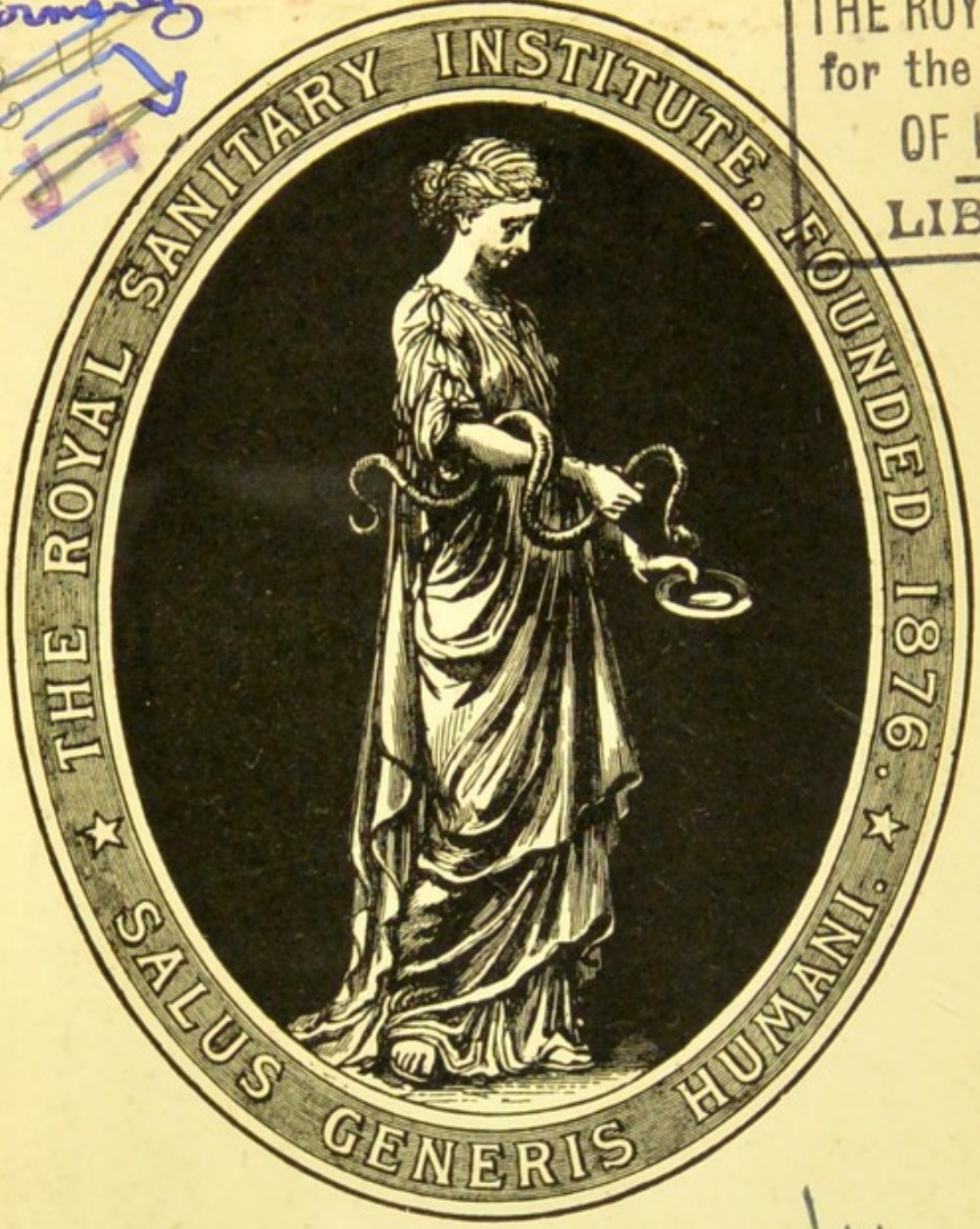
Guide to sanitary inspections / by William Paul Gerhard.

GUIDE TO SANITARY INSPECTIONS

WILLIAM PAUL GERHARD



Loan of Books and Periodicals

(1) Books may be retained for 28 days. Periodicals may be retained for 14 days. Applications for extension of the loan period must be made in writing before its expiry.

(2) Books must be kept clean and protected from damage. Pages must not be turned down ; pencil or other marks must not be made. Borrowers are liable for damage done to books ; they should, therefore, examine books when received and call attention at once to any existing damage.

This book is returnable **on or before the last date Marked below.**

WORKS BY
WM. PAUL GERHARD, C.E.

PUBLISHED BY

JOHN WILEY & SONS

A Guide to Sanitary Inspections.

Fourth Edition, revised and greatly enlarged. 1909. 12mo, x + 229 pages, cloth, $1.50.

The new edition enlarges the scope of the book by taking into consideration not only city and country houses, apartment and tenement houses, but also public buildings, hospitals, schools, and theatres. A large number of schedules for inspections, with questions are given.

Theatre Fires and Panics: Their Causes and Prevention.

12mo, vii + 175 pages, cloth, $1.50.

In this volume Mr. Gerhard has stated clearly the main defective features of theatre buildings as they usually exist, how such defects can and should be avoided, and what safeguards should be introduced. *American Architect.*

Mr. Gerhard evidently has studied his subject carefully and his conclusions are perfectly sound.—*New York Evening Post.*

The author has gone into the subject intelligently and thoroughly.—*New York Tribune.*

Sanitation of Public Buildings (Hospitals, Theatres, Churches, Schools, Markets and Abattoirs).

12mo, xi + 262 pages, cloth, $1.50.

The chapters on church, theatre, and hospital sanitation are of importance to all who frequent these edifices.—*New York Times.*

As a compendium of information in small compass and handy form the volume deserves commendation.—*Engineering News.*

Modern Baths and Bath-Houses.

Illustrated with many Plans and Views. 8vo, xvi + 311 pages, cloth, $3.00, net.

The book is a useful manual on bath-houses and a valuable addition to our sanitary literature.—*Architects and Builders' Magazine.*

The book is a very useful addition to the literature of sanitation and social welfare. —*Engineering News.*

The subject is one of universal interest.—*London Engineering.*

GUIDE

TO

SANITARY INSPECTIONS

BY

WILLIAM PAUL GERHARD, C.E.

Mem. Amer. Soc. Mechanical Engineers

FOURTH EDITION, ENTIRELY REVISED AND ENLARGED

FIRST THOUSAND

NEW YORK

JOHN WILEY & SONS

LONDON: CHAPMAN & HALL, LIMITED

1909

The Scientific Press
Robert Drummond and Company
New York

PREFACE

In revising the fourth edition of "A Guide to Sanitary House Inspection," it was deemed advisable to enlarge the scope of the book by adding considerable new matter. The matter of the original book has been thoroughly revised, and there are besides a new chapter on the sanitary inspection of public buildings and another on sanitary surveys of cities and towns. A novel feature is the embodying in the text of a large number of question schedules, relating to the sanitary inspection of city residences, tenement-houses, and apartments, country houses, schools, hospitals, theatres, and institutions. The majority of these question schedules have been prepared by the author and have been found useful in his practice as consulting engineer.

The chief aim of this little volume is to outline broadly the main features of sanitary inspection work. While one of its aims is to instruct the layman, the householder, the owner of tenements, the principal of a school, the superintendent of a hospital, the manager of a theatre, it is believed that the book will be also useful to health and sanitary inspectors, to boards of health, to fire department officials, insurance companies' inspectors, and to architects, civil engineers, and building superintendents in general.

The principal scope of the book is to be a reliable guide and pocket-book for the search for sanitary defects. For this reason brevity was essential, and it was not feasible to give in detail the reasons why certain constructions or arrangements are deemed to be defective and unsanitary. Those who are in search of this latter information may find it in some of the other works of the author. A general bibliography on sanitary surveys and building inspections is placed at the end of the book. Its title has been changed in conformity with its revision, to GUIDE TO SANITARY INSPECTIONS.

WM. PAUL GERHARD

NEW YORK, 33 UNION SQUARE,
January 1, 1909

CONTENTS

GUIDE TO SANITARY INSPECTIONS

"How can a house be a safe haven, if in winter the winds pierce it, if in summer the sun scorch it, if dampness rises in its walls, if foul air penetrates its chambers, if by neglect or ignorance the demons of fever enter and lurk therein?"

OLIVER B. BUNCE: *My House, an Ideal.*

THE statement has recently been made, that, "of all the buildings put up in the United States, not one in a hundred is made to submit to any official regulation. The local government knows nothing of the plans of the builders or architects: there are no sanitary regulations, or attempts to insure protection against fire. No wonder that whole cities are destroyed by conflagration, and that malaria and disease are common throughout the country! There is no provision by law securing proper drainage, sewerage, or safe construction in ninety-nine out of every hundred buildings erected in the United States."

While the foregoing may not strictly apply to our largest cities, in which building-laws and sanitary regulations are now in force, yet there cannot be much doubt, that, even in these there is room for much improvement. That the statements quoted are true of the majority of buildings in smaller cities and towns, and of many of the country and suburban houses annually erected, nobody will deny.

Necessity of Sanitary Building Inspection

Taken as a whole, the warning given ought to serve a useful purpose in calling attention to the serious risks incurred by people in occupying a dwelling without first having made or ordered a thorough inspection of the premises. Even when a temporary residence only is contemplated, it would not appear prudent to neglect such an investigation and inquiry. Health being the supreme consideration, the greatest stress should always be laid upon a detailed examination of the sanitary condition of the future home. Nevertheless, in by far the majority of instances, the public exhibits an utter indifference and carelessness with regard to this important matter.

In choosing a home, the importance of a wholesome soil, of sound building materials, and of honest workmanship, is apt to be set aside by questions of convenience and fashion, and a number of other considerations of lesser value. What is the prevalent custom with even well-educated people in choosing a dwelling? Disregarding the question of a salubrious site and of a sanitary construction, they are satisfied if the house stands in a nice street and a fashionable locality, and presents an attractive exterior. On entering such a house, the usual points inquired into are the sizes of the principal rooms, but particularly of the parlor, dining-room, and reception-room; the character of the hard-wood trimmings, of plate-glass mirrors, the elaborate decoration of mantle-pieces; the provisions made for look-outs, bay-windows, and plenty of closet space; the convenience of fittings, such as electric bells, speaking-tubes, dumb-waiters; the elegance of the plumbing-fixtures so far as they appear visible, in particular of showy marble tops of basins, of silver-plated faucets, costly

decorated bowls, and hardwood cabinet-work incasing the plumbing. Briefly, it is the superficial appearance of all *visible* finish which exercises more influence upon intending buyers than the more serious considerations of stability, healthfulness, and safety. Only occasionally does it happen that an inquiry is made into the stability and general character of the structure.

No prudent man would think of buying a house without carefully examining the title of the property; and it is now regarded, in real-estate transactions, as a necessary expenditure to pay competent lawyers for services rendered in securing evidence as to the correctness of the title of a property before concluding any bargain. But not one out of a hundred or more purchasers deem it of sufficient importance to secure a certificate from an expert that the house is built in accordance with sanitary rules and regulations. And yet, if the buyer intends to make the house his future residence, his own health, and that of his family and household, will depend upon its cleanliness and salubriousness. The same remarks apply, with equal force, to houses for rent, located in the city, in the suburbs, or in the country, and their importance is particularly great in the case of institutions, like schools and hospitals. With all the weight of his experience as a sanitarian, Col. Waring advises:—

"Let no family man lease any house without a guaranty of its sound sanitary construction. The question of value is too trifling to be thought about; and, as the world goes, houses are not less valuable because their plumbing is defective. We run the risk of losing, not money, but health and life; and these can be secured by the guaranty of no house agent or owner. It is a case where we need the guaranty of absolute knowledge. We ought not to hazard the safety

of our family by moving them into, or by keeping them in, a house whose pipes and drains we do not *know* to be absolutely tight and strong, and to be suitably arranged as to connections, traps, and ventilation. Positive knowledge that the plumbing-work is in this sound condition is the only guaranty that the head of a family, whose eyes have been opened to the dangers of defective work, would be justified in accepting."

It may not seem out of place to utter a word of caution to intending buyers or lessees of buildings, old or new, as to the acceptance of general and indefinite statements made to them by real-estate agents. Let it be understood, that it is not, at the present time, a part of the business of an agent to demonstrate the healthful condition of a property. He is simply acting in the interest of the owner or landlord who commissioned him to sell or to rent, as the case may be, a building at as high a price, and under as favorable terms, as he may be able to secure. Undoubtedly, the time is near at hand when it will be considered indispensable for agents and owners to produce a certificate of the healthfulness and sound construction of a building; and the natural consequence will be that buildings having a proper sanitary certificate will command a much better price and find a more ready sale. At present, however, the duty evolves upon the intending purchaser or lessee to secure expert evidence that a building is properly arranged and constructed as regards its situation and subsoil, its construction, its ventilation, warming, lighting, and protection against fire, and its system of water-supply and sewerage. So good an authority in England as Mr. William Eassie, C.E., says:—

"The wisdom of not entering upon residence in any old house until its healthy condition is vouched for by some competent authority, it would be a work of super-

erogation to affirm, seeing how many sicken and perish for want of the most ordinary care in this respect. In town and in country alike, when this precaution has been neglected, Nemesis, in the form of some indisposition or another, is certain to overtake the careless occupant. This axiom is, unfortunately, applicable to modern houses built within the present decade, as many a sorrowing heart can testify."

The conclusions at which we must arrive, from an earnest and thoughtful consideration of the facts stated, are that, before choosing for occupancy a home, in city or country, a householder should take the precaution to inquire carefully into its healthfulness and the character of its surroundings. A little time devoted to such a preliminary investigation, and a consideration of the facts elicited, are always well worth the trouble, and may save much subsequent illness, especially of those members of the family who are obliged to spend the greater part of each day at home. Those who can ill afford the time required for an investigation, or do not feel themselves competent to pass judgment, should not hesitate to ask expert advice in a matter which may hereafter affect the well-being of those whom they love most. It is particularly true of dwelling-house sanitation, that "an ounce of prevention is better than a pound of cure."

"Skin" Buildings

In cities and in rapidly growing suburbs it will be advisable to avoid, by all means, the cheap houses of the speculative or "jerry" builder, which are run up by the hundreds in an incredibly short time, without any considerations whatever of rules governing healthful house-construction; and if they bear a displayed adver-

tisement of having been built "by day's work," and of being provided with perfect "*sanitary* plumbing and *sanitary* heating," we will not, generally, be far from right if we look upon them with all the more suspicion. Such "skin" houses may easily be recognized, however attractive they may be in outside appearance, by an inferior workmanship of details of construction other than those relating to sanitary arrangements. Health, comfort, convenience, and sound construction are, with them, too often sacrificed to mere outward elegance and fashion.

Wherever we find that a house has settled considerably, owing to poor foundations, and exhibits walls full of cracks; wherever the brick-work is laid with the poorest kind of mortar; wherever the outer walls appear wet or splashed, owing to window-sills that do not project beyond the walls, and are not grooved on the under side so as to throw the water clear of the walls; wherever the plastering is unsatisfactorily done, and does not show well-planed and true surfaces; wherever floor-boards are loose, or show wide cracks favoring the accumulation of dirt and dust, and forming harboring-places for vermin; wherever door-frames are out of plumb, and doors, windows, and shutters constructed of unseasoned wood, with panels full of cracks; wherever gas-fixtures hang out of plumb, or rattle with every footstep, owing to insufficient strength of the joists; wherever locks refuse to work, window-sashes stick, and sash-ropes are torn; wherever the paint soon scales or wears off; wherever the cold-air box is constructed of a poor material, with a multitude of cracks and crevices; wherever hot-air flues are insufficient in size, and carried close to unprotected wood-work; wherever, finally, the whole plumbing job appears to be "scamped," —there we may, with a tolerable degree of certainty,

assume that sanitary conderations have been neglected, that the sanitary work was imperfectly done, even if the building and health regulations have, to all superficial appearance, been complied with.

It must be remembered, that, even in those cities where building and sanitary regulations are in force, and a large corps of efficient building and sanitary inspectors exercise a supervision of work in new buildings, it is very difficult to prevent intentional frauds on the part of unscrupulous builders. As regards drainage and plumbing of buildings, in particular, there always remains a chance for doing defective work, or using improper or poor materials, without necessarily violating any of the official regulations.

One cannot live in a house of this kind, even if only completed just before occupation,without having before long serious defects appear, necessitating frequent and expensive repairs. Flues will not draw, being roughly and improperly constructed without smooth lining, and made insufficient in size; fire-places will smoke; the furnace will not heat a house, although a brisk fire turns the iron red-hot; water-pipes and traps will constantly freeze and burst in mid-winter, owing to carelessness of arrangement and to the light weight of the lead pipe used; faucets soon wear out, and drip; gas-flames burn with an unsteady, dim light, owing to the insufficient size of the gas-service pipes; roofs leak, while dampness and mold appear in the cellar and sewer air from abominable pan-closets and dried-up cellar traps will soon fill the house. Living in such a house means having not only the constant annoyance of mechanics trying to repair an originally bad job, but—and this is infinitely more serious—it means frequent calls for the family physician, or continued low state of health of your wife and children. Avoid such houses, by all means.

But, even where outward indications do not warrant the conclusion that a house is unsafe to live in, it is well to examine the building thoroughly, from cellar to garret, or to get an expert to make a report upon its condition. The investigations of the last twenty-five years, in preventive medicine, have advanced the knowledge of the laws of hygiene and of the conditions favorable to health, to such an extent that it is feasible to establish fundamental rules with regard to healthful house-construction. This is as far as the duty of medical men should extend. It devolves upon architects and engineers to apply their practical knowledge in carrying out such arrangements and details of construction as are best adapted to secure healthful conditions.

In all sanitary inspections the principal aim is to inquire if such rules have been followed; and if not wherein and how far they have been violated. Sanitary house-inspection covers a great many points worthy of discussion, and an effort is made in the following pages of giving at least the chief points which such examinations should embrace.

Essentials of a Healthful Home

It may be well, as an introduction to the subject, to state briefly the requirements of and the conditions which ought to prevail in a healthful house. What is true of dwellings applies equally to the larger buildings, such as hospitals, schools, institutions, and asylums in which a large number of inmates is housed.

Broadly speaking, there should be in and about a habitation *pure air, pure water, and a pure soil.* To enumerate more in particular some of the principal requirements: the house should stand on a dry site, free from moisture or ground exhalations, and should be

isolated from direct contact with the surrounding soil; it should have a light and cheerful aspect, and the surroundings should be in every way unobjectionable; it should be constructed with a view to constant and complete dryness of foundations, walls, and roof; it should have rooms of such a size as to prevent any overcrowding; there should be sufficient ventilation to remove any impurities from respiration, cutaneous perspiration, combustion of fuel, gaseous products of illumination, fumes from cooking, and vapors of steam and soap from the laundry, and noxious odors from plumbing-fixtures; it should have a free admission of pure outer air, of light, and of the sun's invigorating rays during at least a few hours each day. The house must be provided with efficient and unobstructed sewerage, to remove at once all liquid household wastes; and with a good supply of pure and cool water for drinking and cooking purposes, for house-cleaning and laundry purposes, flushing of traps, fixtures, and waste-pipes. Besides, a house should be provided with means for a perfect distribution of an equalized and agreeable temperature; and with means for artificial lighting without deteriorating the atmosphere of halls and rooms. The protection from the danger of fire should be as complete as it is possible to make it; the removal of garbage and ashes should be prompt and regular, and effected without creating any offence; and there should be throughout the house as little as possible chance for the accumulation of dirt and dust.

"Domestic sanitation," says Dr. B. W. Richardson, one of the greatest sanitarians which England has had, "aims at constructing homes, or improving houses already constructed, so as to remove all defects which may affect health. The essentials for maintaining perfect salubrity in a house are,—

"1. It must present no facilities for holding dust or the poisonous particles of disease.

"2. It must possess every facility for the removal of its impurities as fast as they are produced.

"3. It must be free from damp.

"4. It must be well filled with daylight, from all points that can be charged with light from the sun, without glare.

"5. It must be charged with perfectly pure air in steady, changing currents.

"6. It must be maintained at an even temperature, and must be free from draughts.

"7. It must be charged with an efficient supply of pure and perfectly filtered water."

In the following pages, the subject of sanitary inspections will be taken up in this order: First come city houses, and much of what is brought up for discussion in connection with them applies also to suburban and country houses. But the latter differ from the former in many essentials, and hence country houses will receive separate treatment. In many cities, apartment and tenement houses exceed in number the individual dwelling-houses, and their sanitation is made the subject of a special inquiry.

Following the private dwelling-houses, I shall discuss the more important public buildings, such as schools and hospitals, and including theatres, abattoirs, markets, and milk dairies.

A brief chapter will be devoted to the sanitary inspection of summer resorts and that of cities and towns.

Inspection of City Houses

Let us begin with city houses. A good deal of ingenuity, coupled with some common-sense and large

experience, are required in making a sanitary survey of a house. In making such an inspection, it is well to accept with caution all statements made by others, and to trust only to the observations of your own senses. Of course, some information may be gained by making inquiries, but one should feel certain that the parties conveying the information are entirely disinterested.

Before entering a house, take a look at the street. Note its width and general direction, and observe particularly the height of houses on the opposite side of the street; for upon this will, to a great extent, depend the cheerfulness of your front rooms. Avoid the neighborhood of tall apartment-houses, which rob the street and the houses of sunlight and pure air. Free and airy streets, and plenty of parks and breathing-spaces, are much to be desired in cities. The north side of a street is generally preferable; for here your front rooms will be sunny and warm in winter, and will enjoy the benefit of the cooling southern breezes in summer time.

Inspection of the Surroundings and of the Soil.—Inquire carefully into the character of the neighborhood, and ascertain if any noisy factories or offensive trades are near by. Avoid the vicinity of slaughter-houses, stables, carpet-beating works, infectious hospitals, and the like. Observe the character and condition of the street pavement, which has more or less bearing upon the salubriousness of the street, and note particularly the cleanliness of the gutters. But, above all, look carefully into the character of the building site.

If you should be able to refer to old topographical maps, showing the original water-courses and contours of the land, you will find these a great help in studying this all-important question. If the spot was originally a low, damp site, or a swamp, marsh, or pond, filled up to the street level, you may at once look upon the site

with distrust. It is often a difficult matter to ascertain if such a locality has been well drained before the filling process was begun; and, as regards the material used for filling up the lot, it will hardly be necessary to warn against the possibility of its being a mixture of ashes, street-sweepings, garbage, rotten vegetation, and house refuse. If you value your health, you should at once abandon the idea of taking a house built on a site which has only recently been filled to the level of the street. Made land may be rendered available for building sites after some years; but, of course, even then a *perfect isolation* of the house from the surrounding and underlying soil is required, and to investigate this will be one of your first duties.

Even where the soil consists of gravel, sand, or loam, and much more so where it is clay or rock, the matter of drainage—that is, the removal of subsoil water, or the permanent lowering of the level of the ground water to a good depth below the cellar floor—requires careful attention. If subsoil drains are laid, their location should be ascertained, as well as the manner in which they are constructed, whether of stone or tiles; and particular care should be devoted to their outlet, and to their thorough disconnection from the sewer or house-drain.

Inspection of the Cellar.—Upon entering a house it will be well to direct your steps at once to the cellar. If this shows signs of dampness, if the floor is wet, or has pools of stagnant water, if the walls are dripping with moisture, or covered with a moldy growth—you may be sure that the house cannot be healthful.

Examine with care the construction of the foundation-walls. See whether there is a damp-proof course to prevent the dampness from rising in the walls, whether the walls are coated inside and outside with asphaltum, and

whether the wall is built hollow, or is provided with an area all around to keep off soil-moisture. See whether the walls in the cellar are kept in a proper and cleanly condition, and have recently been whitewashed. Note also the depth of the cellar floor below the sidewalk, and the clear height of the cellar. Look for gullies in the cellar floor, and see whether they are left untrapped, or are insufficiently trapped by a bell-trap forming the strainer to the gully, or by siphon-traps with shallow depth of water seal, which is readily lost by evaporation.

Examine carefully the condition of the cellar floor. To isolate the house from the earth, the floor should have a layer of concrete at least four inches thick, finished on top with Portland cement, or, better still, with a layer of coal-tar pitch, or asphaltum. Note whether the cellar has ample movable windows for light and air, or a ventilating flue carried along a heated chimney flue.

Inspection of the Yard.—Next go to the yard, and note its size and general condition, whether it is paved and well drained, whether it has a well, a privy in the rear, or a cesspool; and if so, measure the distances from each other, and from the house foundation walls. See if the yard is well kept, clean, and free from offensive slops or heaps of garbage. If there is a privy-vault, examine its construction, size, material, ventilation, and see if it is water-tight, and how full. If there is a cesspool, or catch-pit for grease, examine its condition; see especially if it is leaching or tight.

Inspection of Structural Details.—Returning to the house, it will be well, before taking up in detail the arrangements as to lighting, warming, ventilation, water-supply, and sewerage, to examine the general construction of the house, the material used for building, the character of the roof, the number of floors, the width

and depth of the house, and the portion of the lot covered. In this connection it will be worth your while to study somewhat closely the character of the back buildings, and their distance from the rear of the house.

In looking into the arrangement of the rooms, particular attention should be given to the size and clear height of bedrooms, to the number and dimensions of windows, and to the ventilation and lighting of bedchambers, closets, pantries, and storerooms. As to the walls, it should be remembered that new walls are always damp. In the process of building, an immense quantity of water is put into the walls of a house, which requires much time to be expelled, and which is much more difficult to expel after a house has once been occupied. Houses, therefore, ought not to be taken for occupancy immediately after the mechanics have left, for a damp house is always unhealthy.

As to the inside finish of walls, the best surface, where perfect ventilation is otherwise provided for, would be one that is impervious, non-absorbent, and polished, which could be washed by means of a sponge with clean water and soap. All other surfaces, such as plaster, wood, paint, or varnish, absorb more or less organic impurities given off from the human skin. If walls are painted, it is better to varnish them, for then they are much easier cleaned. If the walls are papered, make sure that the wall-paper contains no poisonous material, such as arsenic. It should be remembered, too, that (contrary to the popular notion that bright *green* colors only may contain arsenic) color is no guaranty whatever as to freedom from arsenic. Arsenic has been detected in often large amounts in dull greens, and equally so in almost all other colors. Nothing but an examination of the individual sample of paper by chemical analysis will decide this question. Another popular

fallacy is to presume that the presence of arsenic in colors adds to their brightness. It is now admitted by manufacturers that equally bright-colored papers may be manufactured without it, and this at a cost not greater to the manufacturer. Arsenic detached from flocky wall-papers as dust may frequently be found deposited on the tops of furniture, pictures, doors, etc. But it is also developed and diffused in the air of rooms, as arseniuretted hydrogen, from contact with putrefying starch paste. It is well, even where there is no danger from arsenical poisoning, to ascertain that walls of papered rooms are not repeatedly covered with succeeding layers of paper, each layer covering and retaining the organic impurities absorbed by the previous one.

Next inspect the construction of the floors. Well-seasoned wood, free from notches or cracks, should be used. Floors should preferably be constructed of narrow hardwood boards, laid with close joints, and tongued, so as to prevent the dirt from falling through and accumulating in the closed spaces between the ceiling and the floor, or even lodging in the floor joints; for such organic dust is liable to putrefy, and may often become a source of danger to the purity of the air. For like reasons, floors should be, as much as possible, waterproof. The best floors are hardwood floors, laid with closely fitting joints, with a smooth surface, well oiled or waxed, and rubbed and polished.

In going from one floor to another, the construction and easiness of the staircase should be observed, and notice taken whether the staircase hall is well ventilated and well lighted. See also if there is an ample accommodation on the top floor for your servants; for you should not tolerate basement bedrooms, which are always unhealthy and stuffy, and generally dark and dreary. See if the roof is tight, and the chimneys above

the roof well constructed and in a good condition. It is well to provide parapet walls with impervious coping-stones to prevent dampness from descending into the house walls.

Inspection of the Sewerage and Plumbing.—The examination of the sewerage and plumbing of a dwelling should be thorough and minute, for in no other detail of interior construction does "scamping" prevail to such an extent as here; and it is well to fix in your mind, in the preliminary tour of inspection just described, the location of the plumbing fixtures on the different floors of the house. This will be an excellent guide in following up the course of the various vertical lines of waste and soil pipes, and the location of their junction with the main cellar drain. The detailed inspection of the pipes and fixtures should begin in the cellar.

If the house is old, the main drain is generally out of sight, and often difficult to find, being buried below the cellar floor, and left entirely without means of access. It is absolutely necessary to break up the floor concrete, to dig down to the drain and to open it, in order to examine its condition.

Old houses often have square brick drains, large enough to remove the sewage of a whole village, usually in a bad and dilapidated condition, full of the filth accumulations from sinks and water-closets, and forming a veritable "elongated cesspool" under a house. It need hardly be stated that such a condition renders a house absolutely uninhabitable. An equally bad adjunct of such drains is the so-called mason's trap, often and more appropriately called a cesspool trap, serving to disconnect the house from the sewer, but in reality forming a most disgusting and dangerous cesspool.

If the house is of a more recent construction, the

main drain may be of cement or terra-cotta pipe. In either case it is usually of far too large a size to keep clean; and, as a rule, it has leaky joints, causing the contamination of the soil under the house, and also accumulations of solid filth, or else stoppages in the pipes. The round running traps used with such drains, to keep off the air from the sewer or cesspool, are often of defective make or improper shape, and should always be opened and examined as to their freedom from accumulation of sediment and scum. Cement and earthen drains are alike objectionable inside and under habitations.

A point at which leakages are very apt to be found is at the junction between vertical soil-pipes with such earthen drains. The drain may have settled, and the contents of the soil-pipe are simply poured, day after day, into the ground; and such condition of affairs, which is by no means unusual in some of the finest city mansions, may have existed for years without having been noticed, thus rendering the soil under the cellar floor a perfect hot-bed for germs of disease.

One should make it a rule, in inspecting a house-drain, to make observations regarding the free flow of water through it, by discharging a water-closet, a bath-tub, or other fixture, and thus to gain valuable indications as to the inside condition of pipes, which will enable a person to make sure that there are no obstructions, stoppages, or leakages.

In modern town-houses we find, as a rule, the main drain carried above the floor, of iron, generally alongside one of the foundation walls. If it is provided with hand-hole fittings or inspection holes, it is advisable to open these at frequent points, to ascertain definitely the interior condition, and to test the free flow of the house-drain. If the drain has only little fall, or is

unnecessarily large in diameter, or is insufficiently supported, and hence presents sags or depressions, and a generally uneven alignment and grade, it will not be free from accumulations.

Particular attention should be paid to the pipe-joints, which ought not only to show no signs of leakage of water, but ought to be made so as to remain perfectly and securely air-tight. If the pipe happens to be painted with white lead, a brown discoloration at the upper part of the pipe, near the joint, usually indicates a leakage of sewer air. It should be ascertained if the main drain is trapped or left untrapped; and if there is a trap, its size and shape must be noted. See also if there is a good-sized air-inlet just inside of the trap, leading to outdoors, to establish a circulation of air in the pipes. Inspect also the location of the air-inlet, note its distance from windows, from the cold-air box of the heating-apparatus; and if it terminates in a box with open grating in the sidewalk, see whether the opening is not obstructed by dirt, or in winter-time by ice or snow. If the trap is accessible—but it usually is not, although it is important that it should be—have it opened and examined; and this is a quite convenient point to test the free flow of the soil and waste pipes, and drains. It should be observed, when the trap is placed inside the cellar walls, if the cover of the inspection opening closes air-tight.

Having examined the main drain, all its various branches in the cellar must be spotted out, and carefully scrutinized as to size, material, joints, grade, and manner of connection with the main drain; T-branches always being quite objectionable and inadmissible in good work. Drain-pipes removing the surface water from front and rear yards and from basement areas, must be included in the examination. It is very important

to inquire into the method of trapping such wastes, for here evaporation of the water-seal is a frequent occurrence.

The removal of rain-water from the roof should also be properly performed. In old houses the soil-pipe is frequently made to do service as a conductor pipe; in which case the danger of siphonage of traps under fixtures is much increased. In houses recently built, the leaders form separate pipes, placed either outside of the house or sometimes inside of the walls. The method of trapping such leaders must be diligently inquired into, especially if their tops open near attic windows or close to a light-and-air shaft.

Following the examination of the house-drain, the soil-pipe must be traced throughout its whole course and examined as to its soundness and ventilation; and this inspection is often rendered quite difficult where pipes are hidden from view, as is the case in older houses, where they are commonly built into the walls, and very difficult of access. Much time is often lost in trying to trace the course of such inaccessible pipes.

Soil-pipes of lead prevail in older buildings, and are generally found honeycombed and corroded by foul gases, owing to the utter want of proper ventilation; for the soil-pipe usually stops at the highest fixture, or has, at best, a small and entirely insufficient vent-pipe extended up to the roof. For this reason it is advisable, in old houses, always to have the soil-pipe completely exposed by tearing up the walls and removing the plastering. Soil-pipes of iron, insufficiently ventilated, are also sometimes honeycombed, and distribute sewer air throughout a house. Moreover, they are, as a rule, defective in the joints. It should be borne in mind that every soil-pipe, and also every waste-pipe stack, ought to be made perfectly air- and water-tight, and be ex-

tended—without any bends if possible—at least full size through, and several feet above, the roof. On going up to the roof, it is easy to ascertain whether or not these conditions have been complied with. It is equally important to make sure that the free outlet above the roof is not reduced in size, or obstructed by ventilating-caps, return-bends, or cowls. All of these are not only unnecessary, but bad at all times, and positively harmful in winter time when the top of the soil-pipe clogs through hoar-frost, causing siphonage of traps, or forcing of traps by back-pressure, in houses where the plumbing is otherwise well arranged. This is especially likely to happen if the fresh-air inlet opens in a box in the sidewalk, and has the grating of its opening obstructed or closed by mud and snow. While on the roof, it should also be noted if the soil-pipe terminates near chimney-flues, or shafts of any kind serving for ventilation.

It should be ascertained whether the soil-pipe is put together with light or heavy iron pipes, whether it is entirely free from flaws or cracks, and whether the joints are well made and perfectly tight. The same care is, as a matter of course, required in examining vertical lines of waste-pipes. It is of advantage to test the soundness of the whole pipe-system by applying either the smoke test, or the peppermint test, or else a test by means of a force-pump and a pressure-gauge. The water-pressure test, consisting in filling all pipes up to a certain level with water, valuable as it is for new work, is difficult of application in testing plumbing-work in old houses. I shall not need to enter into a detailed description of the above tests, as they have been sufficiently explained in handbooks of house-drainage. The peppermint test is easily applied by laymen, and its indications are exceedingly useful.

The extremely pungent, volatile essences of oil of peppermint are well-known to everybody. It is obvious that if such oil of peppermint is introduced into a system of house-drainage, the slightest leak may easily be revealed by the smell escaping into the house. The best place to introduce the peppermint is at the roof; for, if poured into a water-closet or slop-sink at the upper floor of a house, the smell would be too readily diffused from this fixture directly into the house, and thus would interfere with the proper search for leaks. The fresh-air inlet would, in some cases, constitute a handy place for the introduction of the oil; but in this case all front windows ought to be kept closed during the test. In any case, it is important that the peppermint be not carried much about the house; and it is absolutely necessary that the helper who pours the oil remains out-of-doors, or at the roof, until the test is concluded, for otherwise he would carry the pungent odor attaching to his clothes into the house. Three or four ounces of pure peppermint oil are sufficient, and should be followed up immediately with a few pails of very hot or boiling water. In order to confine the volatile oil in the pipes, it is well to close, during the test, the openings of all soil and waste pipes above the roof. Meanwhile, the inspector or the householder follows up each line of waste and vent pipe, and observes if any smell appears at any fixture, in order to determine, at least approximately, the location of a leak. No fixture should be discharged or used in the house during this test, as the disturbance of the water-level in the trap may liberate some of the smell of peppermint.

The smoke test—in which smoke is forced, by means of a blower, into a house-drain—is superior to the test described, in so far as it fixes exactly, by the appearance

of the smoke, the location of the leak. Other means have been proposed, from time to time, for testing the soundness of pipes and traps. It is said that musk, introduced from out-doors into the drains, is readily diffused, and discloses leakages. It is also contended that, if acetate of lithium or tellurium is passed through soil-pipes, their presence or escape may be detected in the house, by means of the spectroscope, by their characteristic lines. It is evident that such tests, while useful, are not so practical, because they require the use of delicate and expensive optical instruments.

Having examined the pipe-system, the next step is to inspect the plumbing fixtures, their waste pipes, traps, and connections with the main pipes. To do this efficiently and thoroughly, involves the removal of all wood-work about sinks, basins, water-closets, and slop-hoppers. The condition of the enclosed spaces and of the wood-work should be carefully noticed, and will, as a rule, be found to show much foulness, dirt, and dampness from leakage.

The material and particular construction of every plumbing appliance must be inspected in detail. The sizes of waste-pipes and of traps should be noted; and also—although this is a matter of some difficulty—the thickness and weight of the lead pipes. Joints should be closely examined—those between lead pipes, which should be wiped and not bolted joints; and those between lead and iron pipes, which should be made by means of a brass ferrule.

The servants' water-closet, which in the older houses is usually found in the cellar, shows, as a rule, a sadly neglected state of affairs, being rendered foul from spillage, sloppage, leakage, and slovenliness in use, and also being utterly without means of ventilation. The fixture is, in most cases, a cheap and unsatisfactory

hopper-closet, with rough iron surface, rendered foul by an insufficient flush from a supply valve operated automatically by a depression of the seat, or by a pull-up arrangement which is often forgotten by servants. Sometimes the servants' closet is an equally objectionable pan-closet with feeble valve-flush.

The fixtures in the basement are the laundry tubs, the kitchen sink, and possibly a wash-basin. If the laundry tubs are of wood, they often emit a foul smell, due to absorption of organic matter and filth, and present a more or less rotten interior. The trap is usually too large, and probably half-choked with soap-suds and accumulation of sediment. It may not be protected against siphonage, loss of seal by momentum, or back-pressure. In other instances it is entirely absent. The joint of the lead waste-pipe with the main drain is often imperfectly made with putty or cement. Kitchen sinks in older houses are usually trapped by a bell-trap attached to the loose sink-strainer, which is either displaced or lost, thus allowing the free entrance of sewer-air. The kitchen sink often discharges into a large basement grease-trap choked with putrid fat, and always objectionable.

The parlor floor seldom contains any other fixtures than a pantry sink near the dining-room, with the usual defects relating to piping, trapping, and ventilation.

The bathroom requires careful search for defects. Not only is the water-closet usually of a bad construction, and defective in workmanship, with an ill-arranged seat, and no ventilation to the apartment, but the wash-basin and the bath-tub have each waste-pipes without traps near the fixtures, the wastes being trapped only by being run into the almost always foul water-closet trap. Besides having long lengths of slimy

and foul waste-pipes in direct communication with the room, both fixtures have hidden overflow channels; and, moreover, the almost universal dirty plug and chain arrangement is used. Water-closets situated in the centre of the house ought always to be looked upon with suspicion, unless plenty of ventilation is provided for by artificial means; and if they are fitted up with a "patent disinfecting apparatus," there is all the more reason for distrusting them. It is astonishing to see what a number of well-educated people commit the blunder of trusting to such worthless devices, which are nothing more than disguisers of the odor, or, at the best, mere stink destroyers. Instead of striking at the root of the evil, by removing a foul trap or defective water-closet, and by arranging the soil-pipe with a proper circulation of air, much money is uselessly thrown away in buying such "quack" remedies.

It is time that the public should know that, valuable as the sense of smell may be as an indication that something is wrong, it is not so much the smell which causes serious harm. Sewer air may be entirely deprived, by deodorizers or otherwise, of its characteristic odor, and yet be able to cause serious illness. It is far from me to underestimate the value of real disinfection in cases of infectious disease; but true disinfectants must *destroy* the organic impurities and germs of disease, and not merely disguise a bad smell.

What we need more than anything else in our homes, and in particular at our plumbing fixtures, is cleanliness and pure air. A daily application of hot water, soap, and a scrubbing-brush, a good flush, and plenty of ventilation, are quite sufficient to keep any water-closet or slop-hopper sweet under all ordinary circumstances. When a zymotic disease occurs in the house, or an epidemic rages in a city, then it is

time for disinfection by strong chemical disinfectants.

As a rule, the separation of the water-closet from the bath is desirable in city houses, unless there are a larger number of bath-rooms connected with dressing-rooms. This does not, however, necessarily imply that the bath and the water-closet should have separate vertical waste-pipes. They may discharge into the same soil-pipe, but preferably through independent outlets. A multiplication of water-closets or other fixtures is not, however, desirable, especially if they would not be constantly used.

Urinals are, as a rule, offensive and difficult to clean, and they should not be tolerated at all in private houses. Pan-closets, found even to-day in finer houses, with otherwise good plumbing-work, are generators of sewer air, and in every way an abomination. But, whatever the kind of apparatus used, it should be closely inspected, especially as regards the condition of the wood-work enclosing fixtures, and also as to leakage, trapping, and flushing. The flush should always be derived from a special water-closet cistern, and the inspector should ascertain if the overflow from this cistern is properly arranged. If the water-closet has a trap below the floor, its condition should be noted, and the joint at the floor inspected, which is often leaky, owing to the sagging of the trap. At other times the trap is found to have tipped to one side, thus causing the loss of the water-seal. Safe-pipes from water-closet trays are often found running into the trap of the closet, an arrangement as imperfect as it is dangerous.

On the upper floor of a house we often find a slop-sink, usually in a very foul condition, insufficiently trapped, and without ventilation to the usually dark

and stuffy closet in which it is placed. It is often overlooked by builders that slop-hoppers require a strong flush to keep the sides of the vessel clean, and that they should have a fixed strainer to prevent obstructions.

Of all the fixtures in a house, however, none demand a closer investigation than the "set" wash-basins, located, in city houses, between the front and rear bedrooms. Objectionable as such fixtures are in any case in sleeping-rooms, they are rendered still more so by the bad planning and arrangement of their waste-pipes. Their traps, usually of much too large calibre, and hence forming miniature cesspools, are easily siphoned, or rendered useless by evaporation or back-pressure, by tipping over, or loss of seal by capillary attraction, caused by hair or lint hanging over the bend of the trap. In older houses their waste-pipes are carried, with rare exceptions, almost horizontally across floors and halls to the soil-pipe, or into the water-closet trap. The space under the basins is tightly boxed up, or, if accessible, is used to hide away all sorts of used-up household articles; and the enclosed space sadly lacks ventilation. It is usually damp, full of dust, or even filthy. Moreover, the leaden tray or "safe," arranged to prevent damage to ceilings caused by leakage or accidental overflow, is provided with an untrapped "drip-pipe"; or, if the latter is trapped, the trap is rendered useless by evaporation. Particular care is necessary wherever such traps are so arranged as to be supplied by small feed-pipes. The latter often stop up through sediment, or fail to work from some cause or other, and hence should always be considered objectionable as giving a false sense of security. It is only in houses built within the last five years that we find drip-pipes entirely dis-

connected from the foul pipe-system of the house. Even then it is advisable to test such drip-pipes, as well as disconnected overflow pipes, by pouring water through them to ascertain their true course, and to locate the outlet of each of them; above all, to make sure against "dummy" pipes. Much the best plan is to do away entirely with safes and safe-wastes; for they form channels of communication between various parts of a house, and often carry offensive odors from the basement or kitchen into bedrooms or bathrooms.

I have not attempted to give an exhaustive list of defects in the drainage or in the plumbing, but have simply called attention to some of the graver mistakes frequently found in even the better class of houses. Amongst other not less serious defects which are frequently found, I may mention the following:

Broken drains;

Drains improperly laid, or without proper foundation, or with fall the wrong way;

Old cesspools under houses, forming a perfect gasometer for poisonous gases and noxious emanations;

Badly jointed pipes;

Choked pipes and traps;

Pipes obstructed by entrance of tree-roots;

Junctions made by cutting, roughly, holes into pipes;

Bends in drains made with straight pipes instead of with elbow-fittings,

Soil-pipes joined to the drain with T-branches instead of curves or Y-branches;

Traps placed at the foot of vertical soil or waste pipes;

Vent-pipes or soil-pipes run into flues, and often obstructed by soot;

Upper ends of soil-pipes stopping below the roof inside of the house;

Lower ends of soil-pipes broken off by drain settling;
House-drains not connected at all with the sewer;
Extensions of vent-pipes or soil-pipes through the roof, made with galvanized sheet-iron pipes and loose "slip" joints;
All kinds of by-passes in vented traps, whereby traps are rendered useless, and sewer air finds an exit into rooms;
Dummy vent-pipes;
Connections between ventilation pipes at the house side of traps, with soil or vent-pipes;
Soil-pipes terminating near, or on a level with, ventilating-shafts, chimney-flues, or below dormer windows;
Nails driven into lead soil or vent pipes;
Refrigerator wastes having a direct connection with a sewer or drain;
Iron soil-pipes full of sand-holes covered with tar or asphalt;
Split hubs in iron soil-pipes;
All kind of defective and fraudulent joints;
Traps placed at a distance from fixtures;
One trap only used for several fixtures;
The double trapping of fixtures;
Traps unsealed by tipping;
Reservoir and cesspool traps;
D-traps;
Gullies with bell-traps;
Untrapped overflow pipes;
Waste-pipes with fall the wrong way;
Connection of overflow and vent-pipes;
Sink-pipes choked with grease;
Leader pipes used to carry off foul wastes;
Untrapped leader pipes opening near upper windows;
Defective water-closet apparatus;

Concealed or secret waste or overflow arrangements; and water-tanks placed in improper places, for instance, in the same apartment with the slop-hopper.

It may here be remarked, that the popular notion that the so-called "sewer gas" is a specific gas is a fallacy; and the question often asked by people, how the presence of "sewer gas" may, by some easy test, be detected in a room, is absurd. It should be understood that there is no such thing as "sewer gas," and what is usually so called should more correctly be named sewer air, for it is simply air more or less contaminated by products of decomposition emanating from foul vessels or fixtures, from sink, waste, and soil pipes; or from house-drains, street-sewers, privy-vaults, or cesspools.

Sewer air, in other words, is an ever-varying mixture of gases; and of those that are deleterious the more prominent are sulphuretted hydrogen, sulphide of ammonium, and carburetted hydrogen; while ammonia, carbonic acid, and occasionally carbonic oxide derived from leakage of illuminating gas into sewers, are present in more or less large proportions. The effects caused by breathing such impure air are nausea, vomiting, a general feeling of discomfort, loss of appetite, sometimes blood-poisoning, and a reduced state of health, which renders the body more prone to attacks of zymotic disease.

The real danger consists in the dirt and dust, particles of organic matter, and living microscopic organisms (the germs of disease) floating in sewer air, and causing the outbreak or the spread of some preventable disease, such as diphtheria, typhoid fever, cholera, diseases of the bowels, etc. Though the sense of smell occasionally may afford a warning as to the presence of deleterious gases escaping through imperfect pipes and fixtures,

yet it should not be relied upon; for invisible poisons, frequently the most dangerous, are often present in our homes.

Inspection of the Water-supply.—The water-pipes, faucets, the kitchen-boiler, and the water-tank should all be included in the examination of the plumbing-work. See, first, whether the water-supply is constant on all floors of the house; and, should the pressure in the mains be insufficient, see if a cistern and a force-pump of some kind are provided. As to the water-pipes, observe if they are carelessly arranged, unprotected against freezing, or even buried in the wall, rendering it difficult to trace them throughout their whole course. Note if the water-pipes are run with a continuous grade, so that they may be completely emptied if desired. To accomplish this, there should be a stop and waste cock in the cellar, located near the point where the water-pipe enters the house.

