

STUDENTS.

8. When double-poled tents were not issued.

A When single-noled tents were not issued.

On arrival in Abyssinia, in consequence of the difficulties of obtaining forage, water and supplies generally, as well as on account of the great mortality among the animals of the Transport Train, it was found necessary, as shown in Chapter X, to reduce the establishments with each corps, and on the 21st January, 1868, a General Order was issued by Sir Robert Napier, reducing the amount of camp equipage, carriage, sick carriage, and native followers allowed for each regiment and battery composing the Force to the following scale:—

1	Bell Tent for each Commanding Officer.	Scale of camp equipage, as reduced on the 21st January, 1868.
1	„ for every 3 other officers.	
1	„ (single cloth) for every 5 Staff Serjeants or Warrant Officers.	
1	„ „ for every 4 Native Commissioned Officers.	
1	„ „ for 12 European non-commissioned, rank and file.	
1	„ „ for 14 Native non-commissioned, rank and file.	
1	„ „ for Guards for each regiment or battery.	
1	„ „ for Stores for each regiment.	
1	„ „ for Hospital establishment for regiment or battery.	
1	„ „ for Hospital necessary for each regiment.	
2	Tents, Native soldiers' double-poled, for Hospital for each regiment.	
1	„ „ „ for Hospital for each battery.	
1	Bell Tent, for Hospital for a company of Royal Engineers.	
1	„ „ for a company of Native Sappers (when detached).	
1	„ „ for a battery of Native Artillery.	

The number of transport animals allowed was reduced to—

1	Mule for every 2 bell tents.	Reduced scale of transport, 21st January
3	„ for every 2 Native soldiers' double-poled tents.	
1	„ for the conveyance of each Officer's personal baggage.	
1	„ „ of the mess kit of every 3 Officers.	
1	„ „ of the baggage of every 3 Staff Serjeants.	
1	„ „ of the baggage of every 4 European non-commissioned rank and file.	
1	„ „ of the baggage of every 3 Native Officers.	
1	„ „ of the baggage of every 5 Native non-commissioned rank and file.	
5	„ „ of the cooking utensils of a British regiment.	
1	„ „ of the cooking utensils of a battery Royal Artillery.	
2	„ „ of the Quartermaster's stores of a British Infantry regiment.	
1	„ „ of the Quartermaster's stores of a battery.	
1	„ „ of the Quartermaster's stores of a Native regiment.	
1	„ „ of Office Books of each regiment and battery.	
1	„ „ of Armourer's stores of each regiment.	
8	„ „ of the Entrenching Tools of each regiment.	
13	„ „ of the Hospital stores of a British regiment.	
6	„ „ of the Hospital stores of a Native regiment.	
3	„ „ of the Hospital stores of a battery Royal Artillery.	
1	„ „ of the Hospital stores of a Native battery or company of Sappers.	

- 2 Mules for the conveyance of the Hospital stores of a company Royal Engineers.
 22 " " of the spare ammunition of a British regiment.
 20 " " of the spare ammunition of a Native regiment.
 6 " " of the spare ammunition of a company of Royal Engineers, or a company of Sappers.

Sick carriage, 21st January.

Hammocks slung on poles (with 4 bearers each) were issued at the rate of 1 for every 20 European non-commissioned rank and file, and 1 for every 100 Native non-commissioned rank and file.

1 Dhooly, with 6 bearers, was allowed to each regiment.

Followers reduced on 21st January.

The only native followers, public or private, allowed to proceed with the troops, after the 21st of January, were as follows, and no extra carriage was permitted for the conveyance of their baggage :—

26 Cooks for each British regiment.

6 " for a Field Battery of Artillery.

5 " for a Mountain Train Battery.

3 " for a Company of Royal Engineers.

Puckaul bheesties according to existing regulations.

Hand bheesties

1 Servant for the mess kit of every 3 Officers.

1 Grasscutter for each Officer's horse.

1 Syce or grass cutter for each battery horse of a Field Battery.

25 Muleteers for each Mountain Train Battery Royal Artillery.

1 Grasscutter for every 2 mules of a Mountain Train Battery of Royal or Native Artillery. 47 Muleteers for a battery of Native Artillery.

