

Notes with a Prussian Sanitäts Detachment in the Loire Campaign, 1870, by Sandford Moore, Assistant Surgeon, 4th Royal Irish Dragoon Guards

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NOTES

WITH A PRUSSIAN SANITÄTS DETACHMENT

IN THE LOIRE CAMPAIGN, 1870.

R.A.M.C. Historical Museum,

Keogh Barracks,

Ash Vale,

Nr. Aldershot,

BY **Hants.**

SANDFORD MOORE, B.A.,

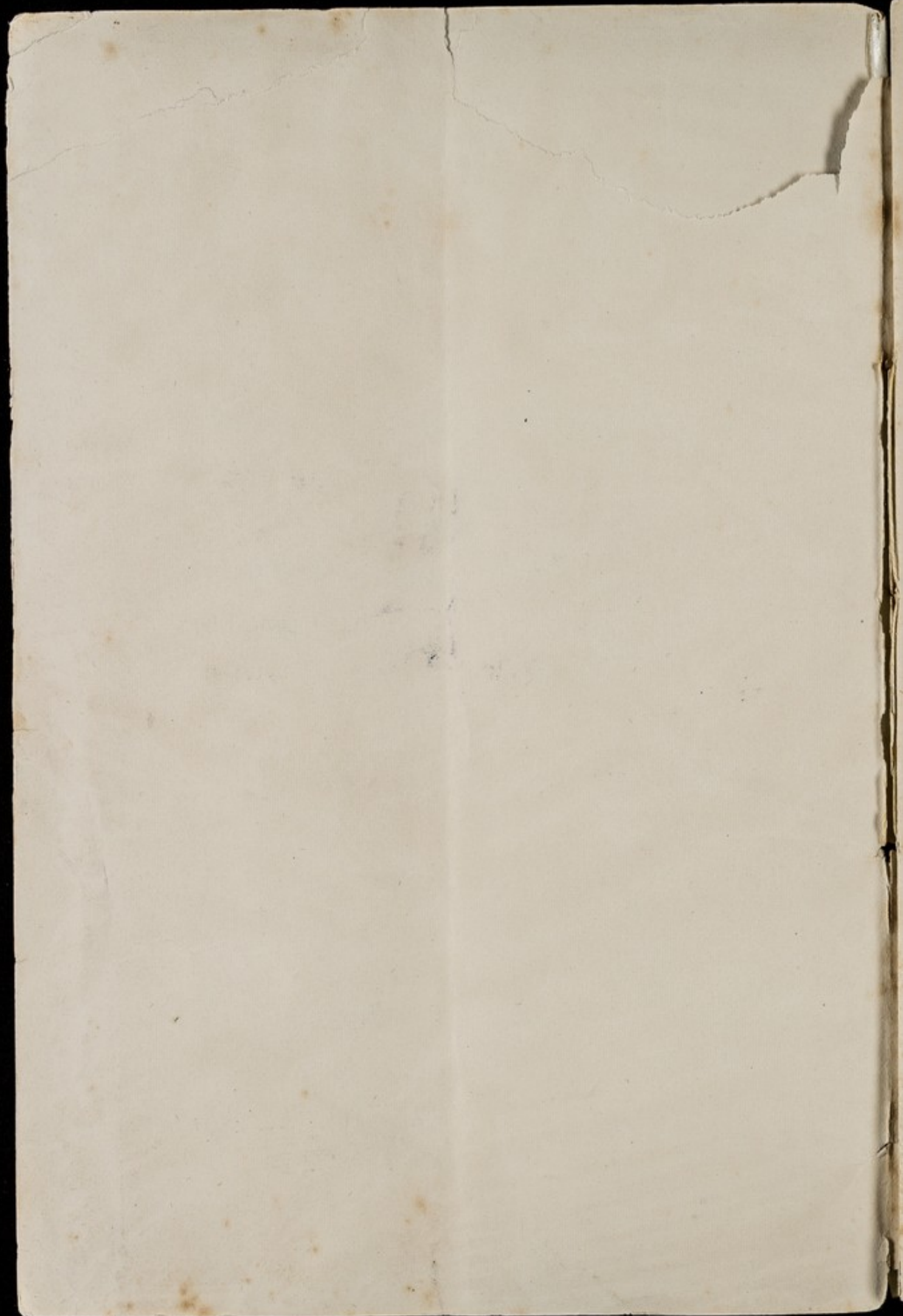
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THE PRUSSIAN AMBULANCE WAGGON.

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NOTES
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IN THE LOIRE CAMPAIGN.

THE Woolwich Ambulance was despatched to the seat of war in October, 1870, under Deputy Inspector-General of Hospitals Guy, by the National Society for Aid to the Sick and Wounded in War. It was a British military ambulance in every respect. Army surgeons, Army Hospital Corps, non-commissioned officers and men (*en civile*, and with the Red Cross *brassard* on the left arm), formed the British *personnel*; while army ambulance waggons and general service waggons, with regulation harness and field hospital stores, formed the *matériel*.

The Ambulance marched from Havre to Saint Germain in the first instance, and on its arrival in that town an attempt was made to establish a hospital there; owing, however, to the jealousy and unfriendliness of certain individuals, this course had to be abandoned. The ambulance, already arranged in four subdivisions, had therefore to be broken up in November, and the B Division, under Surgeon Manley, V.C., R.A., marched on the 12th of that month for Chartres. As it turned out, the subdivision of the ambulance was a most fortunate circumstance, work being

far more easily obtained amongst the outlying besiegers of Paris than at Versailles. Two days subsequent to the marching away from Saint Germain, Mr. Manley, Mr. McNalty, and the writer of these notes, were presented to the General commanding at Chartres, and the B Division of the ambulance forthwith attached to the Sanitäts Detachment of the 22nd Prussian Division, just then quartered in that city, and hourly awaiting orders to march out to meet the enemy. With this Sanitäts Detachment the Division remained associated until the end of December—during some very severe weather and severe marching. It so happened that the B was the only division of the ambulance, and indeed the only foreign ambulance, permitted to march as a component part of the Prussian army, rationed by its commissariat and billeted by the billeting parties. I confess, rare opportunities were thus presented, not alone for the observation of the immediate treatment and removal of the wounded on the field (to which I have already alluded in Nos. 14 and 15, vol. i., of the *Lancet*), but also the working of the wheeled transport, British and Prussian, the former of which had not been previously tried in European warfare.

My notes I classify as follows:—

1. Notes on B Division of the British Ambulance.
2. „ Sanitäts Detachment.
3. „ March with the 22nd Prussian Division.
4. „ Ambulance transport employed... { Hand litters.
Hand-wheel litters.
Ambulance waggons.
5. „ Principles of construction of ambulance waggons.
6. „ Ambulance horses.

1. ON THE B DIVISION OF THE AMBULANCE.

English Personnel.—Surgeon W. G. Manley, V.C., R.A., Director; Assistant-Surgeons G. M'Nalty and S. Moore,* with one civilian groom, and one sergeant and four privates of the Army Hospital Corps.

French Personnel.—One shoeing smith, four drivers, and one groom; or, in all, three officers and twelve men.