Joints in water-pipes, if these are of lead, are often improperly made, and the pipes carelessly run without being well fastened to boards with metal tacks. Joints in brass or iron pipes are often leaky. The kitchen-boiler may also be leaky or patched up, showing that it has previously been bursted, owing probably to a defective arrangement of the hot-water supply system.

The tank in the attic requires particular consideration, as the water in it may easily be rendered foul by an overflow connection to a soil-pipe, or by drawing the flushing-water for water-closet valves directly from it, instead of using proper waste-preventing cisterns over each closet, these being in turn supplied from self-closing ball-cocks. A thick mud is frequently found at the bottom of drinking-water tanks: hence, such tanks should always be placed in a position where they are easily got at for cleaning and examination.

In all cases where water for drinking or cooking purposes must necessarily be drawn from the tank in the attic, this should be frequently emptied, and its bottom and sides scrubbed and cleaned. It is important to ascertain if a drinking-water tank is constructed of or lined with proper materials, such as tinned copper or slate, and not with lead or galvanized iron.

The supply to bath-tubs should always be over the top of the tub, and not by means of a mixing-valve at its bottom.

A plan of the house, drawn to scale, and showing in detail all the drains, soil and waste-pipes, service-pipes, stop-cocks, hand-holes, traps, etc., is always a great aid in making a sanitary house-inspection, but it is very seldom that it is available.

Inspection of the Method of Garbage Disposal.—Having completed the examination of the plumbing, drainage, and water-supply, the next point requiring attention is the proper removal of the solid house-refuse. This ought never to be attempted by aid of the sewers and drain-pipes. There should be two distinct receptacles—one for ashes only, and the other for kitchen offal and garbage. Much of the latter may be disposed of in a simple, yet efficient manner, by being dried and carbonated, and then burned in the kitchen range. Ashes and garbage ought to be removed from houses by entirely separate scavenger carts. Swill-pails, as well as ash-barrels, should not be of wood, but of galvanized iron, circular in shape, fitted with a well-closing cover, and they should be kept at all times most scrupulously clean.

Inspection of the Arrangements for Warming the House.—The next step in the inspection is to look into the arrangements for warming the house. Defective heating and ventilating arrangements may become the

cause of debility, nervousness, and general loss of strength and health, as well as of pulmonary diseases; and hence it is very important to inquire with care into this matter.

The heating-apparatus most usually found in city houses of moderate size is the warm-air furnace; in some cases we find a steam-heating or a hot-water apparatus used. All these are placed in the cellar of the house, in a central position. Local heating by stoves is common only in the smaller houses, or is adopted for minor rooms of larger houses. Openings are then provided into chimney-flues to receive the stove-pipe, leading smoke and gases of combustion from the stove into the chimney. Stoves, being usually a part of the movable furniture of a household, need not here be considered.

In the principal rooms of the better class of houses we also find an auxiliary heating-apparatus, namely, an open fire-place. The examination of these may be confined to the arrangement and size of the flues. It should be noted whether the fire-place is of the ordinary kind or one of the improved, so-called ventilating fire-places, in which case the channel for the admission of fresh air should be inspected.

Much more important is the detailed examination of the warm-air furnace in the cellar, or of the steam-boiler or hot-water apparatus. Note whether the furnace is portable or set in brickwork; whether constructed of wrought-iron, soapstone, cast-iron, or of a combination of wrought and cast iron. Measure the dimensions of the furnace to get at an approximate estimate of its available radiating surface. See to it that the furnace is of proper size, so as to heat the house comfortably without being at any time overheated, or delivering too hot air into the rooms. Care-

fully examine the joints of the furnace (the fewer there are the better), and see if they have not become untight, owing to contraction and expansion of the metal. Look for leaks in the furnace at other places than the joints, and observe the construction of the fire-pot, and whether it is lined properly with fire-brick; for such a lining does good service in preventing excessive overheating of the metal.

Next, take a look at the size and run of the smoke-pipe, and note the presence or absence of a check damper in it. See also if ample provision is made for the evaporation of water. A mixing arrangement for cold air from the air-chamber, and warm air to regulate at will the temperature of the air entering the rooms through the registers, is very desirable, but seldom applied to warm-air furnace apparatus. Above all, look for the cold-air box. Its absence is a cardinal defect in all central heating-apparatus, as it is positively objectionable to take the air-supply to the living and sleeping rooms from the cellar; for, except in houses where unusual care is taken to ventilate the latter properly, its atmosphere is a mixture of noxious emanations from a filthy cellar closet, of sewer air passing up from a dried-up gully-trap, assisted by the suction of the house chimneys, and possibly gases of decay emanating from rotten vegetables or forgotten house-refuse. If there is a cold-air box to the heating-apparatus, see of what material it consists, and how it is constructed and put together. Examine carefully for cracks or imperfect joints. Wooden air-boxes are not to be recommended on this account, they are besides dangerous on account of fire. If the cold-air channel is located below the cellar floor, it is advisable to open it to ascertain whether the channel is sufficient in size, smooth, and clean, and unobstructed, and kept

perfectly dry. If ground water is liable to rise to near the height of the channel, the cold air should preferably be admitted by a channel situated near the cellar ceiling. All air-boxes form convenient receptacles for dirt, insects, cobwebs, dust, and organic impurities, and hence ought to be made, if possible, accessible, so as to be cleaned from time to time. Most important of all is the opening of the cold-air box to the outer atmosphere. In city houses it is preferable to locate it at the rear of the house, in order to take the air from the yard, thereby avoiding the dust from the street. The opening should not be near the level of the ground, terminating at a cellar window; nor should it be near any ventilating-pipe for drains, near a yard gully or yard privy, or a cesspool; nor should the ash-barrel, dust-bin, or any accumulation of rubbish be allowed near it. It is preferable to have the inlet placed at least ten feet above the level of the yard; and its opening should always—and especially if only a few feet above the ground—be suitably protected by wire netting against entrance of cats, rats, mice, or vermin. Wherever the air is loaded with street dust or particles of soot or impurities, it may become necessary to filter the air by means of cotton wads placed at the entrance of the cold-air box. These, however, require frequent renewal, as they soon clog, and obstruct the free admission of air. It is advisable to have in the cold-air channel a movable slide to regulate the amount of air admitted to the furnace. The size of the channel should be ascertained, and also its proportion to the aggregate cross-sectional area of all hot-air pipes.

The hot-air flues should next be examined, their size and course, as well as their length and grade, noted; and it should be remembered that horizontal hot-air pipes should not generally exceed twelve to

fifteen feet in length. Since short lengths of horizontal pipes and vertical flues draw much better than long horizontal pipes to the first-floor registers, an even and nearly equal draught in all pipes should be established by means of valves or dampers, and by rightly proportioning the sizes of the various hot-air pipes and flues. Examine the position of the inlets for warm air in the room—whether located in the floor, in the wall near the bottom or near the ceiling, or at an intermediate height. The size and construction of the register boxes require attention; and wherever registers are placed in the floor, it is advisable to remove them, and to examine the interior of the hot-air pipe, which will usually be found to be far from clean. Hot-air flues opening in the floor are always objectionable, because much dirt and dust must of necessity fall into them. In all rooms heated by warm-air flues, look for and examine the outlets provided for removal of impure air; for no central heating-apparatus will work well unless both inlets as well as outlets are provided.

In the case of houses heated by low-pressure steam-heating apparatus, it is important to examine whether the heating is accomplished wholly or partly by direct radiation (that is, by having heating surfaces, pipe or box coils, placed in the rooms to be warmed); or by indirect radiation, in which case coils of pipe are placed at the cellar ceiling, as nearly as possible directly under the rooms to be warmed, and fresh aid led by cold-air boxes from the outside to such coils, where it is warmed to the requisite temperature. The latter is sometimes regulated by having a number of steam coils, into each of which steam may be turned, and which can be shut off in sections at pleasure by means of valves. From here the warmed air is delivered to

the rooms by means of hot-air flues in all respects similar to those used for furnace-heating.

Where radiators are placed in the rooms, steam-pipes must be carried to the upper floors, sometimes all over a house. The size and construction of the radiators, and of the pipes supplying them with steam, should in this case be examined; the coils should be free from dust; search ought to be made for leaky joints and valves, and particular attention paid to the question of fresh-air supply. If air is admitted from the outside, and warmed at the radiators, which are then usually placed in the window recesses, the system is the so-called direct-indirect radiation; and the channel for fresh air should be examined, its size noted, and its opening to the outer air inspected to make sure that it may not draw its supply from impure sources.

It is important, for sanitary reasons as well as for the sake of economy in the use of steam, to have all steam-pipes in the cellar properly covered with some good non-conducting material. This is, moreover, a very necessary precaution against fire in all cases where steam-pipes pass close to woodwork.

The close and detailed inspection of the steam-boiler is very important; but it is a matter requiring skill, knowledge of the mechanical construction of the apparatus, and experience in the use and application of steam and the combustion of fuel, and it is recommended to call in the aid of an expert in boiler-construction and boiler-management. This inspector should ascertain, by inspection and hammer test, that the boiler is properly constructed, that it has no weak place, and that it is kept in a good condition, free from corrosion, from incrustations, sediment, and dirt or other defects. If necessary, the boiler should be tested by forcing in water under a heavy pressure. It should

be noted if all joints and packings are tight; if the feeding-apparatus, if such is used, is in proper working order; if all trimmings and appendages are complete; especially if the gauge-cocks and glass gauges are working easily, and the steam-gauge and safety-valve are kept clean, and working regularly and easily. Examine all pipes and cocks with care, to ascertain that they are not in any way obstructed; examine also the draught-regulator, the fire-box, the grate and ash-pan, the smoke-flues and dampers,—all of which should be swept, or kept free from soot, slag, or ashes. Brass trimmings ought to be kept bright and polished.

No cotton-waste or oily rags should be kept about the boiler, as they may cause fire by spontaneous combustion. The floor and walls around the boiler ought to be kept neat and clean, and free from standing water. Persons living in a house fitted up with a steam-heating boiler should remember, that, to prevent accidents or danger to property and life, it is safest and best to have a *periodical* inspection of it made, at least once a year, to ascertain if the boiler may be used with safety. Particular care should be taken with steam-heating boilers, if they are put out of use during the spring and summer, to prevent corrosion of the boiler or any of its parts. This may be accomplished either by keeping the boiler filled with water, or, better still, by nearly filling it with water, then adding to it a few gallons of pure mineral oil so as to quite fill the boiler, and then drawing off the water, whereby all the interior surfaces of the boiler will come in contact with the oil. Thus oiled, the boiler should be kept perfectly dry and closed, until the fire is again started in the fall of the year.

Similar hints and cautions might be given with regard to hot-water apparatus: but inasmuch as this is not

usually adopted in city houses of the average size, although possessing some advantages over a steam-heating apparatus, the mere mention of the apparatus must suffice.

Inspection of the Gas-lighting Arrangements.—The next subject of inquiry should be the means provided for lighting the house with illuminating-gas. This is conveyed to the building under pressure, by a main gas-pipe, and distributed throughout the house by a network of small wrought-iron service-pipes, put together with screw-joints and suitable malleable-iron fittings. To get at an idea of the distribution of sizes of gas-pipes in a finished house is generally utterly impossible, owing to the universal habit of mechanics of burying all gas-pipes in walls, in partitions, and between floor joists. Yet the illumination of the house will to a great extent depend upon a proper arrangement of the pipe system, pipes of too small calibre being objectionable, and frequently choking up and causing the flow of gas to be perceptibly obstructed.

All pipes should be run with a slight continuous fall towards the meter, to avoid anywhere in the system a depression which would accumulate water, and cause the trapping of the pipes. Wherever a gas-pipe passes from a warm room into one of much colder temperature, it is a good practice to arrange a pocket with movable plug to enable the removal of water from condensation. As to the gas-meter, see if it is set perfectly level, and located in a cool place in the cellar; for changes of temperature cause a given quantity of gas to occupy a different space and hence affect the correct registering of the gas-meter. It is equally important to prevent the freezing up of the meter; as otherwise constant annoyances, and even serious trouble, may occur in winter-time. I may here remark,

that a gas-meter, measuring the volume of gas burned during a given time, is not, in reality, a just measuring apparatus by which to regulate the total cost of the gas consumed; for, strictly, the price of gas should be fixed according to its specific weight, and, above all, according to its candle power, or better yet, according to its heating power.

Quite frequently defects in the gas-piping, seams, flaws, or pin-holes in pipes, leaky joints, bad fittings, or defective gas-fixtures, exist in houses; and slight, and sometimes imperceptible, leakages, more commonly than most people would imagine, either at burners or at joints, contribute a share to the constantly going on contamination of the air in city houses. A slight and scarcely perceptible escape of gas is apt to cause a peculiar smell, quite unlike the well-known, strong, and pungent odor of coal-gas. Illuminating-gas contains a number of hurtful elements, especially carbonic oxide, and this to a higher degree where the gas supplied is water-gas enriched with naphtha, and the inhaling of such air, polluted by slight but constant leakage, is very injurious to health. If larger quantities of gas escape, and mix with the air in rooms, they bring with them the danger of explosions, not to mention the annoyance of exorbitant gas bills. When a decided smell of gas becomes apparent, or if a large leak is suspected anywhere, search should never be made for it with a lamp or candle, for this always invites the danger of a gas explosion. The first thing to do is to shut off the gas at the meter; then to open all windows, particularly the upper sash; and then to search for the leak. Gas-meters should never be inspected or examined after dark, by lighting a match or otherwise.

Before entering upon occupancy of a house, it is

well to have the gas-pipes and fixtures carefully tested. A very simple way of ascertaining if leakage of gas is going on is to make sure that no lights are burning, and to watch the small index-hand of the gas-meter for several succeeding hours. This can be readily done, even by laymen. Another method is to fix to a burner a water-gauge, a glass tube, with legs at least three inches long, bent in the shape of the letter U, half filled with water. The cock of the burner should be turned on, when the difference of water-level in both legs will indicate the pressure of gas in the pipes. The gas should then be turned off at the meter; and, if the water in the gauge now remains steady, the pipes and fittings are tight; but, should it slowly descend until it again stands level in both legs, there is a leak somewhere. Of course it is important to know that the main cock at the meter shuts perfectly tight, and this should be tested independently.

The best test of the gas-piping where no fixtures are hung is by means of a gas-fitter's pump and a mercury-gauge. To locate a leak, sulphuric ether is sometimes used; but as the sense of smell is inferior to the sense of sight, in exactly locating a leakage, it is better to apply soapsuds to the joints, when a leak will be readily indicated by soap-bubbles. In order to do this in a finished house, one must, of course, first locate the leak, at least approximately, so as to avoid the tearing up of too many floor-boards, or the cutting of plaster, or removal of expensive wall-papers.

Even with a perfectly tight system of gas-piping and gas-burners, the atmosphere is contaminated by the combustion of the gas. If this combustion be perfect, and the gas furnished perfectly purified, the products are only carbonic acid and water; and if, by ceiling ventilation and by the aid of the heat of the gas-flames,

the removal of both is provided for, no evil results may be apprehended. But, for various reasons, the combustion of gas-flames is usually quite incomplete, and the gas is often but imperfectly purified, and hence injurious gases, compounds of sulphur and of ammonia, besides carbonic oxide, escape into the room. This explains why so many complaints are often made as to the disadvantages of gas-lighting—amongst them that the air becomes loaded with noxious vapors, injurious to the human constitution; and that gaslight causes damage to books, pictures, furniture; and that the heat produced is out of all proportion to the illumination.

It should be borne in mind that the intensity of the light obtained depends not so much upon the quantity of gas consumed as upon the conditions under which it is burned. It is stated by good authorities, that, of all the gas passing a meter, from thirty to fifty per cent is not infrequently wasted by imperfect combustion. The chief causes of this waste are an excessive pressure at the burners, bad burners, and unsuitable arrangements of glass globes and fittings.

In inspecting a house it should therefore be noted if it is located on high ground; and, if possible, the pressure of gas on the house side of the meter should be ascertained. The greatest amount of light from a given quantity of gas would be obtained if the flow of gas at the burner and the flow of air to the flame be slow, regular, steady, and uniform; the pressure at the burner being moderate, and not exceeding six-tenths of an inch of water-pressure. If, on the other hand, gas rushes from the burner, generally with a whizzing noise, under a high pressure, it mixes quickly with the air, and passes in an unconsumed state into the room; the light is unsteady and flick-

ering; the flame jumps on account of unequal pressure; and the illumination is bad, because not all the carbon has time to become incandescent. The air-supply being insufficient, smoke is produced, and blackens ceilings or walls, and the air is contaminated. If a single flame is kept burning at night, the turning-off of a large number of flames in a district may suddenly increase the pressure at the burner so much that the flame jumps up very high, and may even set things on fire.

Since the pressure of gas in the mains necessarily varies much at different times, and is almost always, in cities, in excess of what is required for economical and efficient illumination, it is advisable to regulate it by pressure governors or regulators, placed at the house side of the gas-meter. Even if no other results would be accomplished, the prevention of frequent breakage of glass globes and the saving of gas are important considerations. From a sanitary point of view, the better illumination, and the prevention of air-contamination from unconsumed gas passing through the burners, are of course more important.

Next in importance to the regulation of the gas-pressure is the choice of burners of a suitable material, shape, and construction. The inspection should ascertain if the burners have metallic or lava tips; the former being objectionable, because they rapidly corrode, besides abstracting much heat from the flame, owing to metal being a good conductor. Lava tips, too, may become obstructed, and will thus cause a diminution of the illuminating power of the light. It should be ascertained what kind of burners are provided, whether single-jet, fish-tail, bat-wing, or incandescent burners. In the case of high flats, it may be advisable to use governor-burners in place of a governor

at the meter in the cellar. Finally, the size and shape of the glass globes should be noted, for globes with narrow opening at the base do not admit sufficient air at a low velocity to insure a steady flame and a good illumination.

Inspection of the Ventilation of the House.—Not the least important subject of inquiry is the ventilation of the house. The air in habitations is deteriorated (1) by a decrease in the amount of oxygen, by the breathing process of persons, and by artificial lighting; (2) by an increase of carbonic acid and watery vapor; (3) by an increase of offensive particles, liberated by cutaneous perspiration; (4) by inorganic dust from outside and from inside, ashes from heating-apparatus, etc.; (5) by vegetable and animal organic and mineral floating impurities; (6) by carbonic oxide from cracks and leaky joints of the heating-apparatus.

Constant admission of pure air, and removal of foul air, are important everywhere, but nowhere more so than in the bedrooms, bathrooms, water-closet, and slop-sink apartments; in the stair-case hall; in pantries, larders, store-closets, where often a faint and musty odor may be detected; in the closet for soiled linen; in the tank-room; in the laundry, where vapors of steam and soapsuds, mixed with particles of organic filth from soiled linen, contaminate the air; in the kitchen, where odors from cooking and the excessive heat of the range often render existence intolerable; and in the cellar, for cellar air is liable to rise and to pervade the whole house.

In questions of ventilation it is well to remember, that, to quote Charles Kingsley,—

"Those who habitually take in fresh breath will probably grow up large, strong, cheerful, active, clear-headed, fit for their work. Those who habitually take

in the breath which has been breathed out by themselves, or any other living creature, will certainly grow up, if they grow up at all, small, weak, nervous, depressed, unfit for work, and tempted continually to resort to stimulants, and become drunkards."

The unwholesomeness of house-air is not always indicated by offensive odors, since the deleterious elements of air possess neither a very decided nor always an unpleasant odor. It is well known that air which may carry with it fatal germs of disease may be entirely devoid of smell. Fire-places in the living rooms and the principal bed-rooms form a great aid in house ventilation, removing a large part of the air fouled by respiration and perspiration; and therefore the throats of fire-places should always be kept entirely open.

In inspecting a house it should be noted whether ceiling-ventilators are provided, which are desirable to remove the heated air contaminated by the combustion from gas-burners, as well as hot, foul air rising to the ceiling in case rooms are crowded with guests. Fresh air should be admitted in ample quantity during the cold months, in connection with the heating apparatus, either by means of cold-air chambers leading to the heating apparatus in the cellar, or by cold-air ducts leading to the warm-air chamber of the ventilating fire-place in the room, or to coils of hot water or steam-radiators in rooms. It is necessary to add a sufficient amount of moisture to air heated by furnaces, steam, or hot-water coils.

It is of much importance to note if the pure air admitted from outdoors is adequately and thoroughly distributed in gentle currents without creating dangerous draughts, and if it is properly diffused throughout the whole space of the apartments. Even with ample

provision for air-supply and foul-air removal, it sometimes happens that currents of pure air take a nearly straight course directly to the foul-air outlets, without being diffused in the space to be ventilated. It is well, therefore, to pay attention, in examining the ventilation of a building, to the probable movement of air-currents in rooms.

In the case of water-closet apartments, the provision for a well-drawing outlet-flue to remove gases is more important than a pure-air supply, which will readily flow in from halls or adjoining rooms. If necessary, recourse should be had to gas-burners arranged in outlet-flues. A kitchen must never be without a large ventilating-flue, and the cooking-range must have a suitable hood connected with it.

A detailed examination of the sufficiency of a system of ventilation should include the measurement of the cubic space available for each person, and of the total volume of air supplied to a room per hour; also the measurement of the sizes and positions of the inlet and outlet flues and registers. Besides this, it is necessary to note the temperature in various parts and heights of each room, to measure the degree of humidity of the air, and the purity of the air, not merely by the senses, although the indications given thereby are also valuable, but also by chemical and microscopical analysis. Such an extended investigation is, fortunately, seldom required in the case of private houses, but it is very important in the case of public buildings. The sense of smell affords a good indication of the amount of ventilation in a room, on entering it from out-doors; yet it cannot always be relied upon, and simple methods for determining the amount of carbonic-acid impurity are always preferable. Such tests are readily performed, and may be of

service, inasmuch as the carbonic-acid impurity, while not in itself an indication of danger in the amounts found present in rooms, is a valuable indicator of the organic impurities present in the air fouled by respiration.

A simple and handy apparatus for quickly making a qualitative test of the purity of air is the pocket apparatus designed by Professor Wolpert. It consists essentially of a glass test-tube with white bottom, and sighting-mark on the latter, and of an india-rubber bulb with glass tube attached, of a certain fixed capacity. The bulb is filled, by repeated squeezing, with air of the room; while the test-tube is filled, up to a certain index-mark, with clear lime-water. The glass tube of the rubber bulb is then inserted into the test-tube, and all the air squeezed out by a gentle pressure, and made to pass through the lime-water. This operation is repeated until a marked turbidity of the lime-water is apparent, and the sight-mark at the bottom of the test-tube disappears. The number of squeezes of the rubber bulb should be counted; and, by referring to a small printed table accompanying the instrument, the corresponding amount of carbonic-acid impurity in the air is readily ascertained. For instance, if fifty squeezes should be required, this would indicate the amount of carbonic acid to be 4 parts per 10,000 parts; in other words, the air would be about normal. If thirty squeezes are required, this corresponds to 6.6 parts of carbonic acid, or about the limit of allowable impurity in rooms. Twenty squeezes would indicate 10 parts carbonic acid per 10,000 volumes of air, and so on. The test is readily accomplished by anybody, and gives sufficiently accurate information to enable a person to judge of the character of the air in a room.

Let no householder who values the health of his

family underestimate the importance of house-ventilation. To the frequent question, "Why make all this fuss about ventilation? Our forefathers got on very well without it," Charles Kingsley, in his lecture, "The Two Breaths," answers:—

"Our ancestors did nothing of the kind. Our ancestors got on usually very ill in these matters; and when they got on well it was because they had good ventilation in spite of themselves. First, they got on very ill. To quote a few remarkable cases of longevity, or to tell that men were larger and stronger on the average in old times, is to yield to the old fallacy of fancying that savages were peculiarly healthy, because those who were seen were active and strong. The simple answer is, that the strong alone survived, while the majority died from the severity of training. Savages do not increase in number, and our ancestors increased but very slowly for many centuries. I am not going to disgust my audience with statistics of disease; but knowing something, as I happen to do, of the social state and of the health of the Middle Ages, I have no hesitation in saying that the average of disease and death was greater than it is now. Epidemics of many kinds—typhus, ague, plague, all diseases which were caused more or less by bad air—devastated this land and Europe in those days with a horrible intensity, to which even the choleras of our times are mild. The back streets, the hospitals, the jails, the barracks, the camps,—every place in which any large number of persons congregated,—were so many nests of pestilence engendered by uncleanliness, which defiled alike the water which was drunk and the air which was breathed. And as a single fact, of which the tables of insurance companies assure us, the average of human life in England has increased twenty-

five per cent since the reign of George I., owing simply to our more rational and cleanly habits of life.

"But secondly, I said, that when our ancestors got on well they did so because they got ventilation in spite of themselves. Luckily for them, their houses were ill-built, their doors and windows would not shut. They had lattice-windowed houses too, to live in; one of which, as I can testify from long experience, is as thoroughly ventilating as living in a lantern with the glass broken out. It was because their houses were full of draughts, and still more, in the early Middle Ages, because they had no glass, and stopped out the air only by a shutter at night, that they sought for shelter rather than for fresh air, of which they sometimes had too much; and, to escape the wind, built their houses in holes, such as that in which the old city of Winchester stands. Shelter, I believe, as much as the desire to be near fish in Lent, and to occupy the rich soil of the valleys, made the monks of old England choose the river-banks for the sites of their abbeys. They made a mistake therein, which, like most mistakes, did not go unpunished. These low situations, especially while the forests were yet thick on the hills around, were the perennial haunts of fever and ague, produced by subtle vegetable poisons, carried in the carbonic acid given off by rotten vegetation. So there again they fell in with man's old enemy, bad air. Still, as long as the doors and windows did not shut, some free circulation of air remained. But now our doors and windows shut only too tight. We have plate glass instead of lattices; and we have replaced the draughty and smoky, but really wholesome, open chimney, with its wide corners and settles, by narrow registers and even by stoves. We have done all we can, in fact, to seal ourselves up hermetically from

the outer air, and to breathe our own breaths over and over again; and we pay the penalty of it in a thousand ways unknown to our ancestors, through whose rooms all the winds of heaven whistled, and who were glad enough to shelter themselves from draughts in the sitting-room by the high screen round the fire, and in the sleeping-room by the thick curtains of the four-post bedstead, which is now rapidly disappearing before a higher civilization. We therefore absolutely require to make for ourselves the very ventilation which our ancestors tried to escape."

If the air in a house is defiled by bad odors, the trouble is usually ascribed to the drains; but it sometimes happens that such smells cannot be traced either to defective plumbing or to bad arrangement of the warm-air furnace, or to a leak in the gas-pipes. Decaying organic matters, particularly dead animals, either mice or rats hidden under floors, are at times found to be the cause of the trouble. Foul air is often found to make itself unpleasantly felt in places entirely remote from its source. It travels along rat-runs under cellar-floors, in the hollow spaces between floors and ceilings, behind wainscoting or paneling, along the air-spaces in hollow partitions, or in the hollow flues of furred brick walls. All such channels should be closed at each floor, to prevent not only the distribution of bad smells, but also to avoid a dangerous spreading of smoke and fire. Drip-pipes form another ready channel of communication between the remotest parts of the house. Speaking-tubes are likewise the cause of such trouble, and it is even said that the tubes enclosing bell-wires at times lead foul air from one floor to another. The search for the origin of such bad smells is often a puzzle, even to those experienced in such investigations.

Intimately connected with the subject of dwelling-house ventilation is the prevention of dirt and dust. Heavy flock-papers, hangings, portières, curtains, and carpets collect dust and absorb unhealthy impurities from the air. But they belong rather to the furnishing of a house; and, while it is possible and advisable to pay some attention to a healthful decoration and furniture of houses, it is a subject which does not properly come under sanitary house-inspection. The latter will have to deal only with whatever stationary or fixed furniture a house for sale or to rent contains.

It is not unusual to provide rooms with cupboards or wardrobes having sunken tops and moldings, on which a large amount of floating dust collects, and generally remains there for months, except so far as it is disturbed by draughts, whereby it is mixed with the atmosphere of the room, and helps to make it stuffy and unwholesome, or settles down upon the furniture of the room, and upon curtains, bedding, and carpets. There is a very simple and efficient way of preventing this by having all cupboards, wardrobes, or fixed bookcases, and buffets, carried up clear to the ceiling, and also quite down to the floor-line. This does not at all exclude a proper and artistical designing and construction of such fixed furniture. It is of great importance that some attention should be paid in every household to this matter.

Inspection of the Arrangements insuring Safety Against Fire.—Having finished the inspection of the important subjects of plumbing, drainage, heating, lighting, and ventilation, there is one other question which requires consideration, and that is the safety of a house from and the precautions taken in a house against fire.

As regards, first, the proper and safe construction

of a house, it is generally a matter of great difficulty to ascertain definitely facts bearing upon this point. In a stone or brick house the hollow spaces usually left between the wall and the furring act as flues, which will rapidly carry the flames from one floor to another. This may be prevented by closing the flues at each floor with bricks and mortar by so-called "fire-stops;" and in an inspection this point should not be overlooked. Interior hollow partition-walls may be similarly protected.

As far as possible, the construction of the chimneys should be inspected. Defective flues, cracks in the masonry of smoke-flues (allowing sparks to come in contact with the furring of chimneys), floor-joists built into the chimney, badly pargeted flues, or woodwork carried too near a flue, are often causes of fires in dwelling-houses. Note particularly whether the smoke-flue of the cooking-range has at least eight inches of brickwork.

The heating-apparatus is a frequent cause of fires and hence it should be closely inspected, not merely as regards its sanitary and mechanical features, but also as regards its safe arrangement. Smoke-flues for furnaces and steam-boilers should have at least a thickness of eight inches. It is best, however, to line them inside with round glazed earthen pipes. The hot-air flues and the smoke-pipe should never come into close contact with woodwork. See that there is at least six inches of space between any floor-joists, beams, or partition-studs and a hot-air flue, or the top of a hot-air furnace or a steam-boiler; and see whether all woodwork in closer contact with hot-air flues or steam-pipes is well protected by a lining of bright tin. It is preferable to have the cold-air box constructed of galvanized iron, to obviate all danger from fire in case the

movement of air-currents should be reversed, passing from the register down to the furnace, and out at the cold-air inlet. Care is required in the proper carrying of stove-pipes across and through partitions. Inspect, if possible, the method used in carrying vertical hot-air flues in wooden partitions. Here, too, all woodwork ought to be lined and protected by metal, and kept at a distance of at least three inches from the flues. Note if wire-lathing has been used in such places, for this adds greatly to the security of a house against conflagration. Observe if hot-air flues, in passing through floors or stud partitions, are incased by a large pipe-collar, and if the register-boxes are suitably set.

As to gas-fixtures, note if they are kept at a sufficient distance from all woodwork and from ceilings; and wherever bracket lights are used, see to it that they are at a safe distance from curtains, or any other combustible hangings or furniture.

Herewith I present a form of questions prepared by me, of which I have often made use in the sanitary examination of city houses.

Schedules for Sanitary Inspections of City Houses.

Report No..... Date .....

GENERAL NOTES.

Name of owner .....tenant.....
Address.....
Location of house—N. S. E. W. side of St. or Ave.
Number of stories .....
Extension .....Number of stories.
Size of lot.....sq. ft.....
Area of lot.....sq. ft.....

Size of house: front.....ft.
Extension .....
depth .....ft.
Number of floors .....
Area covered by house.....
Ratio of unoccupied space on lot .....
Material—stone, brick, frame.....
Erected about .....years ago.
Architect .....Builder .....
Valuation of house.....
Altered or overhauled in .....
Occupied as { private residence ..... / boarding-house ..... / tenement-house .....
Plumbing done by .....Cost $ .....
Number of persons in house.....Number of families .....
Has infectious disease occurred in house? .....

SURROUNDINGS

Site.....nature of soil, sand .....gravel.....
clay.....loam.....rock .....made ground .....
Elevation above mean sea-level .....
Old watercourses? .....
Site of former pond or swamp? .....
Sewered by connection with sewer in .....St. (Avenue)
Size and material of street sewer .....depth .....
Street or avenue, how wide?.....What kind of pavement?.....
Direction of street.....Grade of street? .....
Condition of pavement?.. .....
Size of yard.....width.....depth .....
Is yard paved? .....
Is yard drained? .....How many cesspools? .....
How are cesspools connected? .....
Where are leaders?.....in front.....in rear .....
How trapped? .....
Condition of yard? .....
Area and court drains? .....
Condition of street and gutters?.....
Are there high buildings adjoining or opposite (rear or front)?
Shade trees on street? .....
Is locality generally considered healthful? .....

Are there any yard closets? . . . . . .
What kind? . . . . . .
Any adjoining nuisance? . . . . . .
Any catch-basins? . . . . . .

WATER-SUPPLY

Water supplied from . . . . . .
Size of tap or connection at main . . . . . .
Size of service-pipe at front cellar wall . . . . . .
Is there a shut-off valve? . . . . . .
Is there a drip-cock to empty all house pipes? . . . . . .
Is there a water-meter? . . . . . .
Are pipes below cellar floor? . . . . . or along cellar ceiling? . . . .
Are pipes well supported, graded, and aligned? . . . . . .
Have pipes sagged? . . . . . .
Are water-pipes exposed to freezing? . . . . . .
Material of service-pipe? . . . . . .
Material of supply-pipes in house? . . . . . .
Is there a house-pump in cellar? . . . . . .
What kind? . . . . . .
Is there a house-tank? . . . . . .
Location? . . . . . .
Size? . . . . . Capacity? . . . . . .
Material? . . . . . .
Safe under tank? . . . . . .
How is tank supported? . . . . . .
Overflow-pipe runs where to? . . . . . Size . . . . . .
Emptying-pipe runs where to? . . . . . Size . . . . . .
Condition of tank? . . . . . .
How often cleaned? . . . . . .
Is there a general house filter? . . . . . .
What kind? . . . . . Size? . . . . . .
Capacity? . . . . . .
How is waste-pipe for filter run? . . . . . .
Is there a rain-water cistern? . . . . . .
How supplied? . . . . . .
Location? . . . . . .
Material? . . . . . .
Is it covered? . . . . . .
Where is rain-water used? . . . . . .
Is water filtered? . . . . . .

Is there a well on premises? .....
Location .....Depth .....
Material .....
Kind of well.....
Has water been analyzed?.....
Result of analysis of well-water? .....

CELLAR

General condition as to cleanliness? .....
Does cellar extend under entire house?.....
Height of cellar from floor to ceiling? .....
How far below sidewalk is ceiling? .....
Is cellar dry? .....damp? .....wet? .....
Is cellar floor concreted?.....cemented?.....
Asphalted? .....water-proofed? .....
Is floor drained? .....
Where is cellar cesspool located? .....
Is it efficiently trapped? .....
Is there a faucet to keep trap sealed? .....
Are there underground drains under floor? .....
What kind? tile.....stone.....brick.....
Size? .....How connected with sewer? .....
Is connection trapped?.....Are means provided for maintaining seal in trap? .....
By a leader connection? .....
How is cellar ventilated? .....
How is cellar lighted? .....Sunlight? .....
Are cellar windows accessible? .....
How are walls finished?...How often are they kalsomined?...
How is cellar ceiling finished?.....
Is it lathed and plastered?.....or fire-proofed?.....
Is there a plan of the system of plumbing of the cellar drains, etc.? .....
Is the main house sewer below the cellar floor? .....
If so, is it accessible by cleanouts?.....
Size? .....material?.....joints?.....
Is the main house sewer above the cellar floor? .....
If so, how supported? .....
Where does it run? .....
Size?.....material?.....joints? .....
How are the cleanouts closed? .....

Is there a main house-trap? .....
Size? .....location? .....cleanouts? .....
Manhole over same? .....
Has the trap a fresh-air inlet? .....
Where does it terminate? .....
What size? .....Is it free and clean or obstructed? .....
What protection against obstruction? .....
Note condition of main sewer by opening some cleanout .....
How is the flow of sewage? .....free? ....obstructed? ..
Is there a cellar water-closet? .....
Location? .....Kind of apparatus? .....
How lighted? .....How ventilated? .....
Condition? .....How flushed? .....
Is it encased in woodwork? .....
Are there other fixtures? .....
Sink .....location .....size .....material .....
How trapped? .....Used for what purpose? .....
Condition? .....
How many soil-pipes? .....Waste-pipes? .....
Leader connections? .....
Are connections T or Y connections? .....
Does the soil-pipe take roof-water? .....
House filter? .....
Hot-water tank? .....hot-water heater? .....
Heating-apparatus in cellar? .....furnace .....
Hot-water heater .....steam-boiler, direct or indirect system
What kind? .....Has the furnace a cold-air box? .....
Material of cold-air box? .....Joints? .....
Size? .....Opens where? .....Location of conduit ..
above or below cellar floor? .....
How far away from area cesspool? .....
Is cold-air inlet protected by wire netting? .....
How high above grade is it carried? .....
Condition of cold-air box or conduit? .....
Has furnace evaporating-pan? .....
Has it water-supply? .....
Condition of furnace? .....make .....size .....
Is iron pot cracked? .....
Is there a gas-supply? .....
Size of gas service? .....Material .....
Size of meter? .....Location .....
Is meter exposed to freezing? .....

Are there separate cellar gas-mains for lighting and for heating or cooking? . . . . . .
Are gas-pipes graded to meter? . . . . . .
Is any gas leak noticeable? . . . . . .
Are there signs of dampness in cellar? . . . . . .
Are foundation walls dry? . . . . . .
Is there a damp-proof course? . . . . . .
Are there any rat burrows? . . . . . .
Are there any openings into house sewer? . . . . . .
Do safe waste-pipes stop at cellar ceiling? . . . . . .
Do they run to cellar sink? . . . . . .
Are they protected with flap-valves? . . . . . .
Refrigerator waste-pipe discharges where? . . . . . .
At cellar sink? . . . . . .
Is it trapped? . . . . . Has it a flap-valve? . . . . . size? . . . . . .
Cleanouts? . . . . . Provisions for flushing? . . . . . .
Are leader traps exposed in cellar? . . . . . .
Are area, court or yard drain-traps exposed in cellar? . . . . . .
General remarks about cellar . . . . . .
Are there any ventilation flues? . . . . . .

BASEMENT

Is there an area around the basement? . . . . . .
Kitchen, on what side of house? . . . . . .
Kitchen range, what kind and make? . . . . . .
Open or brickset? . . . . . .
Is there a hood over range? . . . . . .
Ventilating register? . . . . . .
Is water-back iron or brass? . . . . . .
Box or pipe coil? . . . . . .
Has range a household garbage carbonator or cremator? . . . . . .
Kitchen sink, location? . . . . . .
Material? . . . . . Size? . . . . . .
Drain-board . . . . . .
Grease-trap? . . . . . Strainer? . . . . . .
Size of water-pipe? . . . . . Trap? . . . . . Is it vented? . . . . . .
Faucets? . . . . . Kitchen slop-sink? . . . . . Kitchen boiler?
Location? . . . . . size? . . . . . material? . . . . . .
Emptying-pipe for boiler runs where to? . . . . . .
Is boiler of sufficient size? . . . . . .
Does it become overheated? . . . . . .

Laundry, what side of house?.....
Laundry tubs, number of?.....material?.....
Covers?.....
Waste-pipe, size.....How trapped?.....
material?.....
How many traps?.....Is trap vented?.....
Laundry boiler?.....material?.....size?.....
Cross-connections?.....
Laundry heater, style and make?.....
Has it water back?.....
Other sinks?.....
Other plumbing fixtures?.....
Servants' water-closet.....Location.....
Kind of apparatus.....
Refrigerator, is it stationary or movable?.....
Does it drip into pan?.....
Is there a lead or marble safe with strainer?.....
Size of waste-pipe?.....Where does it discharge?.....
Is it disconnected from soil- or drain-pipe?.....
Garbage-can, where kept?.....
Ashes, how and where kept?.....
Are ashes and garbage kept separately?.....
Material?.....cover?.....condition?.....
How often is garbage removed?.....

GROUND OR FIRST FLOOR

Toilet-room.....Location.....
Size of room?.....How lighted?.....
How ventilated?.....
Floor.....Walls.....
Number of fixtures?.....
Water-closet, what kind?.....
Flush?.....Is closet noiseless?.....
Open or enclosed?.....
Marble or tile platform?.....
Ventilated how?.....Is there any disinfecting apparatus?...
Urinal, what kind?.....
How flushed?.....
How trapped?.....
Open or enclosed?.....
Ventilated how?.....

Wash-basin, what material? .....
What make and style of bowl? .....
Overflow? ..... Waste? ..... Chain and plug? .....
Waste-valve? .....
Hot and cold water? .....
What size waste-pipe? ..... material? .....
How trapped? ..... Is trap vented or a non-siphoning trap? .....
Open or enclosed? .....
Butler's pantry, location of .....
Sinks, number of .....
Material ..... Size? .....
How trapped? ..... Size of waste-pipe .....
What kind of faucet? .....
Plate-warmer ..... how heated? .....
Pantry refrigerator, location of? ..... size? ..... how drained?
Pantry sink filter, what kind? .....
Conservatory? .....
Fountain ? .....
Other fixtures? .....
General Remarks: .....

SECOND FLOOR

Bath-rooms, how many? ..... How many bedroom baths? ..
How many hall bath-rooms? .....
Location, in centre of house? .....
in rear hallrooms? .....
in extensions? .....
Are water-closet compartments separate from bathrooms? ....
Bath-room No. 1: How lighted? ..... How ventilated? .... How heated? .....
Floor? .....
Walls? .....
Size? .....
Number of fixtures? .....
Bath-room No. 2: How lighted? ..... How ventilated? ... How heated? .....
Floor? .....
Walls? .....
Size .....
Number of fixtures? .....

Bath-room No. 3: How lighted? .....How ventilated?....How heated? .....
Floor? .....
Walls? .....
Size? .....
Number of fixtures? .....
Bath-room No. 4: How lighted? ....How ventilated? ....How heated? .....
Floor? .....
Walls? .....
Size? .....
Number of fixtures? .....
Water-closets, kind and make? .....
How flushed? .....Size of flush-pipe? .....
Flushing-cistern?....size?....material?....location? .....
Marble floor platforms? .....
Safe waste? .....
Open or enclosed? .....
Open or framed seat?.....Lid? .....
Bidet attachment? .....
Is there a disinfecting attachment? .....
Bathtubs, kind and make? .....
Material?.....Shape?.....Set on legs?.....Set in floor?
Roll rim? .....Wooden rim? .....
How does its waste run?.....size?.....material? .....
How is waste trapped? .....Is there a cleanout .....
Style of faucets? .....
Top or bottom (bell) supply? .....
Shower attachment?.....Hand spray? .....
Marble platform? .....Wooden floor? .....
Linoleum? .....Safe waste? .....
Wash-basins, style and make? .....
Marble slab? .....size? .....thickness? .....
Glazed porcelain slab? .....
How supported? .....
What style bowl?.....size? .....
What style waste? .....
Waste-pipe, material? .....size?.....
How trapped? .....
What style faucets? .....Safe waste? .....
General Remarks: .....
Floor? .....Wall?.....

Bidet? .....Floor? .....
Hip or Sitz bath?.....
Shower-bath?.....
Shower- and needle-bath? .....
Other fixtures on this floor? .....
Housemaid's slop-sink? .....location?.....kind? .....
Has it flushing-cistern?.....size?.....material?.....
Size of flush-pipe? .....
Size of trap?.....How vented? .....
Marble floor slab? .....
General conditions? .....
Ventilation of compartment? .....
Bedroom wash-basins, how many? .....
Location? .....Condition? .....Trapping? .....
Separate waste lines? .....
Lead or marble safes? .....Faucets? .....

THIRD FLOOR

Bath-rooms, how many?.....How many bedroom baths? ...
How many hall baths? .....
Location, in centre of house? .....
in rear hallroom .....
in extension? .....
(Same schedule as for second floor.)

FOURTH FLOOR OR ATTIC

Bath-rooms, how many? .....
Servants' bath-room .. ..
(Same schedule as for second floor.)
Housemaid's slop-sinks. .....
(Same as for second floor.)
House tank, location of.....how supported? .....
Material? .....size?. .....
Safe under? .....Waste runs where? .....
Tank overflow-pipe runs where?.....size? .....
Tank emptying-pipe runs where? .....size .....
Cover?.....Ventilation? .....
How supplied?....By pumping?.....By filling at night?....
Automatic float attachment? .....
Is there a scuttle over tank?.....

ROOF

Kind of roof covering? Tin?.....Copper?.....Shingle?....
Slate?.....Tar and gravel?.....
Slopes whereto?.....
Is there a parapet wall?.....
Is roof tight?.....
Gutter?..... Leaders? .....How many?.....
Protected by strainers?.....Inside leaders?.....
Outside leaders?.....
Ventilating skylights, how many?.....
Where located?.....
Material?.....
Size?.....
Number of plumbing pipes on roof?.....
Sizes?.....Wire baskets?.....Return bends?.....
Vent caps?.....Open outlets?.....
How high are pipes carried?.....
Location of pipes?.....
Do they terminate near ventilating skylights?.....
Near flues?.....
Near water-tank?.....
Roof-tanks?..... Number?.....
Location?.....How supported?.....
Material?.....size?.....
Overflow-pipes, runs where?.....size?.....
Emptying-pipe?.....
Are pipes at tank frost-proofed?.....

Summary of Number and Kind of Plumbing Fixtures in House

Water-closets	Nursery sink
Urinals	Other sinks
Bidets	Wash-basins
Slop-sinks	Bathtubs
Kitchen sink	Special baths
Pantry sink	Tanks
Cellar sink	Boilers
Housemaid's sink	Pumps

TEST OF PLUMBING

What test applied? Smoke test?.....Peppermint test?.....
Combined test?.....Where from?.....
Result of test?.....
Leaks, location of.....
Principal sanitary defects found.....

SUMMARY OF SANITARY CONDITION OF HOUSE

Sanitary condition—excellent
good
fair
not good
bad
very bad
Remarks about smells?.....

SUMMARY OF NOTES TAKEN AT INSPECTION

House sewer: Size?.....
Material?.....
Joints?.....
Trapping?.....
Location....manholes and cleanouts....fall....
Fresh-air inlet: Size?.....
Position, relative to windows or cold-air boxes to heating-apparatus?.....
Branch drain-pipes: Sizes?.....
Material?.....
Joints?.....
How laid?.....
Rain-water drains?.....
Leaders: Number outside leaders?.....
" inside leaders?.....
trapping?.....
Soil-pipes: Number.....
Material?.....
Location?.....
Trapped at foot?.....
Ventilated at top?.....
Position of mouth on roof in reference to windows, chimneys, skylight flues;.....
joints, condition of?.....

Waste-pipes: Number? .....
Material? .....Location? .....
Trapped at foot? .....
Ventilated at top?.....Enlarged? .....
Position of mouth on roof in reference to windows, chimneys, skylight flues? .....
Joints, condition of? .....
Vent-pipes: Number .....
Material? .....
Location? .....
Trapped at foot? .....
Ventilated at top?.....Enlarged? .....
Position of mouth on roof in reference to windows, chimneys, skylight flues? .....
Joints, condition of? .....
Water-closets: Type and make? .....
Flush? .....
Condition? .....
Discharges? .....
Separate cistern? .....
Overflow of cistern?.....
Lead safe? .....Marble platform? .....
Urinals: Shape, type, and make? .....
How flushed? .....
How trapped? .....
How discharged.....waste.....size?.....
Position? .....
Condition? .....
Slophoppers: Type and make? .....
Flush? .....
Condition? .....
Discharge? .....
Separate cisterns?.....
Overflow of cistern? .....
Lead safe? .....Marble platform? .....
Lavatories: Type and make of lavatory? .....
Material? .....Style of waste? .....
How trapped? .....
How is overflow trapped? .....
Is overflow accessible for cleaning? .....
Size of waste and trap? .....
Condition? .....