3 Artificers for each battery of Royal Artillery, and 7 for Native Artillery.

Regimental and battery Officers were allowed each a soldier servant.

The amount of camp equipage and carriage, and the number of Native private followers allowed to each Staff Officer was as follows :—

Reduced camp equipage for Staff Officers.

1 Bell tent, double cloth, for each Staff Officer in charge of an office.

1 " " for every two Staff Officers not in charge of an office.

1 " single cloth, for every five clerks.

1 " " for every 16 public followers.

Reduced carriage for Staff Officers.

1 Mule for every officer's private baggage.

1 " for the tent of every Officer in charge of an office.

1 " for the tent of every two Officers not in charge of an office.

1 " for every two bell tents, single cloth.

1 " for the mess kit of three Officers.

1 " for the personal conveyance of two clerks, Commissariat Inspectors or draftsmen.

1 " for the conveyance of the baggage of four clerks, Commissariat Inspectors, or draftsmen—the baggage of each clerk, &c., being limited to 40 lbs.

1 " for the baggage of eight public followers, the baggage of each follower being limited to 20 lbs.

Reduced followers for Staff Officers.

1 Servant for each Staff Officer.

1 Grasscutter for each Officer's horse.

1 Servant for the mess of every three Officers.

Staff Officers were allowed the option of having a soldier servant each in lieu of a Native private servant.

The following were the scales of camp equipage, carriage, sick carriage and followers as reduced for field hospitals:—

3 Bell tents, double cloth, for each field hospital.	Reduced camp equipage for field hospitals.
1 Bell tent, single cloth, for the hospital establishment of each field hospital.	
1 " " for the necessary of each field hospital.	
1 " " for every five warrant officers, hospital assistants, apprentices, &c.	
1 " " for every 16 public followers.	Reduced scale of transport for field hospitals.
1 Mule, for every bell tent, double cloth.	
1 " for every two bell tents, single cloth.	
1 " for medicine chests for every field hospital.	
2 Mules, for cooking utensils and stationery of field hospital, British troops.	
2 " for medical comforts of each hospital.	
1 Mule, for fracture apparatus for every field hospital.	
1 " for the conveyance of the baggage of every eight public followers, the baggage of each follower being limited to 20 lbs.	
1 " for the conveyance of the baggage of every four warrant officers, the baggage of each warrant officer being limited to 40 lbs.	
15 dandies, dhoolies or hammocks, with six bearers each, and 11 second-class servants were allowed for every field hospital.	Reduced sick carriage and followers for field hospitals.

The scale of camp equipage, carriage, and followers for Medical Officers with field hospitals, was the same as that allowed for Staff Officers.

Commanding Officers of corps and detachments were ordered to arrange (in communication with the Transport authorities) for such spare carriage as might be available to accompany the hospital on the march, for the purpose of receiving the kits of the dhooly bearers when dhoolies or dandies were in use; and Medical Officers were held responsible that this order was duly observed in marches of all detachments of sick under their charge.

On the advance from Senafè to Antalo, the necessities of the Land Transport Train requiring that the amount of requisite transport should be again diminished, a General Order was issued accordingly on the 23rd February, further reducing the amount of Camp Equipage and Carriage, and the number of Native followers to each regiment, battery, or Staff Officer on the highlands. The following was the reduced scale according to this Order:—

1 bell tent, double cloth, for every three Officers.*	Reduced scale of camp equipage, 23rd February.
4 " " for hospital of each regiment of European Infantry.	
2 " " for hospital of each regiment of Native Infantry or Cavalry.	
1 " " for hospital of every battery of Artillery.	
1 " single cloth, for 10 Staff Serjeants or warrant officers.	
1 " " for eight Native Officers.	

* The two Senior Officers of a Regiment were allowed one tent between them.

Reduced
scale of trans-
port, 23rd
February.