The matériel consisted of two regulation ambulance waggons, one general service waggon, and twelve horses. The ambulance waggons were drawn by two horses; the general service waggon by four, in double draught, the near horse carrying the driver postilion-fashion. The harness, though heavy, contrasted favourably with that in the Prussian service for wear and strength. In each ambulance waggon, two field and two ambulance stretchers were carried, as well as a water barrel, water tins, and bucket. In the general service waggon, corn in sacks, a circular tent, two field panniers, two divisional boxes, bedding for twenty-five men, horse clothing, and the men's kit-bags. As the approach to the contents of this waggon was by lowering the tail-board, it frequently happened that almost every article had to be removed before the object for which search was made was discovered, and if some straw, shavings, or empty sacks were not forthcoming to spread at the rear of the waggon, the contents had simply to be deposited on the ground. To this waggon, and to the Prussian store waggons (the *Medecine und Utenseilen*), I hope on some future occasion to be able to draw more particular attention.

The French Drivers.—One had been a postilion, but was, at the period to which I refer, so infirm that he had to

* Assistant-Surgeon J. Power, 4th Regiment, joined the Division after the recapture of Orleans, where he had been detained a prisoner.

mount his horse from the splinter-bar; one was a grocer, and two others dock labourers at Havre—the latter altogether unused to horses or riding. When to these facts I add that our horses, with a very few exceptions, were screws, it may be a matter of surprise that early disaster did not wait upon the B Division. This, however, did not occur, and subsequent success goes far to show that, even with inferior horses and untrained drivers, an ambulance corps, by good management, may undergo severe hardships in the field, and at the same time do good service.

The Army Hospital Corps Men.—It has been the custom of a certain class of individuals in this country lately to eulogise things Prussian at the expense of things British; nor have our Army Hospital Corps escaped some severe handling. They have been spoken of since my return as ignorant, untrained, and rough; and the Prussian Krankenträger (their representatives in the Prussian army) as well trained, well educated, and gentle. For the sake of fair play, what are the facts?

Twenty-seven of the Army Hospital Corps accompanied the ambulance to France. When hard work had to be accomplished, in or out of hospital, no one can say but in our men we always found ready and willing hands. To their credit, I mention the rapid manner in which our twenty waggons, when placed on the quay at Havre in detached pieces, were put together; how in six hours these twenty waggons loaded and 108 horses were drawn to the railway station at Havre and put on trucks; and how in two-and-a-half hours from the time of the train stopping at Saint P. au Louvrier the same transport and horses were disembarked, and the whole ambulance on the move to the neighbouring town. To the exertions

of our Army Hospital Corps men were these satisfactory results due. In hospital, revolting gun-shot wounds were dressed by these men, and shattered extremities handled with tenderness and care. I wish I could say as much always for our friends the Krankenträgers from time to time placed under my own orders.

Let me endeavour to assure the faint-hearted by saying, that our Army Hospital Corps men are not in any respect inferior to the Prussian Krankenträgers, either as regards special training or gentleness.

2. ON THE SANITÄTS DETACHMENT OF THE 22ND DIVISION.

The Division consisted of the 32nd, 83rd, and Saxe-Weimar Regiments, the 13th Hussars, one artillery regiment, one pontoon train, and the Sanitäts Detachment, all under the command of General Wittisch. These regiments were at this time far below their strength; nor was the division a complete division. It was known to the Prussians as an "abtheilung," and in round numbers did not number more than 9,000 or 10,000 men.

To the Sanitäts Detachment I will here refer; and this naturally leads to some brief remarks on the Prussian ambulance arrangements on the outbreak of war. Army medical officers are employed in three different ways—(a) with Regiments, (b) with Sanitäts Detachments, and (c) with Reserve Feld Lazareths.

(a) *Regimentally*.—Two are attached to each battalion of infantry, regiment of cavalry or artillery, which they accompany into action. A small medicine cart accompanies each battalion, containing stimulants and the first dressings, but no stretchers; it is drawn by one horse, and

driven by a soldier of the regiment. All medical officers wear the helmet and Red Cross *brassard*.

(b) *With Sanitäts Detachments*.—To every *corps d'armée* there are three Sanitäts Detachments. Each one consists of an ambulance column, four Feld Lazareths, and one Krankenträger company, with three train officers, and 120 men.

In each *ambulance column* there are seven surgeons, one or two apothecaries, and one inspector; in *each Feld Lazareth*, two or three surgeons, one apothecary, and one inspector, with a proportionate number of train drivers who do not wear the *brassard*, and Krankenträger. With the column are two medicine waggons and six ambulance waggons; and with the Feld Lazareth two medicine waggons and two general store waggons.

Résumé of Sanitäts Detachment, three of which go to a Corps d'Armée.

	Officers.					Waggons.			Men.	Horses.
	Doctors.	Apothecaries.	Inspectors.	Rittmeister.	Lieutenant.	Ambulance.	Medicine.	Utensilien.		
1. Ambulance column	8	1	1	...	...	6	2	...	...	25
2. Four Feld Lazareths	12	4	4	...	...	...	8	8	...	60
3. Krankenträger Company ...	...	...	...	1	2	...	...	...	120	5
	20	5	5	1	2	6	10	8	120	90

(c) *With Reserve Feld Lazareths*.—These, which are “reserve field hospitals,” have not a number fixed for transport, men, or horses. I have met Reserve Feld Lazareths consisting of but two or three surgeons, and twelve men, but without either waggons or stores; while others had a few waggons and stores, and about the same number of sick attendants and surgeons.

Duty of the Sanitäts Detachment and Reserve Feld Lazareth.—The duties of the former are to accompany its own division on the line of march, and to follow it into action. When the Krankenträger get their stretchers into play, and bring in the wounded to the ambulance waggons, in which they are then conveyed to the point where field hospitals have been established—generally farm-houses, or villages near at hand, in the last war—to render such professional help, both on the field and in the temporary field hospital, by its entire medical staff, as the halt of the division will allow of; and on the division's departure, to move away with it, detaching a Feld Lazareth for the subsequent care of the wounded at each point. Thus, after each engagement the Sanitäts Detachment loses one of its Feld Lazareths, the duty of the latter then is to remain in charge of the wounded until either they are all evacuated to the base of operations, or until relieved by the Reserve Feld Lazareth, when it rejoins the Sanitäts Detachment. When, in its turn, the Reserve Feld Lazareth has evacuated the remaining wounded, it also moves further on to the front.

In the Prussian service the General holds the senior medical officer with the Sanitäts Detachment responsible for its discipline, hours of march and billeting, and for proper arrangements being made for the immediate removal and treatment of the wounded. The Ritmeister and two other train officers take their orders from him; he is the sole responsible head. When the Feld Lazareth is on detached duty, it takes orders from an inspectorial officer at headquarters. From the same source the Reserve Lazareth likewise takes its orders.

It must appear evident that the satisfactory performance of such varied duties as are imposed upon the head of the

Sanitäts Detachment, and with so wide a latitude, requires information of a non-professional, as well as that of a professional nature. In the Prussian service great care is taken to select these officers, and the recipient must have this range of information, and in every instance must be a horseman as well.