Baths: Same as lavatories.
Sinks: Same as lavatories.
Water-supply: Street main? .....
Well? .....
Cistern and material .....Position? .....
Covered? .....Overflow? .....
Filter? .....Type? .....size? .....
Gas-supply: Condition? .....Size of gas-service? .....
Meter? .....size? .....location? .....
Ventilation of rooms with plumbing.....
Ventilation of water-closet apartments.....
Result of tests applied.....
Result of sanitary inspection.....

Additional Questions for Schedule of House Inspections

(Applicable to both City and Country Houses.)

STRUCTURAL DETAILS

What are the chief materials used in the construction of the house? .....
How are the floors finished? .....
Single or double wooden boards? . . .Hardwood floor or parquet?
Tiling? .....Oil-painted? .....Covered with carpets? . . .
Covered with loose rugs? .....Linoleum floor-covering? . .
Rubber tile floor? .....
How are the walls finished? .....
Papered? .....Oil-painted? .....Tiled? .....
Wood wainscoting? .....Marble wainscot? .....
Are there any dust-catching projections, cornices, picture rails? .....
Are there hangings and draperies? .....
Inside blinds or outside shutters? .....
How many bedrooms? .....
What is their size? .....their height? .....
How many outside windows do they have? .....
How are the bedrooms ventilated? .....
How are floors of bedrooms finished? .....
Are the dress-closets ventilated? .....
How are pantries and store-rooms ventilated? .....
What is the floor in the kitchen? .....
Is staircase hall ventilated? .....How? .....

Is it well lighted? .....
Are there any basement bedrooms? .....
Are there inside bedrooms with only a skylight for ventilation? ..

SAFETY FROM FIRE

Is the house safely constructed as regards danger from fire? ....
Are there any fire-stops? .....
Are there any defective flues? .....
Are smoke-flues lined with fire-brick? .....
Is the smoke-flue kept sufficiently away from woodwork? .....
Is the cold-air box of heating apparatus of iron? .....
Are gas-brackets kept away from windows, doors, and curtains?
Do all chimney-flues draw well? .....
Is the roof ladder kept unobstructed? .....

WARMING

How is the house warmed? .....
  By stoves? .....
  By fireplace heaters? .....
  By furnaces? .....
  By direct steam heat? .....
  By direct hot-water radiation? .....
  By indirect steam-heating? .....
  By indirect hot-water heating? .....
  By combination systems? .....
Are there fireplaces in the principal rooms? .....
  Are these arranged for coal, wood, or gas fires? .....
  Is there an efficient vent-flue? .....
  Are the fireplaces so-called ventilating fireplaces? .....
Is the furnace portable or brick set? .....
  What make of furnace? .....
  Size of furnace? .....
  Size of firepot? .....
  Is firepot lined with fire-brick? .....
  Are the joints of the furnace air-tight? .....
  What is the size of the furnace smoke-pipe? .....
  Is there a damper in the smoke-pipe? .....
  Is an automatic draft-regulator used? .....
  Is there a water-evaporating pan for furnace? .....

What is the size of the cold-air box?.....
What is material of cold-air box?.....
Is it above or below the floor?.....
Where does the cold-air box terminate?.....
How is it finished?.....
Is the air-supply washed or filtered?.....
Where are the warm-air registers placed in rooms?.....
In walls?.....In floors?.....
Are the register boxes and hot-air pipes kept clean?.....
Are they ever disinfected?.....
Size and make of steam or hot-water boiler?.....
Is the boiler high or low pressure?.....
Is the steam-boiler examined and tested annually?.....
Is it in good condition?.....
Is it free from corrosion or sediment?.....
Are the gauge cocks and glass gauges in working order?.....
Is there a draught regulator?.....

GAS-LIGHTING

What is the size of the gas-service?.....
What is the size or capacity of the gas-meter?.....
Where is the gas-meter located?.....
Is it exposed to freezing?.....
Are the gas-pipes run with fall to the gas-meter?.....
What is the material for the house gas-pipes?.....
Are there any gas leaks noticeable in the cellar or elsewhere?...
Is there a gas-pressure regulator?.....
Is the gas-piping tight as per indications of the small index-hand of the meter?.....
Is gas used for cooking?.....
Is gas used for heating the water?.....
What kind of apparatus is used?.....
Is gas used for heating?.....
In what kind of appliance?.....
Is there an excessive gas pressure at the burners?.....
What kind of gas-burners are used?
Fish-tail?.....
Batwing?.....
Argand?.....
Incandescent?.....
Are all gas-cocks provided with well-fastened pin-stops?.....

VENTILATION

Is there a supply of fresh air to every part of the house? .....
How are the bedrooms ventilated? .....
How are the bath-rooms ventilated? .....
How are closets ventilated? .....
How is the staircase ventilated? .....
Is the kitchen well ventilated? .....
Are pantry and laundry ventilated? .....
Are there any bad odors? .....any musty smells .....
Are there any outlets for foul air in living rooms? .....
If so, where are they placed? .....
Are there any ceiling ventilators? .....
What is the average temperature at which rooms are kept in winter? .....
Are there cooking odors in any part of the house other than in the kitchen? .....

GARBAGE AND ASHES

Are garbage and ashes kept in separate receptacles? .....
How often are they removed? .....
Are the receptacles covered? ..... Are the covers metallic? .....
Are the receptacles water-tight? .....

See also "The Sanitary Survey of a House." By Wm. K. Newton, M.D., in Vol. X (1885) of the Reports of American Public Health Association.

The schedule given above is a very complete one for the inspection of the sanitary condition of a single house. In many cases, however, the object of the sanitary inspection is a broader one, embracing an entire block of houses, or even an entire city district, as would be the case, for instance, in house surveys made when an epidemic threatens (see "Sanitary Surveys of Cities"). In such cases a more compact and more condensed schedule of questions is preferable.

The following directions are taken from an excellent work on "Sanitary House Inspection," by Jensen:

"After a preliminary inspection of the house and its surroundings begin the inspection proper in the cellar.

"In cellar, note the following matters:—Main drain, intercepting trap—size, water-seal, handholes. Material of cellar floor: Concrete, cement, asphalt, non-porous slabs of stone, or tiles in cement.

"In upper floors examine water-closets, baths, basins, sinks. Note type and make, condition, mode of setting, trapping, waste, and vent connections. Test flush of closets and slop-hoppers. Note type of flushing cisterns, whether valve, siphon, automatic; note lining of cisterns. Examine the floor under the closets. Casing or open? Safe-tray? Safe waste-pipe?

"Examine overflows of basins and bath-tubs; also waste-pipes.

"Note kind and size of traps used.

"Look into water cisterns or house-tanks; are they protected against heat or frost? Is there a cover to keep out the dirt or dust? Vermin? Where does the overflow go to?

"Examine for possible sources of pollution of the drinking-water?

"Take sample of the water for analysis. Examine house-filters, if any.

"Examine for defective gas-piping and fittings. Test gas piping.

"Expose and open up all outside drains; trace their course. Test outside drains by the smoke test. Examine the intercepting trap.

"Note construction of drains, size, material, condition, arrangement, fall, joints. Examine all junctions and connections of soil and waste-pipes. Examine joints near trees. Inspect outside grease traps. Look for rain-water cistern; note size, capacity, position, con-

struction, overflow; rain-water pipes. Are they used as drain-ventilators?

"Soil, waste, and vent-pipes: Note size, material, joints, and supports. Look for fresh-air inlet to house-trap.

"Examine sewer outlet: In city houses to street sewer connection; in country houses to cesspool, or sewage disposal works, or to sewage field.

"Examine privies and ash-pits; note distance from house and construction.

"Inspect the water-supply of house: If from well, look for possible source of pollution. See if shallow, deep, dug, driven or drilled well.

"**Testing.**—After the inspection comes the testing of the drainage system. If the inspection has shown that there are serious defects, testing is not really necessary. If, on the other hand, the inspection is satisfactory, then apply the smoke test. No water should be discharged during the test, as this would condense the smoke. It also retards the test. In testing, do not close the openings of roof-pipes until after the smoke has been seen to issue from the mouth of the pipes. Apply the test preferably outside of the house; close all windows and doors. Note all results of the smoke test, the positive as well as the negative. Apply the hydrostatic test or use the olfactory test, or else a pneumatic test.

"**Notes of Inspection and Tests.**—All notes on the test and inspection should be brief, but complete, clear, and intelligible. The notes should form an aid to the memory. Work systematically and uniformly in the inspection, so as not to overlook a single item. Make notes about each fixture as complete as possible. Make, if possible, a sketch plan of the house and the drains."

The following is a brief schedule for inspections devised by a British architect, Mr. Fletcher.

1. Nature of site and soil.....
2. Description of house and aspect: points of compass.....
   Number of stories..... Number of rooms.....
   Nature of adjoining properties.....
3. Nature of materials used.....
   Damp-proof course?.....
   Walls damp?.....
   Floors, dry rot?.....
   Roof, roof covering?.....
4. Means of heating and ventilation.....
   Window area in proportion to floor space? .....
   Proximity of high buildings?.....
5. Water-supply .....
   Source? .....
   Supply constant or intermittent? .....
   Character of pipes? .....
   Means of storage?.....Material of tank?.....
   Filters?.....
6. Sewerage and drainage.....
   Course of drains to be traced?.....
   Sizes?.....Intercepting trap?.....
   Number of drain-pipe lines?.....
   Joints, how made? ....
   Means of access? .....
   Drain tests: olfactory test; smoke test; hydrostatic test; mirror test; pneumatic test. .....
7. Plumbing and fittings.....
   Fixtures, what kind and style?.....
   How trapped?.....
8. Lighting.....
   Gas escapes? .....
9. Method of disposal of refuse?.....
   How often collected?.....how stored?....where? .....
10. Alterations and repairs.....

The following short schedule for notes on sanitary house inspections is taken from *Stockman,* Sanitary Inspection:

Date.....House inspected.....Owner.....
Address.....Occupier.....

Water-supply.....Cistern.....Upper water-closet.....
Lower water-closet.....Drain and soil-pipe.....
Drain ventilation.....Dust bin.....Stack-pipes..
.....Bath and lavatory wastes.....Area around
house.....General condition of premises.....
Cleanliness.....Repairs.....Dampness.....Over-
crowding.....
Remarks: .....
State of walls and ceilings.....Dampness.....Roof.....
Gutters.....Leaders.....Ventilation.....Light
.....Drainage.....Water-closets.....Earth-
closet.....privies.....
Drinking-water cisterns .....
Back yard.....Dust bin.....
State of repair .....

Inspection of Apartment-houses

Within the last twenty-five years a new class of buildings has sprung up in some of our largest cities, in New York City perhaps more than anywhere else, chiefly owing to the increased value of real estate in many parts of the city. These buildings are planned and built so that a larger number of families occupies the different floors of the same house. While such so-called "French flats" or apartment-houses, cannot well be considered as "homes" in the true meaning of the word, yet they are often chosen by many in preference to houses; indeed, many people of small means, the upper forty thousand—to borrow an expression from Mrs. H. M. Plunkett's "Household Sanitation"—are from sheer necessity, owing to the high rates of house-rent, obliged in the largest cities to live in them, if they desire to remain at all in the city.

It is difficult to say any words of praise about them from a health point of view. Even the best of such structures, in the writer's opinion, are but poor apologies for a home. They are often overcrowded, generally ill-ventilated, and have little of the privacy which even the smallest rural cottage affords. The light and air shafts, the staircase halls, the dumb-waiters, but especially the waste-pipes, unless of a superior character of workmanship, would seem to offer increased dangers to health, and to afford ready channels for the spread of zymotic diseases.

In view of the possibility of an outbreak of fire, it is particularly dangerous to live on the uppermost floors, which are not easily reached by the streams of fire-engines. Add to this the well-known fact, that of all the apartment-houses advertised and rented as "fire-

proof," but very few structures are actually built with any regard towards safety, and so as to confine a conflagration to the apartment in which it originates; that, on the contrary, the ventilating shafts, staircase, elevator and dumbwaiter shafts, form the readiest means of spreading a fire with rapidity from the basement to the roof; while the not infrequent, but much to be condemned, construction of a stairway surrounding the elevator, and inclosed in the same shaft with it, entirely cuts off the principal means of escape, by smoke, even when the flames do not reach the shaft.

There are other reasons, however, why flats, and in particular the tall structures having more than five stories, are objectionable. They exclude to a great extent light and air from the streets below and from the adjacent houses. The interior of city houses, already dark in many cases, owing to the inconvenient subdivision of the city lots, is rendered still more gloomy and unhealthy by these lofty structures; and on the other hand, the street is kept continually damp, and deprived of the greatest means of purification—sunlight and pure-air currents. There is also danger to life, as well as to the structures of adjacent property, from the falling of high walls in case of a fire. Hence, a due regard for the equal rights of property-holders calls for a decided condemnation of an unlimited height of apartment-houses.

But, even if apartment-houses are properly limited to a height equal to about the width of the street, the system as a whole ought to be condemned, as being opposed to all domestic interests; as endangering, in many cases, the domestic peace and happiness; as robbing the sense and feeling of privacy in a house; as rendering the education of children more difficult, and as weakening, more or less, the feeling of domestic

comfort and the family ties. Rooms in flats are seldom arranged with any regard to privacy for the members of a household, nor so that the noise of one tenant may not seriously inconvenience and disturb the peace of mind of his more quiet neighbors. Aside from such moral and social dangers, there are dangers to health which ought not to be disregarded. It is quite obvious, and needs scarcely a further explanation, that, in a building containing many people crowded together upon a small area, the air is more easily befouled than in houses occupied by only a single household. In flats, one family must sometimes undergo discomforts, or even sufferings, owing to the unsanitary condition of the rooms of other people in the building. Ventilation is most imperfect or entirely lacking, and tainted air readily passes from one floor to an adjoining or an upper floor. In case of a sudden outbreak of typhoid fever, cholera, scarlet fever, diphtheria, or measles, isolation is quite difficult; and the disease is much more easily spread from one person to another, or from one household to another, particularly if carelessness or negligence prevails.

Our remarks refer particularly to American apartments; for, although flats are also common in European cities, they are never to be found there with dark and unhealthy bedrooms, the back windows always being located around a large court or even garden, with ornamental shrubbery, and possibly a decorative fountain.

In the sanitary inspection of apartment-houses, all the hints given with regard to city houses should be borne in mind and observed, as well as much of what will be said in the following about light and ventilation shafts in connection with tenement-houses.

Inspection of Tenement Houses

From the apartment-house to the tenement-house it is but a gradual step, in fact, the building law makes no distinction between the one and the other. Although what is true of the former holds good to even a greater extent of the latter, yet tenement-houses constitute, and will continue to do so, for many workingmen the only places in cities which they can choose to live in—chiefly because of the necessity of living near their factories or working places. While I do not propose to speak at length about the necessity of tenement-house inspection, and improvement of the construction and condition of such structures, a few hints on the subject will not be out of place.

The inquiry should embrace the following main points, viz., general construction, light and air, floor and cubic space, general cleanliness, freedom from dampness, drainage, condition of cellars, garbage removal, water-supply, heating and ventilation, and personal safety.

See whether the tenement is single or double; note the number of floors, and number of families on each floor, also the number of people constituting each family. Ascertain, if possible, when the building was erected, and look at the general appearance of the house-front; also note the kind of materials used in construction. Measure the width and depth of the main building, as well as the size of the lot; and note the percentage of the lot covered, also the distance from rear buildings.

Note whether the basement rooms are occupied as living or sleeping rooms, whether any animals are kept on the premises, and whether any trade or business is carried on in the rooms. If this is the case, it is

proper to inquire carefully into the kind of manufacturing process carried on, into the raw materials used, and into the inoffensiveness of the products manufactured. Examine with care the condition of the cellar, especially as regards dampness, drainage, condition of walls, light, air, and what use is made of the cellar. Look also for water-closets in the cellar.

In going up-stairs, observe the state of cleanliness of entries, passages, stairs, and halls; and see if they are sufficiently lighted in daytime, and how they are lighted at night, and what means, if any, are provided for ventilating the halls. Examine particularly the means for lighting and ventilating all inside rooms. Measure the dimensions of each room; note its cubic contents, its clear height, and the amount of window surface, especially of bedrooms. Measure the sizes and areas of all light and air shafts, and see if indoor water-closets have special shafts carried to the roof, which ought not to be used to ventilate any living rooms. See if all these air-shafts have proper communication with the outer air at the top as well as at the bottom.

Examine the roof as to construction and material, and see if it is kept in good repair, and gutters and leaders in proper condition, and unobstructed. Note also the appearance of the chimney-tops above the roof; and observe if all soil and waste-pipes are carried at least four inches in diameter well above the roof, preferably to such a height that mischievous persons cannot cause their obstruction. Notice also whether the outlets are large and free, or whether they have the objectionable return-bend, or a ventilating-cap.

Observe, next, if the tenement has properly constructed fire-escapes; if the stairs are well constructed,

and provided with strong railings; and if the roof can be conveniently reached. Examine the provisions made for an ample supply of water on each floor. Note the condition of faucets, pumps, hydrants, and fixtures. Where water does not rise to the upper floors in day time, see if a tank and force-pump are duly provided and duly operated. Observe the construction, material, and condition of the tank, and look to the disposal of its overflow-pipe.

Examine all the plumbing carefully and thoroughly; above all, the construction and condition of the water-closets, the efficient trapping of the sinks and wash-tubs in the kitchens or living-rooms and the proper ventilation of the apartments where plumbing-fixtures are located. Consider also the arrangements for heating and ventilating the rooms. Examine the rear yard as to cleanliness, paving, drainage, freedom from odors; and if there are privy-vaults or school-sinks, observe if they are not full and overflowing, but kept in good order, neat, and unobjectionable in every respect. Finally, inquire into the proper garbage removal by separate closed receptacles, one intended for ashes and the other for the kitchen refuse.

Below I give, first, a brief schedule for tenement-house inspections, and second and third, more complete schedules, such as were in use by the first and the second New York State Tenement House Commissions. A very excellent schedule for inspections of tenement-houses may also be found in Dr. George M. Price's "Handbook of Sanitation," published by John Wiley & Sons.

Schedule for Sanitary Inspection of Tenement-houses

Location? .....

GENERAL CONSTRUCTION

Size of lot .....
Size of building .....
Number of stories .....
Number of tenements .....
Number of families? .....
When erected? .....
Proportion of unoccupied lot? .....
Distance from rear buildings? .....
Construction of first floor? .....

LIGHT AND AIR

Area of light and vent shafts? .....
Number and area of water-closet shafts? .....
Number of windows? ..... Size? .....
Floor space? .....Size of bedrooms? ....Size of kitchens? . .
Cubic space in bedrooms? .....
How are the tenements lighted at night? .....

CELLAR

Is it damp? .....Condition of walls? .....
Condition of cellar floor? .....Condition of cellar ceiling? .....
Are there water-closets in the cellar? .....
Are there any living rooms in the cellar? .....
Is any trade or business carried on on premises? .....

GENERAL CLEANLINESS

Roof? .....
Staircases? .....
Are the stairs ventilated? .....Are they lighted? .....
Are there strong hand-rails? .....
Halls? .....
State of cleanliness? .....Are they lighted at night? .....
Are they dark in day time? .....

Garbage removal?.....
Water-supply?.....
Is it from street pressure?.....Size of supply service?.....
Material?.....
Are there hand-pumps at sinks on every floor?.....
Is there a pump in the cellar?.....
Is there a tank on the roof?.....
What is the condition of the roof-tank?.....
Drainage?.....
Precautions against fire?.....
Are there fire-escapes in front?.....
Are there escapes in the rear?.....
Are the stairs incombustible?.....
Yard?.....
Condition?.....Paved?.....
Does the yard contain the privy vault?.....
Is there any school sink in the yard?.....
Special inquiry as to the plumbing.....
Character, material, size, and condition of—

House drain.....	House-trap.....	Leaders.....
Soil-pipes.....	Waste-pipes.....	Vent-pipes.....
Sinks.....	Water-closets.....	Washtubs.....
Bath-tubs.....	Tank.....	Faucets.....
Traps.....	etc.....	etc.....

Blank Form for Inspection, Prepared by the First New York State Tenement-house Commission of 1884

File No..... Date.....
Inspector.....
House.....No. of stories.....
Material.....Built about how long.....
Single or Double.....Number of families on floor.....
Owner.....
Address.....
Is name posted?.....
Duties of housekeeper.....
Soil (sand, clay, rock, or made ground).....
Street, how paved.....Condition.....
Size of lot.....Per cent of lot covered....
House fronts.....In good or bad repair.....
Width, of areas, front.....Rear.....Alley, width.....

Distance between front and rear houses .....
Adjoining nuisances .....Any stable in building .....
Any animals or fowls kept in house .....
Cellar, depth below sidewalk .....Height of ceiling.....
How used .....Condition .....
How floored.....Are walls damp? .....
Number and size of windows .....
Location of " ..Are they kept closed? .....
How occupied or used .....
House, stairs, width.....Condition.....
Width of well-hole .....Fire-escapes.....How located ..
Are windows obstructed? .....
Halls, are they kept clean? .....By whom? .....
Have walls settled? .....Condition of plaster and ceiling.
How is roof reached? .....Is roof door locked? .....
Are hallways obstructed?.....
Are halls lighted at night?..... .....
How lighted by day .....How ventilated .....
Roof, Material .....Condition .....How used.....
Flat or sloping.....
Are chimneys in good repair.....
Skylights tight or open .....Form of opening .....
Garbage, how stored ..... When removed .....
Yard, how paved.....Size .....Is it cleanly? .....
Is light obscured by clothes hung to dry? .....
Privy vault, material..... Number of seats ...
How connected with sewer .....Condition .....
How ventilated .....How full .....
School sink, size and condition .....
Distance from nearest window..... Any complaint of odors?
Water-closets, kind.....Location .....
Condition .....How flushed? .....
Sinks .....Trapped .....
Are all traps ventilated? .....How ?.....
Are waste-pipes properly jointed? .....
Are sinks improperly used?.....
Water-supply, in yard, rooms, or halls .....
How high does water rise by day?.....
Is water wasting from fixtures? .....
Pumps .....Condition .....
Hydrant, condition .....How wasted? .....
Tanks on roof, size .....Overflow discharges .....

PLUMBING

	Size.	Material.	Location.	Condition.	Running Trap.	Air Inlet.	How Connected.	Opening Where?	Soil-pipe Used as Leader.	Soil-pipe Extended above Roof.	Waste-pipe Ventilated.
House-drain											
Soil-pipe											
Waste-pipe											
Rain leader											

REMARKS:

	How Used.	Condition.	No. Rooms.	Adults.	Children.	Height Ceiling.	Dimensions, Largest Room.	Cubic Contents of Apartments.	Nationality of Adults.	Occupation.	Children at School.	Children at Work.	Sickness.	No. Deaths Within the Year.	Cause of Death.	Rents.
FLOOR																
A............																
B............																
C............																
D............																
Total......																
FLOOR																
A............																
B............																
C............																
D............																
Total......																
FLOOR																
A............																
B............																
C............																
D............																
Total......																

	FLOOR A	FLOOR B	FLOOR C	FLOOR D	*Total*.....
How Used.					
Condition.					
No. Rooms.					
Adults.					
Children.					
Height Ceiling.					
Dimensions, Largest Room.					
Cubic Contents of Apartments.					
Nationality of Adults.					
Occupation.					
Children at School.					
Children at Work.					
Sickness.					
No. Deaths Within the Year.					
Cause of Death.					
Rents.					

	FLOOR A	FLOOR B	FLOOR C	FLOOR D	*Total*.....

Heating and lighting—Stove. . . . . Damper in pipe? . . . . . .
Does chimney smoke? . . . . . Is coal gas noticed? . . . .
Light shafts, how located? . . . . . Size? . . . . . .
End where? . . . . . Is bottom open? . . . . . .
Are they used improperly? . . . . Size of windows opening into . .
Are there side windows therefrom into courts or outer air? . .
Are transom windows into hall kept open? . . . . . .
Bedrooms, how lighted and ventilated . . . . . .
Are there any transom windows over doors between rooms? . .
Summary, Total occupants. . . . . Adults . . . . Children . . . . . .
Number of beggars recorded? . . . . . .
Number of saloons on block front? . . . . . .
Any signs of drunkenness? . . . . . Class of tenants . . . . . .
Any sleeping in halls or yards? . . . . . .

Schedules for Sanitary Inspections of Tenement-houses

(Second N. Y. State Tenement-house Commission of 1900.)

Tenement built in . . . . . Record No. . . . . .

APARTMENTS

Street. . . . . No. . . . . Near . . . . (Street or Avenue) . . .
No. of stories . . . . . Date of inspection. 1900
Hour . . . . . $\frac{\text{A.M.}}{\text{P.M.}}$ (Inspector. . . . .)
No. of buildings in row, of which this is typical? . . . . . .
First Floor:
Used for what business? . . . . . and . . . . . .
Any special fixtures? . . . . . .
Apartments:
No. of apartments on each floor? . . . . . Total No.? . . . . . .
No. of people on each floor? . . . . . .
Each apartment has how many rooms? . . . . . .
Sink in Apartments:
Location? . . . . . Material? . . . . . .
Condition of sink? . . . . . .
Condition of floor and woodwork? . . . . . .
Enclosed in woodwork? . . . . . .
Sink waste, free or choked? . . . . . .
Sink drain-boards, condition? . . . . . .
Cold- and hot-water faucets? . . . . . .
Does water run freely on top floor? . . . . . .

Sink Trap:
Size?.....Material?.....Condition?.....
Sink-trap Vent:
Size?.....Material?.....Condition?.....
Washtubs in Apartments:
Number?.....Location?.....
Material?.....
Condition?.....
Covers, open or closed?.....
Tubs filled or empty?.....
Hot- and cold-water faucets?.....
Condition of floor and woodwork?.....
Washtub Trap:
Size? .....Material?.....Condition?.....
Washtub Trap-vent:
Size? .....Material?.....Condition?.....
Bathtub:
Describe.....
Light and ventilation of bath compartment?.....
Stove-heated Boiler:
Sediment ends where?.....
Water-closets in Apartment:.....(see special card)
Any other Fixtures
Describe.....
Ice-box:
Location and condition?.....
Drip, how disposed of?.....
Is safe waste trapped?.....
Condition of floor?.....
Are clothes dried in apartment;.....
in what rooms?.....
Soil-, Waste-, or Vent-pipes in Apartments:
Visible in apartment or concealed?.....
No. of soil?.....Material?.....Condition?.....
No. of waste?.....Material?.....Condition?.....
No. of vent?.....Material?.....Condition.....
Joints in Soil-, Waste-, and Vent-pipes:
Material?.....
Condition?.....
Remarks:.....
Official Inspection of Building:
When and by whom?.....

Cellar:
Used for what purpose? .....
Closed or open stairs or shafts from cellar to upper floors? ....
Light by day? .....
Light by night? .....
Ventilation? .....
Condition of Cellar:
Clean or dirty? .....
Rubbish or fæcal matter? .....
Whitewashed? .....
Kind of Cellar Floor and Condition:
Earth? ..... Cement? ..... Stone? .....
Water-proofed? ..... How? .....
Damp, wet, or dry? .....
Ceiling of Cellar:
Material? ..... Fireproof? .....
Sound or broken? .....
Openings into pipe chases or flues? .....
Cellar Floor Drain:
How connected? .....
Evidence of under-drains? .....
How connected? .....
Blind drains? ..... Condition? .....
Main Drain:
Above or below floor? .....
Material and quality? .....
Size? .....
How supported? .....
Patched or sound? .....
Kind and condition of joints? .....
Number of free openings in drains? .....
Any odor from drains? .....
Steam or other drips, connecting with drains where? .....
Cleanouts on drains. .....
Kinds and Number? .....
House Trap:
Location? ..... Accessible? .....
Kind of cleanout covers? .....
Fresh-air Inlet:
Size? .....
Ends where and how? .....
Free or choked? .....

Number and Sizes of Connecting Drains in Cellar:
No. of soil-pipes? . . . . . Size? . . . . . Material? . . . . . .
No. of waste-pipes? . . . . . Size? . . . . . Material? . . . . . .
No. of vent-pipes? . . . . . Size? . . . . . Material? . . . . . .
Number of Visible Traps in Cellar for
Leaders? . . . . . .
Yard, court or area drains? . . . . . .
Sink or other Fixtures in Cellar:
Number and kind? . . . . . .
Material and condition? . . . . . .
Trapped and vented? . . . . . .
How supplied with water? . . . . . .
Drips or safe wastes over sink. . . . . Flap-valves? . . . . . .
Water Service in Cellar:
Size of house mains and material? . . . . . .
Meter, what kind? . . . . . .
Supply to house-tank, direct or pump? . . . . . Size? . . . . . .
Controlled by whom? . . . . . .
Pump. . . . . Kind? . . . . . Size? . . . . . Condition? . . . .
Direct supply, to what floors? . . . . . .
Tank supply, to what floors? . . . . . .
Rubbish Bins:
Location? . . . . . Material? . . . . . Condition? . . . . . .
Front and Back Yards, Courts, Areas, Light Shafts:
Condition? . . . . . .
Paved? . . . . . Material? . . . . . .
Will surface drain? . . . . . .
Provision for Drainage, Back Yards and Courts:
Iron cesspools? . . . . . Mason's traps? . . . . . .
Blind drains? . . . . . Trapped? . . . . . .
Leaders:
Number and location? . . . . . Inside or outside? . . . . . .
Material? . . . . . .
Trapped? . . . . . .
Condition? . . . . . .
Used for soil- or vent-pipes? . . . . . .
Are soil-, waste-, or vent-pipes used for leaders? . . . . . .
Hydrant in Yard:
Location? . . . . . .
Used by how many families? . . . . . .
Used by how many people? . . . . . .
Is hydrant water used for drinking? . . . . . .

Pump or Well in Yard:

Location? .....
How near privies? .....
Condition? .....
Used by how many families? .....
Used by how many people? .....
Is water used for drinking? .....

Garbage-cans:

Location and condition? .....

CESSPOOL:

No. and location? .....
Dimensions .....deep
How far from building? .....
How far from pump or well? .....
Nature of surrounding soil? .....
Material of walls? .....
Tight or leaching? .....
Overflow delivers where? .....
Ventilated? .....
Provision for emptying? .....
Emptied, how often and how? .....
Disinfected, how often and how? .....
Receives what drainage? .....

HALLS:

Do water-closets open on halls? .....(see special card)

Public Sink in Halls:

Number? .....Location? .....Total No.? .....
Used by how many families? .....
Used by how many people? .....
Material of sink? .....
Used for fæcal matter or urine? .....
Cased or free? .....
Trap material? .....Size? .....Condition ? .....
Vent material? .....Size? .....Condition? .....
Any odor at sink? .....
Is sink well lighted? .....
Condition of floors and walls? .....

Water-supply for Hall Fixtures:

Street supply, what floors? .....
Deficient supply, on what floors? .....
Pump at fixtures, what floors? .....
Tank supply? .....What floors? .....

Other Fixtures in Halls:

Describe: .....

ROOF:

Condition of roof? .....

Any fæcal matter? .....

Roof-drains, where? .....

Condition of gutters? .....

Are leader connections free? .....

Soil-, Waste-, and Vent-pipes above Roof:

Soil No.? .....Size? ..... Material? .....

Waste No.? .....Size? .....Material? .....

Vent No.? .....Size? .....Material? .....

Wire globe cages or caps? .....

Open how high above roof? .....

Open less than 20 ft. from windows or ventilators? .....

Roof-tank:

Location? .....

Material? .....

Dimensions inside? .....

Capacity in U. S. gallons? .....

Tight or leaking? .....

Cover? .....Material? .....

Tank, how full? .....

Tank, how supplied? .....Ball-cock? .....Pump? .....

Tank frost-proofed? .....

Tank supplies what floors? .....

Tank-water used for drinking? .....

Tank overflow ends where? .....

Tank overflow trapped? .....

Tank clean or dirty? .....

Tank draw-off ends where? .....

Do drain-vents open near tank? .....

Provision for Drying Clothes:

Back yard? .....Back-yard poles? .....

Roof lines? .....In air-shaft? .....

SOIL:

Character of ground shown by Vielé's map? .....

Over water-courses? .....

Over marsh? .....

Over made land? .....

REMARKS .....

LAWS:

Do plumbing and drainage conform with laws in force at time building was built? .....

What violations? .....

WATER-CLOSET ACCOMODATIONS, PIPES:

Number and Kind of Fixtures. Location:

Privy vault? .....

School sink or latrine? .....

Water-closets? .....

Sewer or cesspool disposal? .....

Each Fixture Used by How Many:

Families? .....Total Number of families? .....

People? .....Total Number of people? .....

Buildings in Back Yard:

Number, material of structure, size, condition? .....

How far from other buildings? .....

Used separately or in common? .....

Number of compartments and condition? .....

Locked or open? .....

Separate buildings or compartments for sexes? .....

Building, how lighted by day? .....

how lighted by night? .....

how ventilated? .....

Kind of floor and condition? .....

Number and kind of seats and condition? .....

Cased with wood below seats? .....

Remarks. .....

Privy Vault and Location:

Size and material of vault? .....x.....x.....deep .....

Water-tight or leaching? .....

Is overflow connected to sewer or cesspool? .....

Is overflow trapped? .....

Vault how full? .....

Provision for flushing? .....

Provision for emptying? .....

Emptied, how often? .....

Apparatus used for emptying? .....

Provision for disinfecting? .....

Disinfected, how often? .....

Odor? .....

Remarks. .....

School Sink or Latrine and Location:
No.....Material?.....Above or below floor? .....
Size and how full? .....
Outlet plugged or open? .....
Who operates plug, and how often? .....
Sewer or cesspool connected? .....
Is fixture trapped? .....
Provision for flushing? .....
Water how connected? .....
Condition of fixture? .....
Remarks: .....
Water-closets, Location and Number:
In yard? .....
In cellar? .....
In halls? .....
In apartments? .....
Water-closet Compartment:
Has compartment window to outer air, court, light shaft, light well, hall, cellar, or apartment? specify.....
Well lighted? .....
How lighted at night? .....
Has compartment ventilation flue?.....Size?.. .....
United or individual vent-flues? .....
Material of floor and condition? .....
Material of walls and condition? .....
Floor slab or safe?.....Material?.....Wet or dry?.
Is there a safe waste? .....
Type of Closet and How Trapped:
Pan closet?.....Syphon closet? .....
Wash-out closet?.....Long-hopper closet? .....
Wash-down closet? .....Short-hopper closet? .....
Other type? .....
Material of Bowl and Condition:
Earthenware? .....
Enameled iron? .....Iron? .....
Connected earthenware vent-horn, cracked or broken? ....
Washered coupling on vent? .....
Vented from below floor? .....
Floor plate? .....
Drip-pan?.....Condition? .. ..
Material and condition of seat? .....
Is fixture cased in wood or stone?.....Condition?.....

Closet, How Flushed:
Individual tank? .....
Automatic tank? .....
Direct from water-pipe? .....
Water from house-tank or street pressure? .....
Is there sufficient flush on all floors? .....
Deficient flush, on what floors? .....
Tanks out of order? .....
Odor? .....
What disinfectants used? .....
Remarks: .....

Soil-, Waste-, and Vent-pipes:
Soil, No.? .....Size?.....
Material? .....
Waste, No.? .....Size? .....
Material? .....
Vent, No.? .....Size?.....
Material? .....
Exposed or cased? .....
Patched, and how? .....
Are openings about pipes sealed at floors? .....

Joints:
Kind and condition of joints?.....
Remarks: .....

Street?.....No.?.....
Near? .....(St. Ave.)
Builder? .....
Owner? .....
Plumber? .....
Are plans now on file in Building Department?.....
Plans approved by? .....
Violations filed? .....
Violations removed? .....
Recorded date of water-test by department?.....
Recorded date of final test by department?.....
Deaths? .....in .....years .....
Contagious diseases reported? No. in ....years .....
What diseases? .....
Death-rate of building? .....
Death-rate of block? .....
Sick-rate of building? .....
Sick-rate of block? .....

SMOKE TEST

Applied. Date?.....1900. Hour?. .....
By .....
Machine attached to.....
Smoke returned through .....
Vent-pipes choked .. ..
Drains untrapped ....
Leaks disclosed and location? .....
Total number of leaks? .....
Remarks.. .....

FREE OPENINGS FOR ESCAPE OF DRAIN-AIR TO BUILDING

Disclosed by inspection? enumerate. .....
Total number of openings? .....

TRAP-SIPHONAGE

Any evidence of trap-siphonage?.....Where? .....

Inspection of Country Houses

Let us now pass over to the consideration of country houses. These may be subdivided into (1) suburban residences and (2) summer residences,—the former being occupied all the year round by people doing business in the city, who wisely care more for the health of their growing children than for entertainments which they must forego if living "out-of-town," and who prefer a rural or suburban home to narrow and unventilated apartments, or dark and unsanitary city houses, while the latter are owned or leased by people who go to the country in search of pure air, to avoid the influence of unsanitary surroundings in the city, or who seek refuge at a country-seat in the mountains or at the seaside for at least several months of the year, from the summer's scorching heat, from dusty streets, heated pavements, and the stifling and smoky atmosphere of a city. The sanitary inspection of both classes of houses and of their surroundings does not differ materially.

Healthfulness of Town and Country Houses Compared.—While there are certain undeniable charms and general advantages of rural life as compared with life in cities, yet it is true that the mere fact of living in the country tends, with many people, to create a false sense of security. For on closer observation it is found that in rural not less than in urban districts there may exist certain forms of "filth," due to neglect and disregard of sanitary precautions, which may become fruitful causes of infection and preventable disease. While *air*, rendered impure by all kind of noxious exhalations, by smoke, street dung, and other volatile, injurious matters, may be looked upon as the promi-

nent factor causing sickness in cities, we find in the country a greater danger from a contamination of the *soil* and of the *drinking-water*. Nevertheless, even in the country the atmosphere in the vicinity of houses, and air entering these through doors, windows, and the air-inlets to the heating-apparatus, may be contaminated, if no regard is paid to the proper disposal of waste matters from the household.

The removal of sewage from habitations, the introduction of a pure and never-ceasing supply of water for domestic purposes, and the removal of ashes and garbage, are sanitary measures carried out in cities by the public authorities; and a householder may restrict his attention in the city, so far as his dwelling is concerned, to the purity of the supply of air—in other words, chiefly to the heating-apparatus, to the arrangements for ventilation, and to the plumbing work. In the country, on the other hand, his care and exertion should be principally devoted to the sources of drinking-water—the well, cistern, spring, pond, or lake, as the case may be—and to the means of removing and disposing of the waste matters from the house: therefore sink-pipes, drains, cesspools, vaults, privies, and manure-heaps are the subjects requiring particular attention to maintain a locality in a perfectly salubrious condition.

Inspection of the Site.—It is an old saying, that, in choosing a residence, one should inquire of some person who formerly lived in the neighborhood, and sold out; and this, while referring to town and country houses alike, is particularly true of rural habitations.

Regarding the location, note whether the house stands on elevated ground, at the top of a hill, exposed to wintry blasts, and to bleak and boisterous winds at all seasons of the year; or in a valley or

ravine, enclosed on all sides, and with the air in a stagnant condition; or built too closely against a rather steep hillside; or, finally, on the gentle slope of a hill, with a cheerful and sunny aspect, and a pleasant prospect from the windows of the principal rooms. Always observe or inquire into the direction from which the prevailing winds blow.

Carefully look into the surroundings of the house. The neighborhood of swamps, marshes, sluggish watercourses, stagnant pools, or ponds in which the water-level is liable to frequent fluctuations, should be avoided; for these are the localities where malarial diseases, fever and ague are apt to be most frequent. Sewage farms, cemeteries, rendering establishments and soap-works, bone factories and oil distilleries, etc., are unpleasant neighbors, and should be equally shunned. An important advantage over city houses, common to nearly all country houses, is that they are standing isolated, and surrounded with plenty of free space on all sides; detached and even semi-detached houses are always preferable, from a health point of view, to dull, tiresome, and monotonous rows of brick or brownstone-front city houses.

An abundance of shade-trees about a country residence is much to be desired; but the trees should not surround a house too closely, robbing it of sunlight and a proper circulation of air. The character of the site exerts a great influence upon the healthfulness of a country house, and preference should always be given to houses on dry, sandy, or gravelly soils. Alluvial and clay soils ought to be avoided, as tending to be damp and chilly. The worst possible building-sites, in suburban districts, are low spots, recently filled with house garbage and street rubbish. In this matter of choice of location, it must constantly be borne in mind,

that, while defective construction may generally be remedied, unhealthy surroundings, an undesirable aspect, or an insalubrious building-site cannot be changed. Careful search should also be made for abandoned cesspools, or overflows from cesspools into open ditches or ponds, which in many cases constitute a serious nuisance. As regards the external sewerage, the drain-pipes and the sewage disposal, one may safely assume, that, unless it was recently remodeled, it is not as it ought to be to prevent the contamination of the subsoil, and the accumulation of putrefying organic matter in the pipes.

Inspection of the House Foundations and Cellar.—Having thus ascertained whether the surroundings are free from objection, the next step should be the examination of the dwelling itself. Note its general construction and material, and the distance from the house to the street.

It is well to commence the house-inspection in the cellar, or, if there is no cellar, to make sure that the house is well raised, at least two feet, above the surface-level on brick piers; that there is an abundant air-space between the ground and the building (otherwise, ground-air is liable to rise into the living and sleeping rooms, and, besides this, floor-joists and floor-boards will rot soon); and that there is no rank or decaying vegetation underneath the house. Spaces under piazzas are very apt to accumulate rotten leaves, dust, or rubbish, and should therefore be made accessible, and frequently inspected and cleaned. The cold-air box of the furnace or steam-heating apparatus should not be made to open under a piazza, for here the air stagnates, and is easily rendered foul. Light and air should be freely admitted into a cellar, and nothing kept or stored in it that might taint its atmosphere, such as

rotten vegetables, swill, or other organic refuse; for the impure air of the cellar is sure to rise, and to pervade the whole house. See if the cellar-floor is of earth, concrete, or bricks, and if the cellar-walls and the floor are dry, and free from rat-runs; note also whether provision has been made, by a special vent-flue carried down to the cellar, and running along some heated smoke-flue, for a change of air. A sanitary cellar should always be free from dampness, and should be light, sunny, and airy. It should never be made the storage-place of large quantities of vegetables, which produce unhealthy exhalations.

A perfectly built house should be completely separated from the surrounding soil by a water and air tight cellar-floor, and by damp-proof foundation-walls, to prevent ground-air and soil-moisture from rising. If the house is separated from the ground surrounding it by areas, see if they are dry and ventilated, and whether they have proper outlets for the removal of storm-water. The whole site of the dwelling should be dry, and, if necessary, it ought to be well underdrained; all sub-soil water, especially where a hillside is sloping toward the house, should be cut off, and removed by special drain-trenches or tile pipes, and these should always be kept separate or disconnected from any foul drain or cesspool.

Inspection of Walls, Roofs, and Rooms.—The first and foremost purpose of a habitation is to afford shelter against the elements, hence all the exposed walls of the house should be impervious to moisture. In many frame cottages it is difficult and troublesome to prevent soakage of the walls, and the wetting of the wall-paper during driving rain-storms. The outer walls of an isolated house should be so constructed as to keep out the cold in winter and the heat in summer. Roofs

should be kept thoroughly tight and waterproof, and means provided to prevent moisture from descending into the walls. Dripping roofs, without gutters or eaves, are a frequent cause of the dampness of the soil near dwellings, and hence of damp and unhealthy foundations. Damp houses are insalubrious and persons living in them are very easily chilled, and people often experience draughts or a general feeling of discomfort. Indeed, many a fatal cold has been contracted owing to a damp and chilly atmosphere in a country house.

The principal rooms of country houses should be large, comfortable, and light, with windows of ample dimensions to let in plenty of sunlight; each window should, preferably, admit the invigorating glow of the sun during at least a portion of the day. People as a rule, do not appreciate the beneficial effects of sunshine until compelled to live in a cold and cheerless room, where the rays of the sun never gain entrance. Neither plants nor human beings can do without sunlight: both grow feeble, pale, and weak. Sunlight is, in many respects, a most valuable aid to cleanliness, and at all times a good purifier. Therefore, do not shut it out.

Admit to all living and bedrooms not only the pure air of heaven, but also the warm and pleasant glow of the sunlight. And if, owing to the wrong aspect of a house already built, you find that it does not enter into some of its rooms, do not choose these for the nursery, or for the principal living or bedrooms. At all events, in inspecting a house, do not forget to refer to the points of the compass to note if the house lacks sunshine—one of the most vital factors in domestic sanitation.

Indeed, sunshine is such a precious gift that it would appear wrong and sinful to exclude it from any room

of the house by any permanent arrangements, such as too wide piazza-roofs, trees placed too near a house, or heavy, dark, inside curtains. Movable blinds or shutters are better in this respect, but even they should not be kept closed too long. Says Col. Waring: "Let the sun have free access to the outside of the whole house at some time during the day, and keep shutters and blinds and windows open except when it is necessary to exclude the light. Never mind faded carpets: they are not so bad as faded cheeks; and these cannot be avoided except by fresh air and ample daylight."

In bedrooms insanitary conditions ought to be most studiously avoided. These and the nursery are the most important rooms of a house: they should be located on the sunny side, and be large, airy, well-lighted, and amply ventilated, cosily and cheerfully furnished, but so as to be as much as possible free from "dust-catching and dust-yielding" materials.

The furniture should be light, and curtains, portieres, hangings, carpets, rugs, upholstery, should be sparingly used, and the dust from them frequently removed. Window-curtains too often shut out those best of all disinfectants, sunshine and pure air. All bedding should receive a daily airing. Carpets should be avoided. It is better not to paper the walls of bedrooms; but, if they are thus finished, avoid both the dust-retaining flock-papers and poisonous arsenical papers.

Bedrooms should have, if possible, an open fireplace to remove the air rendered impure from breathing, or from burning lights. Slop-jars and chambers in bedrooms are often the cause of the defilement of the air, unless thoroughly cleaned by a daily application of soap and hot water. Soiled clothing should never be

allowed to accumulate for any length of time in unventilated closets of bedrooms.

The servants' chambers should be as cheerful and light as the circumstances will permit. Unplastered garret rooms ought never to be used as servants' quarters; for in winter they are too cold, in summer too hot, and at all times detrimental to health.

Look carefully into the condition of the walls, floors, and ceilings of all rooms; see especially that the ceilings are whitewashed, and the floors free from cracks and crevices. Examine carefully into the condition of pantries, closets, and storerooms: they should be well-lighted and well-aired to keep the food free from the least suspicion of contamination. Special cleanliness should exist wherever the milk is stored; for it is well known that this very readily absorbs any impurities from the surrounding air, and becomes unfit for use. The refrigerator in which articles of food are kept should never be connected directly with any pipe carrying foul sewage.

Inspection of the Heating Apparatus.—In inspecting those suburban residences which are occupied during all seasons of the year, the heating arrangements must not be forgotten. Warm-air furnaces form the apparatus principally used in the better class of houses; and the most important point regarding them is that they should not take the air from the cellar. They should have large, well-constructed cold-air boxes, taking the supply of pure air from outdoors. The inlet should not be located too near the surface of the ground, nor should it open near manure-heaps, privies, vaults, swill-barrels, openings into sewers, or near cesspools, and it should be well protected against the entrance of dirt or dust. In country houses, which are much exposed, it is advisable to arrange air-inlets on

opposite sides of the house, to avoid the annoyances arising from wind-pressure. As a rule, it is preferable to provide for the larger and much-exposed country houses two furnaces, in order not to be compelled to keep up in very cold weather a fire which would heat the furnace to red heat. The remarks made as to the best arrangement and management of the heating-apparatus of city houses may, with advantage, be here repeated. See if due provision is made for heating the halls; for this will insure a uniformity of warmth all over the house, and will help much to prevent annoying draughts.

Safety from Fire.—Again, all that has been said concerning the precautions against fire applies with equal force to country houses. It is even of greater importance, in the case of these, to guard against the dangers from fire; since the majority of such buildings are constructed entirely of wood—hence are very inflammable—besides being usually out of reach of a fire department.