- 1 bell tent, single cloth, for 14 non-commissioned rank and file.
- 1 " " for 18 non-commissioned rank and file.
- 1 " " for the guards of each regiment, European or Native.
- 1 " " for the stores of each regiment, "
- 1 " " for the hospital establishment of each battery or regiment, European or Native.
- 1 " " for office purposes of every 5 clerks.
- 1 mule for every 2 bell tents, single cloth.
- 2 " for every 3 bell tents, double cloth.
- 75 lbs. weight for each officer's personal baggage.
- 30 " for the baggage of every warrant and Native Officer.
- 25 " for the baggage of every Staff Serjeant or non-commissioned rank and file.
- 75 " for the cooking utensils of a company of a regiment of Infantry or battery of Artillery.
- 150 " for the Quartermaster's stores of a regiment of Infantry, European.
- 75 " for the Quartermaster's stores of a battery of Artillery or a regiment of Native Infantry or Cavalry.
- 150 " for the Armourer's stores of each regiment of Infantry or Cavalry, European or Native.
- 150 " for the mess kit of six officers.

Transport animals were allowed for entrenching tools, hospital stores, Staff officers' offices, and spare ammunition, according to actual weight, to be specially sanctioned in each case by the Assistant Quartermaster-General at the Head-quarters of the Army.

Reduced
scale of sick
carriage,
23rd Feb-
ruary.

- 1 dhooly, with 6 bearers, for every hundred non-commissioned rank and file, European or Native.
- 2 mules, with pads, for every hundred men of a regiment of Infantry, European.
- 1 " " for every hundred men of a regiment of Native Infantry.

Number of
followers
reduced 23rd
February.

No private followers were allowed, except grasscutters for mounted officers' horses, and the only public followers for whom rations could be drawn were the following:—

- 2 cooks for each company of Infantry (European), or for each battery of Artillery.
- Bheesties according to existing regulations.
- Hospital establishment " "
- Artificers, troop moochees, regimental saddlers, according to actual requirement, specially sanctioned in each case by the Assistant Quartermaster-General, at the Head-quarters of the Army.
- 25 muleteers for each mountain train battery of Artillery.
- 1 tent Lascar to each General Officer or Assistant Quartermaster-General of Division.
- 1 muleteer for every 3 Land Transport Train mules or Cavalry baggage animals.
- No syces were allowed to any regiment of Cavalry or battery of Artillery.
- Grasscutters were allowed in the proportion of 1 to every 5 regimental or battery horses.
- No Officers were allowed any private carriage whatever.
- Every Staff, Regimental, or Battery Officer was allowed a soldier servant.
- No civilian clerks were permitted to accompany the Force.

Commissariat Officers were prohibited from issuing rations to any followers, excepting those above-named, unless indents for the same were in the first instance specially counter-signed by the Assistant Quartermaster-General at army Head-quarters.

All public and private followers discharged under the operation of this Order were allowed free rations to Zula, and a passage to India or Egypt as required.

General Officers commanding Brigades, &c., for the highlands were requested to order all followers attached to officers and troops under their command in excess of the scale above noted to be sent to Zula at once, and the Brigadier-Generals Commanding at Kumayli and Zula and Officers Commanding at Suru, Undul Wells, and Rahagedi, were held responsible that no officers or troops left the stations under their respective commands for the highlands with extra followers or carriage.

The Commissariat Department at Zula were authorised to detain any public followers discharged under this Order for any department requiring their services.

When the troops arrived at Lat, in order to conclude the campaign before the rains flooded the Suru Pass, further exertions were necessary to enable them to move quickly. The country was barren, the roads were extremely hilly and bad, in fact were mere hill-paths, which the nightly rainfall made slippery and treacherous. It was necessary, in consequence, to reduce the loads of the pack animals to 100 lbs. each, and to sacrifice everything which could possibly be spared to accelerate the movement of the Force. A General Order was accordingly issued at Lat, on the 22nd of March, again reducing camp equipage, baggage, and followers. Under the operation of this Order—

Single cloth bell tents were only allowed, in the proportion of 1 to every 12 officers, and 1 to every 20 non-commissioned and rank and file. Major-Generals commanding Divisions were allowed a tent each, and Brigadier-Generals 1 tent for themselves and their personal and Brigade Staff.

Further reduction of equipage and baggage, on the 22nd March, at Lat.