Even for the lesser charge, that of the Feld Lazareth, considerable responsibility is incurred. Detached in some small village in the enemy's country, and far away from troops, requisitions have to be made for food and wine, evacuations conducted to the nearest railway depôts or towns, on country carts, discipline maintained amongst all ranks, and when the order comes to rejoin, transport and horses carefully conducted back to the division.

No such arrangements exist in the British service, and although the system described is not a model one, there are many points deserving of notice. There are, however, too many apothecaries and inspectors (quartermasters) in the Prussian service. In our service such posts might with more economy, and as efficiently, I think, be filled, the former by serjeants (past compounders) in the Army Hospital Corps, and the latter by cavalry or artillery serjeant-majors, specially selected and appointed during war time; and the proportion of ambulance waggons, 18 for (30,000 men) *corps d'armée*, seems small. Of this, more hereafter.

3. ON THE MARCH WITH THE 22ND DIVISION.

I have arranged a chronological table, which gives the distances marched, the places of halt, and some remarks on the description of weather and country traversed. Reference will not be made to each day's march in detail, many of which presented very little difference, but matters

which I think worthy of note alone will here be spoken of. *Total distance marched*, 341 miles, in twenty marches, or an average of seventeen miles daily. *The time of march*: this was generally at 7½ a.m; the Sanitäts Detachment marching in rear of the infantry of the division, the British Ambulance immediately in rear of the Sanitäts Detachment. Towards noon the column halted, when what we dignified by the name *déjeuner* was supposed to be enjoyed. The order was that all the wheeled transport was to be drawn up, without loss of distance, to the right side of the road when the halt took place. This occurred indiscriminately on the flat or on the hill side. When on the hill side, owing to there being no scotching apparatus in our waggons, it was necessary to keep the horses in the collar until a stone could be obtained to put under the wheels. This inconvenience was frequently experienced.

Without sound of trumpet or other martial sound, the word "aufsitze" (mount) passed along the line, and the march resumed. The infantry in front rarely removed their packs, but rested themselves by lying on their backs on heaps of stones or banks.* The column halted generally at dusk—sometimes before, sometimes after; the wheeled transport was now drawn up in a well-dressed line, the British waggons on the left, and the horses and men despatched to billets, previously discovered by a non-commissioned officer sent on in front, whose duty it was to inscribe on each door with a piece of chalk the number of men and horses for that billet, with "Sanitäts Detach." written above. Tents not being carried in the Prussian service, long rounds had often to be taken to obtain the

* Not till the men had marched for ten days continuously, and over more than 120 miles, including two engagements, were their packs carried in country carts for them.

necessary shelter for the night. In this way—unwelcome and unknown guests—many a remote château, farm, and village in France was suddenly and unexpectedly called upon to house our British detachment.

Billeting.—When a small village only was available for the whole division a sort of scramble for quarters was admissible—at any rate among the officers; this was the case at Marville-le-Bois. Four friends and myself found a kitchen with one bed; one man somewhat sick was voted to the bed, while the remainder slept in straw on the floor; for many a night after, a by no means rare occurrence.

Very different to this was the case when a large town, or town capable of holding the whole division, was reached. To every corps then distinct quarters were assigned; to one part artillery, to another infantry, and so on. As a regiment marched into its quarters and through a street, a section fell out right and left from a company, and entered the houses on either side of the street—a kind of billeting very rapidly performed.

The Weather during the March.—This was variable. In November, fogs, rain, and cold winds. In December, mild days at the beginning of the month, but hard frost and snow towards the middle and end; all the nights were cold. The rain was felt the most of all, and led to a good deal of sickness. The infantry at this time were sadly in want of new boots and new clothing. It was not a very unusual thing to see a man with a pair of Mobile's trowsers on, and once I saw a Uhlan with a tall silk hat in place of his lancer cap.

The Nature of the Country traversed.—Almost every variety was at one time or another met with, from good roads over level plains, and steep, hilly, or rutty roads, to mere tracks through fields and woods; awkward turns, and

sudden descents into fields adjoining the road to avoid other transport. Plough furrows, and other broken ground had at times to be crossed to avoid cut roads or barricades, or to get a nearer position to the wounded.*

On good roads the wheeled transport travelled with facility, but from the preceding statement it will be seen that it was at other times exposed to very severe strains and thrusts.

On the Sufficiency of the Transport with the 22nd Division.—The British Ambulance (B division) was present at Saint Ange, Bretoncelles, and the general action near Artenay. At Saint Ange the search for wounded was continued till after dark, and sixteen severely, besides other wounded, placed in the eight ambulance waggons. That more men than these were severely wounded and lying about in the thick brushwood was probable, but the darkness of night rendered further search then impossible. The following day all the ambulance waggons were ordered to return from Château Neuf, ostensibly to have the dead interred, but also, I suspect, to search for any further wounded. I returned with them. Wounded, I dare say to the number of thirty, were discovered in the cottages adjoining the scene of action, to which they had either crawled or been carried during the night. Now, had these men been found the night previous, and supposing at a distance from cottages, what course could have been pursued under the circumstances? The eight ambulance waggons were full, the additional severely wounded must have

* To avoid a barricade near Château Neuf, the main road had to be abandoned, and ploughed fields crossed at a smart trot to reach the wounded, it being then almost dusk. On another occasion near Bonneval, the bridge over the Loiret being cut, a tressel bridge lower down, erected by the engineers, had to be crossed, swampy fields, and the river forded at a bend lower down.

remained out all night unsheltered, or at any rate until such time as country carts could be sent back from Château Neuf for them ; the ambulance waggons could not, for they were to march the following morning with the division. Here, after this small affair at Saint Ange, at which some sixty men had been placed *hors de combat*, it was apparent that but for the good fortune of adjacent cottages, the regulation amount of ambulance waggons, even including the British, would not have sufficed on that occasion to remove them to the field hospital at Château Neuf, four-and-a-half miles away. At Bretoncelles, the case was different, for the engagement took place immediately outside the village, so that the ambulance waggons were employed in making frequent journeys to the battlefield, and thus enabled to bring in all the wounded before dusk. At the general action on the 2nd December the 22nd Division was sent out on the morning of the 2nd to make a *reconnaissance* in force, when it unexpectedly came on the left of the French army, strongly posted at the village of Pouprey, near Artenay. A general engagement ensued, resulting in a drawn battle, both armies sleeping on the field by their bivouac fires. On one part of the field was a large farm-house, known as Onaux ; here the British Ambulance established itself towards evening, and in its own two waggons conveyed eighty-five wounded from the field to Onaux, and there treated them. I purposely avoid mentioning the reason for the absence of the Sanitäts Detachment at this critical juncture ; suffice it to say, Mr. Manley received that night, when in the midst of his work, the General's thanks for the help rendered. Here again, as at Bretoncelles, the wounded were conveyed to an adjacent temporary field hospital by frequent journeys of but two ambulance waggons backwards and forwards ;

these journeys had, however, to be continued to an early hour in the morning.*

Favoured by good fortune on each of these occasions in a remarkable manner, the deficient amount of ambulance transport did not then strike me so forcibly as it has done since. And in case such a small limit as eighteen ambulance waggons to a *corps d'armée* of 30,000 men is the one for adoption in other services, it would appear to be very advantageous to have as a provisional arrangement some ready means at hand for adding an upper storey to each ambulance waggon, whereby four severely wounded could be carried in the waggon at a time on any emergency, and likewise marquees in the store waggons, so that in any case, if it so happened that wounded men had to be left out all night on the field, they could be collected and housed in them until removed to a field hospital.