Inspection of the Plumbing Work.—In these days of greater luxury and refinement, country houses are no longer built without having some of the so-called "modern conveniences." It will be wise not to overlook, in our examination of the dwelling, the arrangement of these labor-saving and comfort-promoting appliances. It will suffice, however, to indicate merely the principal points of such an inquiry, as much of what has been said concerning the plumbing of city houses refers equally to that of houses in the country.

Ascertain first if the drain outside of the house is properly laid, with pipes of small size, with sufficient grade, tight joints, and true alignment. Make sure, next, that the house-pipes are completely cut off from the outside drains and cesspools; that all pipes are of a

sound material, and substantially put together with air and water-tight joints; that the main drain in the house is restricted in size, run with proper and sufficient fall, or, if this cannot be had, that some flushing arrangement is provided; that the soil-pipe is not larger than four inches in diameter, and fully ventilated, and carried well above the roof, in a perfectly straight line if possible, without any bends or offsets, an inlet being provided at the foot of the drain to establish a constant circulation of air through every foot of drain- and soil-pipe in the house, but not located too near a window, or near the cold-air inlet of the heating apparatus.

See that each fixture has a separate and efficient trap or barrier against entrance of foul gases; that there is a proper supply of water to each fixture and trap; that all plumbing-appliances are of good, smooth, and non-absorbent material, and arranged as simple as possible, without any concealed overflow-pipes or hidden channels, but with everything in plain sight.

The construction and type of the fixtures should be such that when emptied or discharged, they act like a flush-tank, completely scouring the traps and branch waste-pipes, which latter should form a connecting link with the main soil-pipe as direct and short as possible. Never allow a wash-basin or other plumbing fixture to remain in a bedroom or in an unventilated closet adjoining it; rather than have in any part of the house a fixture which is not used, and which by evaporation of the water in the trap, quickly opens a road to sewer-air, disconnect it and close the waste-pipe carefully. People often say, when an inspection of the premises is made, "Oh, this fixture cannot be the cause of danger, or even annoying odors, for it is hardly ever used!" Popular notion seldom committed a more serious error, for with plumbing-fix-

tures it is disuse which means danger. The more frequently, on the contrary, a fixture is used, *ceteris paribus*, the better will its pipe and trap be flushed.

See that the fullest light and thorough ventilation prevail in the bathroom, and in the closet for the house-maid's slop-sink; make it a rule to have all plumbing exposed to view and accessible, and do away entirely with the usually ill-smelling woodwork incasing such places, particularly at the kitchen-sink and at the water-closet.

Inspection of the Water-supply.—Two subjects of the greatest importance for all country homes, and intimately connected with each other, require particular consideration. These are the water-supply and the disposal of the household wastes.

A public supply, delivering the water to habitations in pressure-conduits or street-mains, is seldom available in the country. The drinking-water has usually to be drawn by buckets or pumps from a well on the premises, sunk to only a shallow depth, and often liable to be contaminated from surface-washings, or by the careless dipping into it of unclean vessels. Driven wells are not quite so liable to surface contamination; yet even they may be contaminated by leakage of sewage, unless sunk to a very great depth, and penetrating below some impervious stratum. It sounds like a truism to say that wells supplying drinking-water should be most scrupulously watched, and kept free from contamination; yet how seldom is proper care bestowed upon this matter! The drain which carries the liquid wastes from the house to a cesspool often passes near the well; and unless the pipes are laid with unusual care and forethought, by experienced workmen, the imperfect and often uncemented joints and broken pipes allow

the slop-water to leak into the soil, from which it passes by filtration into the well.

But the most frequent and most dangerous causes of contamination of wells are the leaching cesspool (that vast receptacle of decomposing organic matter from the household) and the privy, both generally located, on account of convenience and economy, in close proximity to the house. The well from which the household draws its supply of drinking-water is thoughtlessly located, more often than not, quite near to them. It is difficult to state the least distance which ought to exist between a well and a privy or a leaching cesspool, if the latter is at all to be tolerated. While some authorities put it at from one to two hundred feet, the safer rule would seem to be always to put the cesspool in the farthest available corner of the lot. Even when such a location is feasible, it must not be forgotten that a leaching cesspool is at best a makeshift and an unsanitary device; and that, when placed far away from your own dwelling to insure safety, it may contaminate a spring or a water-course from which your neighbor further down the hillside draws his supply of potable water. It is much safer to establish the rigid rule that, wherever a house and its neighborhood has to depend on wells or springs for water-supply, *leaching cesspools should not be tolerated at all;* and, *vice versa,* wherever leaching cesspools exist, the water from pump, draw, or driven well should never be used for drinking purposes.

It is quite easy to ascertain whether any hidden connection exists between a leaching cesspool, house-sewer, or privy-vault and a well or cistern. Add to the contents of the cesspool or privy-vault a large quantity of salt, or introduce a strong salt solution into the house-drain. Make a chemical test of the well or

cistern water for chlorine, before and after pouring the salt solution; and if, in the latter instance, the analysis reveals a largely increased amount, it is a sure sign of a leakage existing. To test for chlorine, fill a glass test-tube about half full with water, and add to it a few drops of a nitrate-of-silver solution. The presence of chlorine is indicated by a white precipitate, consisting of chloride of silver.

Another, although more expensive and not readily available, method, is to apply the "lithia" test, by throwing into the cesspool, privy-vault, or sewer some lithium salts, and testing the well-water afterwards for the lithium, by means of the spectroscope, which clearly indicates by the peculiar red lithium line even minute amounts of this element in the water.

It is far less objectionable if a country house uses a tight cesspool. Examine it carefully as to dimensions and material. Measure its distance from the house; see if it is built water-tight, well covered, and note whether it is ventilated. Let the cesspool be small in size, and have it frequently emptied and cleaned, and occasionally disinfected. If there are any privies, note their location and distance from the house, the well, and the cistern. Note if they are offensive or inodorous and well ventilated, and constructed in such a manner as to be readily emptied and cleaned, and fully protected against entrance of rain or moisture.

Before permitting the water from a well to be used in your household, make a thorough inspection of the well; note if it is a dug or driven well, a shallow or deep well; measure its depth and the depth of the average water-level below the surface; examine the inside lining of the well as to imperviousness; see how the well is covered, and how it is protected against the entrance of surface-washings or vermin.

Next have a sanitary examination of the water made by a competent chemist. Good water ought to be agreeable to the palate, cool, yet not too cold; it should be colorless, clear, and bright, free from odor, without sediment or suspended matter, and not too hard. A water-analysis should cover at least the following points: First, observe the color of the water, which is readily done by filling a tall glass vessel, and looking down upon the water. A decided greenish, yellow, or brown tint indicates animal or vegetable contamination. The sense of smell may be of some value in judging the quality of a certain water by filling a bottle partly, and closing it with a glass stopper, next agitating it violently, and then smelling at the mouth of the bottle. A slight warming of the bottle may aid in disclosing impurities. Next note the taste of the water; but, in doing so, remember that waters which do not taste offensively may yet be badly polluted with sewage. It is a well-known fact that some of the most sparkling and pleasant well-waters revealed, upon examination, a very bad pollution.

After noting the principal physical qualities, a chemical analysis should be made, covering the following points: the amount of total solids; the hardness of the water, especially its permanent hardness; the amount of chlorine, of free ammonia, of nitrates, and of the organic matter contained in the water. As a rule, a qualitative analysis is sufficient to throw light upon the unwholesomeness of a suspicious water; in more important cases, however, a quantitative analysis should also be performed. Occasionally it becomes necessary to test a water for poisonous metals, such as zinc, lead, or copper. A microscopical examination often adds considerable information regarding the quality of a certain water.

The chemical analysis is of equal importance in the case of deep and shallow or surface wells, as in the case of cistern-water, or lake or brook water. If the examination of well-water reveals any pollution by sewage, it is advisable to use only boiled and filtered rain-water for cooking and drinking purposes. If the drinking-water is derived from a running stream or brook, carefully inspect the banks for a long distance above the point where the water is taken, and make sure that no sewage-slops, manufacturing wastes, or surface-washings from manured fields forming a part of the gathering grounds, run into the stream.

The rain falling upon roofs commonly yields for cottages of average size water sufficient in quantity for household purposes; and, if the most ordinary precautions be observed in collecting and storing it, rain-water constitutes a desirable and healthful beverage. It is not advisable to collect rain from zinc roofs, or roofs that are painted. The best roofing material is slate or else tiles; but shingle roofs will answer, except that the water from them acquires at times a taste from decaying wood-splinters washed into the cistern. Care should be taken to have the roofs and gutters clean; and the first washings, containing mineral dust, soot, spores of plants, or other organic matter, ought always to be allowed to run off on the surface by a cut-off or separator, worked by hand, or else arranged to act automatically. It is also very necessary to see if any slop-water can find its way, directly or indirectly, into the cistern. The cistern for storing rain-water should be built thoroughly water-tight, and be protected against any possible pollution, especially against entrance of surface-washings, or leaves of trees, insects, small animals, and all kinds of animal and vegetable impurities. It should be ventilated and thoroughly

cleaned every summer. The overflow-pipe from a cistern should never discharge into any foul drain-pipe or cesspool. It is a good plan, which adds only a trifle to the cost, to build a partition of bricks laid with loose joints, dividing the cistern into a large and a small compartment, and to let the dividing wall act as a filter.

In summer it is a good precaution to boil the water first, next to cool it with ice, and to aërate it before drinking; but such ice, frequently impure, should not be placed in the water. The proper way is to have water-coolers with outer and inner chambers—the outer for the melting ice, the inner one for the pure water.

Drinking-water may be purified by means of domestic filters; but, if these are used, they should never be left in charge of thoughtless servants, for they require to be frequently cleaned; otherwise, their purifying action ceases, and the filtered water soon acquires a bad taste, due to the organic impurities retained in the filtering material. It is desirable to have filters constructed in such a manner as to allow of easy cleaning and aëration.

If a tank is arranged to supply the plumbing fixtures, it should be placed in the attic in some accessible place, protected against entrance of dust or vermin, and ventilated by a suitable opening into the outer air. The best material for water tanks is slate, with properly made cement joints, or else well-painted wrought iron, or finally, tinned copper lining. Lead linings are not safe, for in some cases they are attacked by water, especially by soft water. It is better not to draw any water for drinking or culinary purposes from such a tank; for, no matter how pure the water may be delivered to a dwelling, it may, by storage, be rendered

contaminated and unfit for use, owing to vapors, gases, dust, smoke, or floating organic impurities present about water-tanks. The tank should under no circumstances be used to supply directly the valves attached to water-closet bowls. It is necessary that each water-closet be flushed separately from its own flushing cistern.

Inspection of the Method of Disposal of Household Wastes.—Concerning the best way of disposing of household wastes, and of avoiding the cesspool nuisance, the aim should be, first, to remove all fouled water from the house and its immediate vicinity, as fast as generated; and next, to utilize the slops as much as possible for agricultural purposes, to enrich the soil, and thus to give nourishment to plants and shrubbery in the garden.

The upper layers of the earth possess the power of destroying within a short time the organic matter buried in them, because the oxygen of the atmosphere has free access to the pores of the soil near the surface of the ground. In the case of smaller country houses, a good substitute for the leaching cesspool is a tight sewage tank, located far away from and on a lower level than the well. It should be built of brick, laid in hydraulic cement, and the liquid house-wastes may be delivered into it and be pumped by means of an ordinary garden pump with hose attached, and then distributed in the vegetable garden. Where the house is provided with water-closets, it is necessary to build an intercepting chamber, or catch-basin, to separate the solids from the liquid sewage. It is of no advantage whatever to separate the kitchen slops from the water-closet wastes by using two cesspools. Stagnant kitchen slops decompose as rapidly, and give off as bad gases as putrefying human excreta. Surface irrigation may

sometimes be objectionable where the garden is too near the house. The trouble of pumping out a tight cesspool increases wherever the water-supply is ample, and where a larger number of plumbing fixtures is constantly used. If the dimensions of the cesspool are enlarged, so as to avoid too frequent pumping out, the consequence is that the sewage is stored for a considerable space of time, and that decomposition sets in, which makes its proper and innocuous disposal a matter of more difficulty, and, in fact, may cause frequent complaints of offensiveness.

In such cases, a better system, and one capable of wide adaptability, is the *subsurface irrigation system*, in which the liquid is distributed by gravity, at a depth of about ten inches below the surface, by means of small porous tile drains, laid in parallel lines under a lawn, grass-land, or in the garden. The sewage should be discharged into the distributing pipes in a large volume, and at intervals only, by manual labor, or, preferably, automatically by means of a self-acting flush-tank. Special care is necessary wherever to the slop-water is added the discharge from water-closets in the house. An intermittent discharge is very desirable to allow the filtered liquid to soak away in the surface soil, while the organic impurities attaching to the earth are rapidly oxidized and assimilated by vegetation. In a properly arranged system, the irrigation field is entirely free from noisome odors, and the purification process continues even in severely cold weather. The subsurface irrigation field should be entirely free from trees, because their roots soon grow into the tiles, causing obstructions.

Inspection of the House Surroundings.—Having taken steps to secure a properly arranged system of disposal of the house sewage, and a water-supply ample

in quantity, of perfect purity, and well guarded against contamination, it remains to remove any causes tending to a possible pollution of the atmosphere around a country house.

Observe if the lawns and walks, the yard and the garden, are kept in a neat and inoffensive condition. Let every possible precaution be taken to prevent any accumulation of rotten vegetable matters or kitchen offal of any kind. All animal and vegetable refuse from the kitchen—such as cabbage-leaves, meat-offal, fish-bones, potato-parings, etc.—should be dried and burnt up in the kitchen range or in a small domestic garbage cremator. If a dust bin is required, let it be a small, portable one, circular in section, made of strong iron protected against rust, and with a well-fitting metal cover. Wooden dust barrels are utterly unsuitable. In all cases, dust bins or garbage pails should be protected against rain or dampness. Remove manure heaps or accumulations of rotten vegetation or animal matters. The exposure of these to the scorching heat of a midsummer sun accelerates putrefaction, and is often the cause of illness, due to breathing such impure air. See to it that all ventilation-pipes for the drains or for the sewage-tank are carried to a safe height above ground. Abolish the common privy for servants or farmhands, and substitute for it a properly constructed, well-ventilated, and well-managed earth closet. Never tolerate the throwing out of any slops from the kitchen window. If the slops were poured on to a different spot each time, so as to avoid an over-saturation and fouling of the soil, the practice might not call for severe condemnation. But this will rarely be the case; and nothing is more disgusting than a large, offensive pool of stagnant, foul water near the house, exposed to the scorching rays of the sun.

Barns, stables, cattle-yards, pigsties, hen-coops, and other fowl-houses, dog-kennels, and their immediate surroundings, should be kept scrupulously clean and inoffensive, and their floors ought always to be dry and free from moisture. See that they are not placed too near the dwelling, and have them looked after from time to time, especially if they be located in a direction from which the prevailing winds blow.

Inspection of the Proper Removal of Storm-water.—The surface-water from rain-storms or snow-falls should be carefully removed to prevent undue dampness or rising moisture. Where the rain-water leaders do not deliver into a storage cistern, they ought to discharge into earthen pipes, laid with care and with a true grade, on a firm foundation, and the water carried into some convenient ditch, an open water-course, or a road-gutter. Rain-water should be removed to some distance from the habitation, so that soakage into the sub-soil may not cause dampness of the cellar-walls. It is inadmissible to connect the rain-leaders to the house-drain if the latter discharges into a cesspool; and it is quite important to ascertain that no rain-water pipe, terminating perhaps near upper bedroom windows, acts as a ventilator to any foul drain.

In all country houses, unless they discharge their sewage into a system of sewers, into a large river, or into the sea, the rainfall must be kept entirely separate from the sewage. That portion of the rain falling directly on the ground surrounding the house should be diverted by proper grading so as to protect the foundation-walls. Surface grading is especially necessary wherever roofs are left without gutters. Rain-water and melted snow from paved yards and areas should be removed by surface or underground channels discharging at a distance from the dwelling, where the

water may safely be left to be absorbed by vegetation, or where it may soak away into the soil. Unpaved yards and walks absorb water where the soil is loose and porous; but, in the case of impervious clay soils, properly graded gutters should be constructed to keep the walks dry and in a good condition.

The preceding sections refer in particular to houses already built, for sale or to rent, for permanent or transient occupancy. It is hardly necessary to state that the same rules ought to be followed in the case of dwellings which it is proposed to erect.

In the sanitary inspection of houses located in the suburbs or in the country, the following question blank prepared by me will be found useful.

Sanitary Inspection of Country Houses

No. of Report.....Date.....
Name of Owner.....
Name of Tenant.....
Location and site.....
  Size of lot.....Area of lot.....
  Area covered by house.....
  Number of families.....
Does the house stand on elevated ground?.....
  On hillside?.....
  In valley or ravine?.....
  On level ground?.....
Are there in the neighborhood any swamps or marshes?.....
Is there in the neighborhood any stagnant pool of water of any kind?.....
  Sewage farm?.....
  Cemetery?.....
Are there any offensive trades near by?.....
Are there shade-trees around the house?.....
  How close do they stand?.....
Is there lack of sunshine in rooms owing to closeness of trees?

Soil:

Is the soil dry and porous, sandy or gravelly? .....
Alluvial? .....
Clay? .....
Rock? .....
Is it filled ground? .....
Does the ground contain springs? .....
Are there any abandoned cesspools? .....

Street:

Is the street paved? .....
Is it kept clean? .....
What kind of pavement? .....
Condition of street gutters? .....
Does water run freely? .....

Surroundings:

Is there a yard to the house? ..... is it paved? .....
planked? .....
Are the lawns and walks kept clean? .....
Are the surfaces well-graded and drained? .....
Is there any accumulation of kitchen offal? .....
Are there any manure heaps? .....
Are there any pools of stagnant slopwater? .....

Stable.

Pig-pen.

Hen-coops.

Barn.

House:

Construction? ..... stone? ..... brick? ..... frame?
When built? .....
Is there a cellar under the house? .....
If no cellar, is house well raised above ground? .....
What is the condition of spaces under piazzas? .....
Is there any rotten vegetation? .....
Is the cellar well lighted? .....
Well ventilated? .....
What is the cellar floor? ..... earth? .....
Concrete? ..... brick? .....
Is it dry? .....
Are there any rat runs? .....
Is cellar used for the storage of vegetables? .....

How many steps is the ground floor above general grade? .....

Number of floors? .....Number of rooms? .....
Construction and material of roof? .....
Flat?.....hipped? .....
Slate?.....shingle?.....tile?.....
What is the condition of the roof?.....
Are there gutters and leaders? .....
Are the bedrooms on the sunny side of the house? .....
Is the attic plastered? .....
Are there double windows for winter use? .....
If so, are the outer windows arranged for admission of air?.....

Heating-apparatus:

What system of heating?....stoves?....how many? .....
Are they jacketed? .....
Baltimore or fireplace heaters? .....
Furnace?.....make?.....size?.....material?.....
Is the furnace large enough to heat entire house? .....
Are all joints of furnace tight? .....
Has the furnace a cold-air box? .....
Material? .....size? .....
Where is the inlet to cold-air box located? .....
Is there more than one inlet? .....
Is inlet protected by wire-netting against entrance of cats, rats? .....
Can the cold-air box be cleaned? .....
Are there arrangements for filtering the dust? .....
Is there provision for evaporation of water? .....
Steam, direct, direct-indirect, indirect? .....
Are steam-boilers inspected?.....
Is the hall heated? .....
Is there a supply of fresh air to all parts of house?.....
Where are the registers located?.....size? .....
In wall? .....
In floor? .....
Is the staircase ventilated? .....
At what temperature is the air of living rooms kept in winter? .....
At what temperature is the air of bedrooms usually kept?
Are bathrooms heated?.....
Is the hall heated? ....
How are the toilet and bath-rooms ventilated?. .....

Plumbing Work:

Is there a plan of the drainage and plumbing work? .....
Is the house connected with a sewer? .....
What is the size of the main drain? .....
Material? .....
Fall? .....
Condition of joints? .....
Where does it run to? .....
Is it below or above cellar floor? .....
Are there inspection holes? .....
Soil-pipes, how many? .....Location? .....
Material? .....
Size? .....
Joints? .....
Waste-pipes, how many? .....
Material? .....
Size? .....
Joints? .....
Are vertical stacks straight or have they offsets? .....
If so, how are offsets made? .....
Are all lines extended full size through the roof? .....
Is there a main trap? .....
Location? .....Size? .....
Is there a fresh-air inlet? .....
How protected against obstructions? .....
Is the plumbing exposed to view, or at least readily accessible? .....
How many plumbing fixtures? .....
Are they placed in vertical groups? .....
How many bath-rooms? .....
How many toilet-rooms? .....
Are there stationary washbasins in the bedrooms? .....
How many? .....
Are all plumbing fixtures trapped separately? .....
If, so, state size of trap? .....
Material? .....
Kind? .....Cleanout screws? .....
Are traps vented, or are they non-siphoning? .....
Are any fixtures disconnected? .....
Where do they discharge? .....
Kitchen? .....
Grease-trap for kitchens? .....

Plumbing Work:

Laundry?.....
Scullery?.....
Pantry?.....
Number of fixtures on each floor?.....
Note type, make, and material of fixtures?.....
Do fixtures stand free or are they encased in woodwork?..
Have the fixtures overflow pipes?.....How arranged?....
Refrigerator?....Is waste disconnected?....Does it waste to dry well outdoors?.....
Is flush of water-closets and slop-sinks efficient?.....
Are there any fixtures disconnected or cut off and not used?
Refrigerator wastes, boiler blow-offs, safe wastes, fountain wastes, tank overflow.....

(For a detailed inquiry regarding the Plumbing follow the Schedule for City Houses.)

Lighting:

How is the house lighted?.....
Electric lighting?.....
City gas?.....
Gas from gas-machine?.....
Lighted by acetylene-gas apparatus?.....
Kerosene-lamps?.....
Candles?.....
Are gas-pipes tight?.....
Are there any gas leaks at fixtures?.....
Is gas-meter properly located?.....
What burners are used?.....
Do the gas-cocks have stop-pins?.....

Sources of the Water-supply:

Well?.....Depth?.....Size?.....
Driven well?.....
Dug well?.....
Form of bricking or steining?.....
Is surface around well kept clean and well graded?.....
Are no drains near well?.....
How is water pumped?.....
Form of pump?.....
Is the well protected against surface drainage .....
How near a privy?.....a cesspool .....

Sources of the Water-supply, continued:

Spring? . . . . .
Location? . . . . . Protection? . . . . .
Any danger of pollution? . . . . .
Rain-water cistern? . . . . .
Location? . . . . .
Material? . . . . . Size? . . . . .
Material of roof covering? . . . . Is roof kept clean? . Gutters?
Is there a rain-water cut-off on the leaders? . . . . .
Is the cistern ventilated? . . . . .
Where does the overflow-pipe run to? . . . . .
Is the cistern water-tight? . . . . .
Pond or lake? . . . . .
Filter? . . . . .
Any sources of contamination? . . . . .
River? . . . . .
Examine for sources of pollution upstream. . . . . .
Are there manured fields draining to the stream? . . . . .
Does any sewage or drain run into river? . . . . .
Is the pump intake located near the centre of stream or in the current? . . . . .
Public Supply:
Reservoir? . . . . .
Construction? . . . . . Cleanliness? . . . . .
Is there any vegetable growth or scum? . . . . .
Is it protected from decaying matter? . . . . .
Mode of supply? . . . . .
Gravity? . . . . . Pumping? . . . . .
Is there a filtration plant? . . . . .
Is there any bad taste or odor in water? . . . . .
Has the water-supply been analyzed? . . . . .
Result of chemical analysis? . . . . .
Result of bacteriological analysis? . . . . .
Material of service pipes? . . . . .
Iron? . . . . . Lead? . . . . .
Tinned brass? . . . . .
Tin-lined lead pipe? . . . . .
Block-tin pipe? . . . . .
Are all water-closets in house flushed from cisterns? . . . . .
Is there an inside storage-tank for water? . . . . .
How is overflow disposed of? . . . . .
Is there a general house-filter? . . . . . What kind and size?

Arrangements for the Removal and Disposal of Waste Matters:

Is there a cesspool on premises? . . . . . .
Location? . . . . . .
Character and construction? . . . . . .
Open or leaching? . . . . . .
Water-tight? . . . . . .
Has it one or two chambers? . . . . . .
Size? . . . . . .
Has it an overflow? . . . . . .
Is it ventilated? . . . . . .
How often emptied? . . . . . .
How many feet from the house? . . . . . .
From well or the cistern? . . . . . .
Privy? . . . . . .
Location? . . . . . .
Distance from the house? . . . . . .
Construction? . . . . . .
How often emptied? . . . . . .
In what condition? . . . . . .
How often disinfected? . . . . . .
Earth closet? . . . . . How arranged? . . . . . .
Location? . . . . . .
Is it connected to house by a covered passage? . . . . . .
Condition? . . . . . .
What is the arrangement for depositing the earth? . . . . . .
Is a pail system used? . . . . . .
How often are the pails removed? . . . . . .
How is the slopwater disposed of? . . . . . .
Is there a flush-tank and sub-surface irrigation system? . . . . .
Size of flush-tank? . . . . . .
Has it an automatic siphon? . . . . . .
Number of feet of absorption tiles? . . . . . .
Is the sewage disposed of by surface irrigation? . . . . . .
Is the sewage purified by a septic tank, or contact-filter beds, or by both? . . . . . .
Describe the system briefly . . . . . .

Garbage Disposal:

Is there a kitchen range carbonator to cremate and dispose of the solid refuse? . . . . . .
Garbage pail? . . . . . material? . . . . . size? . . . . . .
Where kept? . . . . . How often emptied? . . . . . .

In the following I give three shorter forms of inspection blanks, the first being one in use for many years by the Sanitary Protection Association of Newport, R. I.; the second being an inspection blank used by the Board of Health of Montclair, N. J., while the third one was adopted some years ago by Princeton University to control the sanitary conditions in houses where students board.

Questions for Sanitary Inspections Prepared by the Sanitary Protection Association of Newport, Rhode Island.

1. Are the sanitary surroundings of the house perfect? Do the trees and shrubbery permit sufficient exposure of it to sun?
2. Is the water pure and drinkable? If from well or cistern, has the water connection with external air?
3. Is the cellar dry, well ventilated and free from decomposing matter, which may give forth seeds of sickness and death, and has it a drain? This drain must be wholly unconnected with any sewer.
4. Is the cellar air entirely excluded from the air supply to the furnace?
5. Has every bed-chamber free ventilation and direct means of communication with the external air?
6. If contagious or infectious disease has occurred in the house, has the sick chamber, etc. (bedding, wearing apparel, curtains, carpets, and upholstered furniture) been thoroughly disinfected and the wall-paper removed?
7. Has each water-closet means of external ventilation, and not into an entry or bed-chamber?
8. Are the soil-pipes in a sound condition and easily accessible for examination? Are they of iron, with lead-calked joints? or are they of lead? and if of lead, have they been in the house a number of years, and thus perforated with holes through which sewer air escapes into the house?
9. Has the soil-pipe a proper vent through the roof?

10. Is the soil-pipe in its exit through the foundation of the house, of iron, or of earthenware? If of the latter, is it broken off in or just outside of the foundation, so as to allow the sewage matter of the house to find its way throughout the foundation?
11. If there are set bathtubs, basins, or washtubs, are they securely trapped? Is the kitchen sink safely trapped? It must not be forgotten that the ordinary bell trap does not perfectly exclude sewer air, which its water absorbs and transmits, and that the S-trap is liable to be siphoned, or emptied by inward suction so as to permit the escape of gas into the house from the soil-pipe or drain.
12. Is the waste water-pipe of the refrigerator entirely cut off from all connection with the soil-pipe?
13. Is the cesspool near the foundation wall? Is the cesspool a loose one? and is there any overflow or leakage into the foundation, cistern, or well?
14. Is there a direct supply connection for cooking and table use, where city water is employed, between the main and the kitchen faucet?

Blank Form for Sanitary Inspection in Use by Board of Health of Montclair, N. J.

Date .....Inspector.....Premises.....
Description of property .....
Owner .....Occupant .....
Number of residents over five years of age....Under five years..
Number of sleeping-rooms.....Condition .....Ventilation ....
Water-supply:
Source .....If well, driven or dug .....
Depth of well.....diameter.....How near any cesspool, privy, manure heap.....Their relative position as regards slope of surface .....
Can surface water find its way to the well?.....
Is well-water used for drinking purposes? .....
If so, how treated before use? .....
Sinks, Baths, Basins, Urinals, etc.:
Clean? .. ..
Properly trapped?.....Traps unobstructed?.....
Do the waste-pipes conform to health ordinance rules? .....
Are the traps vented in accordance with rules? .....

House-drain:
Is it in accordance with the regulations? .....
Soil and Main Waste-pipes:
Are they in accordance with the regulations? .....
Cellar or Basement:
Dampness.....Ventilation.....
Light .....Floor.....Depth below surface.....
Wells.....Tanks .....Plumbing fixtures.....
Do they conform with the rules and regulations? .....
Heating:
Fresh-air entrance .....Is it air-tight? .....
Sewer:
Any in street or under construction? .....
Are any or all plumbing fixtures connected? .....
Is any cesspool or privy in use? .....
Water-closet:
Description and type .....Location .....Ventilation ....
Light .....Cleanliness .....Does it flush well?....
What deodorizer or disinfectant used? .....
Does the arrangement of water-closet conform to rules? .....
Yard:
Cleanliness .....drainage .....
Privy:
Description .....Location .....Ventilation .....
Light .....Cleanliness .....How emptied? ..
What deodorizer or disinfectant used? .....
Cesspool:
Material .....Size .....Covering .....Ventilation ....
Is it water-tight? .....How emptied? .....
Does it conform to the rules? .....
Rain-water Pipe:
Where does it lead to? .....
House-tank in Attic:
Location .....Material .....Size .....Cleanliness ....
Source of contamination .....
For what purpose is water used?.....
If for drinking, how treated before use? .....
Stable:
Relation to dwelling .....Number of horses ....Cows.....
Cleanliness .....Drainage .....
Disposition of manure .....
Is manure pit covered? .....Screened? .....and dry? ....

Chicken Yard—Pig-pen:
Relation to dwelling.....
Cleanliness.....Drainage.....
Garbage and Other Refuse:
Are iron or steel receptacles used for the garbage and offal in accordance with ordinance?.....
Are waste fluids disposed of any other way than by drain?..
If so, how?.....Is there any deposit or accumulation of putrescible matter?.....Are ashes and garbage mixed?...
Disposal of ashes?.....Disposal of the garbage?.....
Miscellaneous:
Character of soil?.....Any made ground?.....
Any cesspool, privy or vaults, etc., abandoned and not filled up?.....If filled, how?.....
Have there been any cases of infectious disease since January 1.....What disease?.....Time of year?...
Remarks.....

Record Blank Adopted by Princeton University for Recording Conditions on Premises where Students Board or Lodge.

Prepared under the Supervision of the Sanitary Committee of Princeton University.

Number of house.....Street.....Date.....
Owner's name.....Address.....
Tenant.....
Size of lot.....Has lot been filled in?.....
Area of lot.....Area covered by buildings.....
Elevation of house sill above curb.....Ground-water level below curb.....Number of stories.....
House erected.....Material of construction.....
Fire-escape.....Roof.....Back dwelling on lot...
Foundation.....Damp?.....Cause of dampness?....
Cellar:
How floored?.....Under all the house?.....Outside entrance.....
Number and size of windows.....Cellar damp?.....
Does the ground-water rise above cellar bottom?.....
Is cellar well ventilated?.....
House faces.....Sun exposure.....
Number of sleeping rooms.....

Heating:
Has furnace an air-tight fresh-air box?.....
Size and length of cold-air box?.....Location of air-intake?
Lighting:
Gas-pipes tested?.....
Yard:
Accumulations in.....Condition of yard?.....
Privy Vault:
Size.....ft....x....ft.; distance from privy vault to dwelling.....ft.; distance from vault to well.....ft.; construction of privy vault.....
Quantity of accumulation in privy vault.....
Date when privy vault was emptied last?.....
Cesspool:
Size, construction, location, ventilation.....
Water-supply:
Analysis of well-water.....
Is water-supply delivered through tank?....Number of gallons
Stable.....How floored?.....
Disposal of fluid excreta.....Storage of solid excreta.....
Chickens kept on premises?.....
Garbage, how stored?.....Frequency of removal?..
House used for boarders?.....For other business?.....
House used for lodgers?.....
Number of inhabitants of house.....Number of lodgers.....of boarders?.....
Is house in good repair?.....Is house and premises maintained in a cleanly and healthful condition?.....
Is house connected with the public sewer?.....
Material and size of main house-drain?....Trap on main drain?
Inlet on house-drain for fresh air?.....
Number and location of drainage fixtures.....
Are all fixtures trapped?.....Are all traps protected against siphonage?.....
Water-closets, style of?.....how flushed?.....condition of water-closets?.....
Window in water-closet apartment?.....
Has house-drain been tested for leakage?.....By what methods?.....Date?.....Result?.....
Diseases reported, with dates.....
Deaths, with dates and causes of death?.....
Supplementary notes.....

The foregoing inspection questions refer principally to country houses, owned or rented by persons of comfortable means, who prefer living in the country or in the suburbs of cities, while doing business in the city.

Much has been said and done in recent years to improve the sanitary condition of the smaller farm houses.* In a book with the title "The Healthful Farm-House," by a farmer's wife (Helen Dodd, authoress), the subject is discussed in a series of chapters, composed each of questions relating to the kitchen, the cellar, the dining-room, living-room, bedrooms, bath-room, and the shed, and those who wish to follow up the subject further, are advised to look up this book.

---

* See Farmers' Bulletin No. 270, U. S. Dept. of Agriculture, by Elmina T. Wilson, "Modern Conveniences for the Farm Home," 1906. See also Wm. Paul Gerhard, "The Sanitation, Water-supply, and Sewage Disposal of Country Houses," D. Van Nostrand Co., 1909; and "Syllabus of Illustrated Lecture on Farm Architecture," by Elmina T. Wilson, U. S. Dept. of Agriculture, Washington, D. C. 1907.

Summer Boarding-houses and Summer Resorts

Much of what has been said in the preceding pages applies to boarding-houses and summer hotels at the seaside or in the mountains; but in these the danger of infection from unsanitary conditions of drainage and water-supply is multiplied, because of the large number of people who seek pleasure or rest, and who are crowded together in a small space, and also because such hotels are fitted up more liberally with what are called "modern conveniences." It is true that at summer resorts the evil influences of a polluted water-supply or contaminated air may become to some extent counteracted by the outdoor exercise, by the greater number of hours spent in the fresh air, at the beach, on the water, or in the woods, and by the temporary abandonment of business thoughts and cares. But this should not be a valid reason for relaxing the watchfulness against unhealthful influences; for neither sea-air nor exhilarating mountain breezes possess the power to counteract completely the injurious effects of drain or cesspool air, breathed in the shut-up rooms at night. One frequently encounters instances where some illness, contracted at such places, breaks out only after the return to the city house and to business.

All large hotels and boarding-houses should be annually re-inspected, and their drainage and water-supply appliances put in a proper sanitary condition. The purity of the sources of drinking-water, in particular, should be guarded with the greatest care, and the arrangements for the disposal of the sewage should be made as perfect as may be attainable. Then, and only then, will the healthful and invigorating influences

of summer days spent in the country be of lasting benefit to those who leave their comfortable city homes in order to benefit their health.

Sanitary Inspection of Public Buildings

Public buildings embrace all structures holding either for a few hours or continuously, a congregation of people, for business, political, civic, educational, religious, entertainment, or sanitary purposes.

How can public buildings be classified?

The *first* classification, the one usually made by architects and builders, is *according to the purposes or objects of the building.*

We have accordingly, buildings for commerce, trade, and business; for manufacturing; for agricultural purposes; for traffic, transportation, and intercommunication; for educational and for scientific purposes; for amusement; for art and exhibition purposes; for worship and ecclesiastical purposes; for police and fire protection; for military purposes; for the care of the sick, injured, demented, deaf, mute, blind; for orphans, and old people; for the administration of justice; for municipal and State government purposes; for bathing and washing purposes; for the engineering works of a city (water-works, sewage, and garbage disposal); for the sale and purchase of provisions; for the preparation of the food (slaughter-houses.)

A *second* classification is *by the location of the buildings with reference to the city plan.* City architects, city engineers, and sociologists interested in city improvement plans usually follow this classification.

We may distinguish: A. Buildings, which are business centres and which *concentrate or centralize street traffic,* for instance, city halls, court-houses, parliament

houses, capitols, exchanges, post-offices, custom-houses, telegraph headquarters, railroad stations, ferry houses, steamer docks, hotels, libraries, large department stores, and fire and police headquarters.

We have next, B. Buildings which *distribute or decentralize street traffic*, such as churches, synagogues, chapels cathedrals, school-houses, colleges, universities, theatres, concert and lecture halls, club houses, art museums, public bath-houses, markets, small retail stores, sub-police stations, sub-stations of post offices.

Finally we have, C. Buildings, which should be *confined to outlying sections* of a city, such as military barracks, military posts, hospitals, asylums, sanatoria, public institutions, soldiers' homes, jails, prisons, penitentiaries, reformatories, slaughter-houses, and the buildings for the city water and gas works, for sewage treatment, garbage disposal and disinfection, large factories, power stations, large commercial steam laundries, and other industrial buildings.

A *third* classification, and the one which is of the greatest use to the practical sanitarian and the sanitary inspector, is one *according to the length of time in which the buildings* are occupied. We distinguish, first, public buildings occupied by a permanent large population, *both in day time and during the night*, such as the hospitals, orphan asylums, homes for aged people, institutions of all kinds, prisons, jails, military barracks, and hotels. These are, perhaps, from a sanitary point of view, the most important ones, and all health measures must in them be very strict and complete.

We have, second, public buildings *which have large gatherings only during the day time*, such as school-houses, court-houses, manufacturing buildings and factories, department stores, bank buildings, museums and libraries. For these buildings sanitation is not less

important, but the requirements are not so rigorous nor so difficult to follow as in buildings of group (1).

We have, thirdly, public buildings *occupied by large congregations for a few hours only*, either in day time or in the evening hours, such as the churches, and theatres, concert halls, lecture rooms, armories, convention halls, etc. In these buildings ventilation is, perhaps, the most important sanitary requirement.

Finally, we have some buildings not readily classified, but important from a health point of view, like bath-houses, bakeries, markets, and abattoirs.

It is out of the question to discuss the features involved in the sanitary inspection of all the buildings mentioned. I shall, therefore, select some representative types, viz., hospitals, school-houses, churches, theatres, bath-houses, markets, and abattoirs.

The chief points to be inquired into when making sanitary inspections of public buildings are the following:—

1. The location, soil, site, and surroundings
2. The grouping of the buildings;
3. The drainage,
4. Sewerage and sewage disposal;
5. The water-supply for domestic use and for fire protection;
6. The plumbing; the bath and toilet-rooms;
7. The natural and artificial lighting;
8. The warming and ventilation;
9. The safety from fire;
10. Details relating to planning and to construction;
11. The maintenance of cleanliness, and
12. The removal of waste food, garbage, and refuse.

Location, Soil, Site and Surroundings

Hospitals.—My long entertained and firm conviction that large hospitals should not be located in the crowded sections of cities has been strengthened by what I saw and learned during a recent trip in Europe. Large hospitals should be relegated and built at the periphery of a city. This location offers numerous advantages, such as the following: Land is not so expensive, and hence one is enabled to obtain a much larger area of ground; this again permits of spreading out the buildings and doing away with five and six-story buildings, as we find them built in our largest cities. A hospital situated in the suburbs will have better air, better surroundings, and for the patients there will be better opportunity for resting, and the quietness of the place will also benefit both the physicians and the nurses. Suburban hospitals should always be built on the pavilion plan, i.e., with one or two-story structures. The large cities will need small reception hospitals, largely for cases of accident or injury, which hospitals may be built on the corridor or closed type of plan. The difficulties of the transportation of the sick to the suburban hospitals will not be found unsurmountable; the transportation can be effected by means of special hospital trolley cars, or with automobile ambulances.

Between four and five hundred patients' beds are generally considered to be the desirable limit for the size of a hospital. In Europe, however, I found that some of the recent and most up-to-date hospitals contained 1000, 1500, and even 2000 beds. A large area of ground, from 1000 to 1500 sq. ft. per bed, is always provided, and affords an opportunity for the arrangement and planning of parkways, lawns, terraces, flower

beds, walks, fountains, etc., which adds much to the attractive appearance of the group of buildings.

School-houses.—These should be located on quiet side streets, away from traffic and noise. The site should be elevated, open, airy, and dry. The size of the school lot should be sufficient to permit of the placing of the building a certain distance back from the street, and also to provide large playgrounds or school yards. An average-sized lot should provide 30 sq. ft. per pupil.

In selecting a location for a school-house, noisy surroundings and noxious trades, railroad depots and freight terminals, factories, stables, hotels, markets, police stations, and fire-engine houses should be avoided, as all of these have a disturbing influence. In large cities one should also avoid the neighborhood of high buildings, of noisy pavements, and of filthy neighborhoods; in the country, swamps, stagnant ponds, and low places.

Theatres should be located at central points of traffic. An open lot is desirable for the location of a theatre for the sake of safety, but is not often attainable here, where theatre buildings are private enterprises, owing to the costliness of the site. Abroad, where many theatres are subsidized by the municipality or by the government, they are usually located on open squares. This provides opportunity for plenty of exits in case of fire, and incidentally enables the architect to design a better looking building.

Churches should be located centrally and convenient of access, and if possible, at prominent street corners. In Europe large churches and the cathedrals are always placed on open squares, or at street intersections, which is certainly a most desirable location. The size of the lot should be ample to meet all requirements of the congregation. An open space means, first, a better

architectural appearance of the edifice, and second, it secures better light and air.

Markets for the wholesale trade of provisions should be located near the harbor and docks, convenient to the railways and to the connecting highways, in order to be easily accessible for the handling of farm products. Retail markets, on the other hand, should be in the centres of populated city districts so as to be accessible for the general public.

Abattoirs should be placed on the outskirts of cities, and below the city, if this is located on a river. They should never be located near any residential districts. The principal points governing the selection are the traffic connections, the drainage, and the water-supply. A large area of ground is required for the numerous buildings, composing an abattoir, and there should be sufficient facilities for the transportation of the cattle and of the butchered meat.

Sanitary Requirements of Hospitals—The Grouping of the Buildings.—The chief sanitary requirements of hospitals are admission of plenty of fresh air and light, and maintenance of minute cleanliness within and without the buildings. We may distinguish two types of hospitals: (1) The older or closed type, sometimes called *block or corridor system*, where the different wards are located along, or connected by, corridors. (2) The newer type, or *pavilion type*, also called the *barrack type* (for temporary structures), which decentralizes the patients, and permits a better separation and a better and more scientific classification of the various diseases. It consists largely of one-story buildings. Since hospitals are always composed of a number of buildings the best way of grouping them requires a great deal of study and experience.

The buildings which compose an abattoir are the

sheds, pens, and stables for the cattle, the separate slaughter-houses for cattle and calves, for sheep and for pigs, the cold-storage buildings, the buildings for diseased and suspected animals, the administration building, power-house, the offices for the meat-inspection service, buildings for the cleaning of the entrails and for the commercial utilization of the offal.

In making sanitary inspections of public buildings a good way to begin is to note carefully the existing conditions regarding location and site, soil, and surroundings. All of what has been said heretofore regarding these points for city and country houses, applies, of course, in the case of public buildings, and in addition those points mentioned in the above paragraphs should be taken into consideration.

Drainage

Drainage, as distinguished from sewerage, means the removal of the surplus moisture from the soil and also the removal of surface-water. Sewerage, on the other hand, signifies the removal of the water which has been introduced into the buildings and which must be removed after use.

Hospital buildings require artificial drainage where the ground is damp, wet, or springy. To accomplish it, the use of open-jointed, small-sized agricultural drain-tiles is recommended, and these drains should never connect with the sewer of any building. They can be discharged into open ditches, or into the nearest water course. Sewers for foul water should never be used for drains, and *vice versa*.

Theatres often have the under-stage placed so deep that it comes below the level of the street sewer, and in order to keep the sub-basement dry, the subsoil water

must be removed by some method of pumping, either automatically or otherwise.

In **churches** where the basements are used for Sunday-school rooms or trustees' meetings, sociables, etc., some attention should be paid to the drainage of the basement. One should always avoid dark, musty places which are necessarily unhealthy, even for temporary occupancy.

For **school-buildings** very much the same requirements apply as given for churches. The play-rooms are often placed in the basement of the school-house, and it is inadvisable to put children into basements which are damp and otherwise unhealthy.

In **markets and abattoirs** located where the soil and the site are not naturally dry, drainage should be provided so that there will be no stagnant pools of surface-water anywhere.

Sewerage and Sewage Disposal

City hospitals can in nearly all cases be connected to a city sewer. There should be, however, some provision made for the disinfection of the liquid wastes from infectious diseases. In Europe I found in some cases that the entire sewage from a hospital was subjected to disinfection before it was discharged into the city sewer; in other cases only the wastes from pavilions for infectious diseases were so treated.

In the case of *hospitals located beyond the city limits*, we cannot usually make connections with a city sewer, as this would involve the carrying of a long line of sewer: therefore, such hospitals must often devise their own independent sewerage plant. In planning for it, the topography of the grounds will decide whether the sewage has to be pumped or can be disposed of by

gravity. The separate system of sewerage, which excludes the rainfall, is the one generally to be used. This involves the laying of smaller pipe-sewers; it has other advantages, for instance, where the sewage has to be pumped the volume to be dealt with is less and more uniform; where the sewage has to be chemically treated the volume remains more constant and is not so large. With six or eight-inch pipe sewers we can dispose of the sewage from the largest buildings in a satisfactory manner. The alignment should be as straight as possible and the grade sufficient to prevent deposits. Manholes and flushing appliances should be provided.

It is rarely the case that the sewage from hospitals can be delivered in its crude state into a stream or water-course. In some States the laws very properly prohibit such a discharge. We must, therefore, purify the sewage to a greater or lesser extent before it can be so discharged.

All ordinary systems of merely straining or subsidence in sewage-tanks will not give satisfaction in the long run; they are imperfect and effect some clarification only, but do not purify. Years ago the chemical treatment of the sewage was advised, but it was found to be expensive in the cost of the chemicals used, in the manipulation and in management, and it did not always give the best results. One of the best systems to-day is the one advocated twenty-five or thirty years ago, viz., land treatment of sewage, either by irrigation or by intermittent sewage filtration. Where the sewage is not too large in quantity, the sub-surface irrigation system gives good results. There must be a sufficient disposal area for the suitable purification of the sewage. Within the last few years, several new systems, called the biological treatment of sewage, have

come up, which are interesting, and promise good results. They comprise purification by septic tank treatment; sewage treatment in contact filter-beds, and in percolating filters.

The septic tank is, practically, a scientifically constructed cesspool, which is usually, though not always, covered over to exclude the light and air. In such septic tanks the sewage is acted upon by the anærobic bacteria, which thrive in darkness, away from air, and the action is such that portions of the sewage are liquefied, but the resulting effluent is rarely so purified that it could be delivered into a water-course. Further purification is therefore required. This can be accomplished by the other biological methods.

Sewage contact filter-beds are large beds filled with broken stone from three to five deep. The sewage is delivered onto such tanks and allowed to stand for several hours; during this time some purification takes place. When the proper time has elapsed, the sewage is discharged, being then in such condition that it can be emptied into any water-course.

The other treatment is by means of trickling or percolating filters, which are filters of coke or broken stone, from seven to ten feet deep, well aërated and well drained; onto these sewage is discharged intermittently. The degree of purification is not as high as in the case of double contact-beds.