Hospital tents were allowed to each regiment, battery, or detachment, according to the recommendation of the Principal Medical Officer only; and, with that exception, no other tents were to be taken for any purpose whatever.

No private baggage animals or camp equipage of any description were allowed to follow the column under any pretext whatever.

Carriage was allowed for the cooking pots of officers, in the proportion of 1 mule to every 12 officers.

Under this Order, no baggage mule proceeding with the Force was to carry more than 100 lbs., except in the cases of boxes of small-arm ammunition and tents, when two of each were to be the load; 4 lbs. of grain were carried in addition to the 100 lbs., to complete the day's rations. The cooking pots of batteries and detachments were carried in the proportion of 50 lbs. to each company or troop.

Sick carriage was taken on in the proportion allowed by the Order of the 23rd February. All dhoolies, however, were brought on in the rear of the whole baggage of the brigade.

No further reduction of followers could take place, as there were no private followers to reduce, and only a very few public followers, and these considered absolutely necessary. All that could possibly be spared had been sent back from Zula and Adabaga. The baggage which was discarded was left in depôts at Zula, Senafè, Antalo, and Dildi, and was picked up by the Force as it returned through these places.

The camp equipage and sick carriage with the Force were fully reported upon at the termination of the campaign, by the desire of Sir Robert Napier, by Captain Holland,

Assistant Quartermaster-General at the Head-quarters of the Force. This Report gives information as to the numbers and description of articles of camp equipage and sick carriage supplied, with sketches, the manner in which each was used, and its capabilities for meeting the requirements of such a campaign as that in Abyssinia. His Report was as follows :—

“ Zula, 1st June, 1868.

“ A full supply of camp equipage and sick carriage was sent from England and India to meet the requirements of the Force.

“ The number and description of tents despatched were as follows :—

“ Tents, European soldier, double-poled	..	..	155
„ European soldier, single-poled	..	..	312
„ Staff-Serjeants	..	..	45
„ European hospital	..	..	39
„ Native soldier, double-poled	..	..	863
„ Native soldier, single-poled	..	..	329
„ English circular, double fly	..	..	323
„ English circular, single fly	..	..	676
„ Hospital marquees	..	..	50

“ The sick carriage consisted of :—

“ Dhoolies	..	..	..	..	..	401
“ Ambulances	..	..	..	..	..	40
“ Kujawahs	..	..	..	..	..	247
“ Camel saddles	..	..	..	..	..	175
“ Mule pads	..	..	..	..	..	144
“ Stretchers	..	..	..	..	..	128

“ In addition to these, eight swing cots (purchased from the shipping), 128 dandies, and 2,129 McGuire's hammocks were landed at Zula, for the conveyance of the sick and wounded.

“ Tents of the following description were not taken by the troops on the march ; a few were, however, pitched at the stations in the Suru Pass and at Senafè :—

“ Tents, European soldier, double-poled.
„ European soldier, single-poled.
„ Staff-Serjeants.
„ European hospitals.
„ Hospital marquees.

“ None of these tents were found suitable for mule carriage, and though comfortable and affording every protection from the sun on the plains, were not of any value to the Force on its march on the highlands of Abyssinia.

“ A few of the Native soldiers, double and single-poled tents, were taken by the Force as far as Antalo.

“ The English circular double fly tents were taken as far as Lat. The English circular single fly was the only description of tent the Force was able to take as far as Magdala.

“ Description of Tents.

Tent, European soldier, double-poled.

“ The European soldier's double-poled tent is large and commodious, weighs 631 lbs., has two flies, each three cloths thick, is 22 feet long by 16 feet broad, and accommodates

" with facility 16 men, giving each soldier the space considered necessary by the Sanitary Commission in the Bombay Presidency.

" The great objection to this tent on active service is its weight, especially when wet, the cloths of which it is constructed being of very soft material and liable to absorb a large quantity of moisture. In rainy weather, moreover, the pitch of the outer fly is insufficient to prevent leakage.

" The European soldiers' single-poled tent is constructed of the same material as the tent above mentioned; it affords good protection from the sun, weighs 525 lbs., has two flies, is 15 feet square, and accommodates with facility 10 men, giving each soldier the space considered advisable by the Bombay Sanitary Commission. European soldiers' single-poled tent.