4. ON THE AMBULANCE TRANSPORT EMPLOYED.

It may be divided into three sorts:—

- (a) Hand stretchers; (b) Hand wheel-stretchers; and
(c) Waggons.

For full details concerning these, the reader is referred to Professor Longmore's "Treatise," and Dr. Gwilt's "Atlas;" and as I have not, however, found a detailed account of the Prussian ambulance waggon, I purpose giving as full a one as I can under the heading of "Waggons."

(a) *Handstretchers: objection to every Dual-stretcher System.*—With the British Ambulance, the two sorts of regulation stretchers were used. They are called the "field stretcher," and the "ambulance stretcher." On the

* From the two days' fighting round Artenay, 1,000 wounded remained collected in Bagneaux, Lunan, and Artenay.

former, the wounded man is carried from where he receives his wound to the waggon, where he is transferred to the "ambulance stretcher," on which alone he can be conveyed in the waggon. On the arrival of the waggon at the second line of surgical assistance—in other words, at the field hospital—another transfer to the field stretcher may or may not be required. If the distance from the waggon be short, this need not take place; if, however, it be considerable, or stairs have to be ascended, it must, owing to the short* handles of the "ambulance stretcher" cramping the bearers' hands,—and besides, its weight,† and smooth, sloping surface.‡ Thus, in every case a double, and in many cases a treble transfer is unavoidable, at a sacrifice of great waste of time, and considerable increase of suffering to the wounded.

The Object of a Dual-stretcher System.—The main object of the system is to have one very light stretcher, and one provided with springs; the former for the bearers' benefit, the latter so as to be used on springless vehicles.

To make the "field stretcher" very light, with the above object in view, it is provided with thin, weak, iron traverses, and is without feet. With regard to the latter, Mr. Longmore says: "The advantages are so great, that the additional liability to injury in consequence of them has been submitted to (elsewhere), rather than the disadvantages of doing without them."

To give elasticity to the "ambulance stretcher," a double framework for the reception of the springs is necessary, giving so much extra weight that the stretcher cannot

* Made short to fit the floor of the waggon. Hinged handles would meet this much better.

† Its springs necessitate much additional weight.

‡ A condition in itself favourable to accidents.

conveniently be carried but in the ambulance or other waggon. During the war, however, when evacuations were conducted on springless carts, as they in the majority of instances always were, the wounded were placed directly on hay or straw, and never on stretchers. Taking into consideration, then, this latter circumstance, with the waste of time and increase of suffering due directly to a dual-stretcher system, it seems to be very desirable that this system should be abolished, and but one pattern of stretcher used instead.

The Prussian Hand Stretcher.—There is but one description in use: on it the wounded man is carried to the waggon—in the waggon, and from the waggon to the field hospital. It is heavier than our “field stretcher,” not so heavy as the “ambulance stretcher.” It has short wooden feet, one stout framework, and wooden traverses; it has no springs, it does not fold up, and can bear, for I have seen it subjected to, the very roughest usage. It has one very great defect—the moveable head-rest, which takes away from its length for the body and legs, and increases the weight.

Rough Outline of a useful Stretcher for the Field.—Two eight-feet solid wooden poles, with padded side flaps at the centre, and iron-bound wooden feet and hinged handles, and two wooden traverses, forming a rigid wooden framework; canvas sacking bottom and waterproof pillow, neither to be removeable nor laced up, scrubbed *in situ* if necessary. (I have seen blood-stained stretchers which had been used at Woërth and Sedan, and were not to be washed till the end of the war—unwashed, therefore, from August until March.)

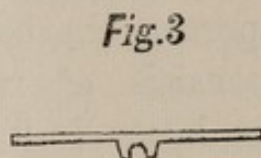
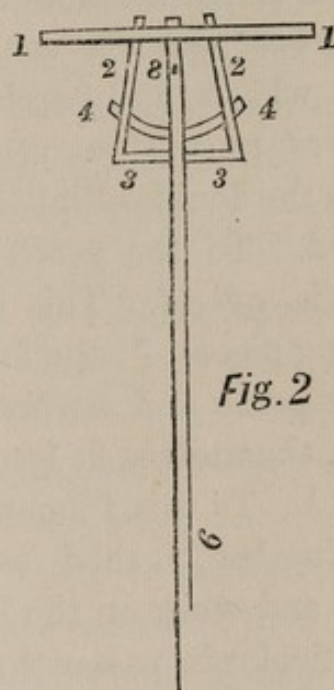
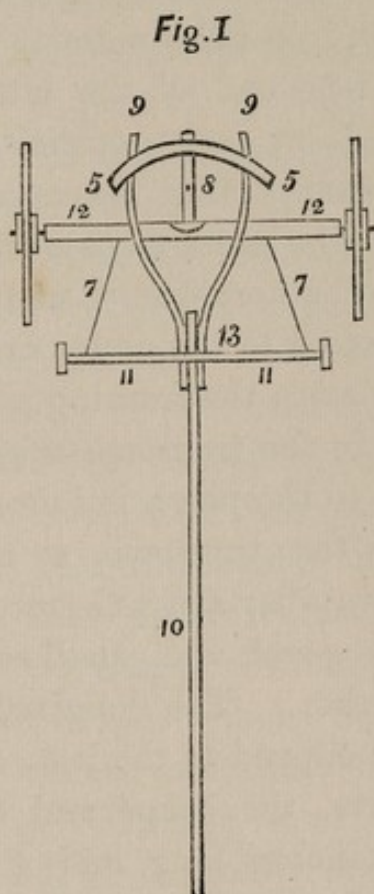
Springs, double frameworks, moveable head-rests, and shoulder straps are but positive encumbrances (the latter in

the British were only used to replace worn-out stirrup leathers). Such a stretcher might be made exceedingly strong, to bear any usage, and not as heavy as the Prussian stretcher at present in use in that army.

(b) *Hand Wheel-stretchers*.—By this is meant a stretcher wheeled by a man. The regulation Prussian hand wheel-stretcher is simply the hand stretcher carried on a wheeled support, consisting of an axletree, two wheels and two double elliptical springs; the latter are clipped down on the axle, and can be fixed at the point opposite, where there is a crutch or socket, to an iron standard attached to the under surface of each side pole at its centre, and when *in situ* retained by a transverse bolt. No wheeled support was sent out with the British Ambulance. By the application of wheels to stretchers it is supposed that the wounded can more quickly, and with less labour, be brought in than when stretchers alone are used, supposing suitable ground to exist. Suitable ground must be defined to be level, unyielding roads; the road may be hilly, but must be free from ruts or other inequalities, as about a fort or large hospital. Hence this support was not used by the Prussians in the field in the last war, where frequently roads had to be abandoned, and fields traversed to reach the wounded. On yielding ground the strain on the bearers' arms is so great as soon to tire a man out.