All systems of sewage purification require careful management and constant attention, and it is well to bear in mind that no sewage disposal system, no matter how carefully planned and arranged, can take care of itself in the long run. Hence it is my practice to advise the use of a minimum amount of automatic appliances.

City school-houses are usually connected with the city

sewers, whereas country schools require some kind of disposal system. The ordinary cesspools and dry-vaults are objectionable and should be done away with. For country schools there are only two methods, viz. (1) earth-closets for small schools; (2) water-carriage system for the larger schools.

Abattoirs require some purification of the waste-water, but in this country the cases are rare where this is done. In Europe we find many municipal abattoirs in which some system, generally a chemical precipitation system, is used for the purification of the waste-water mixed with the blood from the slaughtered animals.

Water-supply

Water-supply is very closely allied to sewerage, in fact one cannot be successful without the other. It would be a mistake, from a sanitary point of view, to introduce water-supply into buildings without providing at the same time adequate sewerage facilities, but on the other hand, plumbing and house-drainage appliances cannot be operated successfully without an ample water-supply.

City hospitals require large water mains because more water is used in hospitals than in other buildings, also for the sake of the desirable fire protection. Where hospitals are located beyond the city limits, it is usually necessary to provide an independent water-supply. In planning for it the chief considerations are:

First, the determination of the quantity to be provided. We must provide very generously, for some hospitals use one hundred and fifty gallons per capita per diem, and where this water has to be pumped, it means a large expense. One should, however, always

endeavor to check the waste and to restrict the consumption.

Water may be obtained from springs or from wells. These may be shallow or deep wells, but the shallow wells should not be used unless the search for better sources of supply fails. Other sources of supply are surface-water from water-sheds, from lakes, rivers and brooks, and finally, the rain-water.

The second point of importance is the quality, which should always be ascertained before deciding upon a source of supply, by chemical and bacteriological examinations.

Third, we should provide an abundance of water pressure for fire-protection purposes. We obtain this pressure, except in the case of the gravity supplies, when the source is at a high elevation, by pumping water into elevated tanks, stand-pipes, or into pressure-tanks. In providing a pumping system, one should always arrange it in duplicate to provide against the breakdown of the machinery.

In hospitals and in other public buildings the question of drinking-water is of importance. While we can purify the water generally by mechanical filters, it is always wise to have a special apparatus, such as the Chamberland-Pasteur or the Berkefeld filter for the drinking-water. These appliances filter slowly, but they give a water which is germ-free for from three to seven days. After this period they should be thoroughly cleaned out. All filters, however, should be washed and sterilized from time to time to accomplish good results.

Theatres require water (1) for domestic use; (2) for drinking purposes for the audience, and (3) for fire protection, which in the theatre buildings involves the installation of a very elaborate system.

Church buildings too, require a water-supply, especially the Baptist churches, which require water for the immersion pools used for baptizing. In others it is necessary to have water to operate the organ.

With regard to the drinking-water supply for **schools,** I would point out that anything in the shape of buckets, with glasses, cups, or other devices, is unsanitary. The new "hygienic fountains," at which the children can drink the water without even touching the fountain, form an almost ideal arrangement.

Abattoirs require enormous quantities of water, and being located on the outskirts of a city, must usually provide an independent supply. The buildings are largely one-story structures and hence do not require a high pressure. It is necessary, in the case of slaughter-houses, to have hot water for washing the sinks and floors, and this is readily provided, as there is almost always a boiler-house, in which steam is available.

Plumbing

Hospitals require a great deal of the usual plumbing, and in addition some special plumbing fixtures. The plumbing should be as simple, direct, compact, and plain as possible, and nickel-plated plumbing should be avoided.

The plumbing in the pavilion or ward buildings should be cut off from the wards. All parts of the plumbing should remain exposed to view. No vent-pipes should be allowed to pass through the wards. If there is any building in which ornamental plumbing is out of place it is a hospital.

Theatres and churches have a larger amount of plumbing than most people would expect, and in both kinds of buildings some very unsanitary conditions have often been discovered.

School toilet-rooms may be placed in the basement or else outside in specially constructed out-buildings. Both types can be properly arranged, but my preference is for basement toilet-rooms in schools, provided these rooms are properly and sufficiently ventilated; that is, in such a way that there will always be a draft of air from the halls into the toilet-room and thence out through the vent-flue, and provided, furthermore, that single or individual closet-bowls or fixtures are used, and not the automatic flushing water-closet ranges, which I hold should be used only in outside toilet pavilions, but never in the basement of a school-house.

I advocate the placing of the plumbing in the basement for the reason that it is much easier to take care of, and that in this position it is better protected from freezing. In large schools there may be a few toilet-rooms on the upper floors for the teachers, but I find that in general, it is much more desirable to put these also in the basement, so that there may be a supervision of these rooms by the teachers, for in many cases the janitor's supervision is lamentably insufficient. In very large schools it may be necessary to provide toilet-rooms on every floor. They should be planned to be placed in a wing of the building. Dry-closets, on the "Smead system," should in my opinion never be permitted in a school-house.

The care of the school plumbing devolves upon the school janitor, but it is my experience that it would be better if the school principals and the health officers of the school district would look after it.

Markets and abattoirs should have plain plumbing, which, however, should be extra strong. These buildings require numerous sinks and troughs, urinals, water-closets, and also a few shower or spray-baths.

Toilet and Bath-rooms

In **hospitals** the toilet and bath-rooms must be located convenient to the wards. I recommend that the toilet-rooms should not contain the lavatories. These should be placed in separate rooms. The toilet-rooms require abundant ventilation and should have floors and walls finished in non-absorbent and readily washable materials, such as tiling.

As to the fixtures, avoid those having sharp corners and use only the plain white earthenware, without any embossing or decoration. For insane hospitals the plumbing should be extra or double strong; the toilet-rooms should have no partitions and no doors for the individual seats. The flushing should be accomplished automatically, or else combination pull and automatic tanks should be used.

As to the bathing appliances, there should be one fixed tub and another tub placed on wheels, the former being located in the centre of the room, so that the attendant may pass all around the patient. In insane hospitals, the bathing formerly accomplished by means of tubs, led to many abuses and some danger, so that it was found preferable to dispense with the tub. In New York State, for instance, it was found advisable to abolish the tub entirely and to use only the spray-bath.* There is another class of bathing appliance, called "permanent water-baths," in which the patient is placed on a frame and allowed to remain in the tub for weeks or even months. Very few of these have been installed in this country, but I have seen a large

---

*See Gerhard, "Modern Baths and Bath Houses," 1908. John Wiley & Sons.

number in the European hospitals. European hospitals also make provision for large central bath-houses, in which medical baths of all kinds are administered and where massage treatment is also given, usually in connection with a mechano-therapeutic installation.

A class of public buildings in which plumbing and bath-rooms form the most important feature of interior equipment and construction are the **bath-houses.** Large public bath-houses of European cities contain all kinds of baths, including steam and hot-air baths, electric-light baths, and some have even baths for dogs. The sanitarian who watches over the health of a city is more especially interested in the so-called people's bath-houses, in which the admission fee charged is very low or which are altogether free to the public. For such bath-houses the rain or spray-baths are eminently well adapted, and are used in the majority of cases, though a few tub baths are also provided for women, young children, and for invalids.

The State of New York passed a law some years ago making the building of a sufficient number of such bath-houses in the crowded districts of cities mandatory upon all cities having a population of 50,000 inhabitants or over. Quite recently a movement for the revival of swimming pools has sprung up, and a combination of spray-baths with swimming basins or pools is important and desirable for cities located on rivers, as for instance, New York City, where the floating river baths are becoming impracticable, owing to the pollution of the rivers with sewage and manufacturing wastes. These combination baths are also desirable for those inland cities which lack swimming facilities altogether.

Plumbing Inspection

In examining the plumbing work of public buildings make sure of the following points, viz.:

(1) That the drainage system removes from the building quickly and completely all the liquid wastes without contaminating either the soil, the air, or the water.

(2) That all outlets in the building are safely trapped so that there can be no escape of sewer air.

(3) That the pipe system is free from any dead ends, where air might stagnate, and that it is freely open to the roof.

A sanitary inspection should always include the testing of the drains and of the plumbing. This is accomplished by either the oil of peppermint test or by the smoke test by means of a smoke-blowing machine or of smoke rockets. The chief details which should be looked after in the inspection of the plumbing refer to the following:

(*a*) The material of the pipes, fixtures, and traps;

(*b*) The pipe-joints and the mode of setting and connecting the fixtures;

(*c*) The alignment and grade of the pipes, whether for waste, vent, or supply;

(*d*) The pipe junctions and the pipe supports;

(*e*) The layout of the piping; the sizes or diameters of pipes;

(*f*) The method of trapping the fixtures;

(*g*) The ventilation of the piping;

(*h*) The flushing of the fixtures, traps, waste-pipes, and drains;

(*i*) The accessibility of all parts of the supply and waste system;

(*j*) The absence of stoppages in the lines;

(*k*) The noiseless operation of the fixtures, as well as of the piping, faucets, valves, ball-cocks, etc.;

(*l*) The exposure of any part of the plumbing to freezing;

(*m*) The avoidance of waste of water;

(*n*) The absence of complicated mechanical apparatus, liable to get out of order and to cause expensive and troublesome repairs;

(*o*) The simplicity of the entire arrangement and the avoidance of all unnecessary complication.

The discovery of the presence of rats in older buildings is often a sure indication that something is wrong with the underground drains. In the inspection, look for floor-drains or so-called gullies in dark parts of cellars. They are usually admitting sewer air, because the water-seal of the trap has become evaporated owing to disuse. Always try to ascertain whether there are many sharp bends or angles in the vent-pipes, for these impede ventilation owing to friction. Make sure that food supplies in hospitals and markets are stored in places free from any air pollution.

Lighting, Natural and Artificial

In **hospital** wards plenty of windows are provided, but these are put in as much, or more so, for the airing of the ward as for lighting purposes. In the wards a subdued light is preferable and is obtained by the use of shades or of blinds. Of the available artificial lights electric lighting is by far the best. In the wards only dim lighting is necessary, but in other parts of the hospital, and particularly so in the operating-rooms, a very strong light is required.

The proper lighting of the **theatre,** and particularly of the stage, is a very complex problem. All new theatres have electric lighting, and this was considered to be much the safest from the point of view of fire, until recent statistics of theatre fires made it seem at least doubtful whether electric lighting was in reality safer than other modes of lighting. About one point, however, there can be do doubt, i.e., that the installation of electric lights has helped in solving the problem of the ventilation of the theatre auditorium.

The day lighting of **school-rooms** is a very important question, for in the inspection of school buildings we find a great many school-rooms which have the light falling in from the wrong side. Which is the proper position for the windows of a classroom? If the windows are put in the back of the room, making the light fall over the pupils' shoulders from the rear, then the teacher has to face the light. If, on the other hand, the windows are put in front it is very bad for the children's eyes. There is really but one correct position, and that is, the light should fall from the left side of the pupil. The windows should reach high up, nearly to the ceiling.

I want to call attention to the importance of having in a school all stairs and halls perfectly lighted, so that they can be used safely at all times. There should be daylight illumination, and also provision for artificial lighting on dark days, by either gas or electric light.

For dark afternoons the classrooms require either gas lighting or incandescent electric lighting. For classes in drawing the indirect reflected light is considered to be the best. Where gas is used, preference should be given to the Welsbach incandescent and the inverted mantle burners.

Market halls must be lighted not only at night but in the early morning hours in winter time, and the electric arc light, in its various improved forms, is the one best adapted for the purpose.

Slaughter-houses are often located out of reach of the gas or the electric light works, and hence require to be fitted up with an independent lighting plant, which may be either an acetylene lighting, a gasoline, or air gas plant, or finally, an individual electric lighting plant with dynamos and electric wiring and lamps.

Warming and Ventilation

The subject of warming and ventilation is of the greatest importance in the case of the buildings under discussion, but it is of such magnitude that I could not do it justice here, hence I shall content myself with the mention of a few points on ventilation.

Ventilation of **hospital** wards is accomplished in the best modern examples from American practice by mechanical means, such as fans and blowers, run by steam-engines or by electric motors. It is frequently, however, the case where such ventilating machinery was originally installed, that the fans are found not in use, for reasons of economy, after the building has been occupied for some length of time. It would seem rather absurd to put in such expensive installations which practically accomplish no good, because not kept in operation. I am inclined, therefore, to give preference to natural over mechanical ventilation, although I am aware of the fact that to keep the air in the wards pure or up to standard, very large volumes of fresh air have to be provided. It is usual to provide an air-supply of from 2700 to 3500 cubic feet per hour per bed.

The least that can be done is to provide for the wards a change of air three times an hour.

In **theatre** buildings mechanical ventilation is more feasible, because it is required only for a few hours each day, hence nearly all modern theatres have such installation. In addition to any ventilating system it is desirable to practice "air-flushing" between the afternoon and evening performances.

Defective ventilation in **churches** is often the cause of the drowsiness of the audiences. Ventilation of these buildings is particularly important where two or three services are held on the same day. It is one of the often neglected duties of the sexton to see that the church building is properly ventilated.

For **school-houses** a system of mechanical ventilation is, as a rule, too costly. It is certainly out of the question for the majority of schools of smaller towns, which have but one or two classrooms. A fair, natural ventilation can, however, always be secured by means of properly built and properly dimensioned exhaust flues, in which a positive updraft has been provided.

In school ventilation, two points are essential, viz.:

(1) Provide abundant air-flushing during recess;

(2) Remove carefully all sources of air-pollution;

This means (*a*) that the wardrobes for pupils should never be placed in the classrooms;

(*b*) That school baths should be provided to keep the children clean and to teach them cleanliness of the body;

(*c*) That a scrupulous cleanliness be maintained everywhere in the building.

In **bath-houses** ventilation is quite necessary to remove the vapors arising from the hot water when the sprays are running or the tubs are filling. Efficient ventilation is very necessary in Turkish bath establishments, but is also very costly. In the swimming-baths of

German cities I found water-sprays provided in the four corners of the clerestory over the swimming-pool which are intended to cool and purify the air.

Market halls require ventilation principally on account of the odors attaching to some of the provisions for sale; it is likewise necessary to keep the food from spoiling.

The room or building in **abattoirs** where, according to my observations, ventilation is most essential, is the one where the entrails of slaughtered animals are cleaned and boiled.

Some Building Details

Number of Stories.—In large *hospitals* there should not be more than two principal floors; one-story pavilions are even better. But the administration building and the pathological building may be higher.

School-houses should, where the ground area permits, not be higher than two or three stories. Stair climbing is objectionable and injurious, and also adds to the danger of panic and loss of life.

Abattoirs and markets are usually one-story buildings, and have the offices located on an upper gallery floor. The model slaughterhouse erected recently in the City of New York is an exception, it being six stories high.

Theatres would be much safer if they had only one tier in addition to the parquet; the largest number of victims in all theatre fires have always been in the highest gallery, from which the escape in case of a calamity is the most difficult.

Principal Rooms.—The *hospital* ward is the unit in hospital planning. The best form is the oblong or rectangular room, with windows on both long sides.

The rooms for the nurses, the pantry, and the doctor's room should be placed at one end, and the bathroom, lavatory, toilet, scullery, and the patient's dayroom at the other. The dayroom should have a wide front and a sunny exposure. In two-story pavilions the stairs should be kept away from the ward and placed directly at the entrance.

Both the circular and the octagonal forms of wards are rare, though they offer some advantages, such as good exposure to air and sunlight; but the disadvantages outweigh the advantages, for they are wasteful in centre floor space and require a larger floor area for the same number of beds than the oblong ward. Constructional difficulties are apt to increase the cost of building them. Square wards are not desirable except for wards containing only a few beds.

Suitable dimensions for a rectangular ward to contain 30 beds are: Length 100 feet; width 28 feet; beds spaced 3½ feet apart; centre space between rows of beds should be from 10 to 12 feet. Thirty-two beds is the maximum capacity of a large ward, 20 to 30 beds are the average; corridor wards are smaller and contain from 10 to 12 beds, and never more than 18.

For each bed there should be provided from 85 to 100 square feet floor space and from 1500 to 1750 cubic feet. A larger allowance should be made for wards in the pavilions for infectious diseases.

Suitable dimensions for a *school-room* are: Length 28 to 32 feet; width 20 to 28 feet; height 13 to 14 feet. The maximum number of pupils for a classroom may be taken as 45 to 50; the floor space per pupil should be 16 square feet, and the cubic space 200 to 225 cubic feet.

In slaughter-houses we may distinguish two types of the arrangement of the slaughter-hall: One is the open hall system, generally having a wide centre hall

and two side halls, open and connected; the other type is the one with individual killing compartments, separated by walls or partitions.

Furniture and Equipment.—Of particular interest in the case of *hospitals* is the furniture of the wards, and the equipment of the operating-rooms, which require so-called aseptic furniture. It is important that the windows and outer doors of kitchens, pantries, and dining-rooms be provided with metallic screens to keep out flies and thus to protect the food.

In *school-houses* it is of importance to provide hygienic desks and seats, which favor a good posture of the pupils and prevent curvature of the spine and near-sightedness. For the pupils of different ages in a classroom there should be seats and desks of varying height.

For the comfort of *theatre-goers*, allow a floor space of 5 to 6 square feet per person. In *churches* this allowance is even higher, viz., from 7 to 8 square feet.

A hygienic equipment of *slaughtering-halls* is important. There should be plenty of sinks, and an ample water-supply with numerous taps for both hot and cold water. Inside hydrants should be provided for the washing of floors. The floors should not be slippery; ample and conveniently arranged hoisting machinery, numerous trucks and tanks, barrels, and pails are essential. A cold-storage plant for meat is absolutely required.

Safety from Fire

In the inspection of public buildings we should not overlook the question of safety from fire. The safety of the building interests us only indirectly and is a matter well taken care of by the underwriters. What concerns the sanitarian most is the safety of the inmates.

All public buildings, where a large number of people are congregated or assembled, whether for a few hours only, or for the entire day, or which are occupied both night and day, are more than ordinarily susceptible to calamities due to fire or panic, and should for this reason receive particular attention by the authorities in charge, the building department, the fire, local health, and the State Board of Health departments.

The following table, taken from the *Chronicle* fire tables, gives a good idea of the enormous annual fire loss of such structures:

BUILDINGS OF PUBLIC OR SEMI-PUBLIC CHARACTER INJURED OR DESTROYED BY FIRE IN UNITED STATES (THREE YEARS).

(*From Chronicle.*)

	1900.	1901.	1902.	Total.	Per Week.
Theatres and opera houses	133	149	145	427	2.7
Public halls, dancing	38	46	44	128	.8
Churches	575	658	588	1821	11.7
Schools	528	546	509	1583	10.1
Hospitals	73	79	103	255	1.6
Asylums	78	72	72	222	1.4
College buildings and seminaries	110	96	106	312	2.0
Libraries	19	15	9	43	.3
Jails	64	79	78	221	1.4
Hotels	1321	1378	1463	4162	26.7
	3065	3229	3196	9490	60.8

The inspections recommended should be made, not only during the construction of the buildings, but after their completion as well.

In some of the buildings under discussion it seems desirable to introduce apparatus or appliances for the automatic extinguishment of fire. This is already

being done in theatres, and also in extra-hazardous parts of hospitals, and after a recent school fire calamity it was proposed for school-houses. According to recent statistics, 93 per cent of fires starting in buildings equipped with sprinklers are extinguished, or at least held in check by them.

In dealing with this problem, we should bear in mind the dangers due to an actual outbreak of fire as well as those due to panic caused by a false alarm of fire, or otherwise. Regarding the danger of a panic in places of assembly and schools, the question of planning is of more immediate importance than fireproof construction. A good, symmetrical plan, with wide corridors and ample and numerous stairways is desirable. Stairs should be fire and smoke-proof and well-lighted; doors should always swing outward, and they should never be locked in schools, churches, or theatres during a session, service, or performance.

In making an inspection of public buildings, with a view to their safety from fire, and the safety of their inmates, look first of all after the means of intercommunication between the floors, and after the exits and fire-escapes. In public buildings stairs should never have winding steps; long flights of stairs should be interrupted by landings; hand-rails should be well fastened and placed on both sides of the stairs. There should always be at least two wide staircases from the second floor to the street. In theatres the building laws require two separate stairs for each tier, and two means of exit from the stage. Elevators should never be placed in the centre of the staircase-shaft. Exits should be well located, made conspicuous and dimensioned sufficiently wide to permit of the quick emptying of the building. Doors should always open outward. In my judgment, no "emergency exits" should

ever be permitted to exist in schools, theatres, and churches; all stairs should be in daily use by the public after the session, service, or performance, in order that the people using the building may have ample opportunity to become acquainted with the location of the exits.

A few years ago the City of Munich determined that the word "emergency exit" should not be used any longer in theatres. All those exits which were intended for the public, and which hitherto were so called, were hereafter lettered merely "exits." It was ordained that they must be so maintained and arranged that they are regularly used after each and every performance, in order to make the public acquainted with the available ways of exit from the theatre, so that in case of actual danger they shall know where to find them. In Berlin this safety measure has been in use since the year 1890. It is also used in some of the Boston and New York theatres. It is certainly a measure which deserves to be widely promulgated. Another good reason why the term emergency exit should be done away with is that playgoers go to the theatre or the concert hall to enjoy a few hours of quiet comfort and amusement after the worry and excitement of the day's work; it is obvious that they cannot do so if they find staring at their face at every other door the unfortunate words which only serve to remind them again and again of the danger and peril to which they may become exposed. The public should, on the contrary, find all possible cause for reassurance, for this helps more than anything else to prevent a panic. The public should learn that plenty of exits are provided, which are always kept open during the performance, and that the widest possible provision is made for them to leave the building in the shortest possible time should a fire or false panic occur.

Omitting the consideration of the fire-extinguishing equipment, I wish to point out that the maintenance of cleanliness and careful, periodical inspections assist materially in preventing outbreaks of fire. The inspection of the heating-apparatus, of the smoke-flues, of the lighting arrangements, and of the water-supply are of particular importance.

In the case of *hospitals* we are dealing with a congregation of helpless patients, many of whom are bed-stricken. The annual fire record regarding *theatres* and *churches* destroyed by fire is appalling. In some large cities the building rules are now very strict and here we find recently-built theatres to be much safer.

A frequent inspection of churches is equally desirable. Many modern *school* buildings are still erected without due regard to safety. The record for the six months from January to June, 1908, shows the occurrence of fifty-eight fires in the school-houses of the United States and Canada. School-houses should be built of fire-resisting or slow-burning construction. The danger points should be equipped with automatic sprinklers, chiefly the basements, the boiler or furnace-rooms, the closets under stairs, the storerooms, clothes-rooms, lockers, corridors, and laboratories.

A school-house should be capable of being emptied in from three to four minutes, and the necessary stairways and exits to accomplish this should always be provided. The suggestion, made after the Collinwood, Ohio, school fire by several architectural papers that schools should have emergency exits, is entirely wrong. I claim that all exits should be used by teachers and children daily, and at the fire-drills to make them acquainted with the means of escape. The ceilings over boilers should be fireproofed, and no storage of inflammable material of

any kind in the cellar and no wooden enclosures near the heating apparatus, should be tolerated.

If these and similar precautions were more generally observed, we should have fewer horrors like the one of the Lakewood school, near Cleveland, Ohio, of March 4, 1908, wherein 173 children and 2 teachers perished out of total of 310, and where, *within one hour* from the time the fire was discovered, the entire school building was in ruins.

Removal of Waste Food and of Offal

Hospital buildings should always have a garbage-furnace or crematory, not only for the destruction by fire of ordinary refuse and offal from the kitchen, but also for the burning of infected bandages and dressings. This should generally be erected at or near the boiler-house, but sometimes we find it placed in connection with the sewage disinfecting station.

School-houses of country districts should have a lunch-room for those children who live far from the school and who remain there during the noon recess. The janitor should take scrupulous care of the food remains and have them stored in covered tight receptacles pending removal.

In **markets** decomposing animal and vegetable food should not be permitted to accumulate, but must be removed daily. The maintenance of cleanliness is very important and embraces daily sweeping, flushing, and occasional disinfection. Waste bits of food, butcher's offal, fruit peelings, etc., should be removed in covered carts, and the removal of any food materials condemned by the health officer should be prompt and regular.

In **abattoirs** the maintenance of absolute cleanliness and sanitation is furthered by a prompt removal of all

waste accumulations which might attract flies and rats. The fight against these pests must be kept up at all hazards. A prompt disposal of the manure from the cattle-yards, stables, and slaughtering-halls is also necessary.

Maintenance of Cleanliness

In **hospital** buildings constant vigilance is required to exclude all manner of dirt. A proper sanitary construction of the walls, floors, ceilings, windows, and doors will assist in maintaining the wards, the bath and toilet-rooms, the pantry, kitchen, and laundry, clean and wholesome.

Thorough cleanliness is most essential in hospitals for three reasons:

1. To prevent air contamination;
2. To preserve the highest degree of personal cleanliness and thus to prevent contagion or blood-poisoning;
3. To maintain the purity of the water and food supply.

In **theatres** and halls of amusement the floors, stairs, aisles, chairs, and carpets must be kept clean by daily sweeping and dusting. Both should be done in a sanitary manner, and in this connection it may be mentioned that the new mechanical or vacuum systems for the removal of dust and dirt are worthy of investigation. Much can also be done to maintain cleanliness by avoiding the use of heavy hangings and decorations, and of the plush seats which catch and retain the dust.

In **churches** carpets and pew-cushions are harbingers of dust. The floors require sweeping and scrubbing, and once in a while they should be washed with disinfecting solutions. The Sunday-school room requires the greatest amount of attention. The matter of clean-

liness is particularly important in those churches where more than one service is held in a day, and where all classes of people congregate.

The janitor is the custodian of the **school** building, and as such is intrusted with the important task of keeping the building clean. This involves the care of the classrooms, of the wardrobes, of the corridors, stairs, and entrances, and of the toilet-rooms. Metallic door-mats or shoe-scrapers should be provided at the entrance doors. The cleaning of the windows should be done frequently and thoroughly.

The school principal should control the janitor's work, and it should not be overlooked that in large school buildings the work is so onerous as to require some assistance for the janitor.

This person should follow a regular routine in the daily cleaning after school closes. Sweeping should be done with wet sawdust, and the dusting of the school furniture with damp cloths. Hygienic methods of cleaning are not always followed by the janitors, nor are they pointed out or encouraged by all Boards of Education.

Besides the daily cleaning there is the periodical cleaning, which should be even more thorough, and include the walls, windows, ceilings, etc. Periodical sanitary inspections of schools are desirable to guard against the building becoming unsanitary. Besides this, there should be kept during the entire school period a medical inspection service as a constant precaution against the spread of communicable diseases brought to the schools by the pupils.

In **markets and abattoirs** proper drainage facilities, a sufficiently ample water-supply, and an efficient removal of all offal and refuse, assist in maintaining general cleanliness. There should be a thorough daily flush-

ing of walls and floors after the slaughtering, to remove the blood, the waste bits of hair, and other dirt.

The slaughtering equipment should be kept scrupulously clean, so that the work of killing the animals and preparing the meat and the meat food-products may be performed in a sanitary manner. The tables, trucks, racks, utensils, and butchers' tools should be cleaned daily and sterilized from time to time. The working clothes of the employees and the persons themselves should always appear neat and clean.

The sanitary inspection service of the abattoirs should embrace three divisions, namely:

(1) The examination of the live stock by veterinary surgeons;

(2) The inspection of the meat from slaughtered animals, performed by Government and municipal inspectors, and which should include a microscopical inspection in the laboratory;

(3) The sanitary inspection of the buildings and of their surroundings by well-qualified sanitary inspectors. This inspection service is among the most important duties of the administration of abattoirs. The proper and successful management of central abattoirs requires a strict enforcement of carefully drawn up rules and regulations, which should be framed by the State Board of Health, which should have ample legal power to enforce them.

In the following pages I present a number of inspection schedules for school-houses (the first and second being prepared by me), two schedules for hospitals, and one suitable for general institutions and prisons.

Schedule for Sanitary Inspection of Schools

No. of Report . . . . . Date . . . . . .
Name of school . . . . . .
Location . . . . . Built when? . . . . . .
Altitude . . . . . Area of school site . . . . . .
How is site as regards elevation and drainage? . . . . . .
Neighborhood? . . . . . .
Stagnant pools? . . . . . .
Offensive trades? . . . . . .
Other nuisances? . . . . . .
Barnyards? . . . . . .
Slaughter-houses? . . . . . .
How is the site as regards the aspect? . . . . . .
Distance of building back from the street? . . . . . .
Character of the soil? . . . . . .
Character of the surface drainage? . . . . . .
Size of building . . . . . .
Material of construction . . . . . .
Brick or stone? . . . . . .
Frame? . . . . . .
Combination? . . . . . .
Fire-proof building? . . . . . .
How many stories? . . . . . .
Is there a basement or a cellar? . . . . . .
What is the condition of the basement? . . . . . .
Wet? . . . . . .
Damp? . . . . . .
Dirty? . . . . . .
Dark? . . . . . .
Unventilated? . . . . . .
Cemented? . . . . . .
Waterproofed? . . . . . .
Floored? . . . . . .
How many class-rooms? . . . . . .
Size of principal class-rooms? . . . . . .
Length? . . . . . .
Width? . . . . . .
Height? . . . . . .
Number of pupils? . . . . . .
Cubic space per pupil? . . . . . .
Floor space per pupil? . . . . . .

How many entrances are there to the building? .....
Do the entrance doors open outward? .....
Are the class-rooms wainscoted? .....
How are the floors of class-rooms finished? .....
How are the walls of class-rooms finished? .....
How are the ceilings of class-rooms finished? .....
How many windows in class-room? .....
How are the windows placed? .....
Mullion windows or single windows? .....
Size of glass surface in windows? .....
Proportion of glass surface in windows to floor surface? .....
How close to the ceiling do the windows come? .....
Are the windows placed at the left side of desks only? .....
Are they placed at the left side and behind? .....
Are there any windows to the right or in front of pupils? .....
Are school-rooms sufficiently lighted? .....
Are there shades or inside or outside blinds for windows? .....
What is the width of corridors? .....
Yard .....Size? .....
How is it used? .....
Is it walled in? .....
Is it well drained? .....
How is the yard surface finished? .....
How is building heated? .....
Stoves? .....Are they jacketed? .....
Furnaces? .....Cold-air box? .....
Direct steam radiators? .....
Direct-indirect steam heating? .....
Indirect steam heating? .....
Hot-water heating? .....Direct? .....Indirect? .....
What is the average temperature maintained in class-room? .....
How are the class-rooms ventilated in winter? .....
In summer? .....
Where are the ventilating registers located? .....
How is fresh air introduced into class-rooms? .....
Give any analyses of air of class-rooms during school hours .....
How are the blackboards placed? .....
Are there blackboards between windows? .....
What is the source of water-supply? .....
Wells? .....
Cisterns? .....
City supply? .....

If from wells, what is their depth? . . . . . .
Are any privy vaults, stables, cesspools near the well? . . . . . .
If so, at what distance? . . . . . .
Is the well protected from surface pollution? . . . . . .
Is the well cleaned out periodically? . . . . . .
Has the well-water been analyzed? . . . . . .
Are there any outhouses or privies belonging to school-house? . .
How many feet away from main building are they placed? . . . .
Are the buildings kept in a sanitary condition? . . . . . .
Are there privies, or vaults, or earth-closets? . . . . . .
How often are the vaults cleaned and disinfected? . . . . . .
Does a janitor live on the premises? . . . . . .
How often is the school building inspected? . . . . . .
Are water-closets used in the school? . . . . . .
If so, are they located in the basement? . . . . . .
Or in a separate building? . . . . . .
Are the water-closets abundantly flushed? . . . . . .
Are they kept clean and odorless? . . . . . .
What type of water-closet is used? . . . . . .
How are the water-closets ventilated? . . . . . .
Where are the wardrobes located for pupils' garments? . . . . . .
Are there facilities for drying pupils' wet clothes? . . . . . .
Are the school seats and desks fitted to the size of pupils? . . . . .
Are any class-rooms overcrowded? . . . . . .
Is there any provision for lavatories for the pupils? . . . . . .
Are there any school-baths for the pupils? . . . . . .
What type are the baths? . . . . . .
Where located? . . . . . .
What is the general condition of the plumbing of the school? . .
How is the building sewered? . . . . . .
Is there a gymnasium? . . . . . State the area of outdoor playgrounds? . . . . . .
Are there opportunities for pupils to exercise, sheltered from the cold, heat, wet, and without breathing foul air contaminated by the privies or the water-closets? . . . . . .
Is the school building located away from factories and commercial buildings? . . . . . .
Is the school building erected with due regard to fire resistance?
Is it regularly inspected with a view to fire prevention? . . . . . .
Is the basement completely isolated from the first floor? . . . . . .
Is the ceiling of basement fire-proofed? . . . . . .
Are the heating boilers in a fire-proof enclosure? . . . . . .

Are combustible or inflammable materials stored in the basement?.....in the attic?.....

Are the stairways fire-proofed and enclosed in fire-proof enclosures like "wire glass?".....

Are there sufficient inside stairways to permit emptying the school in three minutes?.....

Have the stairways handrails on each side?.....Is there a centre rail on stairways wider than five feet?.....

Are the stairways located on opposite sides or corners of the building?.....

Do the class-room doors open into the room?.....

Do the stair doors on upper floors open toward the staircase?..

Are there sufficient exits to permit the pupils to leave the school building at the rate of 120 persons per minute for each exit?

Do all exit doors swing outward?.....

Are there so-called emergency exits ?.....Are these in daily use?.....Are they kept locked?.....Who has the key?

Is the "rapid dismissal drill" practiced regularly?.....

Are there any roof ladders in the school?.....Are these of iron?

Is there a fire-alarm system?.....

Are fire-pails, chemical extinguishers, or fire standpipes provided?.....

Is there an automatic sprinkler equipment?.....If so, what parts of the school building does it protect?.....

Examine the school building with regard to the known chief causes of fire, which, in their order of frequency, are about as follows:

Hot-air furnaces, defective flues;
Sparks on roof; spontaneous combustion;
Electric lighting;
External incendiary by tramps;
Bad exposure;
Careless use of matches;
Carelessness of mechanics doing repairs in building;
Heating stoves;
Carelessness of pupils;
Boys smoking in school basement;
Kerosene-oil stoves;
Mice and matches;
Gas-jets;
Coal-gas explosions and leaky gas-pipes.

Sanitary School-house Inspection

(Plumbing and Toilet-rooms only)

Date . . . . . .

1. Name of school . . . . . .
2. Location . . . . . .
3. Number of stories . . . . . 4. Number of pupils . . . . . .
5. Character of building in general (very old, not so old, new, just completed) . . . . . .
6. Where are the pupils' toilet rooms located? . . . . . .
7. Are the toilet rooms heated? . . . . . .
8. How many seats on each side? . . . . . 9. Walls and floors? . .
10. Light? . . . . . 11. Ventilation? . . . . . .
12. Are toilet rooms free from odor? . . . . . .
13. What kind of fixture is used for the water-closets? . . . . . .
    Type? . . . . . .
    Construction? . . . . . .
    Trapping? . . . . . Flushing? . . . . . .
    Maintenance of fixture? . . . . . .
14. What kind of fixture is used for boys' urinals? . . . . . .
    Type? . . . . . .
    Construction? . . . . . .
    Trapping? . . . . . Flushing? . . . . . .
    Maintenance? . . . . . .
15. Are there any pupils' lavatories? . . . . . Where located? . . . .
    Type? . . . . . .
    Construction? . . . . . .
    Trapping? . . . . . Maintenance of fixture? . . . . . .
    Are towels furnished? . . . . . .
16. Teachers' closets, where located? . . . . . How many? . . . . . .
    Type of fixture? . . . . . .
    Construction? . . . . . .
    Trapping? . . . . . Flushing? . . . . . .
    Maintenance of fixture? . . . . . .
17. How is the building supplied with water? . . . . . .
18. How is the building sewered? . . . . . .
19. Character of plumbing in general? . . . . . (Exposed and accessible or closed up? . . . . . Modern or old-fashioned?) . .
20. Are there any pupils' drinking fountains? . . . . . .
    Type and construction? . . . . . .

21. Are there any school baths? . . . . . .
Type and construction? . . . . . .
Number of baths? . . . . . .
22. Are there any outhouses or privies? . . . . . .
Construction? . . . . . .
How many feet away from main building? . . . . . .
Sanitary conditions? . . . . . .
Are there any vaults? . . . . . .
Are there earth closets? . . . . . .
How often are the vaults cleaned out? . . . . . .
Are there any cesspools in the school grounds? . . . . . .
RESULT OF INSPECTION: . . . . . .

I submit herewith another schedule for school-house inspections:

I. THE BUILDING

A

Name of school . . . . . .
Average attendance (boys, ... ; girls, ...). Enrolment.
Building is on clay . . . . sand . . . . gravel . . . . . earth . . . . . rock . . . . .
Ground is usually wet . . . . . dry . . . . . .
The site is naturally elevated . . . . . artificially elevated . . . .
Site is drained by what means? . . . . . .

B

The building is in what part of the city or town? . . . . . .
It fronts north; . . . . south; . . . . west; . . . . east; . . . . northeast; . . .
southeast; . . . . . northwest; . . . . . southwest . . . . . .
Distance from nearest buildings . . . . . .
Nearest buildings are on what side? . . . . . .
Character of the nearest buildings, e.g., dwelling-houses, etc. . .
Are they high enough to intercept light? . . . . . Do their walls
reflect light strongly (white walls)? . . . . . .
Do their walls absorb light strongly (dark walls)? . . . . . Are
there large trees near enough to intercept light? . . . . . .
Are there in the neighborhood factories (if any, state kind)?
workshops . . . . . stables . . . . . markets . . . . . .
If yes, they are on what side? . . . . . At what distance? . . . . . .
Height of school building to top of upper story . . . . . .

Width of school building .....Length of school building .....
Has it an attic over upper story?.....Depth of cellar.....
Width of cellar . .....Length of cellar . .....
Number of floors in building .....
Number of class-rooms on each floor .....
Number of class-rooms on north side.....east side.....
south side.....and west side.....on the first floor...
Number of class-rooms on the north side.....east side.....
south side.....and west side.....on second floor.....
Number of class-rooms on the north side..... east side.....
south side.....and west side.....on third floor .....
Number of hallways on each floor.....The hallways run in what direction? .....
They extend the whole length or breadth of the building?.....
Locality of wardrobes on each floor?.....
They communicate with the rooms?.....They communicate with the hallways? .....

C

Kind of latrines: water-closets.....earth-closets.....vaults.
If water-closets, how many rooms for boys?.....girls?.....
They are within the building?.....If yes, on what floor?....
Those for boys on what side?.....those for girls? .....
They communicate with the hallway? .....
If in the basement, those for boys are on what side?.....girls?
They communicate with the cellar or a stairway? . .....
They are ventilated by pipes or flues extending how high?.....
Their floor is of brick.....cement.....asphalt.....Water is constantly running or not? .....
Are urinals in same room with water-closets? .....
If earth-closets are used, they are within or without the building? .....
If within, they are on what floor?.....Those for boys are on what side?.....girls? . .....
They are emptied how often? .....
The urinals are on what floor?.....on the north....east.... south.....or west side?.....How ventilated? .....
If without the building, they are in the yard, on the north..... east.....south.....or west side? .....
If tanks, vaults, or trenches are used, they are within or without the building? .....

If within, they are for boys, in the basement.....on the north.....east.....south.....or west side;.....for girls on the north.....east.....south.....or west side.
How often emptied?.....cleaned?.....
The vaults are of wood.....brick.....stone..... Cemented?
They are ventilated by pipes or flues extending how high?.....
The closets are ventilated by pipes or flues extending how high?
Where are urinals placed?.....Constantly flushed with water or not?.....
Any odor usually perceptible from the water or other closets; if yes, on what floor and in what room?.....
Are there bathtubs in building?.....If so, state locality.....
Are they connected with sewer?.....
Are the lavatories fixed washstands connected with sewer?.....
Are they independent of sewer?.....
Are they in a separate room from the water-closets?.....
In what part of building are they?.....
Is drinking-water taken from street mains?.....From well or spring on premises?.....
Locality of such well or spring on premises.....
Distance from drain or closet vault.....

D

The building is of wood.....brick.....stone.....The cellar walls are of brick.....stone.....cement.....
The cellar floor is of brick.....stone..... cemented..... water-proofed.....
Mention any other material.....The floor is usually dry.....moist.....

II. The Rooms

(Fill out for each Room separately)

Name of school.....
No. of room.....on what floor?.....on what side of building?.....
Length of room.....breadth.....height.....
Cubic feet (reduced from above questions).....
Number of single desks in room.....double desks.....
Kind of desks (describe by name known in trade).....

They face north.....east.....south.....west. Floor space to each pupil (deduced from above question).....
Distance from windows to farthest desks.....Number of windows in the room .....
Height of sills from floor.....Height of windows.....
Breadth of windows .....
Square feet lighting surface (deduced from foregoing questions).
How many are on the north.....east.....south.....west, etc.....sides? .....
Is the room lighted from above?.....Is the room ventilated by flues provided with registers? .....
The flues open into both the top and bottom of the room?.....
Area of openings into flues * .....
Do the flues communicate with other rooms? .....
Is there an artificial draught up the flues? .....
How produced? .....
Do the wardrobes open into the room or connect with separate flues? .....
Number of doors in room .....
Number of doors on the north.....east.....south.....and west sides .....
They open into what? .....
Height of doors .....width.....
Number of gas-burners in room .....
Room is heated by stove.....hot air.....steam-pipes..... hot water .....or steam .....
Location in the room of hot-air inlets or other sources of heat.....
How is moisture supplied to the air? .....
Walls of room are of wood.....brick.....stone.....lath and plaster.....tiles.....glazed .....
State any other material .....
Tint of walls.....Are maps, etc., hung between windows?..
The floor of the room is of wood.....cement.....brick..... stone.....Are the walls and floor "packed" or not?.....
If on first floor and no cellar is below, how far is the floor above the ground? .....

---

* If the opening is covered with an iron grating, the area can only be estimated. In such cases give the height and breadth of the opening and approximate area.

Another schedule is as follows:

Name and location of school.....Name of principal....

1. *a.* What open spaces are there attached to your school?...
   b. Are they adequate for play purposes?.....
   c. If not, is there vacant ground adjacent?.....
   d. Are you in favor of properly equipped and managed playgrounds as part of the educational system?.....
   e. Have you school gardens for nature study?.....
   f. Are you in favor of them?.....
2. *a.* Have you a gymnasium in connection with your school?
   b. Are you in favor of them for elementary schools?.....
3. *a.* Have you a shower-bath or bathing facilities at your school?.....
   b. Are you in favor of them?.....
4. *a.* Have you an assembly hall in connection with your school?.....
5. *a.* Are you in favor of the establishment of a branch of the Public Library in your school?.....
   b. Have you a school library?.....
6. *a.* Have free lectures been held at your school?.....
   b. If so, with what success?.....
   c. Do you favor their continuance and extension?.....
   d. Do you favor the public use of schools after school hours as social centres?.....
7. *a.* Is there a parents' club in connection with your school?.
   b. Are you in favor of such organization?.....
8. *a.* Have you a manual training department?.....
   b. Do you favor manual training for boys and girls of all grades in the public schools?.....
9. *a.* Have vacation schools been established in connection with your school?.....
   b. If so, with what success?.....
   c. If you have not one, what demand is there for such a school in your community?.....
10. *a.* What is the most urgent need in your school?.....

INVESTIGATION OF VENTILATION AND SANITATION

11. *a.* Name of system of ventilation used?.....
    b. When installed?.....
    c. Is it in good order?.....

d. Is it satisfactory to the principal? .....
e. If not, why not? .....
f. State your own views about it? .....
g. How many rooms have you visited, and what was their condition, generally and particularly? .....
h. Are the rooms large or small, and what number of pupils in each? .....
i. What is your opinion as to the number of pupils any one teacher should have charge of? .....
j. Do teachers find it necessary to open windows? .....
k. Is it permitted or forbidden? .....
l. Have you personally investigated the means for getting fresh air into rooms, where patent ventilation machinery is used, so that you can report on that outside of what has been told you about it? .....

12. Great caution should be used with your report of branch schools, as there may be subjects calling for special attention, not covered by the above questions, and which should be covered on separate sheets of paper . .

Still another school-inspection schedule is the following:

1. Name and grade of school? .....
2. Name of principal? .....
   First assistant? .....

SITE

3. Is the school-house built on land which is high or low, in comparison with adjoining land? .....
4. Is it built on soil which is naturally dry or porous? .....
   (*a*) If not, is the soil well underdrained? .....
   (*b*) Or does it retain moisture after rain? .....
5. Is it away from marshes and stagnant pools, and from noisy or objectionable industries, stables, and from railroads?
6. Is it near the centre of the district and accessible from the street-cars? .....
7. What is the distance of the school-house from other buildings? .....
   What is the height of those buildings? .....

8. What is the size of the play-grounds?.....
   Are they sunny and dry?.....
   Is the pavement of brick or asphalt?.....
   In what part of the play-grounds are the outhouses, if any, situated?.....
9. How many cesspools in the yard?.....
   How often cleaned?.....
   Are they connected with the sewers?.....
10. How often are the neighboring streets cleaned?.....
    How often watered?.....
11. Is there any alley on any side of the school-house?.....
    Is it kept clean and free from refuse?.....

BUILDING

12. How many pupils was it designed to accomodate?.....
    How many now occupy it?.....
13. How old is the building?.....
14. What is the material of which it is built?.....
15. How many stories has it?.....
16. How many flights of stairs to the highest classroom?.....
    How many times a day does each pupil go over these stairs?.....
17. If there is a hall on the upper floor, how often do the pupils go there?.....
18. What provisions are made for fire-escapes?.....
19. Is there any fire-drill?.....
    How often practised?.....
20. Number of rooms built for class-room purposes?.....
    Are all of these rooms used for classes?.....
    How many rooms in one floor?.....
21. What extra rooms could be, or have been, brought into use for class-rooms?.....
22. How are the extra class-rooms situated with regard to closets or other plumbing, sun, and ventilation?.....
23. Are the rooms which are used for recitation used also for study?.....
    Are they used for both purposes at the same time?.....
    Does this increase the average number of pupils occupying the room?.....
24. If halls are used for recitation are they sufficiently lighted?

25. If rooms or halls are used for play during recess, are they sunny and well ventilated? . . . . . .
26. If rooms are used for play during recess, have they been unoccupied and thoroughly aired for at least fifteen minutes preceding? . . . . . .
27. If the basement is used for play, is it properly floored, dry, and open to sunlight? . . . . . .
    How situated with reference to closets and washrooms? . . .
28. What provision is made for outside clothes? . . . . . .
    Is the space large enough to allow of good airing, and of ready access by the children? . . . . . .
    Are the cloak rooms ventilated? . . . . . .
    What provision is made for drying clothes in rainy weather?
29. How often are the cloak rooms cleaned? . . . . . .
    How thoroughly? . . . . . .
    Are the walls ever wiped with a disinfectant? . . . . . .

BASEMENT

30. Is there any fence or wall which prevents sunlight from reaching the basement walls? . . . . . .
31. What is the height of the basement inside? . . . . . .
    How much of this height is above ground? . . . . . .
32. Is there any part to which the sunlight does not penetrate, or which has no ventilation? . . . . . .
33. Are there several windows on at least two sides, admitting sun and air? . . . . . How large are these windows? . . . . .
34. Are they accessible, and opened daily? . . . . . .
35. Are the floors and walls always dry? . . . . . .
36. Is basement kept clean and free from rubbish? . . . . . .
37. If there is no basement, is there a ventilated air space under the whole building? . . . . . .
    Are there at least three feet of this air space above ground?