" This tent is more water-tight than the double-poled tent, on account of the outer fly having a higher and better pitch.

" It is also more suited for service than the double-poled tent, in consequence of its being lighter and easier to pitch. It was not, however, found sufficiently light for mule carriage, and has the disadvantage of absorbing moisture to a great extent.

" The Staff-Serjeants' tent is smaller than, but somewhat similar in shape to the European soldiers' single-poled tent. It weighs 361 lbs., has a superficial area of 144 square feet, is constructed solely for the accommodation of Staff-Serjeants in India, and was not found suited for mule carriage. Staff Serjeants' tent.

" The European hospital tent is similar in shape to the European soldiers' tent, double-poled, but is fitted with two walls or 'konnats,' leaving a passage of about four feet broad all round the tent under the outer fly. European hospital tent.

" This tent is generally used for hospital purposes only. It weighs 1,440 lbs., is 27 feet long by 14 feet broad, and affords accommodation for 12 patients.

" It has all the disadvantages in material of the tents above-mentioned, and is, moreover, too heavy for ordinary camel or mule carriage. It forms, however, a most comfortable camp hospital for sick, affording every protection from the sun and rain.

" The Native soldiers' double-poled tent is made of the same material as other Indian tents, but consists of only one fly, is of an oval shape, 24 feet long by 19 feet broad, 344 lbs. in weight, and is calculated to accommodate 30 Native soldiers in India. Native soldiers' double-poled tent.

" It was not found suitable for mule carriage.

" The Native soldiers' single-poled tent is a small circular tent, made of the same material as the above-mentioned tent. It is 12 feet in diameter, 176 lbs. in weight, and calculated to accommodate 13 Native soldiers. Native soldiers' single-poled tent.

" Both these tents are used exclusively for the accommodation of Native troops in India.

" It is sufficiently light to be carried by a mule, but is not a useful tent on service, being very hot, and giving very little space for the number of men allotted to it. Its weight also is considerably increased by heavy dew or rain.

" The English circular double-fly tent weighs 112 lbs., and is made of stout linen. It is 13 feet in diameter, and has proved throughout the campaign the best tent for such service as that on which the Force has been employed. It keeps out the rays of the sun, and the ventilators (causing a free current of air) render the tent during the day comparatively cool. The English Circular double-poled tent.

" This tent was used only by officers and for hospital purposes, in Abyssinia, but it is admirably suited for the accommodation of British soldiers, and would probably answer well for the cold season in India. It is light, easily carried, and can be pitched with facility by two men.

" Both inner and outer fly being made of linen, it does not absorb moisture to the extent Indian tents do.

"It is capable of accommodating 10 or 12 British soldiers in a cold climate; it is not, however, suitable for standing camps on the plains in a hot climate. It might, however, be improved by having another doorway cut opposite to the present entrance.

"The entrances to the tent should be made so as to fasten from the inside and not the outside, in order that the inmates may be able to let themselves out when required, which at present is not possible.

Tent
English
Circular
single-fly.

"The 'Tent English circular single-fly' was used more than any other tent during the campaign. It has answered all our requirements admirably, weighing only 66 lbs., absorbing very little moisture (and accommodating as it did from Lat to Magdala and back again, 12 officers or 20 soldiers) it has been a most useful tent for all purposes.

"Its diameter is 12 feet. Owing to this tent having only one fly it is not capable of keeping out the strong rays of the sun, and though admirably adapted for service on the highlands of Abyssinia, it cannot be considered a suitable tent for European soldiers at any season on the plains of India.

Hospital
marquee.

"The hospital marquee is 492 lbs. in weight, and made of stout linen; it has two flies and a wall all round. It is not, however, suited to mule carriage, and was not used at all in the highlands of Abyssinia.

" Sick Carriage.

Dhoolies.

"The dhooly is very much used in India for the carriage of sick; it weighs 123 lbs. It is a description of cot made of teak, with cane bottom and short legs, suspended from a bamboo pole by a light iron framework, which is covered with waterproof canvas.