(c) *The Prussian Ambulance Waggon* (see Frontispiece).—This is called "Kranken Transport Wagen," or sick conveyance waggon, and consists of a fore and hind carriage carrying a body and coupé over them. *The fore-carriage*, *vide* Figs. 1 and 2, is formed by a Y-shaped futchell, 9 9, a pole, 10, splinter-bar, 11, axletree bed, 12, and axletree with small (3 feet 2 inches) fore wheels; the futchells are housed across the axletree bed, and close to their free extremities

support the bottom sway-bar,⁵. The stem of the Y helps to form a pole socket, the end of the pole being received



between the futchells; the under surface of the centre of the splinter-bar is hollowed out, the hollow (Fig. 3) houses the pole and futchells (a locality technically known as "the chops"); bands of iron (nose plates) hook across the hollow, over the end of the pole, and under the extreme ends of the futchells. When these bands are secured *in situ*, the pole, futchells, and splinter-bar are here retained firmly together. A strong iron bar, 7, runs from either side of the splinter-bar to the axletree bed, and serves to strengthen the connection between these parts; on each end of the splinter-bar is nailed an iron step, which facilitates entrance and exit to the coupé. The axletree

bed and the bottom sway-bar, 5, are shod with iron plates to take the bearing of the perch and framework. The splinter-bar is fitted for double draught with swingle-trees.

The hind carriage consists of an iron axle (without bed), 4-foot wheels, and perch, 6; the fore end of the latter is *morticed* to a stout cross-piece, 1, on each extremity of which the double elliptical springs supporting the coupé are clipped. To the perch here and the cross-piece a framework is *affixed*. This consists of a horn-bar, 3, and two framing pieces, 2; the former is bolted to the under surface of the perch and *morticed and bolted* to the framing pieces, which themselves fit into sockets in the transome or cross-piece, 1. To this framework and to the perch is *bolted* the top sway-bar, 4, shod as well as the transome, so as to travel and work on the bottom sway-bar and axletree bed. A vertical pin passes through the perch and small centre futchell, and secures them together. The longitudinal springs supporting the body are clipped to the iron axle. *The body* consists of two parts, the coupé and body proper. The latter is 9 feet 4 inches long, and 4 feet 4 inches wide, and is formed of a framework and planking like every other waggon, and with low wooden sides; it is separated from the coupé by a permanent partition of wood and canvas. A small square orifice at the centre admits of communication between the recumbent patients and those in the coupé. The floor of the coupé is one foot and a half higher than the floor of the body, a lock-hole is thus formed for the small fore wheels to travel under. The floor of the coupé is supported by two strong curved iron "body plates," which spring on either side from the body. The roof of the coupé is higher than that of the body, and is also a little wider. Both are slightly arched, and covered with painted canvas.

The latter is formed of a framework, on which the canvas is nailed down; this is maintained *in situ* by nine wooden standards, four from the corners, two from each side, and one from the end of the body. The framework itself is formed of four pieces, and a long central one on which nine crosspieces are morticed and bolted. Small canvas curtains close the sides and ends, and can be rolled up or let down at pleasure.

The roof of the coupé is covered with black painted canvas, a red cross on each side in white ground and flag; the coupé is protected by a leather apron, provided with an excellent sheepskin cushion, well padded all round, and large enough for four men. This is a snug and excellent seat. An iron ladder with four steps is carried on the near side, and intended to facilitate entrance to and exit from the coupé, but it is rarely used; when one man stands in the coupé to help, and the wounded man steps on the fore wheels, or splinter-bar step, he is got in easier without it. On the floor of the body two stretchers are carried for severely wounded, head foremost, and separated by a low partition; near the top four web-tags hang from the roof about a yard long each, so that the men on the stretchers can lift themselves up, and so change their position. The end of the waggon is closed by a step suspended by two hinged iron arms.

Packs, wheeled-stretcher supports, are carried immediately behind the coupé on the roof (a low iron rail about six feet long, and the width of the roof, retains them there; while wooden laths are laid along to keep the canvas roof from being injured); stimulants and medicine in presses attached to the bottom of the waggon; spare stretchers strapped to the side, or inside the waggon, or on country carts. The chain for the drag-shoe is fastened to

the perch near the vertical pin, and a *narrow and semi-circular piece of iron* is nailed to the axletree bed on either side, and by projecting over the naves of the fore wheels, prevents to some extent the mud from getting into the pipe boxes.

This waggon is not free from defects. The low centre of gravity, small fore wheels, perch, and short sway-bar, which augments the vibration and wabbling ("swagging" as it is technically called) when descending hills, these have all been noticed and remedied in waggons which have been more recently constructed by the Germans; in point of fact, a new ambulance waggon is about to be constructed in Prussia.

5. ON THE PRINCIPLES OF CONSTRUCTION OF AMBULANCE WAGGONS.

The bulk of authorities seem agreed that waggons, and not carts, are the proper forms of vehicle for transporting wounded in Europe; that sick and wounded men—never stores—are alone to be carried in the waggon; and that that capacity by which six or eight wounded (two severely) are conveyed in a waggon drawn by two horses is calculated to allow of the greatest amount of work being accomplished in a given time, and with the least waste of motive power. So far, then, as concerns the general form, the capacity, and the nature of the load of the ambulance waggon, definite views have been arrived at. I believe, however, I am right in saying the principles of construction have hitherto been very little discussed. I will now attempt to explain what appear to me to be the more prominent points.

(a) *Ambulance waggons should possess such an arrangement of the parts of their roofs and sides as will at all times,*

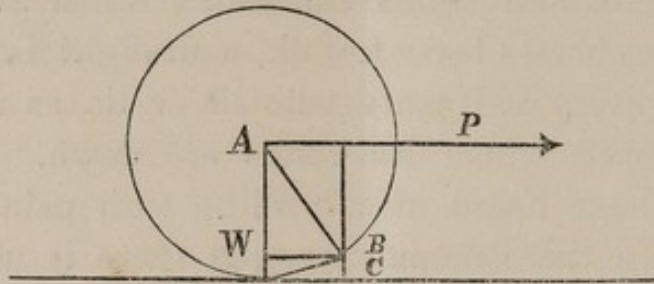
and independent of the season, afford adequate protection to the occupants. This would seem to be almost self-evident. Yet the British waggon sent out with the expedition was found suitable for summer use only; and although our ambulance work had to be carried on unintermittingly all through the winter (1870-71), it was carried on under this disadvantage, viz., with a waggon totally unsuited for a winter campaign. In what, then, did its shortcomings consist? Its roof and sides are formed by one continuous waterproof canvas cover stretched over bale hoops. There is no partition; canvas falls can be let down in front and behind instead. When the wind is ahead, or the horses leave a walk, a draught is felt, more or less, by every occupant—who sit or lie, as it were, in a tunnel—even when these falls are down. In severe weather I have heard men howling with pain from this draught. In the Prussian waggon there is no draught, owing to its partition, made of wood and canvas. This partition is, I think, a most essential part of an ambulance waggon, as by dividing the waggon into two comfortable compartments, one for sitting, another for recumbent wounded, all draught is avoided. With it of course there must be side curtains, to be raised or lowered according to the state of the weather—raised in warm weather, when the occupants need abundance of cool fresh air; lowered and fastened down in cold or wet weather, or at night evacuations, at all of which times the compartments of the waggon require to be rendered most comfortable. Remembering, then, the long periods for which men have at times to occupy the waggons,* and the severe weather

* On the 20th December I took 260 wounded on three British waggons and forty country carts, from Moree to Cloyes. At noon I commenced to load at Moree. I did not get rid of my charge until

during which modern armies continue tactical movements in the field, adequate provision for the protection of the wounded, by some such arrangement as I have pointed out, seems to be indispensable for European ambulance waggons, at all events.