SANITARIES

38. Is the water-carriage system used in disposing of excreta? If not, what system? . . . . . .
39. How many closets are provided for the use of the pupils? . .
40. How many for the use of the teachers? . . . . . .
41. Are the closets in a separate tower, or shut off from the main building any way? . . . . . .

42. If not, how are they situated?.....
43. How are they ventilated?.....
44. Is all the plumbing exposed to view, or easily accessible?.....
45. How many pupils to a closet?.....
(Answer by computation.)
46. What facilities are provided in the way of washrooms, or washbowls, or sinks and towels?.....
47. Has each water-closet or sink a trap?.....
48. Are the traps ventilated?.....
Does the vent-pipe extend through to the roof and two feet above it, entirely separate from the chimney-flue?.....
49. Has the old-fashioned pan closet been replaced by one of the simple modern closets?.....
50. Does each closet have a sufficient supply of water, discharged with sufficient force completely to scour the trap,—i.e., two or three gallons of water?.....
51. How often are the washbowls and basins of the closets washed?.....
52. How often are the floors of the closets scrubbed?.....
53. Is any disinfectant ever used?.....What?.....
54. Is there a plan of the drainage system hung on the wall of the engineers' or janitors' office?.....
55. Is any instruction given to the children as to the importance of care in the use of the closets?.....
(*a*) As to cleanliness?.....
(*b*) As to throwing into the closet articles that would clog the pipes—strings, sticks, fruit debris?.....
56. Is there any regular inspection of the plumbing by an expert?.....
57. When was it last inspected, and by whom?....(See him)..
Does he consider it in good condition?.....
58. If there is no water-carriage system, where are the privies?
Are receptacles cemented?.....
How often are the contents removed?.....
59. If there has been a run of any contagious disease in this school, has the plumbing been supposed to be at fault?.....
If so, has it been properly inspected and repaired, or replaced?.....

HEATING

60. What is the system of heating,—steam, furnace, or hot water? .....
    Is the heat furnished by direct or indirect radiation? .....
61. How long has the heating apparatus been in? .....
62. Is there provision for the evaporation of water? .....
63. Is the air for the furnace drawn from the cellar, or from outdoors? .....
64. When was the boiler (if any) last inspected, and by whom? (See him.)
    What was the verdict? .....

VENTILATION

65. What is the method of producing ventilation,—by the natural circulation of air, by mechanical method (by fans) or by the heated air shaft? .....
66. If mechanical, is either the vacuum or plenum system, or are both systems used? .....
67. Whatever the system, is it in full use? .....
    Does it work well? .....
68. If the system of ventilation is separate from the system of heating, is the fresh air brought into the building by a cold-air room in the basement or cellar, or by ducts leading into the outer air? .....
    What is the size of the cold-air box or space? .....
69. Is the opening leading to the cold-air duct or room so arranged that it can be regulated? .....If so, by whom?
70. What is the size of the flue or box leading to each room? ...
71. How does the janitor or engineer regulate the amount of heat or fresh air needed? .....
72. How many cubic feet of air is furnished per minute per pupil? (To be determined by an expert.)
73. Is the shaft for removing foul air upright? .....
    Does it lead unmistakably to the outer air? .....
    Is it heated? .....
74. How are the halls ventilated? .....
    Are they kept clean? .....
    Are they as warm as the classrooms? .....
75. Are they used for storage of material, or for cases? .....

76. Is it possible for used-up air from one room to enter another room?.....
77. Are the air-ducts and flues for the ventilation of the school-rooms entirely separate from the appliances used for ventilating the sanitary rooms?.....
78. What per cent of carbonic acid gas is there in the air of the school-rooms during school hours? (To be determined by an expert.)

CLEANING

79. What are the duties required of the janitor in regard to cleaning?.....
80. Is the regular cleaning supplemented by outside work?....
    By whom paid?.....
81. How often are the floors of school-rooms and halls well swept?
    How often washed?.....
    Is damp sawdust used in sweeping?.....
82. How often are the windows washed?.....
83. How often is the room dusted?.....
    By feather-dusters or cloth?.....
    By whom?.....
84. Are the seats, desks, and walls ever wiped with a damp cloth?
85. Is any disinfectant (and what) ever used in connection with the sawdust, or with the water used for cleaning or wiping furniture and walls?.....
86. What cleaning is done in the long vacation?.....
    What painting, whitewashing, or calcimining.....
87. Are there bath-rooms?.....
    Sufficient to meet the needs of pupils?.....
88. Are they provided with attendants?.....
89. Does the principal consider the present cleaning sufficient?
90. Has he made any effort to have the number of cleanings increased?.....
91. Has he made estimates with additional outside labor, such as is used in office-buildings, etc.....
92. What contagious diseases have prevailed among the pupils during the past year?.....
93. Was the illness probably caused
    (*a*) By conditions at home?.....
    (*b*) By conditions at school?.....
    (*c*) Was it of uncertain origin?.....

94. How many deaths of registered pupils during the year 1900–1901? .....
Remarks .....

ROOM BLANK

1. Specify the room by number, and by the name of the teacher in charge. .....
2. Size of room? .....Length? .....
Width? .....Height? .....
3. What is the total air space of the room? .....
4. The number of pupils it was built to accommodate? .....
5. The number it usually does accommodate? .....
6. Have any of the pupils belonging to this district been refused admittance on account of lack of room? .....
How many are still out on that account? .....
7. Are the seats adjustable, or of different sizes, to accommodate the large and smaller pupils? .....
8. How are the extra pupils seated? .....
9. Are the pupils in close proximity to registers, or radiators, or cold-air flues, or loose windows? .....
10. Is there sun in the room at any time during the day? .....
What part, and how long? .....
11. Are there any complaints of unpleasant odors from halls or flues, or windows? .....
12. How many windows in the room? .....
What is their size? .....
How far from the floor? .....
How far from the ceiling? .....
13. Are they at the side, rear, or front of the room? .....
14. Is the light sufficient on a bright day? .....
On a cloudy day? .....
If not sufficient, how often and how long is gas or electricity used? .....
15. Has the teacher noticed any trouble with the children's eyes, which might come from insufficient or wrongly placed light? .....
16. Are blackboards placed between windows, or in the same wall with them? .....
Are such blackboards used, so as to require the children to look at them? .....

17. Is there a thermometer, and where placed? .....
    How high above the floor? .....
    Does the teacher consult it frequently, or attempt to regulate the temperature by it? .....
    What is the temperature desired? .....
18. What is the average temperature? .....
19. When the heat is diminished, is the amount of fresh air diminished? .....
20. What is the size of the inlet for the warm air; that is, of the flue or pipe? .....
    Where situated? .....
    Is there more than one? .....
21. What is the size of the outlet or outlets for foul air? .....
    Where situated? .....
22. Are both inlets and outlets kept always wide open? .....
    Are draughts complained of? .....
23. Do teachers supplement the regular system of ventilation by opening the windows at intervals? .....
    Where are the pupils in the meantime? .....
24. Are the windows open at recess? .....
    Are the pupils required to leave the room at recess? .....
25. Does the room seem stuffy or dusty? .....
26. How often is the floor well swept? .....
27. How often are the windows washed? .....
28. How often is the room dusted? .....
    With feather dusters, or cloth? .....
29. Are the seats and desks ever wiped with a damp cloth, with or without a disinfectant? .....
30. Does the teacher ever hire extra cleaning done? .....
    What? .....
    Remarks by teacher, concerning ventilation, heat, health, "danger *spots*," or concerning other facts considered important .....

SCHOOL-HOUSES

(From New Jersey State Board of Health's Inspector's Guide)

Building, how located as to elevation and drainage? .....
Size of house? .....
Is it brick or wood? .....

Has it a cellar or basement? .....
If so, state its condition—whether wet, damp, dirty, dark, unventilated, cemented, or floored, etc.? .....
Size of school-room? .....Give number, length, breadth, and height, that the cubic space may be computed? .....
Is there an entry? .....
Is room wainscoted? .....Kind of wall? .....
Number of doors? .....
How many windows? .....
Size of windows and glass? .....
Correct answers are necessary to ascertain lighting surface .....
Distance from ceiling? .....
Are the windows to the right or left, behind or in front of the scholars? .....
What is the size of the yard? .....
Is it fenced? .....
Does water ever stand in the yard or beneath the house? .....
Is it well heated, and how? .....Is there dust? .....Is water supplied to stove or furnace? .....
Do you register by thermometer? .....Is temperature even? .
Is it well ventilated, and how? ..... If by ventilating registers, state whether they are in ceiling overhead, or in flues at bottom or top of room, or both .....Also, if there is any provision for allowing fresh air to enter the room? .....
If by windows, have you ways of preventing draught? .....
Are the blackboards placed between the windows? .....
Blackboards, if possible, should be on side where there are no windows, on account of less reflection of light.
Are the surfaces in good condition? .....
What is the source of water-supply? .....
If from wells, give depth .....Is there any privy vault, stable, sink-drain or cesspool near? .....See diagram, and mark, as nearly as possible, the distance in feet from such sources of pollution.
Is the well protected from all surface pollution? .....
Is the condition of the well carefully looked after? .....
Are there two privies belonging to the school-house? .....
How many feet from school-house? .....
Are the buildings kept in good order? .....
Have they vaults? .....
How often cleansed or disinfected? .....
How is it done? .....

Do trustees or others inspect buildings and school monthly?...
Have you a janitor?.....
If water-closets are in use, in what condition are they kept?....
Are they always flushed with an abundance of water?.....
Are they odorless?.....
Are there any offensive or dangerous nuisances near the school-house, such as barnyards, slaughter-houses, stagnant pools etc.?.....
Is the law providing for vaccination attended to?.....
Are pupils from families, where infectious or contagious diseases are prevailing, excluded from school?.....
Are all the doors hung to swing outward, as the law requires?..
In what year was the school-house built?.....
Is it a suitable house for the district?.....If not, state reason why.....Has it proper places for hanging garments, hats, etc.?.....
Are the seats and desks fitted to the size of the scholars?.....
How many pupils can be comfortably seated in the building? Is any room too crowded?.....
What is thus far the average daily attendance this quarter?....
How many of your pupils are near-sighted?.....
Have you known pupils to become near-sighted while attending school?.....
Are there curtains, or inside or outside blinds, to the windows?.....
How and to what extent is either physiology or hygiene taught?.....
Is there provision for hand and face-washing?.....
General remarks as to needed improvements.....

Questions on Sanitary Condition of School-houses

(Wisconsin State Board of Health, 1879)

Give your name, post-office, and location of school building upon which you report.....
Describe as fully as possible the buildings in which you teach, or which are under your control; give the character of the soil on which they stand, presence of any marsh, or other stagnant water in the neighborhood, material of which they are built, their size, number of stories in each, number of rooms, number of cubic feet in each school-room.....

Describe the entries, passages, and stairways, using rough diagrams if necessary, and give the height of each flight of stairs, as a whole, and the height and breadth of the steps .....

Describe the study and recitation rooms, stating whether the walls are hard-finished, papered, white or tinted, giving the relative positions of blackboards and windows, the proportion of glass (excluding sash work) to floor surface, and any other particulars that may be needed to convey an accurate idea of all arrangements.....

Are all seats and desks in each room of uniform height, or is allowance made for varying height and age of pupils?.....

What is the whole number of pupils and what the number in each room? .....

How are your school-rooms ventilated, and how many cubicf eet of air per hour is secured to each pupil?..... If there be any special system of ventilation, describe it fully.....

Is the apparatus for ventilation in operation or in disuse?.....

Is it satisfactory? .....

How are your school-rooms warmed?.....Has the system of warming them any connection with that of ventilation?.....

Is there any cellar or air space under the building?.....

Is there any proper drainage system for the cellar or air space, if there be any, or any such system for the building and its site? .....

Describe the school yard or playground, stating whether it is enclosed or open, paved or not, its area, etc.?.....

Are there any rooms in the building into which the sun never enters?..... If so, for what purpose are they used.....

From what direction do the pupils receive the light upon their work, i.e., right or left hand, front or rear, above or below the level of the eyes? .....

Describe as clearly as possible all water-closets or privies, giving size, location, in or out doors, distance from main building, distance from pump or well, and the character of the vault, whether stoned or otherwise curbed? .....

Are the privies properly screened from observation and from the weather?.....If out doors, are they connected with the main building by covered ways?..... Is proper care taken to keep them dry, clean, warm, and generally comfortable?...

Are sufficient and separate privies provided for the accommodation of the sexes, and is any special provision made for the needs of the youngest pupils? . . . . . .

If hat and cloak closets are provided, what is their position with relation to the study-rooms? How are they warmed and ventilated, and is there any provision made for the drying of wet shoes, wrappers in wet weather? . . . . . .

From what source is drinking-water obtained? . . . . . Do you know or suspect any means by which the supply may be contaminated? . . . . . .

In your opinion, does any large number of the children suffer from the effects of hard study? . . . . . .

Is one sex more liable than the other to injury from this cause, and if yes, which? . . . . . .

Does the advent of puberty increase such liability? . . . . . .

Does the sight often suffer? . . . . . .

What is the largest number of studies pursued by any one pupil? What proportion of your pupils are obliged to study out of school hours, and how much time is needed by an average student to prepare the amount of work required? . . . . . .

What is the length of your daily session, and how is it divided? How frequent and long are your intermissions? . . . . . Are the intermissions for older and younger pupils of the same length? . . . . . .

What text-books on hygiene are in use in your school? . . . . . .

What text-books on physiology? . . . . . .

Is any instruction given in either of the above two subjects other than by text-book? . . . . . .

What proportion of your pupils are studying them in any way?

How can the physical condition of the pupils of our schools be improved, in your opinion? . . . . . .

What, if any, means are used to prevent the spread of any contagious disease which may appear among the pupils in the school? . . . . . .

Schedule for Sanitary Inspection of Hospitals

No. of Report . . . . . Date . . . . . .

Name of hospital . . . . . .

Location . . . . . .

When built? . . . . . .

Altitude above sea-level . . . . . .

Area of grounds . . . . . .
Are the grounds improved? . . . . . .
Are there shade-trees? . . . . . .
Character of soil? . . . . . .
How is the drainage arranged? . . . . . .
How is the building sewered? . . . . . .
How are the sewers ventilated? . . . . . .
General character of buildings . . . . . .
How many buildings? . . . . . .
Material of construction? . . . . . .
Number of patients' beds? . . . . . .
Number of wards? . . . . . .
Floor area per bed? . . . . . .
Cubic space per bed? . . . . . .
How are the floors of wards finished? . . . . . .
How are the walls of wards finished? . . . . . .
How many windows in the ward? . . . . . .
How are the windows placed? . . . . . .
Do the doors open outward? . . . . . .
How is the hospital heated? . . . . . .
Ventilated? . . . . . .
How are the wards ventilated? . . . . . .
Where are the water-closets located? . . . . . .
How many to each ward? . . . . . .
Type of water-closet? . . . . . .
Ventilation? . . . . . .
Flushing? . . . . . .
General sanitary condition? . . . . . .
How many urinals? . . . . . .
How many slopsinks? . . . . . .
How many bathtubs? . . . . . .
Are there any portable tubs? . . . . . .
Are there any special tubs? . . . . . .
Are there any vapor baths? . . . . . .
How many lavatories? . . . . . .
Where located? . . . . . .
Ward kitchen? . . . . . .
Ward dining-room? . . . . . .
How many beds in ward? . . . . . .
Character of furniture? . . . . . .
Bedsteads? . . . . . .
Mattresses? . . . . . .

Tables? .....
Chairs? .....
Medicine-trays? .....
Spittoons? .....
Ward physician's apartments, where located? .....
Ward nurses, where located? .....
Main kitchen, where located? .....
Size? .....
Floor? .....
Walls? .....
Ventilation? .....
Kitchen furniture? .....
Rooms for storage of food, condition of? .....
Laundry where located? .....
Size? .....
Floor? .....
Walls? .....
Ventilation? .....
Laundry appliances? .....
Linen closets? .....
Disinfecting apparatus? .....
Is there a central bathing establishment? .....
What special appliances does it contain? .....
Dead house .....
Operating theatre .....
Other operating-rooms .....
Patients' dispensary .....
Pharmacy .....

Inspection Schedule Relating to Hospitals

(From Reports of New Jersey State Board of Health)

..... Hospital,
at .....
Date of examination .....
Location .....
Area of grounds and altitude above sea-level .....
Character of soil .....
Arrangement of drainage .....
Are sewers connected with drains? .....
How are sewers ventilated? .....

Grease traps?
How are the grounds improved, trees, etc.?
General character of buildings
Material of construction
Date of erection
Cost of buildings
Number of beds for patients
Wards, general character, number
How many patients in a ward?
Floor area per bed
Cubic space per bed
Ward floors
Ward walls
Ward windows
Ward doors and blinds
Ward heating
Ward ventilation
Ward water-closets
Urinals, slopsinks
Ward baths
Special baths
Portable baths
Lavatories, separate from baths?
Ward kitchens
Ward dining-rooms
Ward furniture
Bedsteads
Mattresses
Tables
Chairs
Spittoons
Medicine-trays
Bells
Patients' clothing, how cared for?
How registered?
Ward physicians' rooms
Ward nurses' rooms
Special rooms or small wards connected with wards
Nurses' duties
Other ward attendants
Main administration building
Main office

Visitors' reception rooms
Rooms of president, physicians, and employees
Main kitchen
Kitchen furniture
Food storerooms
Laundry
Laundry appliances
Number of laundresses
Laundry records and registers
Washing for employees
Linen closets
Mending
Mattress rooms
Disinfection apparatus
Central bathing establishment
Dead house
Amphitheatre
Out-door patients' dispensary
Number treated per year.
Cost
Dispensary and pharmacy
Lifts
Number of days' treatment of patients yearly
Total annual cost
Daily cost per patient
Annual cost of employees
Annual cost of repairs
Annual cost of fuel, and quantity
Annual cost of medicines and apparatus
Annual cost of food
How is the hospital governed?
How are governors or trustees appointed?
Superintendent: Duties, pay, how appointed?
Nurses: Male, duties, how appointed, pay?
Cooks
Porters
Steward
Clerks
Matron
Nurses, female
Rules for admission of patients
Place and mode of admission

Rules for conduct of patients .....
Registration of patients .....
Registration of diseases .....
Registration of beds .....
Diet forms .....
Permits to go out .....
Rules for visitors .....
Special wards .....

Schedule of New Jersey State Board of Health for Inquiries Concerning Institutions

(Other than Hospitals)

No. of Report .....Date .....

GENERAL

Name of institution .....
Location and post-office address .....
Name and address of chief officer.....of physician .....
Date of inspection .....Name of inspector.....
Names and addresses of all managers .....
Surrounding land and elevation above sea-level .....
Character of soil in vicinity of buildings. .....
How many acres of land?.....Is there a topographical map?
Is there a plan of all subsurface drains and other structures?...
Have natural watercourses been turned or changed in any way?
Is there any damming up of water for ponds, and if so, how near to the buildings? .....

WATER-SUPPLY

What is the system of water-supply? .....
Give place, size, depth, character, and locality of any springs and wells .....
Are they open or closed, and what is the mode of getting water therefrom? .....
Are any slops spilled or vessels rinsed about wells, or is the ground near in any way foul? .....
Any other sources of water-supply? .....
Is water introduced into buildings? .....

If so, state each place, and each floor.....Is it by pump or by faucet?.....What kind of pump?.....
Are there house-tanks?....Of what material?....Where does overflow discharge?.....
Is it through lead pipes?.....Is there a cistern, and if so, where?.....Describe its construction?.....
Is the water used for both drinking and general purposes and handy in case of fire?.....
Is the supply of drinking-water abundant and satisfactory, and if not, state objection?.....

BUILDINGS

General character of buildings.....
How many buildings are attached to the institution?..... Show diagram.....
Size of buildings and material.....
Estimated value.....
Date of erection?.....by whom owned?.....What additions since, and when?.....
Describe basement or cellar: How much above ground?..... Is it ventilated?.....Is it dry?.....Is it well lighted? How used?.....Is there kitchen or laundry in it?..... Does any one sleep in basement?.....If so, how many and who?.....Are vegetables stored in it?.....Is it frequently whitewashed?.....Is the floor watertight?..... Has it plastered walls and ceiling?.....Is there a milk cellar, and if so, describe it?.....
Number of rooms?.....
Number of bedrooms?.....Average size of bedrooms?.....
Number of occupants?.....Floor space?.....Cubic space?..
Size of rooms and height of ceiling on first floor?.....On second floor.....Third floor?.....
Describe attic.....What is the finish of walls in buildings? Are any rooms wainscoted?.....
Is the number and size of windows enough for air and light? How near to ceilings are windows?.....Do windows let down from top?.....
How is admission of sunlight regulated—by shutters, blinds, or curtains?.....
Does the sun shine into all rooms sometime during the day?...

PLUMBING AND DRAINAGE

Number, location, and description of all drainage fixtures.....
Are all water-closet apartments well lighted and ventilated?...
What is the method of disposal for waste fluids?.....
How are the drain-pipes and sewers ventilated?.....
Is there a trap and fresh-air inlet on the main drain?.....
Describe trap ventilation.....
Any earth-closets?.....
Any privy vaults?.....
Location.....Size.....Construction.....
When excavated?.....Condition.....
State the material, size, and mode of laying all terra-cotta drains?
Sizes and construction of iron drain-pipes?.....
Is the flow ever sluggish?.....
Is there a grease trap on the premises?.....
Is each fixture adequately trapped?.....Describe the traps?.
Number of water-closets?.....ventilation?.....flushing?
General sanitary condition?.....
Number of bathtubs?.....
How is sewage disposed of?.....
Any cesspools?.....
Location.....Size.....Construction.....
Ventilation?.....When excavated?.....
Frequency of excavation?.....Disposal of contents?....
Do water-closets discharge into cesspools?.....
Are any waste fluids cast upon the surface of the ground?.....

VENTILATION AND HEATING

What is the system of ventilation?.....
Is there any provision for changing the air of rooms during cold weather?.....
What is the method of heating?.....
Are all rooms sufficiently heated?.....

INMATES

How many inmates are there in all?.....
How many males over 16 years?.....
How many females over 16?.....
How many inmates from 12 to 16?.....
How many inmates between 5 and 12?.....

How many inmates under 5 years of age? .....
How many of the inmates were born in the institution? .....
How many the last year? .....
How many of these have been vaccinated within 5 years? ...
Have all adults been vaccinated within ten years? .....
What are the facilities for the usual hand and face washing of inmates? .....
What are the towel arrangements? .....
What for bathtub bathing with warm water? .....
What are the regulations as to baths, and how fully are they carried out? .....
Is a list kept of those who have had a full bath, and how often? and of those who are washed by others? .....
Is the hair of inmates kept properly cut and cleansed? .....
Is there a regular system of changing underclothing? .....
How and where is laundry work and ironing work done? .....
Is there any system by which new suits of plain outside clothing are furnished to the inmates, and by which clothing long worn is cleansed by airing or heating? .....
Is there a separate place or hospital for those taken sick, or are persons attended in their rooms? .....
Describe hospital and asylum arrangement.
When a new inmate is presented what facilities are there for thorough cleansing before admission to the general rooms, or for separation for a few days, in case of any suspected sickness? .....
Have there been any accidents since the last report? .....
If so, what? .....
Are the inmates fed at a common table? .....
Is there a regular dietary for each day? .....
If so, append it to this report.
Are the bedsteads wood or iron? .....
Give size of bedsteads? .....
What form of mattress is used, and how often aired and changed? .....
Does each inmate have a separate bed? .....
Is the bed linen changed each week? .....
How often are all contents of rooms, and especially bedrooms, moved out and the rooms scrubbed and whitewashed, as in general house-cleaning? .....
What system, besides ordinary house-cleaning, is provided for cleansing and varnishing the furniture? .....

What fire-escapes, buckets, extinguishers or other provision in case of fire?
What is the method of lighting?
Is any register kept of inmates as to habits, cause of dependence, mental condition?
What is the allotted cubic space per inmate?
Is there any oversight of or inquiry into the physical condition of inmates?
Is there a record of causes or history of the cases of those bedridden or fully incapable of work?
What was the per capita expense of maintenance last year?
What is the plan of outdoor relief, if any?
What was its cost last year?
Any insane paupers?
How many are demented or foolish or epileptic?
How many such are harmless?
How many are violent?
How many should be kept separate?
What are the arrangements for separation of males and females?
What are the nursing arrangements?
What is the medical attendance?
Does the physician come at stated times or only when sent for?
How much is paid him per year?
How are medicines furnished?
What changes are needed in any present arrangements?
What was the number of deaths and their causes last year?
Is there any system of employment of the inmates?
What is the discipline and oversight of the attendants?
Is any special industry followed?
If so, give particulars?
Is it profitable or merely for occupation?
How many inmates have tobacco furnished them?
How many have opium furnished them?
What was the tobacco bill last year?
What was the liquor bill?
What was the quinine bill?
What are the arrangements for schooling the children?
Are any apprenticed out, and at what age?
Are homes sought for any not apprenticed?
What provisions are there for amusements and for reading matter for inmates?

INQUIRIES SPECIALLY FOR JAILS

Have any been detained as witnesses during the last year, and how long?.....Give particulars?.....
What system have you for receiving the excretions of the body during night?.....What in case of sickness?.....
What are the chances for sunlight to enter cells and corridors?..
Are prisoners allowed to wash and smoke in the cells?.....
Cubic space for each cell?.....
What chance for change of air in cells?.....
If prisoners are taken ill during night, how is aid summoned?..
Size of windows in cells.....Size of doors.....

Theatre Inspections and Surveys

A survey or inspection of a theatre may be made from three view-points, all of which are important. One may consider the building as to its construction and safety from, and as to the means of protection against, fire; or one may consider the theatre chiefly as to the safety of the persons in it when a fire or panic breaks out; and thirdly, one may wish to ascertain the sanitary condition of the building, its plumbing, drainage, and water-supply.

The schedule given below makes an attempt to cover all three features, and may be used in the preparation of annual or special reports on conditions in existing theatres, a matter which should never be delayed or postponed until a theatre fire catastrophe like the one of the Iroquois Theatre in Chicago, on December 30, 1903, occurs.

Schedule for Theatre Inspections

A. In General.

City .....Name of theatre.....Owner.....
Location of theatre.....When built?.....
Date of inspection .....
Surroundings .....
Total seating capacity.....
Parquet .....Boxes.....
Balcony .....Gallery.....
Maximum standing admission permitted .....
Building, constructed of .....
Quick-burning .....semi-burning .....
Incombustible .....

B. Construction of Building.—*Auditorium Section:*

Walls .....brick .....wood .....
concrete .....reinforced concrete....
Is the thickness of main walls in accordance with Building Department requirements? .....
Interior walls and partitions, how constructed? .....
Roof .....joisted .....steep .....
flat .....incombustible .....
How is the roof covered?.....sheet metal.....copper tiles.....slate.....shingles.....tar and gravel?..
Floors: basement ..... } wood or incombustible.
auditorium ..... }
attic ..... }
Attic: how used? .....how large? .....vacant? .....
used for storage? .....
Auditorium?.....dangerous rooms connected with it, furnishings and finish: dangerous, fair, good, safe?...
Is there a roof garden? .....Is there a stage on roof garden? .....
Basement: how used? .....
Smoking-room .....
Toilet-rooms .....
Plenum chamber of ventilating apparatus .....
Passages .....
Are there any dressing-rooms belonging to stage section?
Structural iron work?.....
Is all iron work encased and well protected? .....

Stage Section:

Is the proscenium wall of brick from basement to roof?.....
Does it extend above roof?.....
What is the size of main stage opening?.....
What is the number and size of other openings?.....
Are openings protected by fire-doors?.....
Are fire-doors of wood?.....Of wood lined with tin?...
Are fire-doors of iron?.....
Is the fire curtain of asbestos?....Is it of steel?.....
Is the steel protected or not?.....
Does it run in iron guides or grooves?.....
How is the curtain suspended?....By steel wire cables?
How is curtain operated?.....By hand power?...
Is power hydraulic?.....electric?.....
How often is fire-proof curtain used?.....
From where is it operated?.....fly-gallery?.....stage?
manager's office?.....
Walls of stage house:.....Are they of brick?.....
Roof: what is its construction?.....steep or flat?.....
combustible or incombustible?....How covered?..
Gridiron: Is it of wood?.....Is it fireproof?.....
Vent-flues for stage (see section *J*).
Fly-galleries: how constructed?.....
Stairs: are they of wood?.....Are they incombustible?
Fire-escapes: where placed and how many?.....
Dressing-rooms: are there any on galleries?.....
are there any in understage?.....
Stage basement: how occupied?....how used?.....
For storage?.....for dressing-rooms?
Are there any toilet-rooms?.....Is it vacant?.....
Exit doors for stage house: where located?.....Where do they lead to?.....Can they cause dangerous draughts?.....
Scenery. (See section *I*).

Foyers, Lobbies, Stairs, Exits.

What is the construction of the floors?.....
What is material and construction of stairs?.....

Outside Windows:

Are all outside windows arranged to open?.....
Are any outside windows obstructed by iron grillage?....

Dressing-room Section:

Are the dressing-rooms in a brick building?.....separated from stage house by fire-walls and fire-doors?....

Property-room:

Are any costumes made in the theatre?.....

Where are the costumes stored?.....

Basement.

Carpenter and Paint Shops:

Are they in a detached building?.....

Is ever any scene painting done in theatre?.....

Attic:

How used?.....

C. SANITATION:

(*a*) *Auditorium:*

What is the condition of the plumbing in the toilet-rooms?.....

Who looks after these rooms?.....

Are the toilet-rooms ventilated?..... How?.....

Are disinfectants used for the fixtures?.....

Is the plumbing in general arranged in accordance with best modern rules of house drainage?.....

Is there adequate water-closet and urinal accommodation?.....

Are there in the auditorium any outside windows for "air flushing?".....

How often are the chairs or seats cleaned and dusted?.

Are there floor carpets?....How often are they cleaned?

(*b*) *Stage:*

Where are the stage dressing-rooms located?.....

Are they sanitary and well arranged?.....

What is the condition of the lavatories in dressing-rooms?.....

Have these basins hot and cold water?.....

Have the dressing-rooms windows to the outer air?....

What is the average size of the dressing-rooms?.....

In what condition are the actors' water-closet accommodations?.....

Are they separate for men and women?.....

Is the plumbing open or boxed up?.....

Are there any gas leaks?.....

How often is the floor of the stage swept?.....

Is the stage ventilated?.....

(*c*) *Drainage and Plumbing:*

Are the areas and courts properly and sufficiently drained? .....
Are the soil-pipes carried the full size to the roof? .....
Are basins and sinks properly and separately trapped?
Are there any pan-closets, or other old types of mechanical water-closets? .....
Are the urinals flushed automatically? .....

(*d*) *Domestic Water-supply:*

Is the house supply entirely separate from the supply for fire-extinguishing purposes? .....
Is any water for house use drawn from the sprinkler-tank? .....
Is there a hot-water tank? .....Is there a house tank?
Size and capacity? .....
Is the drinking-water filtered? ....What filter is used?
Is the ice for cooling the water kept separate from the water? .....

(*e*) *Ventilation:*

Where is the fresh-air supply for the heating apparatus taken from? .....
Are the inside courts or alleys kept clean? .....
What is, in general, the system of ventilation? .....
Natural? .....mechanical? .....
Is it a plenum or an exhaust system? .....
Is the downward system of ventilation used? .....
or the upward system? .....

(*f*) *Understage:*

Are the main sewer and drain-pipes exposed? .....
Are they defective and leaky? .....
Are there any untrapped floor cesspools? .....
How is the floor of understage drained, if below the level of the sewer in street? .....
Is the cellar made watertight? .....

(*g*) *Lighting:*

Is the lighting of the theatre by gas or by electricity? .....
Is there a separate auxiliary lighting system for halls, stairs, and exits? .....

(*h*) *General Sanitary Condition:*

Is the boiler and engine room ventilated?.....How?...
Where are oily wastes kept?.....
Are there any accumulations of dirt and rubbish?.....
How is the dusting done?.....
How is the sweeping done?.....
How is the furniture finished?.....leather.....cane?
upholstery?.....
How are the aisles covered?.....
What flooring is there in the stairs and lobbies?.....
Is a vacuum cleaning apparatus installed?.....

D. Water-supply for Fire Protection:

What is the average pressure in the street main?.....
What is the size of the water-supply main in the street?.....
How far is the main from building?.....
How many fire-hydrants are there outside of the building, in the theatre block?.....
What is the size of the service-pipe for water to the theatre?.....
Is there a water-meter on the line?.....
If so, is it bye-passed?.....
Is there a suction-tank or suction-reservoir?.....
How many inside fire standpipes are there?.....
How many in the auditorium?.....
How many on the stage?.....
How many elsewhere?.....
What is the inside diameter of the standpipes?.....
What is the size of the fire-valves?.....
How many feet of fire hose to each fire-valve?.....
What is the character of the fire hose?.....
Make.....brand.....condition.....
How are the standpipes supplied?.....
How many tanks are there for fire protection?.....
Where located.....size.....capacity..
How are they supplied?.....
Is there a fire-pump?.....
Type.....rotary.....direct-acting underwriter pattern.....steam or electric?.....
What is the capacity of fire-pump per minute?.....
Number of fire-streams?.....

What is boiler pressure?.....Make.....
location.....suction from?.....
How often operated and tested?.....
Are there one or more outside fire department connections?.....
Is there an automatic sprinkler system?.....
What part of the building does it protect?.....Roof, stage, under gridiron, fly-galleries, dressing-rooms, smoking-room, attic over auditorium?.....
Basement?.....
How is it arranged?.....
How is it supplied?.....
Gravity or pressure tank?.....
State capacity and size of tank?.....
How is tank kept filled?.....
How is the tank supported?.....
Is there a perforated pipe over the proscenium opening?.....
How many fire-pails or buckets are there?.....Where located?.....
Number of pails in auditorium?.....
Number of pails on stage?.....
Number of pails in cellar?.....
Are the pails kept filled?.....
Are there casks or tanks of water?.....Where located?
Are there chemical or pneumatic portable fire extinguishers?.....
How many?.....Where located?.....
How many in auditorium?.....on stage?.....
Make?.....capacity?.....
Are there any portable pumps?.....

E. Apparatus for Extinguishing Fires:

Is there telephonic connection with the fire department?
with police department?.....with the nearest fire-engine house?.....
Are there outside fire-department connections for the standpipes?.....for the sprinklers?.....
Is there a regular theatre fire brigade?.....
How is it organized?.....
Is it well and regularly drilled?.....
Is its discipline good?.....

Are city firemen detailed for inspection of the theatre during performances?.....How many?.....
To whom do they report?.....
Is there a fire-alarm box?.....Where located?.....
At main entrance?.....
On stage?.....
In manager's office?.....
Is there a theatre fire-alarm system?.....
Describe.....
Are there any life-saving appliances kept in theatre?..
Jumping net?.....Rope fire-escape?.....
Are woolen blankets or asbestos sheets kept on stage?
Are any long poles and wet sponges kept on stage?...
How many fire axes or hatchets?.....Where kept?....
Are there any small dry-powder extinguishers?.....

F. Means for Egress for Players and Theatre-goers.—*Ways of Egress.*

How many separate and distinct ways of egress are there for each division of the audience?.....
Main floor?.....
Balcony?.....
Gallery?.....
Stage?.....
Dressing-rooms?.....
How many of these ways are used regularly as entrances and exits?.....
How many, if any, are "emergency" exits?.....
Are all exits, including emergency exits, opened at the close of each performance?.....
Are exits properly lettered and distinguished by red lights?.....
Are the exits of proper width?.....
Are they free from all obstruction?.....
Do any of the ways of egress converge or cross at any point causing congestion or crowding?.....
Are the public exits separate from the stage entrance?.
Are there any passages or doors likely to be mistaken by public for exits?.....
What is the distance for each division of audience to the the street by way of the exits?.....
Have the fire-escapes any doors opening across them so as to obstruct them?.....

Exit Doors:

Do all exit doors open outward? .....
Are the door bolts so arranged that they can be opened by a slight pressure from behind? .....
Do any of the exit doors obstruct a free passage? .....
How many exit doors in front? .....
How many at sides? .....
How many at rear? .....
Are more exits required for the safety of life? .....
How many minutes does it require to empty the building completely? .....

Seats and Aisles: .....

What is the distance between rows of seats? .....
What is the width of seats? .....
What is the width of the aisles? .....Are they straight? .....Tapering? .....
Are there any steps in the aisles? .....or gradients? ...
Are the slopes of the aisles excessive? .....In balcony? In gallery? .....
Are there any exit doors opposite the ends of the aisles?
Are the aisles clear and unobstructed? .....
Are camp chairs permitted in aisles during performances? .....

Foyers or Lobbies:

Have each of the tiers or divisions for the audience a lobby or foyer? .....
Are these foyers separated from the auditorium by fire-walls? .....
Do the lobbies surround the division which they serve?
What is the floor area of the lobbies? .....
Are they equal in area to the division of the auditorium which they serve? .....

Passages:

Are the passages dark or well lighted? .....
Is there danger of smoke reaching the passage ways to the street? .....

Outside Fire-escapes:

Are the outside fire-escapes of iron or wood? .....
What width are they? .....
Would they be exposed to the flames of a fire? .....
Are they covered over so that ice or snow may not render them impassable in winter? .....

How many are there? . . . . . .
Where located? . . . . . .
Are they well placed and easily reached? . . . . . .
Are they sufficiently strong? . . . . . .

Stairways:

How many stairs are there for the balcony? . . . . . .
How many for the upper gallery? . . . . . .
What is the width of stairs? . . . . . .
Are there any landings? . . . . . Any winding steps? . . .
Are the stairs well lighted? . . . . . How? . . . . . .
Are the staircases free and unobstructed? . . . . . .

G. Heating Apparatus:

Is boiler in basement? . . . . . Is the boiler in a separate building? . . . . . .
Is steam-boiler in a fire-proof enclosure or in a vault? . . . .
What is the system of heating the building? . . . . . .
Hot-air furnace? . . . . . .
Steam heating? . . . . . .
Hot-water heating? . . . . . .
Is the plenum chamber of ventilating apparatus well cut off? . . . . . .

H. Lighting:

How is the theatre lighted? . . . . . .
By oil-lamps? . . . . . .
By gas? . . . . . .
By electric lights? . . . . . .
Are oil-lamps used on the stage in performances? . . . . . .
What kind? . . . . . Glass? . . . . . Metal? . . . . . .
What gas is used? . . . . . .
City gas? . . . . . .
Private plant? . . . . . .
Acetylene lighting? . . . . . .
What is the size of gas service to building? . . . . . .
Is there a cut-off gas-valve outside of building? . . . . . .
Is there a shut-off inside? . . . . . .
Where is the gas-meter located? . . . . . .
Is the gas vault ventilated to the outer air? . . . . . .
How is lighting of stage done? . . . . . .
How is the auditorium lighted? . . . . . .
Are the two systems separate and independent? . . . . . .
How are the dressing-rooms lighted? . . . . . .
How are the stairs and exits lighted? . . . . . .

Are there red lights at all the exits? .....
Is electric current obtained from outside? .....
Is there a separate electric lighting plant? .....
Is the wiring done according to approved rules? .....
Is calcium light used during performances? .....
Any other special light? .....
Are movable electric lights used on stage? .....
If gas, are the flames open or guarded? .....
Are stage fires used? .....Where are the materials for same stored? .....
Are movable table-lamps used in plays? .....
How are the exits lighted? .....oil? .....candles? independent electric current? .....
What restrictions, if any, are imposed in the use of matches? .....
Is the theatre lighting system approved by Board of Fire Underwriters? .....
Are all open gas flames well protected? .....

I. Scenery and Stage Apparatus:

Is the scenery rendered uninflammable by chemical treatment? .....
What treatment is used? .....
Is the curtain of asbestos? .....of canvas? ....treated?
Where is scenery not in use stored? .....
Is there a separate building for scenery? .....

J. Ventilators for Auditorium and Stage Roofs:

Are there any ventilators or automatic skylight for the stage roof? .....
What is their size? .....construction? .....area? ..
Are they automatic? .....
How do they operate? .....Are they reliable? .....
How often are they tested? .....
Are there means to open them from the stage? .....or from rigging loft? .....
Are there exhaust ventilators over the auditorium? .....
How are these arranged? .....

K. Watchman:

Is there a night-watchman? .....What are the hours when he is to be on duty? .....
Is there a watchman's clock? .....Where are the stations located? .....

Are there stations on the stage?.....in fly-galleries? in rigging loft?.....in engine-room?..... in property room?.....repair shop?.....paint shop?.....smoking-room?.....and in each division of the auditorium?.....

Is the watchman's service thoroughly reliable?.....

L. Maintenance of Cleanliness and Order:

Where are waste sweepings and rubbish stored?.....

Are there metal-covered receptacles for them?.....

Are they removed daily?.....

Note maintenance of cleanliness in auditorium.....in dressing-rooms.....on stage.....in property... room....in refreshment room....in lavatories.... toilet-rooms.....in boiler-room.....in cellar..... in wardrobes.....carpenter shop.....in machine shop.....in stairways.....in fire-escapes?.....

M. Inspections:

Is there kept a book to enter complaints?.....

How often is the theatre inspected?.....

Who makes the inspection?.....

Date of last inspection?.....

N. Tests:

Test of fire-protection apparatus?.....

Test of sprinkler system.....

Test of fire-proof curtain.....

Test of auditorium roof ventilation.....

Test of gas-piping.....

Test of plumbing.....

Test to determine time required to empty the building...

O. Exposure to Fire from Outside:

What is the fire hazard of the building with regard to neighboring properties or buildings?.....

Is the theatre protected against fire exposure from outside?

P. Summary and Conclusions:

What is the condition of the building in respect to risk of life?

Use marks as follows:

(I) for "excellent;"
(II) for "good;"
(III) for "fair;"
(IV) for "poor;"
(V) for "bad;"
(VI) for "very dangerous."

What is the condition of building as regards safety of building? . . . . . .
What is the character of building as regards sanitation, cleanliness, and good order? . . . . . .
What is the character of the water-supply? . . . . . .
What is the fire service as regards the theatre? . . . . . .
What is the character of building as regards quick means for exit or egress in case of panic or fire? . . . . . .

RECOMMENDATIONS:

A. Recommendations tending to protection of life in building.
B. Recommendations tending to protection of building and its contents.

Sanitary Inspection of Dairies

When we consider the important bearing which some special types of buildings have upon the health of a community, it will be readily seen how broad becomes the field of work for an efficient and competent sanitary inspector.

Among such special buildings I mention the bake-houses or bakeries, which come under the supervision of the municipal health board, but also under the State factory law; the slaughter-houses, which come under Municipal, State, and Governmental inspection; the steam laundries, the common lodging-houses, the river steamers, and canal boats, and finally, the dairies and cow-sheds, which are subject to inspection by the health boards of the cities which they supply with milk, but also under the general inspection of the U. S. Department of Agriculture.

As the purity of the milk-supply is of especial importance in the case of typhoid and other epidemics, I give, in the following, two municipal, one State, and one Government schedule for the inspection of farm dairies.

I. Rochester Bureau of Health.—Division of Milk Inspection

Inspector .....Date .....19..
Name.....Town.....P.O. address .....
Marketed.....Size of stable.....containing fresh cows .....dry cows .....
Separate place for calving .....
Separate building for sick cows .....
Health and comfort of cows .....
Tuberculosis test .....
Location on hill or slope .....
Window space for each cow .....
Efficient system of ventilation .....
Cubic feet of air for each cow (450 counts 10, for each 25 feet less take off 1).....
Food .....
Water .....clean .....
Cleanliness of cows .....
Shavings for bedding .....
Clean stalls and passageways .....
Barnyard and pasture clean .....
Presence of cobwebs, of dust, of odors .....
Good cleaning of utensils.....
Sterilizing of utensils .....
Plentiful supply of water .....
Location and protection of source .....
Inside of utensils kept free from dust after sterilizing .....
Small top pail .....
Health of employees.....
Wearing clean washable suit .....
Washing and drying hands before and during milking .....
Washing udder .....
Discarding foremilk .....
Prompt and efficient cooling in an hour to { 40° counts 40 / 45 counts 35, etc.
Holding milk at low temperature in transportation .....
Sanitary condition of milkroom .....
Protection by lock or seal from opening cans .....

II. Department of Health, City of New York

Dairy inspection .....Division of inspections .....
Inspection No.....Time.....A. or P.M. Date....19..
Tenant .....P.O. address.....
Township.....County.....State .....
Owner.....Party interviewed.....
Milk delivered at.....Since .....
Formerly delivered at .....
Creamery on.....R.R.....Branch.....Miles to N. Y.
Creamery operated by.....Address .....
Distance of farm from creamery.....Occupied farm since..
No. of cows.....Breed.....No. milking .....
Quarts of milk produced .....
All persons in the households of those engaged in producing or handling milk are.....free from all infectious disease.....
Date and nature of last case on farm .....
A sample of the water-supply on this farm taken for analysis .....and found to be .....
Size of cow barn,.....length.....width.....height (ceiling) .....

Stable:

Cow stable is.....located on elevated ground with no stagnant water, hogpen, or privy within 100 feet .....
Floors are.....constructed of concrete or some non-absorbent material .....
Floors are.....properly graded and watertight.....
Drops are.....constructed of concrete, stone, or some non-absorbent material .....
Drops are.....watertight .....
Feeding-troughs, platforms or cribs are.....well lighted and clean .....
Ceiling is constructed of.....and is.....tight and dust proof .....
Ceiling is.....free from hanging straw, dirt or cobwebs.....
Number of windows.....total square feet.....which is .....sufficient .....
Window panes are.....washed and kept clean .....
Ventilation consists of .....
which is sufficient, or fair, or insufficient .....
Air space is.....cubic feet per cow, which is .....sufficient .....

Interior of stable painted or whitewashed on.....which is satisfactory.....fair.....never.....

Walls and ledges are.....free from dirt, dust, manure or cobwebs.....

Floors and premises are.....free from dirt, rubbish or decayed animal or vegetable matter.....

Cow beds are.....clean.....

Live stock, other than cows, are.....excluded from rooms in which milch-cows are kept.....

There is.....direct opening from barn into silo or grain pit.

Bedding is.....clean, dry, and absorbent.....

Separate building is.....provided for cows when calving...

Separate quarters are.....provided for cows when calving..

Manure is.....removed daily to at least 200 feet from the barn.....

Manure pile is.....so located that the cows cannot get at it.

Liquid matter is.....absorbed and removed daily and..... allowed to overflow and saturate ground under or around cow barn.....

Running water-supply for washing stables is.....located within building.....

Dairy rules of the Department of Health are.....posted.

Cowyard:

Cowyard is.....properly graded and drained.....

Cowyard is.....clean, dry, and free from manure.....

Cows:

Cows have.....been examined by veterinarian.....Date Report made.....

Cows have.....been tested by tuberculin, and all tuberculous cows removed.....

Cows are.....all in good flesh and condition at time of inspection.....

Cows are.....all free from clinging manure and dirt.....

Long hairs are.....kept short on belly, flanks, udder, and tail.....

Udder and teats of cows are.....thoroughly cleaned before milking.....

All feed is of.....good quality and all grain and coarse fodders are.....free from dirt and mould.....

Distillery waste or any substance in a state of fermentation or putrefaction is.....fed.....

Water-supply for cows is.....unpolluted and plentiful.

Milkers and Milking:

Attendants are.....in good physical condition.
Special milking suits are.....used.
Clothing of milkers is.....clean.
Hands of milkers are.....washed clean before milking.
Milking is.....done with dry hands.
Foremilk or first few streams from each teat is.....discarded.
Milk is strained at.....and.....in clean atmosphere.
Milk-strainer is .....clean.
Milk is.....cooled to below 50° F. within two hours after milking and kept below 50° F. until delivered to the creamery.
Milk from cows within fifteen days before or five days after parturition is.....discarded.