"It is carried usually in India by six bearers. Its great weight and bulk, however, render it unfit for service in a hilly country.

"During the passage of the Bashilo and Jidha rivers, it was found that 12 bearers could not carry a dhooly at a greater rate of speed than one mile an hour, and along the steep ascents and descents the army has had to travel, dhoolies constantly delayed the baggage animals.

"Dhoolies might be improved if constructed entirely of light ironwork, instead of heavy teak. They need not be made so high, or of such great breadth as at present, and their legs should not exceed from two to three inches in length. Over a level country the dhooly is an admirable means of sick carriage.

Ambulances.

"The ambulances brought to Africa were constructed to be drawn by bullocks; they are heavy and unfit for draught except on made roads; they were very little used in the campaign, only between Kumayli and Zula.

"Light ambulances drawn by mules, similar to those used by the American and Prussian armies, might have been of some service on the roads between Zula and Adigrat.

Dandies.

"The dandy consists of a light wooden framework with a cane bottom, with two pieces of iron at either end, supporting the bamboo pole. It weighs 54 lbs., has nearly all the advantages of a dhooly, and its portability renders it more suitable over bad roads in a hilly country. A temporary cover can be made by fastening a blanket across the pole.

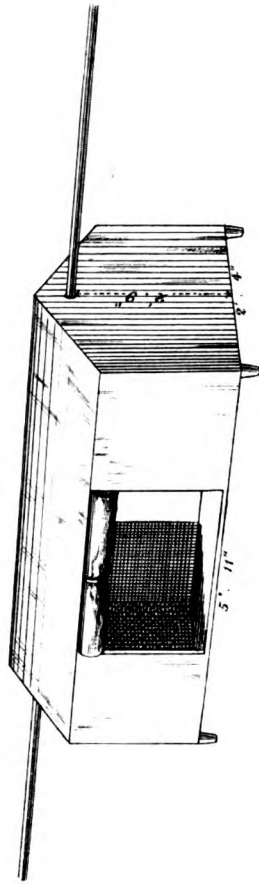
Swing cots.

"A few swing cots purchased from the shipping in Annesley Bay were used by the Force. A swing cot is simply a framework of light wood covered with canvas, the whole being supported by a bamboo pole, and weighing altogether 45 lbs.

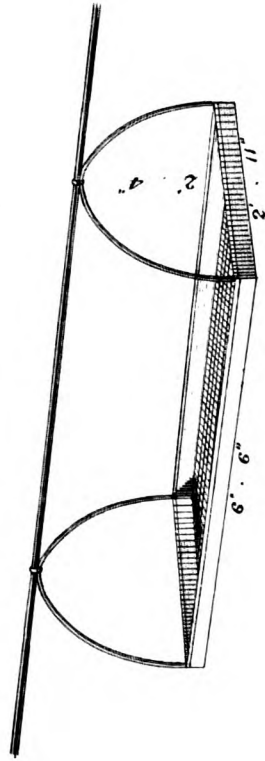
"Swing cots were found to be well adapted for carrying men suffering from slight

SICK CARRIAGE

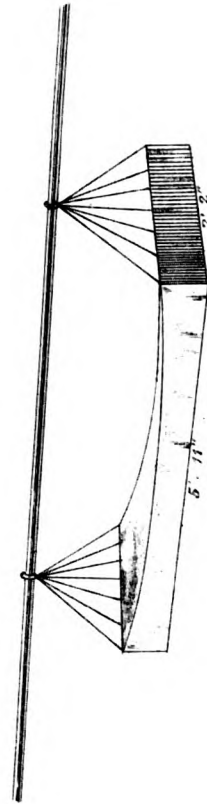
Dooley



Dandy



Swing Cot



Hammock



“ailments or injuries, but uncomfortable for patients when placed on the ground
“ (especially in wet weather), as is occasionally necessary, to rest the bearers on the line
“ of march. They have the advantage, however, of being light, and require only four
“ bearers each.

“Several of MccGuire's field hammocks were sent with the Force; these, lashed on Hammocks.
“ bamboos, were used for the conveyance of sick on the line of march. They weigh,
“ with pole, only 24 lbs. each.