(b) *The best Size for the Wheels.*—Wheels serve two ends; they remove friction to where it takes place between hard and smooth surfaces, and they give power to surmount obstacles. It is not difficult to show that the larger the wheel the less is the power required to pass over

Fig. 4



inequalities of the ground, *i.e.*, where the height of the point of attachment of trace (or the splinter-bar) depends on the radius of the wheel. In the construction, Fig. 4, let B C be an obstruction with which the wheel meets;

2 a.m. at Cloyes—just fourteen hours' occupation of the waggons by the wounded. The next day, the 21st December, I took the convoy, increased to 300, from Cloyes to Chartres, forty-five miles (English), marching continuously from 2 p.m. to 6 a.m., or just sixteen hours' occupation of the waggons and country carts. Both marches were made by Prussian orders, both in severe frosty weather—so cold that drivers and horsemen had to walk the entire distance, and not once during either were food or stimulants administered. The latter march, 140 prisoners trudged along with the convoy. I have never been able to ascertain whether the wounded, placed simply on hay or straw on the springless carts, and exposed with but scanty clothing, and for such a time without food, to this severe weather, were at all injured thereby. Prussian ambulance waggons are not, or were not then, or at any other time, used in evacuations. Nor do I suppose in our future wars ours ever will.

α , the angle which it subtends; P , the power acting horizontally from A , the centre; and w , the weight acting in the perpendicular downwards through A w . As the angle $BAW = 2\alpha$, it follows $P = w \tan. 2\alpha$. In this equation, w is a constant, and P diminishes as α diminishes, but α diminishes of course as the radius of the wheel increases, and $\therefore P$, the power diminishes as the radius of wheel increases. Not alone for the increased power* it gives in surmounting obstacles does the high wheel recommend itself, but also for another reason. Where speed, in contradistinction to great power, is required, experience has shown that a high wheel gives more ease to the horse. Is no limit, then, to be placed to the height? A large wheel raises the body high off the ground, making it more liable to upset; for the higher the wheel the smaller the angle of upset.

Now, an ambulance waggon is a moderate weight generally; it has to be drawn sometimes rapidly over ploughed and broken ground. Does not this point to high, but still not very high wheels—anything but low wheels? I have repeatedly noticed the superiority of the equirota British waggon wheels (4 feet 2 inches) to the smaller Prussian waggon wheels, in broken ground.

Small Fore Wheels.—Braine, in "The Dictionary of Science and Art," says, "The fore wheels of waggons in this country are usually too small." The main reason advanced for them is to facilitate turning, for by their passing under the lock hole the angle of lock is increased,† and the space to turn is diminished. But for an ambulance waggon, is there ever this pressing necessity to turn

* Major Close, R.A., Superintendent, Royal Carriage Department, shows the relative power of wheels to be as the square roots of their radii.

† Angle of lock, British waggon = 35° ; Prussian ditto, = 45° .

short? I have not seen any such, nor do I believe it ever exists—to such an extent, at all events, as to give anything like an adequate return for the disadvantages attending small fore wheels and the lock-hole.*

The Dish.—The outward inclination of the spoke is called the dish. It is given to a wheel to enable it to withstand lateral thrusts. As ambulance waggon wheels are exposed at times to these, it is an essential.

The Tyre.—The 3-inch tyre of our waggon wheels worked well, and did not allow of the sinking that the 2-inch tyre of the Prussian waggons did in soft ground.

Metal Naves.—These are recommended for waggons brought under fire, and may therefore be adopted in the case of ambulance waggons. The new Prussian medicine waggons have them.†

(c) *The requisite Elasticity* (ελαστε, a spring; ελαυνω, I draw).—A spring is defined to be a mechanism applied for the purpose of preventing shocks from the collision of hard bodies. In all modern waggons of every description it has been found expedient to add to solidity, elasticity, secured by the application of steel springs as well; solidity, to withstand shocks, and elasticity, to diminish their transmission. These are transmitted prin-

* To build a carriage with a lock-hole, one of two things must happen: either the capacity (cubic space) is diminished, or the total length of the waggon must be increased, in itself a preventive to sharp turning.

† At Sedan the Sanitäts Detachment of the 22nd Division was brought under fire, and had a horse killed by a shell; at Artenay I saw that of the 17th Division removing the wounded immediately in left rear of a battery of artillery, and exposed to shell fire. And in many other instances I have heard of the same happening. This exposure follows from the long range of modern projectiles, and from the fact that destruction and relief, so to speak, to be effective, must go on almost side by side; for if not, how can “the Detachment” continue to march with the division?

cipally in three directions—vertically, laterally, and horizontally, and may be familiarly instanced by a waggon crossing a furrow. When its fore wheels cross the furrow at right angles, and drop into it, a vertical shock is transmitted to the front of the waggon; on striking the opposite border, a horizontal shock; and if the wheels cross the furrow obliquely, a lateral one. To diminish the transmission, three sorts of springs have been designed—transverse elliptical springs for lateral shocks; longitudinal and platform for the vertical, and C springs for the horizontal. To give the maximum of protection, all three sorts are required. But this plan, from its complexity and resulting liability to injury on service, is not possible for ambulance waggons.

In both the British and Prussian waggons, vertical shocks alone are provided for; in the Johanniter waggons, both lateral and vertical. Lateral shocks are the most common form to which the waggon is exposed, as when one wheel only crosses over an obstacle, then vertical ones, and then horizontal ones. It seems to be a defective arrangement which does not provide for lateral shocks; and consequently, if one system of springs is to be applied to a waggon, they should be transverse elliptical, in preference to longitudinal. It certainly has been stated in favour of longitudinal springs, that they are more portable than any form.

The Dimensions of Springs.

	Longitudinal Front Pair.			Longitudinal Rear Pair.		
	No. of plates.	Long. Ft. In.	Wide. In.	No. of plates.	Long. Ft. In.	Wide. In.
British waggon...	(double 4	3 7	2½	6	4 5	2½
Prussian	elliptical) 5	2 10	...	5	3 7	...