Utensils:

Milk-pails have.....all seams soldered flush.
Milk-pails are.....of the small-mouthed design, top opening not exceeding 8 inches in diameter. Diameter.....
Milk-pails are.....rinsed with cold water immediately after using and washed clean with hot water and washing solution.
Drying racks are....provided to expose milk-pails to the sun.

Milkhouse:

Milkhouse is.....located on elevated ground with no hog-pen, manure pile or privy within 100 feet.
Milk has.....direct communication with..... building.
Milkhouse has.....sufficient light and ventilation.
Floor is.....properly graded and watertight.
Milkhouse is.....free from dirt, rubbish and all material not used in the handling and storage of milk.
Milkhouse has.....running or still supply of pure clean water.
Ice is.....used for cooling milk and is cut from.....

Water:

Water-supply for utensils is from a.....located..... feet deep and apparently is.....pure, wholesome and uncontaminated.
Is.....protected against flood or surface drainage?.....
There is.....privy or cesspool within 250 ft. of source of water-supply.
There is.....a stable, barnyard or pile of manure or other source of contamination within 200 ft. of source of water-supply.

III. U. S. Department of Agriculture.—Bureau of Animal Industry—Dairy Division

SANITARY INSPECTION OF DAIRIES

Owner or lessee of farm.....Town.....State.....
Total number of cows.....Number milking.....
Quarts of milk produced daily.....
Is product sold at wholesale or at retail?.....
If shipped to dealer give his name and address?.....
Permit No.....Date of inspection.....19....

Cows:

Condition.....health.....cleanliness....water-supply.

Stables:

Construction.....cleanliness.....light.....ventilation..
Cubic space per cow.....removal of manure.....stable yard.....

Milkhouse:

Construction.....equipment.....cleanliness.....care and cleanliness of utensils.....water-supply (temperature?)

Milkers and Milking:

Health of attendants.....cleanliness of milking.....

Handling the Milk:

Prompt and efficient cooling..... temperature of milk.... storing at low temperature.....Protection during transportation.....

Sanitary Conditions are:

Excellent.... ...good.....fair.....poor.....
Suggestions by inspector.....
Signed.....inspector.

Directions for Scoring......

IV. COMMONWEALTH OF MASSACHUSETTS

State Board of Health

INSPECTION OF DAIRIES

City or town.....Date.....
Name of owner.....Time of visit.....
Number of cows.....Number of cow stables.....

Condition of cows: (1) as to health .....
(2) as to cleanliness .....
If any cows are sick, note same on reverse side of blank .....

Condition of Cow Stables:

Construction .....Approximate cubic space per cow.....
Means of ventilation.....Condition as to light.....
Nature of floor of cow stalls.....Means of drainage ....
Are the cows bedded?.....If so, with what?.....
Where is manure stored?.....How often removed? .
Is hay stored where cows are kept?.....Are horses kept in same stable? .....
General condition as to cleanliness .....

Water-supply:

Source of supply (*a*) for watering stock.....(*b*) for washing cans .....
Distance of latter from (*a*) stable.....(*b*) possible source of pollution .....
Direction of ground level from each such source.....

Milk:

Are the udders cleaned before milking?.....If so, how?....
How is the milk cooled? .....
Where is it cooled and handled?.....Where is it stored?....
Where are cans, etc., washed?.....Where kept during milking? .....
Has the owner an ice-house?.....Is ice easily obtainable in the vicinity? .....
How much milk is sold?.....To whom is it shipped?
How far is it hauled for delivery?.....At what hours is it hauled? .....
If delivered at a railway station, how long a time is likely to elapse before it is taken into the car? .....

Signature .....
Inspector.

Memoranda as to diseased cows: .....
Name and number of cow? .....Condition.....
Remarks: .....

Sanitary Surveys of Cities and Towns

The sanitary survey of cities and towns is of the highest importance, and it should be made at least every five years, under the direction of the municipal health department, assisted by the city engineering department. The principal topics which such a survey should embrace are the drainage and sewerage system, the water-supply, the lighting, the conduits for water, gas, electric current in public streets, the care of the streets and squares, the collection and disposal of garbage and ashes, inspections of inhabited houses, of hospitals and public bath-houses, of the markets and slaughter-houses.

An excellent example of what such a survey should be, may be found in the Annual Report of the National Board of Health for 1879, in Appendix H, which gives the sanitary survey of Jersey City, Hoboken, and Bayonne, N. J.

Other surveys of cities are described in some supplemental reports of the same board for 1880, and refer to the city of Memphis, Tenn., and to the city of Baltimore, Md. Very good and complete sanitary surveys of Camden, N. J., and of Newark, N. J., may be referred to in the New Jersey State Board of Health reports for 1880 and 1884.

When a city is threatened with an epidemic, a special sanitary inquiry should be instituted,* and in the schedule for the survey special attention should be given to matters like the following: Location, topography, and area of the city; population and number of buildings; chief industries; drainage and sewerage;

* See "Sanitary Engineering," by Wm. Paul Gerhard. Second, revised and enlarged edition, 1909.

water and milk supplies; collection and removal of garbage and rubbish; to the isolation hospitals and the disinfection station. The board of health should direct the disinfection of houses where infectious disease has occurred. The sources of infection should be traced and measures taken to limit the spread of the disease. A correct census should be kept of the number of persons taken sick, and of the number of deaths from the epidemic.

The subject is a broad one and cannot be adequately treated in a small handbook. In the following I give a schedule for sanitary inspections of cities, which was originally prepared by the National Board of Health, of which the late Col. George E. Waring, Jr., was a prominent member. I have shortened some of its sections and inserted a few new ones.

Schedule for Sanitary Surveys of Cities

A. Location, Population, and Climate:

Name of city.....county.....and State .....
Location.....latitude.....and longitude .....
Area of city .....
When was city founded? .....
When was it incorporated? .....
Give population according to U. S. census in. .....
1860....1870....1880....1890....1900.....Present (estimated) .....
What is the density of population? .....
What is the estimated population under five years of age?
Give population according to whether native or foreign born? .....
according to whether white or colored? .....
What is the number of dwelling-houses of city? .....
What is the average number of persons to each dwelling?
Have meteorological observations been kept regularly in the city? .....

Who made the observations?.....Have they been published?.....

B. Topography and Geology:

Altitude of city?.....on what authority?.....
Give highest and lowest elevations?.....
Is the surrounding country level or hilly?.....
Are there any marshes, low lands, or swamps near city?..
State if any of the city land is filled or made land?.....
Are there any mountains near city; if so, what is the altitude?.....
Is the site of the city level?.....hilly?.....
Are there any covered up watercourses in the city?.....
Have any original watercourses been diverted from their course, or modified?.....
State if there are any ponds or other stagnant water?....
What is the distance of the city from tide-water?.....
State the character of the soil and of the subsoil?.....
Describe any rivers, lakes or canals in the city limits?....
Are they affected at all by the tides?.....
Is the water of the streams clean or foul?.....
Does any foul surface drainage or sewage enter any of the streams?.....
Is any part of the city subject to overflows, and to what degree?.....
To what geological formation does the site of the city and vicinity belong?.....
What are the underlying geologic strata?.....
Are they permeable or impermeable to water?.....
Does the disturbance of the surface soil cause malaria? ..

C. Water-Supply:

Describe the sources of water-supply for the city?.....
Describe the character and degree of purity of the supply.
Give chemical and bacteriological analyses if obtainable.
What are the physical characteristics of the water-supply?
What is the distance from the source of supply to the city?
How is the water brought to the city?.....
Gravity conduits?.....Pumping?.....
State capacity of the conduit?.....of the pumps?....
How many reservoirs are there?.....
State capacity of each.....its location....elevation.

Do the waterworks comprise filtration works? .....
What is the average consumption in million gallons per day? .....
What is maximum consumption? .....
What is the average daily consumption per capita? .....
What is the average water pressure in the city? .....
What is the maximum? .....
How many fire-hydrants does the city have? .....
How many public fountains? .....
How many house connections or taps? .....
Are the house services metered generally.....or what is the proportion of metered to unmetered taps? ....
To what extent, if any, is cistern or well water used in the city? .....
What is the average depth of the wells?.....
Are the wells dug, driven, drilled or bored? .....
Are there any artesian wells in the city? .....
Has the use of well-water caused any sickness?.....
How many public baths?.....What kind and type? What is average daily water consumption of the bath-houses? .....

D. Drainage and Sewerage:

What is the proportion of closely built-up area compared with the open or suburban area? .....
What is the character of the surface drainage?.....
Is any subsoil drainage provided.....How is it arranged? .....
Are cellars in any part of the city subject to overflow or flooding during or after heavy rainstorms? .....
Does the city have a regular system of sewerage? .....
Furnish sewerage map .....
Is the city sewered on the combined system?.....on the separate system?.....or on a combination of both? .....
Give the mileage of sewers .....
Give the number of sewer outfalls .....
State their size .....
Where do the sewer outfalls discharge? .....
Are the city sewers self-cleansing? .....
Are flush-tanks used? .....
What proportion of the area of the city lacks sewerage? ..

State the number of house connections?.....
Describe the manner in which the house connections are made in the street?.....
How are the street sewers ventilated?.....
Is the plumbing and drainage work in the houses governed by rules and regulations?.....
Are sewer connections compulsory where a street has been sewered?.....
Are any cesspools tolerated?.....If so, how are they constructed?.....
Describe any other methods of disposal of the waste liquids from houses?.....
Is there any regular system of sewage disposal?.....
What system of sewage disposal is in use?.....
Describe its chief features?.....
Are any odors ever noticed from the sewer openings?....
Are odors perceptible at the sewage purification works?..

E. Streets and Public Grounds:

Give the total number of miles of streets?.....
State how many miles are paved with granite stones?....
With asphalt?.....
With macadam?.....
With cobble-stones?.....
With wood?.....
With asphalt paving-blocks?.....
With any other artificial pavements?.....
What is the usual width of the streets?.....
What is the width of the sidewalks?.....How are they finished?.....
Are the streets regularly cleaned by the city?.....
Are they sprinkled in summer?.....
Is the street-cleaning method satisfactory?.....
Is hand labor used exclusively?.....
Are any sweeping-machines used?.....
Are shade-trees planted along the streets?.....
What kind?.....How arranged?.....
Does the asphalt pavement injure the trees?.....
Are the trees unfavorably affected by leakage from gas mains?.....
Who cares for the trees in the streets?.....
State number and area of all public parks?.....

How many smaller open squares are within the city limits? .....
Are there any grade crossings in the city? .....
How many lives lost annually by them? .....
Is there a municipal street railway system, or are the lines owned by private companies or corporations? .....
How many companies are there? .....
What system of electric traction is used? .....
State the number of accidents on trolley lines per year...

F. Habitations and their Tenants:

How many dwelling-houses are there in the city? .....
How many office-buildings? .....How many factory buildings? .....
How many public buildings? .....
What proportion of dwellings is occupied by the owners?
How many tenement-houses are in the city? .....
What is the average number of persons to a dwelling? ....
Does the city have a building department? .....
Are there any building regulations? .....
Are the rules enforced, and is there a regular system of inspection? .....
How many dwellings are connected with the sewers? ....
How many houses are connected with the water mains? ..
Do any houses use wells, springs or rain-water cisterns for supply? .....
How many detached buildings? .....How many houses in blocks? .....
Do any of the houses have damp or wet cellars? .....
Are the floors of the cellars cemented? .....
What is the usual height of the dwelling-houses? .....
How many houses in the city are without bathtub? .....
How are the yards kept? .....

G. Lighting:

Is the city lighted by gas? .....
Is the city lighted by gas and electric lights? .....
Describe the location of the gas works? .....
Is the gas plant owned by a private corporation or by the city? .....
How many miles of gas street mains?
What kind of gas is supplied to the users? .....

What is the price charged by 1000 cubic feet of gas?.....
Is the quality of the gas supplied satisfactory?.....
Is it tested by municipal inspectors or gas-testers?....
What proportion of dwelling-houses are supplied with gas?
How many gas accidents have occurred within a year?...
Is the city lighted up by electric light?.....
Who owns the electric-light works?.....
Municipal or private plant?.....
What is the capacity of the plant?.....
What is the price charged for electricity, for lighting?....
What is the price charged for electric current for power purposes?.....
Are streets, squares and parks lighted by electricity?....
Which is the better system of street lighting, gas or electric?.. .....
How many electric lamps are there in the streets?.....
How many accidents have occurred in a year from the use of the electric current?.....
Other modes of lighting.....oil in lamps.....gasolene lamps.....
Is there an acetylene lighting plant?.....

H. Garbage and Refuse Disposal:

Is the household garbage removed by the municipality?..
Is it removed at private expense?.....
How often is the garbage removed?.....how often the ashes?.....
Is garbage removed in covered vessels or carts?.....
Are ashes and garbage kept separate by ordinance?.....
What is the cost per annum of the removal?.....
Where are the ashes disposed of?.....
What is done with the garbage?.....
Any reduction plants?.....
Any refuse destructors?.....
Do large hotels and department stores have their separate refuse destructors?.....
Which city department takes care of the removal of dead animals?.....
How are the carcasses disposed of?.....
Is the work done satisfactorily?.....
Are any houses still served by cesspools?.....If so, what proportion?.....

What is the construction of these cesspools?.....
leaching?.....water-tight?.....
Are any cesspools with overflows to sewers permitted?...
Are there municipal rules regarding the construction of cesspools?.....
How often are the cesspools cleaned out?.....
Are the methods pursued satisfactory?.....
Are there any privy vaults attached to houses?.....
How many?.....
Where are the vaults located?.....
Are there any municipal rules regarding the construction of the vaults?.....

I. Markets:

How many public markets does the city have?.....
What is the size and area of each of them?.....
Where are the markets located?.....
How many buildings does each market contain?.....
Describe construction and arrangement of the markets?..
Are the market stalls rented by the city?.....
What is the average rental per year?.....
On how many days of the week are the markets open?...
Are the markets kept in a cleanly and sanitary condition?
What are the rules in force regarding the cleaning of the buildings?.....
How often are the markets inspected and by whom?....
What are the principal transportation routes for the fresh food supplies brought to the markets?.....

J. Slaughter-houses:

How many slaughter-houses are located in the city? ....
Are they built by the municipality or by private owners?
Are there municipal rules and regulations in force regarding the slaughter-houses?.....
What is the location of the slaughter-houses with reference to the city plan?.....
What is the condition of the water-supply and sewerage of the buildings?.....
What is the mode of killing the animals?.....
What is done with the offal?.....
Is any nuisance to the neighborhood caused by the slaughter-houses?.....

What is the average annual number of animals slaughtered at the abattoirs?.....Of each kind?.....
Is there any fat-rendering establishment at the abattoir?..
How are the noxious gases from same disposed of?.....
Are private slaughter-houses permitted in the city?.....
What is the average annual rental of the slaughtering stalls to butchers?.....
Is there any official meat inspection at the abattoirs?....
Is there a cold-storage plant connected with the abattoir?

K. Manufactures and Trades:

Are there located within the city limits any manufacturing establishments which constitute a nuisance?.....
Do any of the factories pollute the water-courses?.....
Do any of the manufacturing establishments create offense to the public by being unduly noisy?.....
What are the hours of labor?.....
Is there any factory inspection law?.....Is it enforced?
How is the ventilation of the factories?.....

L. School-houses:

How many public schools are there in the city?.....
Where are they located?.....
State for each of the schools the following:
Location.....altitude and area of site.....nature of soil.....drainage.....date of erection.....cost of building.....number of stories.....number of rooms.....number of pupils.....
(See special school schedule for the following subjects:)
Material of construction.....heating apparatus....
ventilation system.....daylight lighting.....
artificial lighting.....cloak-rooms.....basement playrooms.....toilets.....water-supply.....
drinking-fountains.....hours of study.....
Is there a medical inspection of the school?.....
Are school baths installed?.....
What are the results obtained with them?.....
Do the schools have a gymnasium?.....Do they have playgrounds?.....
Are the water-closets located within or without the buildings?.....

L. Public Libraries, Museums, Art Galleries:

Is there any public library in the city?.....How is it maintained?.....
How many volumes has it?.....
Is there any public museum or art gallery?.....

M. Theatres, Churches, Amusement Halls, and other Public Buildings:

(For these see the special schedules.)

N. Hospitals:

(For these see also the special schedule.)
State the number of hospitals in the city?.....
Give their location with reference to the city plan?.....
How many patients do each accommodate?.....
How many physicians are employed?.....
Does the hospital have an ambulance service?.....
Are any of the hospitals overcrowded?.....

O. Prisons, Jails, and Police Stations:

How many policemen are on the force?.....
Do some of them act as sanitary inspectors?.....
How many police stations are there?.....
How many prisoners' cells in each?.....
What is the sanitary condition of the police cells?.....
What is the average daily number of prisoners?.....
Are the prison cells well ventilated?.....
Are there water-closets in the cells?.....
Where are the lavatories located?.....
Are there any spray baths for the prisoners?.....
How are the police cells heated?.....
Is there a police matron?.....Is there a police surgeon?.....
Have there been any outbreaks of epidemic diseases in the prisons?.....
How are the prison inmates occupied?.....
What is the estimated number of prostitutes in the city?.
Is there any medical inspection of prostitutes?.....
How many drinking-saloons are there in the city?.....
Are there any dance halls?.....
How many cases of drunkenness are brought before police courts per year?.....

P. Public and People's Bath-houses:

Is there a municipal system of public baths? . . . . . .
How many public bath-houses does the city have? . . . . . .
Where are they located? . . . . . What was their cost? . . .
How many bath units in each bath-house? . . . . . .
What is the prevailing form of bath? . . . . . .
Tub baths? . . . . . Spray or rain baths? . . . . . .
Are any swimming-pools connected with public baths? . . . .
Do the swimming-pools have cleansing baths? . . . . . .
If city is located on a river, lake or the ocean, how many floating municipal bath establishments are there? . . .
Are the city bath-houses self-supporting? . . . . . .
Is any admission fee charged? . . . . . If so, how much? . . . .

Q. Fire Department:

Is there a municipal paid fire department? . . . . . .
Is the fire service performed by volunteers? . . . . . .
How many fire- and engine-house stations are there in the city? . . . . . .
Does the fire department control the construction of buildings? . . . . . .
How many steam fire-engines does the city own? . . . . . .
How many hook and ladder companies? . . . . . .
Is the water-supply for fire purposes satisfactory? . . . . . .
If city is on a river, lake or harbor, are there city fire-boats? . . . . . .
Is there an auxiliary high-pressure system? . . . . . .
Is salt-water used for fire-extinguishing purposes? . . . . . .
How many firemen are employed in the fire department?
Is there an insurance patrol service for saving property? . .
What is the average annual number of fires? . . . . . .
What is the average annual property loss by fire? . . . . . .
What is the annual loss of lives by fire? . . . . . .
What are the chief causes of fires? . . . . . .
How many fire-alarm boxes has the city? . . . . . .

Public Parks and Boulevards:

What is the total acreage of public parks? . . . . . .
Where are they located? . . . . . .
Are public parks and squares kept in good condition? . . . .

Are there any comfort stations in the parks and squares?.
How many?.....What is their condition?.....
Who maintains them? .....

R. Cemeteries and Modes of Burial:

Are there any cemeteries within the city limits?.....
State total number of cemeteries near the city? .....
Are they private concerns or municipal? .....
State location of cemeteries? .....
Describe soil in the cemeteries .....
Is it well and thoroughly underdrained? .....
What is the usual average depth of the graves? .....
What is the number of burials per year? .....
Are all burials recorded in the health office? .....
Are other modes of burial permitted or practised? .....

S. Public Health Laws and Ordinances.

T. Vital Statistics of the City:

Are births and deaths recorded? .....
What is the annual number of deaths? .....
What is the annual number of births? .....
What is the birth-rate? .....
What is the death-rate? .....
What is the average increase per annum in population of the city? .....

U. Diseases of the Year and Epidemics.

V. Disinfection:

Does the city have a municipal disinfecting station?.....
Who operates the plant and under whose control is the same? .....
Where is it located? .....
What method of disinfection is practised? .....
Are houses in which epidemic disease occurred disinfected before any new tenants move in? .....
At whose expense is the disinfection done? .....

W. Municipal Sanitary Expenses:

Total annual appropriation:
For sanitary purposes? .....
For sewerage and drainage purposes? .....

For street paving? . . . . . .
For street cleaning? . . . . . .
For removal of garbage and ashes? . . . . . .
For care of markets? . . . . . .
For municipal abattoirs? . . . . . .
For care of public parks and fountains? . . . . . .
For public comfort stations? . . . . . .
For lighting? . . . . . .
For fire department services? . . . . . .
For police department services? . . . . . .
For building department services? . . . . . .

For other interesting questions on municipal institutions and engineering, I refer to Prof. Charles Zueblin's valuable work, entitled "American Municipal Progress," published in 1902.

Necessity of Periodical Inspection

In conclusion I desire to emphasize the necessity of a *periodical* inspection of the sanitary condition of all kinds of buildings. It is not sufficient to spend once a large amount of money to put the sanitary arrangements in a good condition. Constant supervision and thought are required to keep everything in good order. Professor Fleming Jenkin of Edinburgh, who gave the first impetus towards the establishment of sanitary associations, thus forcibly explains the necessity of periodic inspection:—

"It is not enough to call in the engineer, and have all put in the best order once in a way. This is, indeed, very necessary in most cases,—how necessary, few know; but when it has been done, the inspection must be maintained. The case is quite analogous to that of a steam-boiler. We must, in the first instance, provide ourselves with a good article, designed by competent engineers, and experimentally tested; but we must also pay competent men to come year after year, and examine whether any deterioration has occurred."

If a householder or the mistress of a house will take the pains to keep themselves well informed about sanitary matters, and to understand the chief points which should be inquired into, they will often be able to perform such an inspection themselves, after a house has been once properly arranged and built; it might even be advantageous to combine such an inspection with the annually recurring house-cleaning, and not to wait until some noxious smells indicate that the plumbing has become defective, or that other serious defects exist. As Col. Waring has truly said,—

"It is not unusual for a householder, unless his house fairly stinks, to consider it as 'sweet as a rose,' and to rest happy in the conviction that it is perfectly healthy. The truth is, that a foul odor is not in itself poisonous. When it exists in a house, it indicates a source of foulness which may also be a source of disease. But, unfortunately, the source of disease may, and often does, exist without obvious bad smells. The fainter odors which more often accompany dangerous emanations are not perceptible to those who live constantly subject to them. To one fresh from the country, they are almost always obvious in an average city house."

House owners are much too apt to postpone a sanitary inspection until a severe case of illness in the family, or a death from one of the preventable diseases, opens their eyes to the dangers to which they are exposed. To send for an expert after a fatal case of illness, might well be compared with the calling-in of an inspecting engineer after a steam-boiler explosion has occurred.

If, in making a sanitary house-inspection, it is considered impracticable to remove tight woodwork, rip up floors, cut up walls, dig holes, so as to clearly expose every fixture, trap, and every foot of waste or vent-pipe, and to gain access to the interior of drains, or to make sure that no old cesspools exist under a house, the results of the examination will enable the inspector to make a general or preliminary report only. It is, however, always better to make a thorough examination; and a complete report of the sanitary inspection of a dwelling should contain: (1) a general statement describing the sanitary condition of a building at the time of the inspection; (2) a detailed statement of the sanitary defects discovered, with reasons why the arrangements are faulty; (3) a detailed recommenda-

tion of improvements to be made to put a house in a proper and healthful condition.

To sum up, no house should be purchased or leased, in the city or in the country, the sanitary condition of which has not been carefully examined into, and its fitness for occupancy certified, by some well-educated, disinterested professional man.

There is not the slightest doubt, that if the public will thus insist upon healthful surroundings and salubrious buildings, a greater attention will soon be paid by landlords and builders to the important questions of drainage and plumbing, heating and ventilating, lighting and safety from fire, water-supply, and disposal of sewage.

A healthful home having been once secured, it becomes the sacred duty of the householder to inquire at frequent intervals into its continued good sanitary condition. To aid the householder in the search for such structural defects as may endanger the health of his household is one of the objects of this—*Guide to Sanitary Inspections.*

BIBLIOGRAPHY ON SANITARY SURVEYS AND INSPECTIONS

I. Books

The Choice of a Dwelling. Gervaise Wheeler. London, 1871.
Sanitary Assurance. F. de Chaumont. London, 1881.
Hints to Househunters and Householders. Ernest Turner. London, 1883.
Handbook of Sanitary Information. Rogers Tracy. New York, 1884.
Sanitary Arrangements of Dwellinghouses. M. H. Judge. London, 1884.
A Guide to Sanitary House Inspection. Wm. Paul Gerhard. New York, 1885.
Practical Hints on Taking a House. H. P. Boulnois. London, 1885.
Home Sanitation. A Manual for Housekeepers. Boston, 1887.
Health Inspector's Guide. New Jersey State Board of Health. Trenton, 1890.
Model Answers to Questions for Examination of Sanitary Inspectors. Compiled from the *Sanitary Record*. London, 1893.
Drainage Work and Sanitary Fittings. W. H. Maxwell. London, 1895.
Hygienisches Taschenbuch. E. von Esmarch. Berlin, 1896.
Plumbers' Textbook. F. W. Tower. Springfield, 1897.
Hygienische Winke fuer Wohnungssuchende. E. von Esmarch. Berlin, 1897.
House Drainage: Its Inspection and Testing. R. J. Jenkins. London, 1898.
Modern Drainage Inspection and Sanitary Surveys. G. J. G. Jensen. London, 1899.
Architectural Hygiene. B. and H. P. Fletcher. London, 1899.
House Drainage and Sanitary Fitments. G. J. G. Jensen. London, 1900.
Questions and Answers on the Practice and Theory of Sanitary Plumbing. H. M. Starbuck. Hartford, 1900.
Handbook on Sanitation. George M. Price. New York, 1901.

Sanitary Fittings and Plumbing. G. L. Sutcliffe. London, 1901.
The Sanitary Inspector's Guide. Henry Lemmoin-Cannon. London, 1902.
Sanitation in the Modern Home. Edited by John K. Allen. Chicago, 1907.
Testing Drainage, Plumbing and Gas-Piping. John K. Allen. Chicago, 1907.
Guide to Sanitary Inspections. Wm. Paul Gerhard. New York, 1909. (Revised and enlarged edition of A Guide to Sanitary House Inspection.)

II. Pamphlets and Articles

House Inspection. F. Jenkin. London, 1881.
Testing House Drains before and after Occupation. *Amer. Architect.* 1882.
Sanitary Inspection of Houses. W. K. Burton. Reprint from *The Sanitary Record.* 1883.
Drain Testing. H. Masters. *Amer. Architect.* 1884.
Inspecting and Testing the Sanitary Arrangements in Houses. J. Spencer. *Amer. Architect.* 1884.
The Sanitary Survey of a House. W. K. Newton. Concord, 1885.
Qualifications and Duties of Sanitary Inspectors. F. W. Barry. Wakefield, 1892.
The Pneumatic Test. Frederic Tudor. Boston, 1892.
Sanitary Inspection of the State Institutions. Report of State Board of Health of North Carolina. Wilmington, N. C., 1895.
Suggested Standard for Drain Testing. Gilbert Thomson. 1898.
A Few Words on the Sanitary Arrangements of Houses.
Practical Drain Inspection. C. H. Clarke. London, Leyton.
Sanitary Inspection Work and How to Organize it. J. R. Kaye. London, 1901.

III. Inspection Blanks

The Sanitary Engineer's Pocket Report Book. Spon and Chamberlain, Publ., N. Y.

Sanitary Inspection Note Book. G. J. G. Jensen. London.

Sanitary Inspection of Houses and Premises in Cities, Towns, etc. Circular LII. N. J. State Board of Health.

Sanitary Survey of School Houses. Circular LV, State Board of Health of N. J.

Institutional Inquiry into Sanitary Condition, Circular LXXVIII State Board of Health of N. J.

Schedule for Hospital Inspection. National Board of Health.

Schedule of Questions for a Sanitary Survey of Cities. National Board of Health. Washington, 1880.

SHORT-TITLE CATALOGUE

OF THE

PUBLICATIONS

OF

JOHN WILEY & SONS,

NEW YORK.

LONDON: CHAPMAN & HALL, LIMITED.

ARRANGED UNDER SUBJECTS.

Descriptive circulars sent on application. Books marked with an asterisk (*) are sold at *net* prices only. All books are bound in cloth unless otherwise stated.

AGRICULTURE—HORTICULTURE—FORESTRY.

Armsby's Manual of Cattle-feeding	12mo,	$1 75
Principles of Animal Nutrition	8vo,	4 00
Budd and Hansen's American Horticultural Manual:		
Part I. Propagation, Culture, and Improvement	12mo,	1 50
Part II. Systematic Pomology	12mo,	1 50
Elliott's Engineering for Land Drainage	12mo,	1 50
Practical Farm Drainage	12mo,	1 00
Graves's Forest Mensuration	8vo,	4 00
Green's Principles of American Forestry	12mo,	1 50
Grotenfelt's Principles of Modern Dairy Practice. (Woll.)	12mo,	2 00
* Herrick's Denatured or Industrial Alcohol	8vo,	4 00
Kemp and Waugh's Landscape Gardening. (New Edition, Rewritten. In Preparation).		
* McKay and Larsen's Principles and Practice of Butter-making	8vo,	1 50
Maynard's Landscape Gardening as Applied to Home Decoration	12mo,	1 50
Quaintance and Scott's Insects and Diseases of Fruits. (In Preparation).		
Sanderson's Insects Injurious to Staple Crops	12mo,	1 50
* Schwarz's Longleaf Pine in Virgin Forests	12mo,	1 25
Stockbridge's Rocks and Soils	8vo,	2 50
Winton's Microscopy of Vegetable Foods	8vo,	7 50
Woll's Handbook for Farmers and Dairymen	16mo,	1 50

ARCHITECTURE.

Baldwin's Steam Heating for Buildings	12mo,	2 50
Berg's Buildings and Structures of American Railroads	4to,	5 00
Birkmire's Architectural Iron and Steel	8vo,	3 50
Compound Riveted Girders as Applied in Buildings	8vo,	2 00
Planning and Construction of American Theatres	8vo,	3 00
Planning and Construction of High Office Buildings	8vo,	3 50
Skeleton Construction in Buildings	8vo,	3 00
Briggs's Modern American School Buildings	8vo,	4 00
Byrne's Inspection of Material and Wormanship Employed in Construction.	16mo,	3 00
Carpenter's Heating and Ventilating of Buildings	8vo,	4 00

* Corthell's Allowable Pressure on Deep Foundations 12mo, 1 25
Freitag's Architectural Engineering 8vo 3 50
Fireproofing of Steel Buildings 8vo, 2 50
French and Ives's Stereotomy 8vo, 2 50
Gerhard's Guide to Sanitary House-Inspection 16mo, 1 00
* Modern Baths and Bath Houses 8vo, 3 00
Sanitation of Public Buildings 12mo, 1 50
Theatre Fires and Panics 12mo, 1 50
Holley and Ladd's Analysis of Mixed Paints, Color Pigments, and Varnishes Large 12mo, 2 50
Johnson's Statics by Algebraic and Graphic Methods 8vo, 2 00
Kellaway's How to Lay Out Suburban Home Grounds 8vo, 2 00
Kidder's Architects' and Builders' Pocket-book . . . . . 16mo, mor., 5 00
Maire's Modern Pigments and their Vehicles 12mo, 2 00
Merrill's Non-metallic Minerals: Their Occurrence and Uses 8vo, 4 00
Stones for Building and Decoration 8vo, 5 00
Monckton's Stair-building 4to, 4 00
Patton's Practical Treatise on Foundations 8vo, 5 00
Peabody's Naval Architecture 8vo, 7 50
Rice's Concrete-block Manufacture 8vo, 2 00
Richey's Handbook for Superintendents of Construction . . . . . 16mo, mor., 4 00
* Building Mechanics' Ready Reference Book:
* Building Foreman's Pocket Book and Ready Reference. (In Preparation).
* Carpenters' and Woodworkers' Edition . . . . . 16mo, mor. 1 50
* Cement Workers and Plasterer's Edition . . . . . 16mo, mor. 1 50
* Plumbers', Steam-Filters', and Tinners' Edition . . . . . 16mo, mor. 1 50
* Stone- and Brick-masons' Edition . . . . . 16mo, mor. 1 50
Sabin's Industrial and Artistic Technology of Paints and Varnish 8vo, 3 00
Siebert and Biggin's Modern Stone-cutting and Masonry 8vo, 1 50
Snow's Principal Species of Wood 8vo, 3 50
Towne's Locks and Builders' Hardware . . . . . 18mo, mor. 3 00
Wait's Engineering and Architectural Jurisprudence 8vo, 6 00
Sheep, 6 50
Law of Contracts 8vo, 3 00
Law of Operations Preliminary to Construction in Engineering and Architecture 8vo, 5 00
Sheep, 5 50
Wilson's Air Conditioning 12mo, 1 50
Worcester and Atkinson's Small Hospitals, Establishment and Maintenance, Suggestions for Hospital Architecture, with Plans for a Small Hospital. 12mo, 1 25

ARMY AND NAVY.

Bernadou's Smokeless Powder, Nitro-cellulose, and the Theory of the Cellulose Molecule 12mo, 2 50
Chase's Art of Pattern Making 12mo, 2 50
Screw Propellers and Marine Propulsion 8vo, 3 00
Cloke's Gunner's Examiner 8vo, 1 50
Craig's Azimuth 4to, 3 50
Crehore and Squier's Polarizing Photo-chronograph 8vo, 3 00
* Davis's Elements of Law 8vo, 2 50
* Treatise on the Military Law of United States 8vo, 7 00
Sheep, 7 50
De Brack's Cavalry Outpost Duties. (Carr.) . . . . . 24mo, mor. 2 00
* Dudley's Military Law and the Procedure of Courts-martial . . . Large 12mo, 2 50
Durand's Resistance and Propulsion of Ships 8vo, 5 00

* Dyer's Handbook of Light Artillery	12mo,	3 00
Eissler's Modern High Explosives	8vo,	4 00
* Fiebeger's Text-book on Field Fortification	Large 12mo,	2 00
Hamilton and Bond's The Gunner's Catechism	18mo,	1 00
* Hoff's Elementary Naval Tactics	8vo,	1 50
Ingalls's Handbook of Problems in Direct Fire	8vo,	4 00
* Lissak's Ordnance and Gunnery	8vo,	6 00
* Ludlow's Logarithmic and Trigonometric Tables	8vo,	1 00
* Lyons's Treatise on Electromagnetic Phenomena. Vols. I. and II.	8vo, each,	6 00
* Mahan's Permanent Fortifications. (Mercur.)	8vo, half mor.	7 50
Manual for Courts-martial	16mo, mor.	1 50
* Mercur's Attack of Fortified Places	12mo,	2 00
* Elements of the Art of War	8vo.	4 00
Metcalf's Cost of Manufactures—And the Administration of Workshops	8vo,	5 00
* Ordnance and Gunnery. 2 vols	Text 12mo, Plates atlas form	5 00
Nixon's Adjutants' Manual	24mo,	1 00
Peabody's Naval Architecture	8vo,	7 50
* Phelps's Practical Marine Surveying	8vo,	2 50
Powell's Army Officer's Examiner	12mo,	4 00
Sharpe's Art of Subsisting Armies in War	18mo, mor.	1 50
* Tupes and Poole's Manual of Bayonet Exercises and Musketry Fencing	24mo, leather,	50
* Weaver's Military Explosives	8vo,	3 00
Woodhull's Notes on Military Hygiene	16mo,	1 50

ASSAYING.

Betts's Lead Refining by Electrolysis	8vo,	4 00
Fletcher's Practical Instructions in Quantitative Assaying with the Blowpipe	16mo, mor.	1 50
Furman's Manual of Practical Assaying	8vo,	3 00
Lodge's Notes on Assaying and Metallurgical Laboratory Experiments	8vo,	3 00
Low's Technical Methods of Ore Analysis	8vo,	3 00
Miller's Cyanide Process	12mo,	1 00
Manual of Assaying	12mo,	1 00
Minet's Production of Aluminum and its Industrial Use. (Waldo.)	12mo,	2 50
O'Driscoll's Notes on the Treatment of Gold Ores	8vo,	2 00
Ricketts and Miller's Notes on Assaying	8vo,	3 00
Robine and Lenglen's Cyanide Industry. (Le Clerc.)	8vo,	4 00
Ulke's Modern Electrolytic Copper Refining	8vo,	3 00
Wilson's Chlorination Process	12mo,	1 50
Cyanide Processes	12mo,	1 50

ASTRONOMY.

Comstock's Field Astronomy for Engineers	8vo,	2 50
Craig's Azimuth	4to,	3 50
Crandall's Text-book on Geodesy and Least Squares	8vo,	3 00
Doolittle's Treatise on Practical Astronomy	8vo,	4 00
Gore's Elements of Geodesy	8vo,	2 50
Hayford's Text-book of Geodetic Astronomy	8vo,	3 00
Merriman's Elements of Precise Surveying and Geodesy	8vo,	2 50
* Michie and Harlow's Practical Astronomy	8vo,	3 00
Rust's Ex-meridian Altitude, Azimuth and Star-Finding Tables. (In Press.)		
* White's Elements of Theoretical and Descriptive Astronomy	12mo,	2 00

Abderhalden's Physiological Chemistry in Thirty Lectures. (Hall and Defren). (In Press.)

* Abegg's Theory of Electrolytic Dissociation. (von Ende.) 12mo, 1 25

Adriance's Laboratory Calculations and Specific Gravity Tables 12mo, 1 25

Alexeyeff's General Principles of Organic Syntheses. (Matthews.) 8vo, 3 00

Allen's Tables for Iron Analysis 8vo, 3 00

Arnold's Compendium of Chemistry. (Mandel.) ..... Large 12mo, 3 50

Association of State and National Food and Dairy Departments, Hartford Meeting, 1906 ..... 8vo, 3 00

Jamestown Meeting, 1907 ..... 8vo, 3 00

Austen's Notes for Chemical Students 12mo, 1 50

Baskerville's Chemical Elements. (In Preparation).

Bernadou's Smokeless Powder.—Nitro-cellulose, and Theory of the Cellulose Molecule 12mo, 2 50

* Blanchard's Synthetic Inorganic Chemistry 12mo, 1 00

* Browning's Introduction to the Rarer Elements 8vo, 1 50

Brush and Penfield's Manual of Determinative Mineralogy 8vo, 4 00

* Claassen's Beet-sugar Manufacture. (Hall and Rolfe.) 8vo, 3 00

Classen's Quantitative Chemical Analysis by Electrolysis. (Boltwood.) 8vo, 3 00

Cohn's Indicators and Test-papers 12mo, 2 00

Tests and Reagents 8vo, 3 00

* Danneel's Electrochemistry. (Merriam.) 12mo, 1 25

Duhem's Thermodynamics and Chemistry. (Burgess.) 8vo, 4 00

Eakle's Mineral Tables for the Determination of Minerals by their Physical Properties 8vo, 1 25

Eissler's Modern High Explosives 8vo, 4 00

Effront's Enzymes and their Applications. (Prescott.) 8vo, 3 00

Erdmann's Introduction to Chemical Preparations. (Dunlap.) 12mo, 1 25

* Fischer's Physiology of Alimentation ..... Large 12mo, 2 00

Fletcher's Practical Instructions in Quantitative Assaying with the Blowpipe. ..... 12mo, mor. 1 50

Fowler's Sewage Works Analyses 12mo, 2 00

Fresenius's Manual of Qualitative Chemical Analysis. (Wells.) 8vo, 5 00

Manual of Qualitative Chemical Analysis. Part I. Descriptive. (Wells.) 8vo, 3 00

Quantitative Chemical Analysis. (Cohn.) 2 vols 8vo, 12 50

When Sold Separately, Vol. I, $6. Vol. II, $8.

Fuertes's Water and Public Health 12mo, 1 50

Furman's Manual of Practical Assaying 8vo, 3 00

* Getman's Exercises in Physical Chemistry 12mo, 2 00

Gill's Gas and Fuel Analysis for Engineers 12mo, 1 25

* Gooch and Browning's Outlines of Qualitative Chemical Analysis. ..... Large 12mo, 1 25

Grotenfelt's Principles of Modern Dairy Practice. (Woll.) 12mo, 2 00

Groth's Introduction to Chemical Crystallography (Marshall) 12mo, 1 25

Hammarsten's Text-book of Physiological Chemistry. (Mandel.) 8vo, 4 00

Hanausek's Microscopy of Technical Products. (Winton.) 8vo, 5 00

* Haskins and Macleod's Organic Chemistry 12mo, 2 00

Helm's Principles of Mathematical Chemistry. (Morgan.) 12mo, 1 50

Hering's Ready Reference Tables (Conversion Factors) ..... 16mo, mor. 2 50

* Herrick's Denatured or Industrial Alcohol 8vo, 4 00

Hinds's Inorganic Chemistry 8vo, 3 00

* Laboratory Manual for Students 12mo, 1 00

* Holleman's Laboratory Manual of Organic Chemistry for Beginners. (Walker.) 12mo, 1 00

Text-book of Inorganic Chemistry. (Cooper.) 8vo, 2 50

Text-book of Organic Chemistry. (Walker and Mott.) 8vo, 2 50

Holley and Ladd's Analysis of Mixed Paints, Color Pigments, and Varnishes. ..... Large 12mo 2 50

Hopkins's Oil-chemists' Handbook.....8vo, 3 00
Iddings's Rock Minerals.....8vo, 5 00
Jackson's Directions for Laboratory Work in Physiological Chemistry..8vo, 1 25
Johannsen's Determination of Rock-forming Minerals in Thin Sections...8vo, 4 00
Keep's Cast Iron.....8vo, 2 50
Ladd's Manual of Quantitative Chemical Analysis.....12mo, 1 00
Landauer's Spectrum Analysis. (Tingle.).....8vo, 3 00
* Langworthy and Austen's Occurrence of Aluminium in Vegetable Products, Animal Products, and Natural Waters.....8vo, 2 00
Lassar-Cohn's Application of Some General Reactions to Investigations in Organic Chemistry. (Tingle.).....12mo, 1 00
Leach's Inspection and Analysis of Food with Special Reference to State Control.....8vo, 7 50
Löb's Electrochemistry of Organic Compounds. (Lorenz.).....8vo, 3 00
Lodge's Notes on Assaying and Metallurgical Laboratory Experiments.....8vo, 3 00
Low's Technical Method of Ore Analysis.....8vo, 3 00
Lunge's Techno-chemical Analysis. (Cohn.).....12mo 1 00
* McKay and Larsen's Principles and Practice of Butter-making.....8vo, 1 50
Maire's Modern Pigments and their Vehicles.....12mo, 2 00
Mandel's Handbook for Bio-chemical Laboratory.....12mo, 1 50
* Martin's Laboratory Guide to Qualitative Analysis with the Blowpipe..12mo, 60
Mason's Examination of Water. (Chemical and Bacteriological.).....12mo, 1 25
Water-supply. (Considered Principally from a Sanitary Standpoint.) 8vo, 4 00
Matthews's The Textile Fibres. 2d Edition, Rewritten.....8vo, 4 00
Meyer's Determination of Radicles in Carbon Compounds. (Tingle.)..12mo, 1 00
Miller's Cyanide Process.....12mo, 1 00
Manual of Assaying.....12mo, 1 00
Minet's Production of Aluminum and its Industrial Use. (Waldo.).....12mo, 2 50
Mixter's Elementary Text-book of Chemistry.....12mo, 1 50
Morgan's Elements of Physical Chemistry.....12mo, 3 00
Outline of the Theory of Solutions and its Results.....12mo, 1 00
* Physical Chemistry for Electrical Engineers.....12mo, 1 50
Morse's Calculations used in Cane-sugar Factories.....16mo, mor. 1 50
* Muir's History of Chemical Theories and Laws.....8vo, 4 00
Mulliken's General Method for the Identification of Pure Organic Compounds. Vol. I.....Large 8vo, 5 00
O'Driscoll's Notes on the Treatment of Gold Ores.....8vo, 2 00
Ostwald's Conversations on Chemistry. Part One. (Ramsey.).....12mo, 1 50
" " " " Part Two. (Turnbull.).....12mo, 2 00
* Palmer's Practical Test Book of Chemistry.....12mo, 1 00
* Pauli's Physical Chemistry in the Service of Medicine. (Fischer.)....12mo, 1 25
* Penfield's Notes on Determinative Mineralogy and Record of Mineral Tests. 8vo, paper, 50
Tables of Minerals, Including the Use of Minerals and Statistics of Domestic Production.....8vo, 1 00
Pictet's Alkaloids and their Chemical Constitution. (Biddle.).....8vo, 5 00
Poole's Calorific Power of Fuels.....8vo, 3 00
Prescott and Winslow's Elements of Water Bacteriology, with Special Reference to Sanitary Water Analysis.....12mo, 1 50
* Reisig's Guide to Piece-dyeing.....8vo, 25 00
Richards and Woodman's Air, Water, and Food from a Sanitary Standpoint..8vo, 2 00
Ricketts and Miller's Notes on Assaying.....8vo, 3 00
Rideal's Disinfection and the Preservation of Food.....8vo, 4 00
Sewage and the Bacterial Purification of Sewage.....8vo, 4 00
Riggs's Elementary Manual for the Chemical Laboratory.....8vo, 1 25
Robine and Lenglen's Cyanide Industry. (Le Clerc.).....8vo, 4 00
Ruddiman's Incompatibilities in Prescriptions.....8vo, 2 00
Whys in Pharmacy.....12mo, 1 00

Ruer's Elements of Metallography. (Mathewson). (In Preparation.)
Sabin's Industrial and Artistic Technology of Paints and Varnish. 8vo, 3 00
Salkowski's Physiological and Pathological Chemistry. (Orndorff.). 8vo, 2 50
Schimpf's Essentials of Volumetric Analysis. 12mo, 1 25
* Qualitative Chemical Analysis 8vo, 1 25
Text-book of Volumetric Analysis. 12mo, 2 50
Smith's Lecture Notes on Chemistry for Dental Students. 8vo, 2 50
Spencer's Handbook for Cane Sugar Manufacturers. ..... 16mo, mor. 3 00
Handbook for Chemists of Beet-sugar Houses ..... 16mo, mor. 3 00
Stockbridge's Rocks and Soils. 8vo, 2 50
* Tillman's Descriptive General Chemistry. 8vo, 3 00
* Elementary Lessons in Heat 8vo, 1 50
Treadwell's Qualitative Analysis. (Hall.). 8vo, 3 00
Quantitative Analysis. (Hall.). 8vo, 4 00
Turneaure and Russell's Public Water-supplies 8vo, 5 00
Van Deventer's Physical Chemistry for Beginners. (Boltwood.) 12mo, 1 50
Venable's Methods and Devices for Bacterial Treatment of Sewage 8vo, 3 00
Ward and Whipple's Freshwater Biology. (In Press.)
Ware's Beet-sugar Manufacture and Refining. Vol. I ..... Small 8vo, 4 00
" " " " " Vol. II. ..... Small 8vo, 5 00
Washington's Manual of the Chemical Analysis of Rocks 8vo, 2 00
* Weaver's Military Explosives. 8vo, 3 00
Wells's Laboratory Guide in Qualitative Chemical Analysis. 8vo, 1 50
Short Course in Inorganic Qualitative Chemical Analysis for Engineering Students. 12mo, 1 50
Text-book of Chemical Arithmetic 12mo, 1 25
Whipple's Microscopy of Drinking-water. 8vo, 3 50
Wilson's Chlorination Process. 12mo 1 50
Cyanide Processes 12mo 1 50
Winton's Microscopy of Vegetable Foods 8vo 7 50

CIVIL ENGINEERING.

BRIDGES AND ROOFS. HYDRAULICS. MATERIALS OF ENGINEERING. RAILWAY ENGINEERING.