“They proved very useful for carrying men falling out on the line of march from
“ fatigue or temporary ailments, but they were not found to be adapted for wounded men
“ or for patients suffering from serious illness; they might, however, be easily made a
“ most comfortable means of carrying men suffering from any complaint, and owing to
“ their lightness, portability, and other advantages they would then doubtless be the
“ best description of sick carriage for such a country as that we have just marched
“ through.

“The field hammock had the same disadvantage as the swing cot, in that it could
“ not be placed on the ground in wet weather (this defect might, however, perhaps be
“ remedied by using the staves as supports). If made longer and wider, and fitted inside
“ with a light wooden frame, so as to prevent the patient from being doubled up (which
“ he is very liable now to be, unless poles are specially fitted), the field hammock would
“ be a better means of conveyance for sick, and forming as it does a sleeping hammock
“ for men when encamped, and thus keeping them clear of damp ground and conducting
“ to their health and comfort, it would appear highly desirable that some means should
“ be taken to improve the MccGuire field hammock, to render it a more perfect means of
“ conveyance for sick men.

“A stretcher weighs 17 lbs., consists of a piece of canvas of about 7 feet by 2 feet, Stretchers.
“ slung between two slight bamboos. Stretchers are useful for conveying wounded men
“ off a battle-field, but are not of much use on the line of march.

“Iron kujawahs and cacolet kujawahs weigh respectively 119 and 181 lbs. each; Kujawahs.
“ they were used for the conveyance of two sick men on each camel on the return march
“ of the army from Senafè to Zula, and have not been sufficiently tested to enable me to
“ frame a report on them.

“The kujawah in a camel country is a good means of conveyance for sick men. No
“ protection, however, is afforded the patient from sun or rain.

“Double-seated camel saddles weigh 133 lbs., and afford carriage for two men Camel
“ sitting astride on each camel. These saddles are fitted with good backs, and in a saddles.
“ camel country constitute a very suitable means of conveyance for men suffering from
“ fatigue or slight ailments, and who are able to sit up. They were used to carry the
“ sick from Antalo to Kumayli, and answered admirably.

“Mule pads weigh 35 lbs. each; they were very little used in this campaign, Mule pads.
“ the Otago saddle having been generally available for the conveyance of men who fell
“ out on the line of march.”

CHAPTER XXX.

WATER SUPPLY.

AS ABYSSINIA was known to be a sterile country, arrangements were made to procure a proper supply of water, which would have been unnecessary in a European campaign.

Her Majesty's Transport Regulations require every vessel engaged for the transport of fifty persons or upwards to have a condenser. It was impossible to comply with this in the case of the Abyssinian Expedition, as the number of vessels required with condensers was not to be found in the Indian seas.

Water
ration on
board ship
for men and
animals.

Vessels chartered in Bombay were fitted up with tanks, giving a two months' supply of water to all on board at the rate of 3 gallons per man for Europeans, 1 gallon per man for natives, 6 gallons per horse, 5 gallons per pony, 6 gallons per bullock, and 40 gallons per elephant.

The Bombay rate, when camels are shipped, is 8 gallons per diem per camel, but no camels were sent from Bombay. This rate was, however, observed in the vessels sent to fetch camels from Aden, Berbera, and ports in the Red Sea.

An extra supply of water was shipped in all vessels which had not condensing apparatus, and coal was placed in every ship with condensing apparatus to supplement.

Condensers
sent from
Bombay and
Aden.

With this supply the Force started for Abyssinia. Two special condensing hulks, the "Semiramis" and "Hyderabad," which could condense respectively 4,000 and 10,000 gallons daily, were sent from Bombay to Annesley Bay at the commencement of operations.

A number of spare tanks filled with water were sent from Bombay to Aden, for the use of the transports.

Two Normandy's condensers were sent from Aden, and one condenser from Bombay, to be fixed on shore for the use of the troops.

The condensing power of the vessels of the Bombay Marine and of the transports chartered was as follows :—

Condensing
power of
transports.