It will be seen that the springs in the British waggon are longer than those in the Prussian—that in the former the front pair of springs are weaker than the rear pair; in the latter the front pair, being double elliptical, are stronger than the rear pair. This greater strength has not been given without a reason. In the British waggon the line of the centre of gravity is over the rear pair; in the Prussian, nearly over the front pair. Double elliptical springs are ever a source of weakness (though productive of more elasticity), and, as such, unsuited for ambulance purposes.*

(d) *The Means of diminishing the Vibration and Noise of the Waggons.*—By reason of the rear pair of springs in the Prussian waggons being clipped down on the iron axle, without any intervening non-conductor, such as exists in the British waggons, there is greater vibration in the former. This is further increased by the rigidity given to the parts of the Prussian waggon, from a perch being employed to connect the fore and hind carriage together; a connecting chain serves this purpose in the British waggon, and helps to break, not to increase the vibration. To construct a waggon with a perch is considered a retrograde principle in modern carriage building.

Springs in Floor of Waggon.—In some American waggons small springs are placed in the floor, so that the feet of the stretchers, when pushed home, rest on them. This of course gives additional protection to the wounded on the stretchers, and appears a somewhat desirable addition.

* In the Prussian service a limit has not as yet been reached either with regard to the length of the spring or the number of plates; for in the last constructed medicine waggon the length is 3 feet 8 inches, and there are eight plates.

(e) *The best Position for the Centre of Gravity of the Load, with reference to its Position in the Vertical Line.*—It must not be at a great height from the ground, for there will be greater liability to upset; nor must it be low down, on the other hand, for then there will neither be sufficient momentum to take the waggon over obstacles, nor will the draught be easy on the horses. The centre of gravity of the British waggon, when loaded, is a foot or more farther from the ground than that of the Prussian. To this circumstance, as well as the larger fore wheels and wider tyre, may be ascribed the easier draught of the former.

With Reference to its Position in the Horizontal Line.—If it be far distant from the hame hook it places the horses at a great distance from their work, and so gives a waste of motive power. When loaded, the centre of gravity of the British waggon is over the hind axle (owing to there being a back seat for three men); in the Prussian, under similar conditions, the centre of gravity is immediately behind the coupé; thus, although that waggon is of greater extreme length, the horses are some five feet nearer their work, and consequently there is less waste of power.

Notwithstanding the greater liability to upset; I have before alluded to the desirability of having some provisional arrangement by which an upper storey of stretchers might be erected on emergencies. This could best be effected by having a permanent roof supported by standards, on the ledges of which the upper stretchers might rest.

(f) *Stores not to form part of the Load of an Ambulance Waggon.*—It is desirable that stores carried with a Sanitäts Detachment should be carried in its store waggons, and

not in its ambulance waggons. These remarks apply to water, packs, stimulants, spare horseshoes, &c. Thus the non-composite character of the latter will be strictly preserved; the waggon will be more simple to construct and more economically constructed than if of a composite character, partly adapted for the carriage of stores and partly for the carriage of wounded. Nor will the stores, if carried in the store waggons, be any the less handy, judging from the experience of the winter of 1870-71; for, like a tender to a locomotive, so was the store waggon then to the ambulance waggon; where the latter was found—I speak now of the Prussian waggon—the former was always in close proximity.

6. ON AMBULANCE HORSES.

The best kind of Horse.—Ponies, mules, or undersized animals are worthless for this purpose. Bone, substance, and strength are required, and a height varying from 15.1 to 16 hands. The points of most importance are clean bony legs, short and strong back (*i.e.*, a short way from the shoulder to couplings), with, if possible, a certain amount of breeding to give endurance; the same stride and action in each pair of horses; and, lastly, the horses must be aged, young horses suffer on exposure so much from cold and influenza. Heavy animals will not do, nor will thoroughbred weeds. Cavalry or horse-artillery horses are not wanted, rather those used in field artillery—a compact, thick-set class of animals, with endurance, strength, and soundness, for prolonged exertion for the most part at low rates of speed, occasionally at rapid rates. The shape recommended will allow the weight, never excessive, to be drawn with the least waste of motive power. The best

horse in the British Ambulance was a "kicker," with good action and shoulders, standing 15.3, powerful and compact, with a fair show of breeding. The Prussian horses were thoroughbred weeds or cobs not over 15 hands high, and quite too light for the work.

Riding Postilion-fashion versus Driving from a Box.—The great objection to the former is the additional fatigue it causes to the near horse. If the horse be of the right stamp, this need not be feared; the few good horses in the British Ambulance carried their drivers day after day for weeks; a horse unable to endure such fatigue is unfit for transport. Besides, the precision in driving the waggon which, on the line of march or in forming up, is required, can never be attained by driving from a box. Driving from a box is a speciality, and requires great practice and skill; whereas riding and driving is considered so very little different from riding, that little or nothing has been laid down on the subject of the former. During the war I had opportunities of practising to ride and drive myself; the art seems not very difficult to acquire. As it is much more easy to find a number of men on the outbreak of war to ride and drive than to drive from a box, it seems desirable to retain the former method.

The Pole versus Shafts.—For the pole it has been advanced that the work of the horses is equally divided with it, for in shafts the shaft-horse has more work on hilly roads and in backing. This is partly true, but the latter movement is rarely requisite, and then only for short periods, and even then the shaft-horse is assisted by half the breeching of the near horse; the former cannot be a constant, so that in reality, for three-quarters of the time with shafts, the horses have not unequal work. Besides, if the near horse (with shafts) carries the driver,

the fatigue is equalised. If the near horse (with the pole) carries the driver, the work of the horses is unequal. If the near horse (with the pole) does not carry the driver, and that he drives from the box, then certainly the horses have an equal share of work. It has, however, been already shown that driving from the box is open to great disadvantages. It is also said shafts are difficult to mend and bad to extricate a horse from. In the ambulance a shaft was once broken (the shaft-bar is the most vulnerable part of the shafts); a neat splice was in a short time made on the road-side. As to extricating a horse, if the old rule of sitting on his head and unhooking the traces and breeching be followed, little difficulty will ever be experienced.