Baker's Engineers' Surveying Instruments. 12mo, 3 00
Bixby's Graphical Computing Table. ..... Paper 19½ × 24¼ inches. 25
Breed and Hosmer's Principles and Practice of Surveying 8vo, 3 00
* Burr's Ancient and Modern Engineering and the Isthmian Canal 8vo, 3 50
Comstock's Field Astronomy for Engineers. 8vo, 2 50
* Corthell's Allowable Pressures on Deep Foundations 12mo, 1 25
Crandall's Text-book on Geodesy and Least Squares 8vo, 3 00
Davis's Elevation and Stadia Tables. 8vo, 1 00
Elliott's Engineering for Land Drainage. 12mo, 1 50
Practical Farm Drainage. 12mo, 1 00
*Fiebeger's Treatise on Civil Engineering 8vo, 5 00
Flemer's Phototopographic Methods and Instruments. 8vo, 5 00
Folwell's Sewerage. (Designing and Maintenance.). 8vo, 3 00
Freitag's Architectural Engineering. 8vo, 3 50
French and Ives's Stereotomy 8vo, 2 50
Goodhue's Municipal Improvements. 12mo, 1 50
Gore's Elements of Geodesy. 8vo, 2 50
* Hauch and Rice's Tables of Quantities for Preliminary Estimates. 12mo, 1 25
Hayford's Text-book of Geodetic Astronomy. 8vo, 3 00
Hering's Ready Reference Tables (Conversion Factors). ..... 16mo, mor. 2 50
Howe's Retaining Walls for Earth. 12mo, 1 25

* Ives's Adjustments of the Engineer's Transit and Level.....16mo, Bds. 25
Ives and Hilts's Problems in Surveying.....16mo, mor. 1 50
Johnson's (J. B.) Theory and Practice of Surveying.....Small 8vo, 4 00
Johnson's (L. J.) Statics by Algebraic and Graphic Methods.....8vo, 2 00
Kinnicutt, Winslow and Pratt's Purification of Sewage. (In Preparation).
Laplace's Philosophical Essay on Probabilities. (Truscott and Emory.)
12mo, 2 00
Mahan's Descriptive Geometry.....8vo, 1 50
Treatise on Civil Engineering. (1873.) (Wood.).....8vo, 5 00
Merriman's Elements of Precise Surveying and Geodesy.....8vo, 2 50
Merriman and Brooks's Handbook for Surveyors.....16mo, mor. 2 00
Morrison's Elements of Highway Engineering. (In Press.)
Nugent's Plane Surveying.....8vo, 3 50
Ogden's Sewer Design.....12mo, 2 00
Parsons's Disposal of Municipal Refuse.....8vo, 2 00
Patton's Treatise on Civil Engineering.....8vo, half leather, 7 50
Reed's Topographical Drawing and Sketching.....4to, 5 00
Rideal's Sewage and the Bacterial Purification of Sewage.....8vo, 4 00
Riemer's Shaft-sinking under Difficult Conditions. (Corning and Peele.)..8vo, 3 00
Siebert and Biggin's Modern Stone-cutting and Masonry.....8vo, 1 50
Smith's Manual of Topographical Drawing. (McMillan.).....8vo, 2 50
Soper's Air and Ventilation of Subways. (In Press.)
Tracy's Plane Surveying.....16mo, mor. 3 00
* Trautwine's Civil Engineer's Pocket-book.....16mo, mor. 5 00
Venable's Garbage Crematories in America.....8vo, 2 00
Methods and Devices for Bacterial Treatment of Sewage.....8vo, 3 00
Wait's Engineering and Architectural Jurisprudence.....8vo, 6 00
Sheep, 6 50
Law of Contracts.....8vo, 3 00
Law of Operations Preliminary to Construction in Engineering and Architecture.....8vo, 5 00
Sheep, 5 50
Warren's Stereotomy—Problems in Stone-cutting.....8vo, 2 50
* Waterbury's Vest-Pocket Hand-book of Mathematics for Engineers.
$2\frac{1}{8} \times 5\frac{3}{8}$ inches, mor. 1 00
Webb's Problems in the Use and Adjustment of Engineering Instruments.
16mo, mor. 1 25
Wilson's Topographic Surveying.....8vo, 3 50

BRIDGES AND ROOFS.

Boller's Practical Treatise on the Construction of Iron Highway Bridges..8vo, 2 00
Burr and Falk's Design and Construction of Metallic Bridges.....8vo, 5 00
Influence Lines for Bridge and Roof Computations.....8vo, 3 00
Du Bois's Mechanics of Engineering. Vol. II.....Small 4to, 10 00
Foster's Treatise on Wooden Trestle Bridges.....4to, 5 00
Fowler's Ordinary Foundations.....8vo, 3 50
French and Ives's Stereotomy.....8vo, 2 50
Greene's Arches in Wood, Iron, and Stone.....8vo, 2 50
Bridge Trusses.....8vo, 2 50
Roof Trusses.....8vo, 1 25
Grimm's Secondary Stresses in Bridge Trusses.....8vo, 2 50
Heller's Stresses in Structures and the Accompanyin Deformations.....8vo,
Howe's Design of Simple Roof-trusses in Wood and Steel.....8vo, 2 00
Symmetrical Masonry Arches.....8vo, 2 50
Treatise on Arches.....8vo, 4 00
Johnson, Bryan, and Turneaure's Theory and Practice in the Designing of Modern Framed Structures.....Small 4to, 10 00

Merriman and Jacoby's Text-book on Roofs and Bridges:

Part I. Stresses in Simple Trusses....8vo, 2 50
Part II. Graphic Statics....8vo, 2 50
Part III. Bridge Design....8vo, 2 50
Part IV. Higher Structures....8vo, 2 50

Morison's Memphis Bridge....Oblong 4to, 10 00

Sondericker's Graphic Statics, with Applications to Trusses, Beams, and Arches. 8vo, 2 00

Waddell's De Pontibus, Pocket-book for Bridge Engineers....16mo, mor, 2 00

* Specifications for Steel Bridges....12mo, 50

Waddell and Harrington's Bridge Engineering. (In Preparation.)

Wright's Designing of Draw-spans. Two parts in one volume....8vo, 3 50

HYDRAULICS.

Barnes's Ice Formation....8vo, 3 00

Bazin's Experiments upon the Contraction of the Liquid Vein Issuing from an Orifice. (Trautwine.)....8vo, 2 00

Bovey's Treatise on Hydraulics....8vo, 5 00

Church's Diagrams of Mean Velocity of Water in Open Channels. Oblong 4to, paper, 1 50

Hydraulic Motors....8vo, 2 00
Mechanics of Engineering....8vo, 6 00

Coffin's Graphical Solution of Hydraulic Problems....16mo, morocco, 2 50

Flather's Dynamometers, and the Measurement of Power....12mo, 3 00

Folwell's Water-supply Engineering....8vo, 4 00

Frizell's Water-power....8vo, 5 00

Fuertes's Water and Public Health....12mo, 1 50
Water-filtration Works....12mo, 2 50

Ganguillet and Kutter's General Formula for the Uniform Flow of Water in Rivers and Other Channels. (Hering and Trautwine.)....8vo, 4 00

Hazen's Clean Water and How to Get It....Large 12mo, 1 50
Filtration of Public Water-supplies....8vo, 3 00

Hazlehurst's Towers and Tanks for Water-works....8vo, 2 50

Herschel's 115 Experiments on the Carrying Capacity of Large, Riveted, Metal Conduits....8vo, 2 00

Hoyt and Grover's River Discharge....8vo, 2 00

Hubbard and Kiersted's Water-works Management and Maintenance....8vo, 4 00

* Lyndon's Development and Electrical Distribution of Water Power....8vo, 3 00

Mason's Water-supply. (Considered Principally from a Sanitary Standpoint.) 8vo, 4 00

Merriman's Treatise on Hydraulics....8vo, 5 00

* Michie's Elements of Analytical Mechanics....8vo, 4 00

Molitor's Hydraulics of Rivers, Weirs and Sluices. (In Press.)

Schuyler's Reservoirs for Irrigation, Water-power, and Domestic Water-supply....Large 8vo, 5 00

* Thoma and Watt's Improvement of Rivers....4to, 6 00

Turneaure and Russell's Public Water-supplies....8vo, 5 00

Wegmann's Design and Construction of Dams. 5th Ed., enlarged....4to, 6 00
Water-supply of the City of New York from 1658 to 1895....4to, 10 00

Whipple's Value of Pure Water....Large 12mo, 1 00

Williams and Hazen's Hydraulic Tables....8vo, 1 50

Wilson's Irrigation Engineering....Small 8vo, 4 00

Wolff's Windmill as a Prime Mover....8vo, 3 00

Wood's Elements of Analytical Mechanics....8vo, 3 00
Turbines....8vo, 2 50

Baker's Roads and Pavements.....8vo, 5 00
Treatise on Masonry Construction.....8vo, 5 00
Birkmire's Architectural Iron and Steel.....8vo, 3 50
Compound Riveted Girders as Applied in Buildings.....8vo, 2 00
Black's United States Public Works.....Oblong 4to, 5 00
Bleininger's Manufacture of Hydraulic Cement. (In Preparation.)
* Bovey's Strength of Materials and Theory of Structures.....8vo, 7 50
Burr's Elasticity and Resistance of the Materials of Engineering.....8vo, 7 50
Byrne's Highway Construction.....8vo, 5 00
Inspection of the Materials and Workmanship Employed in Construction.
16mo, 3 00
Church's Mechanics of Engineering.....8vo, 6 00
Du Bois's Mechanics of Engineering.
Vol. I. Kinematics, Statics, Kinetics.....Small 4to, 7 50
Vol. II. The Stresses in Framed Structures, Strength of Materials and Theory of Flexures.....Small 4to, 10 00
*Eckel's Cements, Limes, and Plasters.....8vo, 6 00
Stone and Clay Products used in Engineering. (In Preparation.)
Fowler's Ordinary Foundations.....8vo, 3 50
Graves's Forest Mensuration.....8vo, 4 00
Green's Principles of American Forestry.....12mo, 1 50
* Greene's Structural Mechanics.....8vo, 2 50
Holly and Ladd's Analysis of Mixed Paints, Color Pigments and Varnishes
Large 12mo, 2 50
Johnson's Materials of Construction.....Large 8vo, 6 00
Keep's Cast Iron.....8vo, 2 50
Kidder's Architects and Builders' Pocket-book.....16mo, 5 00
Lanza's Applied Mechanics.....8vo, 7 50
Maire's Modern Pigments and their Vehicles.....12mo, 2 00
Martens's Handbook on Testing Materials. (Henning.) 2 vols.....8vo, 7 50
Maurer's Technical Mechanics.....8vo, 4 00
Merrill's Stones for Building and Decoration.....8vo, 5 00
Merriman's Mechanics of Materials.....8vo, 5 00
* Strength of Materials.....12mo, 1 00
Metcalf's Steel. A Manual for Steel-users.....12mo, 2 00
Patton's Practical Treatise on Foundations.....8vo, 5 00
Rice's Concrete Block Manufacture.....8vo, 2 00
Richardson's Modern Asphalt Pavements.....8vo, 3 00
Richey's Handbook for Superintendents of Construction.....16mo, mor., 4 00
* Ries's Clays: Their Occurrence, Properties, and Uses.....8vo, 5 00
Sabin's Industrial and Artistic Technology of Paints and Varnish.....8vo, 3 00
* Schwarz's Longleaf Pine in Virgin Forest.....12mo, 1 25
Snow's Principal Species of Wood.....8vo, 3 50
Spalding's Hydraulic Cement.....12mo, 2 00
Text-book on Roads and Pavements.....12mo, 2 00
Taylor and Thompson's Treatise on Concrete, Plain and Reinforced.....8vo, 5 00
Thurston's Materials of Engineering. In Three Parts.....8vo, 8 00
Part I. Non-metallic Materials of Engineering and Metallurgy.....8vo, 2 00
Part II. Iron and Steel.....8vo, 3 50
Part III. A Treatise on Brasses, Bronzes, and Other Alloys and their Constituents.....8vo, 2 50
Tillson's Street Pavements and Paving Materials.....8vo, 4 00
Turneaure and Maurer's Principles of Reinforced Concrete Construction.....8vo, 3 00
Wood's (De V.) Treatise on the Resistance of Materials, and an Appendix on the Preservation of Timber.....8vo, 2 00
Wood's (M. P.) Rustless Coatings: Corrosion and Electrolysis of Iron and Steel.....8vo, 4 00

RAILWAY ENGINEERING.

Andrews's Handbook for Street Railway Engineers.....3x5 inches, mor. 1 25
Berg's Buildings and Structures of American Railroads.....4to, 5 00
Brooks's Handbook of Street Railroad Location.....16mo, mor. 1 50
Butt's Civil Engineer's Field-book.....16mo, mor. 2 50
Crandall's Railway and Other Earthwork Tables.....8vo, 1 50
Transition Curve.....16mo, mor. 1 50
* Crockett's Methods for Earthwork Computations.....8vo, 1 50
Dawson's "Engineering" and Electric Traction Pocket-book.....16mo, mor. 5 00
Dredge's History of the Pennsylvania Railroad: (1879).....Paper, 5 00
Fisher's Table of Cubic Yards.....Cardboard, 25
Godwin's Railroad Engineers' Field-book and Explorers' Guide...16mo, mor. 2 50
Hudson's Tables for Calculating the Cubic Contents of Excavations and Embankments.....8vo, 1 00
Ives and Hilts's Problems in Surveying, Railroad Surveying and Geodesy 16mo, mor. 1 50
Molitor and Beard's Manual for Resident Engineers.....16mo, 1 00
Nagle's Field Manual for Railroad Engineers.....16mo, mor. 3 00
Philbrick's Field Manual for Engineers.....16mo, mor. 3 00
Raymond's Railroad Engineering. 3 volumes.
Vol. I. Railroad Field Geometry. (In Preparation.)
Vol. II. Elements of Railroad Engineering.....8vo, 3 50
Vol. III. Railroad Engineer's Field Book. (In Preparation.)
Searles's Field Engineering.....16mo, mor. 3 00
Railroad Spiral.....16mo, mor. 1 50
Taylor's Prismoidal Formulæ and Earthwork.....8vo, 1 50
* Trautwine's Field Practice of Laying Out Circular Curves for Railroads. 12mo. mor, 2 50
* Method of Calculating the Cubic Contents of Excavations and Embankments by the Aid of Diagrams.....8vo, 2 00
Webb's Economics of Railroad Construction.....Large 12mo, 2 50
Railroad Construction.....16mo, mor. 5 00
Wellington's Economic Theory of the Location of Railways.....Small 8vo, 5 00

DRAWING.

Barr's Kinematics of Machinery.....8vo, 2 50
* Bartlett's Mechanical Drawing.....8vo, 3 00
* " " " Abridged Ed.....8vo, 1 50
Coolidge's Manual of Drawing.....8vo, paper, 1 00
Coolidge and Freeman's Elements of General Drafting for Mechanical Engineers.....Oblong 4to, 2 50
Durley's Kinematics of Machines.....8vo, 4 00
Emch's Introduction to Projective Geometry and its Applications.....8vo, 2 50
Hill's Text-book on Shades and Shadows, and Perspective.....8vo, 2 00
Jamison's Advanced Mechanical Drawing.....8vo, 2 00
Elements of Mechanical Drawing.....8vo, 2 50
Jones's Machine Design:
Part I. Kinematics of Machinery.....8vo, 1 50
Part II. Form, Strength, and Proportions of Parts.....8vo, 3 00
MacCord's Elements of Descriptive Geometry.....8vo, 3 00
Kinematics; or, Practical Mechanism.....8vo, 5 00
Mechanical Drawing.....4to, 4 00
Velocity Diagrams.....8vo, 1 50
McLeod's Descriptive Geometry.....Large 12mo, 1 50
* Mahan's Descriptive Geometry and Stone-cutting.....8vo, 1 50
Industrial Drawing. (Thompson.).....8vo, 3 50

Moyer's Descriptive Geometry. 8vo, 2 00
Reed's Topographical Drawing and Sketching. 4to, 5 00
Reid's Course in Mechanical Drawing. 8vo, 2 00
Text-book of Mechanical Drawing and Elementary Machine Design. 8vo, 3 00
Robinson's Principles of Mechanism. 8vo, 3 00
Schwamb and Merrill's Elements of Mechanism. 8vo, 3 00
Smith's (R. S.) Manual of Topographical Drawing. (McMillan.). 8vo, 2 50
Smith (A. W.) and Marx's Machine Design. 8vo, 3 00
* Titsworth's Elements of Mechanical Drawing . . . . . Oblong 8vo, 1 25
Warren's Drafting Instruments and Operations. 12mo, 1 25
Elements of Descriptive Geometry, Shadows, and Perspective. 8vo, 3 50
Elements of Machine Construction and Drawing. 8vo, 7 50
Elements of Plane and Solid Free-hand Geometrical Drawing . . . 12mo, 1 00
General Problems of Shades and Shadows 8vo, 3 00
Manual of Elementary Problems in the Linear Perspective of Form and Shadow. 12mo, 1 00
Manual of Elementary Projection Drawing. 12mo, 1 50
Plane Problems in Elementary Geometry 12mo, 1 25
Problems, Theorems, and Examples in Descriptive Geometry. 8vo, 2 50
Weisbach's Kinematics and Power of Transmission. (Hermann and Klein.). 8vo, 5 00
Wilson's (H. M.) Topographic Surveying. 8vo, 3 50
Wilson's (V. T.) Free-hand Lettering. 8vo, 1 00
Free-hand Perspective. 8vo, 2 50
Woolf's Elementary Course in Descriptive Geometry. . . . . Large 8vo, 3 00

ELECTRICITY AND PHYSICS.

* Abegg's Theory of Electrolytic Dissociation. (von Ende.) 12mo, 1 25
Andrews's Hand-Book for Street Railway Engineering . . . . 3×5 inches, mor., 1 25
Anthony and Brackett's Text-book of Physics. (Magie.). . . . . Large 12mo, 3 00
Anthony's Lecture-notes on the Theory of Electrical Measurements 12mo, 1 00
Benjamin's History of Electricity. 8vo, 3 00
Voltaic Cell. 8vo, 3 00
Betts's Lead Refining and Electrolysis 8vo, 4 00
Classen's Quantitative Chemical Analysis by Electrolysis. (Boltwood.) . 8vo, 3 00
* Collins's Manual of Wireless Telegraphy. 12mo, 1 50
Mor. 2 00
Crehore and Squier's Polarizing Photo-chronograph. 8vo, 3 00
* Danneel's Electrochemistry. (Merriam.). 12mo, 1 25
Dawson's "Engineering" and Electric Traction Pocket-book. . . . . 16mo, mor 5 00
Dolezalek's Theory of the Lead Accumulator (Storage Battery). (von Ende.) 12mo, 2 50
Duhem's Thermodynamics and Chemistry. (Burgess.). 8vo, 4 00
Flather's Dynamometers, and the Measurement of Power. 12mo, 3 00
Gilbert's De Magnete. (Mottelay.). 8vo, 2 50
* Hanchett's Alternating Currents 12mo, 1 00
Hering's Ready Reference Tables (Conversion Factors) . . . . . 16mo, mor. 2 50
Hobart and Ellis's High-speed Dynamo Electric Machinery. (In Press.)
Holman's Precision of Measurements. 8vo, 2 00
Telescopic Mirror-scale Method, Adjustments, and Tests . . . . Large 8vo, 75
* Karapetoff's Experimental Electrical Engineering. 8vo, 6 00
Kinzbrunner's Testing of Continuous-current Machines. 8vo, 2 00
Landauer's Spectrum Analysis. (Tingle.). 8vo, 3 00
Le Chatelier's High-temperature Measurements. (Boudouard—Burgess.) 12mo, 3 00
Löb's Electrochemistry of Organic Compounds. (Lorenz.). 8vo, 3 00
* Lyndon's Development and Electrical Distribntion of Water Power 8vo, 3 00
* Lyons's Treatise on Electromagnetic Phenomena. Vols. I. and II. 8vo, each, 6 00
* Michie's Elements of Wave Motion Relating to Sound and Light. 8vo, 4 00

Morgan's Outline of the Theory of Solution and its Results.....12mo, 1 00
* Physical Chemistry for Electrical Engineers.....12mo, 1 50
Niaudet's Elementary Treatise on Electric Batteries. (Fishback)....12mo. 2 50
* Norris's Introduction to the Study of Electrical Engineering.....8vo, 2 50
* Parshall and Hobart's Electric Machine Design.....4to, half morocco, 12 50
Reagan's Locomotives: Simple, Compound, and Electric. New Edition.
Large 12mo, 3 50
* Rosenberg's Electrical Engineering. (Haldane Gee—Kinzbrunner.)...8vo, 2 00
Ryan, Norris, and Hoxie's Electrical Machinery. Vol. I.....8vo, 2 50
Schapper's Laboratory Guide for Students in Physical Chemistry.....12mo, 1 00
Thurston's Stationary Steam-engines.....8vo, 2 50
* Tillman's Elementary Lessons in Heat.....8vo, 1 50
Tory and Pitcher's Manual of Laboratory Physics.....Large 12mo, 2 00
Ulke's Modern Electrolytic Copper Refining.....8vo, 3 00

LAW.

* Davis's Elements of Law.....8vo, 2 50
* Treatise on the Military Law of United States.....8vo, 7 00
* Sheep, 7 50
* Dudley's Military Law and the Procedure of Courts-martial....Large 12mo, 2 50
Manual for Courts-martial.....16mo, mor. 1 50
Wait's Engineering and Architectural Jurisprudence.....8vo, 6 00
Sheep, 6 50
Law of Contracts.....8vo, 3 00
Law of Operations Preliminary to Construction in Engineering and Architecture.....8vo 5 00
Sheep, 5 50

MATHEMATICS.

Baker's Elliptic Functions.....8vo, 1 50
Briggs's Elements of Plane Analytic Geometry. (Bôcher).....12mo, 1 00
* Buchanan's Plane and Spherical Trigonometry.....8vo, 1 00
Byerley's Harmonic Functions.....8vo, 1 00
Chandler's Elements of the Infinitesimal Calculus.....12mo, 2 00
Compton's Manual of Logarithmic Computations.....12mo, 1 50
Davis's Introduction to the Logic of Algebra.....8vo, 1 50
* Dickson's College Algebra.....Large 12mo, 1 50
* Introduction to the Theory of Algebraic Equations.....Large 12mo, 1 25
Emch's Introduction to Projective Geometry and its Applications.....8vo, 2 50
Fiske's Functions of a Complex Variable.....8vo, 1 00
Halsted's Elementary Synthetic Geometry.....8vo, 1 50
Elements of Geometry.....8vo, 1 75
* Rational Geometry.....12mo, 1 50
Hyde's Grassmann's Space Analysis.....8vo, 1 00
* Jonnson's (J. B.) Three-place Logarithmic Tables: Vest-pocket size, paper, .15
100 copies, 5 00
* Mounted on heavy cardboard, 8 × 10 inches, 25
10 copies, 2 00
Johnson's (W. W.) Abridged Editions of Differential and Integral Calculus
Large 12mo, 1 vol. 2 50
Curve Tracing in Cartesian Co-ordinates.....12mo, 1 00
Differential Equations.....8vo, 1 00
Elementary Treatise on Differential Calculus. (In Press.)
Elementary Treatise on the Integral Calculus.....Large 12mo, 1 50
* Theoretical Mechanics.....12mo, 3 00
Theory of Errors and the Method of Least Squares.....12mo, 1 50
Treatise on Differential Calculus.....Large 12mo, 3 00
Treatise on the Integral Calculus.....Large 12mo, 3 00
Treatise on Ordinary and Partial Differential Equations..Large 12mo, 3 50

Laplace's Philosophical Essay on Probabilities. (Truscott and Emory.).12mo, 2 00
* Ludlow and Bass's Elements of Trigonometry and Logarithmic and Other Tables 8vo, 3 00
Trigonometry and Tables published separately .....Each, 2 00
* Ludlow's Logarithmic and Trigonometric Tables 8vo, 1 00
Macfarlane's Vector Analysis and Quaternions.....8vo, 1 00
McMahon's Hyperbolic Functions.....8vo, 1 00
Manning's IrrationalNumbers and their Representation bySequences and Series 12mo, 1 25
Mathematical Monographs. Edited by Mansfield Merriman and Robert S. Woodward.....Octavo, each 1 00
No. 1. History of Modern Mathematics, by David Eugene Smith. No. 2. Synthetic Projective Geometry, by George Bruce Halsted. No. 3. Determinants. by Laenas Gifford Weld. No. 4. Hyperbolic Functions, by James McMahon. No. 5. Harmonic Functions, by William E. Byerly. No. 6. Grassmann's Space Analysis, by Edward W. Hyde. No. 7. Probability and Theory of Errors, by Robert S. Woodward. No. 8. Vector Analysis and Quaternions, by Alexander Macfarlane. No. 9. Differential Equations, by William Woolsey Johnson. No. 10. The Solution of Equations, by Mansfield Merriman. No. 11. Functions of a Complex Variable, by Thomas S. Fiske.
Maurer's Technical Mechanics.....8vo, 4 00
Merriman's Method of Least Squares.....8vo, 2 00
Solution of Equations 8vo, 1 00
Rice and Johnson's Differential and Integral Calculus. 2 vols. in one. Large 12mo, 1 50
Elementary Treatise on the Differential Calculus.....Large 12mo, 3 00
Smith's History of Modern Mathematics 8vo, 1 00
* Veblen and Lennes's Introduction to the Real Infinitesimal Analysis of One Variable 8vo, 2 00
* Waterbury's Vest Pocket Hand-Book of Mathematics for Engineers. $2\frac{7}{8} \times 5\frac{3}{8}$ inches, mor., 1 00
Weld's Determinations.....8vo, 1 00
Wood's Elements of Co-ordinate Geometry.....8vo, 2 00
Woodward's Probability and Theory of Errors.....8vo, 1 00

MECHANICAL ENGINEERING.

MATERIALS OF ENGINEERING, STEAM-ENGINES AND BOILERS.

Bacon's Forge Practice.....12mo, 1 50
Baldwin's Steam Heating for Buildings.....12mo, 2 50
Barr's Kinematics of Machinery.....8vo, 2 50
* Bartlett's Mechanical Drawing.....8vo, 3 00
* " " " Abridged Ed.....8vo, 1 50
Benjamin's Wrinkles and Recipes.....12mo, 2 00
* Burr's Ancient and Modern Engineering and the Isthmian Canal.....8vo, 3 50
Carpenter's Experimental Engineering.....8vo, 6 00
Heating and Ventilating Buildings.....8vo, 4 00
Clerk's Gas and Oil Engine.....Large 12mo, 4 00
Compton's First Lessons in Metal Working 12mo, 1 50
Compton and De Groodt's Speed Lathe.....12mo, 1 50
Coolidge's Manual of Drawing.....8vo, paper, 1 00
Coolidge and Freeman's Elements of General Drafting for Mechanical Engineers.....Oblong 4to, 2 50
Cromwell's Treatise on Belts and Pulleys.....12mo, 1 50
Treatise on Toothed Gearing.....12mo, 1 50
Durley's Kinematics of Machines.....8vo, 4 00

Flather's Dynamometers and the Measurement of Power. 12mo, 3 00
Rope Driving. 12mo, 2 00
Gill's Gas and Fuel Analysis for Engineers. 12mo, 1 25
Goss's Locomotive Sparks 8vo, 2 00
Hall's Car Lubrication. 12mo, 1 00
Hering's Ready Reference Tables (Conversion Factors). . . . . 16mo, mor., 2 50
Hobart and Ellis's High Speed Dynamo Electric Machinery. (In Press.)
Hutton's Gas Engine. 8vo, 5 00
Jamison's Advanced Mechanical Drawing. 8vo, 2 00
Elements of Mechanical Drawing 8vo, 2 50
Jones's Machine Design:
Part I. Kinematics of Machinery. 8vo, 1 50
Part II. Form, Strength, and Proportions of Parts. 8vo, 3 00
Kent's Mechanical Engineers' Pocket-book. . . . . 16mo, mor , 5 00
Kerr's Power and Power Transmission. 8vo, 2 00
Leonard's Machine Shop Tools and Methods 8vo, 4 00
* Lorenz's Modern Refrigerating Machinery. (Pope, Haven, and Dean.) . . 8vo, 4 00
MacCord's Kinematics; or, Practical Mechanism. 8vo, 5 00
Mechanical Drawing. 4to, 4 00
Velocity Diagrams. 8vo, 1 50
MacFarland's Standard Reduction Factors for Gases. 8vo, 1 50
Mahan's Industrial Drawing. (Thompson.). 8vo, 3 50
* Parshall and Hobart's Electric Machine Design. . . . . Small 4to, half leather, 12 50
Peele's Compressed Air Plant for Mines. (In Press.)
Poole's Calorific Power of Fuels. 8vo, 3 00
* Porter's Engineering Reminiscences, 1855 to 1882. . . . . 8vo, 3 00
Reid's Course in Mechanical Drawing. 8vo, 2 00
Text-book of Mechanical Drawing and Elementary Machine Design . 8vo, 3 00
Richard's Compressed Air 12mo, 1 50
Robinson's Principles of Mechanism. 8vo, 3 00
Schwamb and Merrill's Elements of Mechanism. 8vo, 3 00
Smith's (O.) Press-working of Metals. 8vo, 3 00
Smith (A. W.) and Marx's Machine Design. 8vo, 3 00
Sorel's Carbureting and Combustion in Alcohol Engines. (Woodward and Preston). Large 12mo, 3 00
Thurston's Animal as a Machine and Prime Motor, and the Laws of Energetics. 12mo, 1 00
Treatise on Friction and Lost Work in Machinery and Mill Work... 8vo, 3 00
Tillson's Complete Automobile Instructor 16mo, 1 50
mor., 2 00
* Titsworth's Elements of Mechanical Drawing. . . . . Oblong 8vo, 1 25
Warren's Elements of Machine Construction and Drawing. 8vo, 7 50
* Waterbury's Vest Pocket Hand Book of Mathematics for Engineers.
$2\frac{7}{8} \times 5\frac{3}{8}$ inches, mor., 1 00
Weisbach's Kinematics and the Power of Transmission. (Herrmann—Klein.). 8vo, 5 00
Machinery of Transmission and Governors. (Herrmann—Klein.). . 8vo, 5 00
Wolff's Windmill as a Prime Mover. 8vo, 3 00
Wood's Turbines. 8vo, 2 50

MATERIALS OF ENGINEERING.

* Bovey's Strength of Materials and Theory of Structures. 8vo, 7 50
Burr's Elasticity and Resistance of the Materials of Engineering. 8vo, 7 50
Church's Mechanics of Engineering. 8vo, 6 00
* Greene's Structural Mechanics 8vo, 2 50
Holley and Ladd's Analysis of Mixed Paints, Color Pigments, and Varnishes. Large 12mo, 2 50
Johnson's Materials of Construction. 8vo, 6 00
Keep's Cast Iron. 8vo, 2 50
Lanza's Applied Mechanics. 8vo, 7 50

Maire's Modern Pigments and their Vehicles 12mo, 2 00
Martens's Handbook on Testing Materials. (Henning.) 8vo, 7 50
Maurer's Technical Mechanics. 8vo, 4 00
Merriman's Mechanics of Materials 8vo, 5 00
* Strength of Materials 12mo, 1 00
Metcalf's Steel. A Manual for Steel-users. 12mo, 2 00
Sabin's Industrial and Artistic Technology of Paints and Varnish. 8vo, 3 00
Smith's Materials of Machines. 12mo, 1 00
Thurston's Materials of Engineering. ..... 3 vols., 8vo, 8 00
Part I. Non-metallic Materials of Engineering, see Civil Engineering, page 9.
Part II. Iron and Steel. 8vo, 3 50
Part III. A Treatise on Brasses, Bronzes, and Other Alloys and their Constituents. 8vo, 2 50
Wood's (De V.) Elements of Analytical Mechanics. 8vo, 3 00
Treatise on the Resistance of Materials and an Appendix on the Preservation of Timber 8vo, 2 00
Wood's (M. P.) Rustless Coatings: Corrosion and Electrolysis of Iron and Steel. 8vo, 4 00

STEAM-ENGINES AND BOILERS.

Berry's Temperature-entropy Diagram. 12mo, 1 25
Carnot's Reflections on the Motive Power of Heat. (Thurston.) 12mo, 1 50
Chase's Art of Pattern Making 12mo, 2 50
Creighton's Steam-engine and other Heat-motors 8vo, 5 00
Dawson's "Engineering" and Electric Traction Pocket-book ..... 16mo, mor., 5 00
Ford's Boiler Making for Boiler Makers 18mo, 1 00
Goss's Locomotive Performance 8vo, 5 00
Hemenway's Indicator Practice and Steam-engine Economy 12mo, 2 00
Hutton's Heat and Heat-engines. 8vo, 5 00
Mechanical Engineering of Power Plants. 8vo, 5 00
Kent's Steam boiler Economy. 8vo, 4 00
Kneass's Practice and Theory of the Injector. 8vo, 1 50
MacCord's Slide-valves. 8vo, 2 00
Meyer's Modern Locomotive Construction. 4to, 10 00
Moyer's Steam Turbines. (In Press.)
Peabody's Manual of the Steam-engine Indicator. 12mo, 1 50
Tables of the Properties of Saturated Steam and Other Vapors. 8vo, 1 00
Thermodynamics of the Steam-engine and Other Heat-engines. 8vo, 5 00
Valve-gears for Steam-engines. 8vo, 2 50
Peabody and Miller's Steam-boilers. 8vo, 4 00
Pray's Twenty Years with the Indicator. ..... Large 8vo, 2 50
Pupin's Thermodynamics of Reversible Cycles in Gases and Saturated Vapors. (Osterberg.) 12mo, 1 25
Reagan's Locomotives: Simple, Compound, and Electric. New Edition. Large 12mo, 3 50
Sinclair's Locomotive Engine Running and Management 12mo, 2 00
Smart's Handbook of Engineering Laboratory Practice. 12mo, 2 50
Snow's Steam-boiler Practice. 8vo, 3 00
Spangler's Notes on Thermodynamics 12mo, 1 00
Valve-gears. 8vo, 2 50
Spangler, Greene, and Marshall's Elements of Steam-engineering 8vo, 3 00
Thomas's Steam-turbines 8vo, 4 00
Thurston's Handbook of Engine and Boiler Trials, and the Use of the Indicator and the Prony Brake. 8vo, 5 00
Handy Tables. 8vo, 1 50
Manual of Steam-boilers, their Designs, Construction, and Operation. 8vo, 5 00

Thurston's Manual of the Steam-engine.....2 vols., 8vo, 10 00
Part I. History, Structure, and Theory.....8vo, 6 00
Part II. Design, Construction, and Operation.....8vo, 6 00
Stationary Steam-engines.....8vo, 2 50
Steam-boiler Explosions in Theory and in Practice.....12mo, 1 50
Wehrenfenning's Analysis and Softening of Boiler Feed-water (Patterson) 8vo, 4 00
Weisbach's Heat, Steam, and Steam-engines. (Du Bois.).....8vo, 5 00
Whitham's Steam-engine Design.....8vo, 5 00
Wood's Thermodynamics, Heat Motors, and Refrigerating Machines...8vo, 4 00

MECHANICS PURE AND APPLIED.

Church's Mechanics of Engineering.....8vo, 6 00
Notes and Examples in Mechanics.....8vo, 2 00
Dana's Text-book of Elementary Mechanics for Colleges and Schools..12mo, 1 50
Du Bois's Elementary Principles of Mechanics:
Vol. I. Kinematics.....8vo, 3 50
Vol. II. Statics.....8vo, 4 00
Mechanics of Engineering. Vol. I.....Small 4to, 7 50
Vol. II.....Small 4to, 10 00
* Greene's Structural Mechanics.....8vo, 2 50
James's Kinematics of a Point and the Rational Mechanics of a Particle. Large 12mo, 2 00
* Johnson's (W. W.) Theoretical Mechanics.....12mo, 3 00
Lanza's Applied Mechanics.....8vo, 7 50
* Martin's Text Book on Mechanics, Vol. I, Statics.....12mo, 1 25
* Vol. 2, Kinematics and Kinetics..12mo, 1 50
Maurer's Technical Mechanics.....8vo, 4 00
* Merriman's Elements of Mechanics.....12mo, 1 00
Mechanics of Materials.....8vo, 5 00
* Michie's Elements of Analytical Mechanics.....8vo, 4 00
Robinson's Principles of Mechanism.....8vo, 3 00
Sanborn's Mechanics Problems.....Large 12mo, 1 50
Schwamb and Merrill's Elements of Mechanism.....8vo, 3 00
Wood's Elements of Analytical Mechanics.....8vo, 3 00
Principles of Elementary Mechanics.....12mo, 1 25

MEDICAL.

Abderhalden's Physiological Chemistry in Thirty Lectures. (Hall and Defren). (In Press).
von Behring's Suppression of Tuberculosis. (Bolduan.).....12mo, 1 00
* Bolduan's Immune Sera.....12mo, 1 50
Davenport's Statistical Methods with Special Reference to Biological Variations.....16mo, mor., 1 50
Ehrlich's Collected Studies on Immunity. (Bolduan.).....8vo, 6 00
* Fischer's Physiology of Alimentation.....Large 12mo, cloth, 2 00
de Fursac's Manual of Psychiatry. (Rosanoff and Collins.).....Large 12mo, 2 50
Hammarsten's Text-book on Physiological Chemistry. (Mandel.).....8vo, 4 00
Jackson's Directions for Laboratory Work in Physiological Chemistry..8vo, 1 25
Lassar-Cohn's Practical Urinary Analysis. (Lorenz.).....12mo, 1 00
Mandel's Hand Book for the Bio-Chemical Laboratory.....12mo, 1 50
* Pauli's Physical Chemistry in the Service of Medicine. (Fischer.)....12mo, 1 25
* Pozzi-Escot's Toxins and Venoms and their Antibodies. (Cohn.).....12mo, 1 00
Rostoski's Serum Diagnosis. (Bolduan.).....12mo, 1 00
Ruddiman's Incompatibilities in Prescriptions.....8vo, 2 00
Whys in Pharmacy.....12mo, 1 00
Salkowski's Physiological and Pathological Chemistry. (Orndorff.).....8vo, 2 50
* Satterlee's Outlines of Human Embryology.....12mo, 1 25
Smith's Lecture Notes on Chemistry for Dental Students.....8vo, 2 50

Steel's Treatise on the Diseases of the Dog. 8vo, 3 50
* Whipple's Typhoid Fever ..... Large 12mo, 3 00
Woodhull's Notes on Military Hygiene 16mo, 1 50
* Personal Hygiene 12mo, 1 00
Worcester and Atkinson's Small Hospitals Establishment and Maintenance, and Suggestions for Hospital Architecture, with Plans for a Small Hospital 12mo, 1 25

METALLURGY.

Betts's Lead Refining by Electrolysis 8vo. 4 00
Bolland's Encyclopedia of Founding and Dictionary of Foundry Terms Used in the Practice of Moulding 12mo, 3 00
Iron Founder 12mo. 2 50
" " Supplement 12mo, 2 50
Douglas's Untechnical Addresses on Technical Subjects 12mo, 1 00
Goesel's Minerals and Metals: A Reference Book ..... 16mo, mor. 3 00
* Iles's Lead-smelting 12mo, 2 50
Keep's Cast Iron 8vo, 2 50
Le Chatelier's High-temperature Measurements. (Boudouard—Burgess.) 12mo, 3 00
Metcalf's Steel. A Manual for Steel-users 12mo, 2 00
Miller's Cyanide Process 12mo 1 00
Minet's Production of Aluminum and its Industrial Use. (Waldo.) 12mo, 2 50
Robine and Lenglen's Cyanide Industry. (Le Clerc.) 8vo, 4 00
Ruer's Elements of Metallography. (Mathewson). (In Press.)
Smith's Materials of Machines 12mo, 1 00
Thurston's Materials of Engineering. In Three Parts 8vo, 8 00
Part I. Non-metallic Materials of Engineering, see Civil Engineering, page 9.
Part II. Iron and Steel 8vo, 3 50
Part III. A Treatise on Brasses, Bronzes, and Other Alloys and their Constituents 8vo, 2 50
Ulke's Modern Electrolytic Copper Refining 8vo, 3 00
West's American Foundry Practice 12mo, 2 50
Moulders Text Book 12mo, 2 50
Wilson's Chlorination Process 12mo, 1 50
Cyanide Processes 12mo, 1 50

MINERALOGY.

Barringer's Description of Minerals of Commercial Value. Oblong, morocco, 2 50
Boyd's Resources of Southwest Virginia 8vo 3 00
Boyd's Map of Southwest Virginia ..... Pocket-book form. 2 00
* Browning's Introduction to the Rarer Elements 8vo, 1 50
Brush's Manual of Determinative Mineralogy. (Penfield.) 8vo, 4 00
Butler's Pocket Hand-Book of Minerals ..... 16mo, mor. 3 00
Chester's Catalogue of Minerals ..... 8vo, paper, 1 00
Cloth, 1 25
Crane's Gold and Silver. (In Press.)
Dana's First Appendix to Dana's New "System of Mineralogy." ..... Large 8vo, 1 00
Manual of Mineralogy and Petrography 12mo 2 00
Minerals and How to Study Them 12mo, 1 50
System of Mineralogy ..... Large 8vo, half leather, 12 50
Text-book of Mineralogy 8vo, 4 00
Douglas's Untechnical Addresses on Technical Subjects 12mo, 1 00
Eakle's Mineral Tables 8vo, 1 25
Stone and Clay Products Used in Engineering. (In Preparation).
Egleston's Catalogue of Minerals and Synonyms 8vo, 2 50
Goesel's Minerals and Metals: A Reference Book ..... 16mo, mor. 3 00
Groth's Introduction to Chemical Crystallography (Marshall) 12mo, 1 25

* Iddings's Rock Minerals 8vo, 5 00
Johannsen's Determination of Rock-forming Minerals in Thin Sections 8vo, 4 00
* Martin's Laboratory Guide to Qualitative Analysis with the Blowpipe. 12mo, 60
Merrill's Non-metallic Minerals: Their Occurrence and Uses 8vo, 4 00
Stones for Building and Decoration 8vo, 5 00
* Penfield's Notes on Determinative Mineralogy and Record of Mineral Tests. 8vo, paper, 50
Tables of Minerals, Including the Use of Minerals and Statistics of Domestic Production 8vo, 1 00
Pirsson's Rocks and Rock Minerals. (In Press.)
* Richards's Synopsis of Mineral Characters ..... 12mo, mor. 1 25
* Ries's Clays: Their Occurrence, Properties, and Uses 8vo, 5 00
* Tillman's Text-book of Important Minerals and Rocks 8vo, 2 00

MINING.

* Beard's Mine Gases and Explosions ..... Large 12mo, 3 00
Boyd's Map of Southwest Virginia ..... Pocket-book form, 2 00
Resources of Southwest Virginia 8vo, 3 00
Crane's Gold and Silver. (In Press.)
Douglas's Untechnical Addresses on Technical Subjects 12mo, 1 00
Eissler's Modern High Explosives 8vo 4 00
Goesel's Minerals and Metals: A Reference Book ..... 16mo, mor. 3 00
Ihlseng's Manual of Mining 8vo, 5 00
* Iles's Lead-smelting 12mo, 2 50
Miller's Cyanide Process 12mo, 1 00
O'Driscoll's Notes on the Treatment of Gold Ores 8vo, 2 00
Peele's Compressed Air Plant for Mines. (In Press.)
Riemer's Shaft Sinking Under Difficult Conditions. (Corning and Peele) ... 8vo, 3 00
Robine and Lenglen's Cyanide Industry. (Le Clerc.) 8vo, 4 00
* Weaver's Military Explosives 8vo, 3 00
Wilson's Chlorination Process 12mo, 1 50
Cyanide Processes 12mo, 1 50
Hydraulic and Placer Mining. 2d edition, rewritten 12mo, 2 50
Treatise on Practical and Theoretical Mine Ventilation 12mo, 1 25

SANITARY SCIENCE.

Association of State and National Food and Dairy Departments, Hartford Meeting, 1906 ..... 8vo, 3 00
Jamestown Meeting, 1907 ..... 8vo, 3 00
* Bashore's Outlines of Practical Sanitation 12mo, 1 25
Sanitation of a Country House 12mo, 1 00
Sanitation of Recreation Camps and Parks 12mo, 1 00
Folwell's Sewerage. (Designing, Construction, and Maintenance.) 8vo, 3 00
Water-supply Engineering 8vo, 4 00
Fowler's Sewage Works Analyses 12mo, 2 00
Fuertes's Water-filtration Works 12mo, 2 50
Water and Public Health 12mo, 1 50
Gerhard's Guide to Sanitary House-inspection 16mo, 1 00
* Modern Baths and Bath Houses 8vo, 3 00
Sanitation of Public Buildings 12mo, 1 50
Hazen's Clean Water and How to Get It ..... Large 12mo, 1 50
Filtration of Public Water-supplies 8vo, 3 00
Kinnicut, Winslow and Pratt's Purification of Sewage. (In Press.)
Leach's Inspection and Analysis of Food with Special Reference to State Control 8vo, 7 00
Mason's Examination of Water. (Chemical and Bacteriological) 12mo, 1 25
Water-supply. (Considered principally from a Sanitary Standpoint) .. 8vo, 4 00

* Merriman's Elements of Sanitary Engineering	8vo,	2 00
Ogden's Sewer Design	12mo,	2 00
Parsons's Disposal of Municipal Refuse	8vo,	2 00
Prescott and Winslow's Elements of Water Bacteriology, with Special Reference to Sanitary Water Analysis	12mo,	1 50
* Price's Handbook on Sanitation	12mo,	1 50
Richards's Cost of Food. A Study in Dietaries	12mo,	1 00
Cost of Living as Modified by Sanitary Science	12mo,	1 00
Cost of Shelter	12mo,	1 00
* Richards and Williams's Dietary Computer	8vo,	1 50
Richards and Woodman's Air, Water, and Food from a Sanitary Standpoint	8vo,	2 00
Rideal's Disinfection and the Preservation of Food	8vo,	4 00
Sewage and Bacterial Purification of Sewage	8vo,	4 00
Soper's Air and Ventilation of Subways. (In Press.)		
Turneaure and Russell's Public Water-supplies	8vo,	5 00
Venable's Garbage Crematories in America	8vo,	2 00
Method and Devices for Bacterial Treatment of Sewage	8vo,	3 00
Ward and Whipple's Freshwater Biology. (In Press.)		
Whipple's Microscopy of Drinking-water	8vo,	3 50
* Typhod Fever	Large 12mo,	3 00
Value of Pure Water	Large 12mo,	1 00
Winton's Microscopy of Vegetable Foods	8vo,	7 50

MISCELLANEOUS.

Emmons's Geological Guide-book of the Rocky Mountain Excursion of the International Congress of Geologists	Large 8vo,	1 50
Ferrel's Popular Treatise on the Winds	8vo,	4 00
Fitzgerald's Boston Machinist	18mo,	1 00
Gannett's Statistical Abstract of the World	24mo,	75
Haines's American Railway Management	12mo,	2 50
* Hanusek's The Microscopy of Technical Products. (Winton)	8vo,	5 00
Ricketts's History of Rensselaer Polytechnic Institute 1824–1894	Large 12mo,	3 00
Rotherham's Emphasized New Testament	Large 8vo,	2 00
Standage's Decoration of Wood, Glass, Metal, etc	12mo,	2 00
Thome's Structural and Physiological Botany. (Bennett)	16mo,	2 25
Westermaier's Compendium of General Botany. (Schneider)	8vo,	2 00
Winslow's Elements of Applied Microscopy	12mo,	1 50

HEBREW AND CHALDEE TEXT-BOOKS.

Green's Elementary Hebrew Grammar	12mo,	1 25
Gesenius's Hebrew and Chaldee Lexicon to the Old Testament Scriptures. (Tregelles.)	Small 4to, half morocco,	5 00