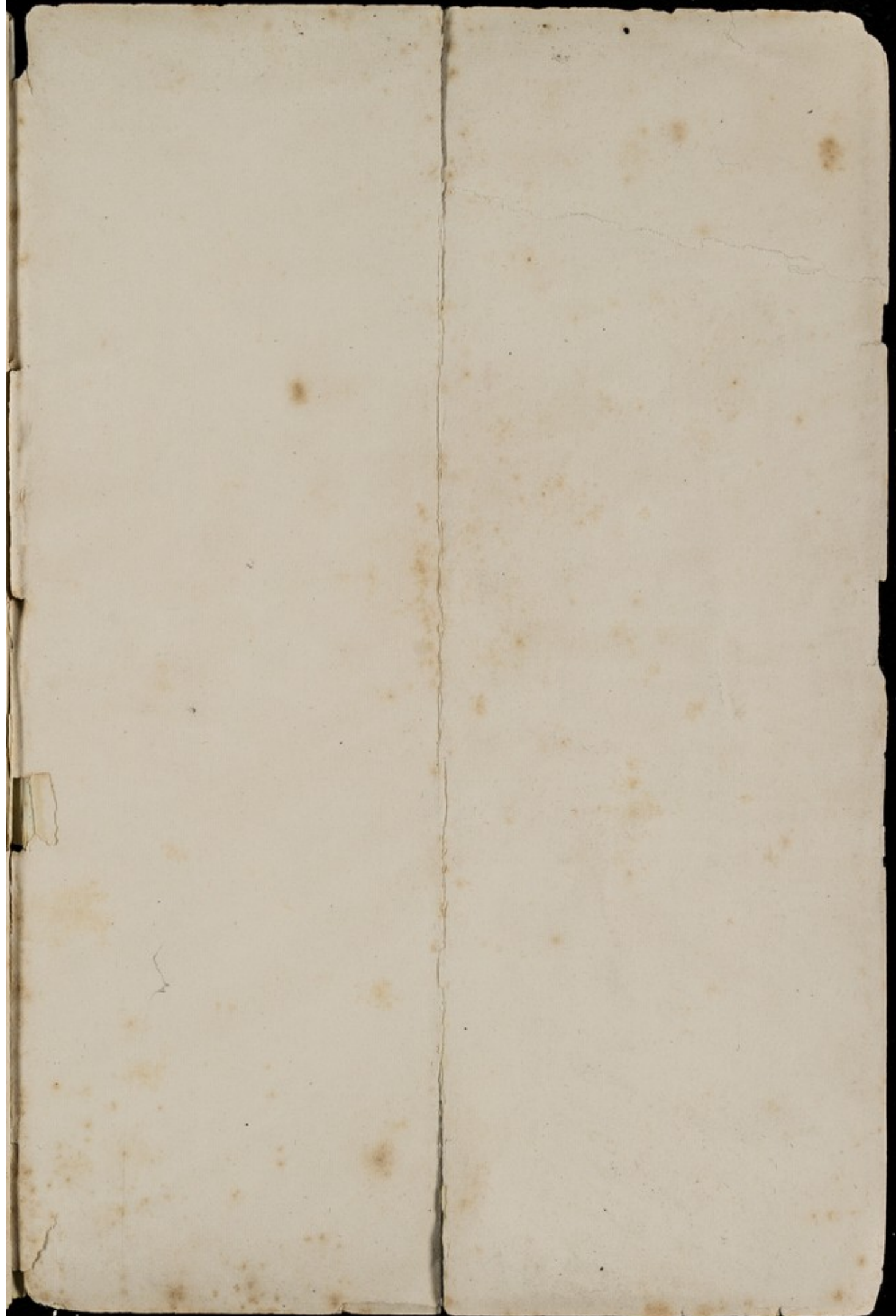
CONCLUSION.

Though of rough exterior, with solid and unfinished look, and uncomfortable to a degree for a winter campaign, when a Prussian surgeon wished to have a friend transported, he placed him in the British waggon. Its easier draught, and greater freedom from noise and vibration, made him prefer our waggon to his own. Its faults are to be found more above the flooring than below, for, for the easy draught of an ambulance waggon, there must be below the line of the stretchers, besides strength (without a rigid connection of parts, such as a perch gives) and elasticity, high fore wheels, high point of attachment of trace, and high, as regards the position of the horses, adjacent centre of gravity of the load; and above the line of the stretchers, for the comfort of the

wounded being transported, there should be such an arrangement of the parts of the roof and sides of the waggon itself as will admit of its use at all seasons of the year. This, in winter at all events, can best be secured by a stout partition completely separating the recumbent and sitting occupants.

CHRONOLOGICAL TABLE OF MARCH WITH THE 22ND DIVISION.

Date.	Distance, English miles.	From	To	State of Weather, Roads, &c.
Nov. 17	14	Chartres	Marville-le-Bois..	Weather mild—Good level roads.
„ 18	14	Marville-le-Bois..	Château Neuf ..	Rainy weather—Roads across fields, soft and clayey—Narrow lanes with deep ruts and plough had to be crossed—Engaged French at Saint Ange.
„ 19	10	Château Neuf ..	Saint Ange & back	Conveyed the wounded to Château Neuf—Arrived at 9 p.m.
„ 20	17	Château Neuf ..	La Loupe.. ..	Rainy weather—Level good roads.
„ 21	16	La Loupe.. ..	Bretoncelles ..	Heavy rain—Carried village at point of bayonet from French marines—Roads good but hilly—Field hospital established in schoolhouse.
„ 22	15	Bretoncelles ..	Berdhuis	Rain—Bad, rutty roads—Clayey tracks through woods and high hills.
„ 23	11	Berdhuis	Bellisme	Dreadful rain—Steep mountainous road—Obliged to make frequent turns off the road to make way for other transport.
„ 24	14	Bellisme	Nogent	Retiring over the same road—Weather mild.
„ 25	12	Nogent	Authon	Good roads, narrow and lilly—Mild—Plenty of forage at Authon.
„ 26	12	Authon	Brou	Bye-roads and hills—Clayey and sticky to Cocharde.
„ 27	15	Brou	Bonneval.. ..	Halted outside Bonneval at Augonville—Bridge over Loire cut—Crossed temporary bridge, and then forded the river higher up afterwards—Saw village of Allues burned—Fog and cold wind.
„ 28	..	Halted for	the first time.	
„ 29	14	Bonneval.. ..	Immonville ..	Cold wind, but dry—Passed in review by Prince Albrecht, the General of cavalry division, and was understood to express his approval.
„ 30	14	Immonville ..	Champilory ..	Good roads, level; but dreadful cold winds.
D.c. 1	..	Halted .. ..	.. ..	Hard frost—Cold piercing wind—The halt made at a farm.
„ 2	12	Champilory ..	Pouprey	Hard frost—General action—Field hospital established at Onaux, a farm—Roads paved and level—Visited by General Wittisch, who gave his thanks in the name of Prussia to Mr. Manley, R. A.—85 wounded conveyed off the field to the farm by the two British waggons.
„ 3 & 4	..	Halted at	Onaux	Was present on the 3rd with the Sanitäts Detachment of the 9th Corps d'Armée at Artenay, having that day returned from Versailles.
„ 5	1	Onaux	Bayneux	Assisted the Feld Lazareth here with the wounded—Hard frost.
„ 15	20	Halted at	Bayneux	Halted here until the 15th, when proceeded to overtake 22nd Division.
„ 16	32	Bayneux	Coulmiers ..	Mild, but bad roads—Marched with Feld Lazareth.
„ 17	18	Coulmiers ..	Beaugency ..	Good cross-country roads—Mild.
„ 18	14	Beaugency ..	Oucques	Raw fog—Roads rutty and bad.
„ 19	..	Oucques	Cloyes	Variable weather—Narrow, bad, hilly roads cross country.
„ 20	21	Halted at	Cloyes	Overtook the division.
„ 21	45	Cloyes	Moree and back..	Cold wind and rain—Bad roads—I took two British waggons and forty country carts from Moree to Cloyes with 260 wounded—Left at 12, arrived at 2 a.m.
„ 21	45	Cloyes	Chartres	Hard frost—Cold wind—Good roads—Took 300 wounded on same transport—Left Cloyes at 2 p.m., arrived at Chartres at 6 a.m., or sixteen hours' continuous travelling without a halt—In a week after the B division separated from the 22nd Division, having marched 341 miles in twenty days' marching.
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THE PRUSSIAN AMBULANCE WAGGON.