Name of Vessels.	Number of gallons distilled.	Name of Vessels.	Number of Gallons Distilled.
<i>Vessels of the Bombay Marine.</i>		Premchund Roychund ..	600 gallons daily.
Coromandel, S.	1,200 gallons daily.	Diliwar	80 "
Dalhousie, S.	1,200 "	Ann Millicent	50 "
Earl Canning, S.	1,200 "	Cowasjee Jehangeer ..	50 "
Lord Elphinstone, S. ..	1,200 "	Carona	520 "
Sir John Lawrence, S. ..	1,200 "	Michael Scott	30 "
May Frere, S.	700 "	Underley	44 gals. per hour.
Semiramis, S.	4,000 "	Atalanta	26 "
Hyderabad	10,000 "	Durham	56 "
<i>Transports.</i>		Dallam Tower	30 "
Arminian, S.	1,125 "	India	52 "
Arabia, S.	500 "	Malabar	48 "
Asia, S.	500 "	Squando	45 "
Great Victoria, S. ..	1,000 "	Vernon	20 "
General Havelock, S. ..	500 "	Oriental	30 "
India, S.	800 "	Court Hey, S.	50 "
Indore, S.	800 "	Hunsdon, S.	50 "
John Bright, S.	400 "	Electric, S.	25 "
Lord Clyde, S.	800 "	Bombay, S.	25 "
Madras, S.	500 "	Himalaya, S.	30 "
Norna, S.	625 "	Waterwitch	20 "
Ottawa, S.	400 "	Nile	26 "
Thales, S.	300 "	Legion of Honour ..	50 "
Sir Bartle Frere, S. ..	500 "	Alabama	20 "
Sunda, S.	300 "	Golcondar, S.	75 "
Salsette, S.	600 "	Bengal, S.	73 "
Sattara, S.	1,200 "	T. A. Gibb, S.	48 "
Sultan, S.	800 "	Catherine Apcar, S. ..	42 "
Altear	120 "	Paris, S. Mauritius, S.	80 gals. per hour when under weigh.
Agamemnon	500 "		
Geriant	20 "	Defiance, S.	250 when at anchor.
Haneman	120 "	Challenge, tug, S. ..	50 gals. per hour.
Humber	150 "	Punjab, S.	50 "
Indian Chief	40 "	Middlesex	21 "
Jessy Gilbert	50 "	Far East, S.	40 "
Mabel	30 "	Far East, S.	45 "
Mofussilite	30 "	City of Manchester, S.	1,800 "
Nelson	500 "	City of Dublin, S. ..	1,700 "
Royal Standard	700 "	England, S.	2,900 "
West Indian	60 "	Queen, S.	2,200 "
Windsor Castle	500 "	Peruvian, S.	2,002 "
Zoroaster	36 "	Kangaroo, S.	1,700 "
Zenobia	450 "	Californian, S.	2,780 "
Star of Brunswick	250 "	West Indian, S.	2,780 "
Sam Cairns	740 "	Golden Fleece, S. ..	1,440 "
Sir Hugh Rose	100 "	Mauritius, S.	1,500 "
Star of India	400 "	Queen of the South, S.	1,600 "
Scimitar	500 "	American, S.	2,700 "

Representing in all a daily condensing power of about 96,000 gallons.

Amount of
coal ex-
pended in
condensing.

The coal expended for condensing water on board transports, and in the "Semiramis" and "Hyderabad" in Annesley Bay, was about 8020 tons.

The water supplied to the Force from Aden during the campaign was 854,796 gallons.

Total
amount of
water con-
densed.

The water supplied in Annesley Bay was as follows:—

	Tons.	Gallons.
Condensed by transports and ordinary ships	29·068	} = 9,989,500
Supplied by men of war, sailing transports, and sent from Suez and Bombay	about 10·850	
Condensed on shore	daily 50	
		= 12,500

Water ar-
rangements
on arrival at
Annesley
Bay.

On arrival at Annesley Bay, native boats were employed as tank-boats. These collected the superfluous and condensed water from the different vessels, and lay in as shallow water as possible. From these boats the water was pumped into a falling wooden trough about 200 yards long, which led into a cluster of tanks collected from several transports, and stationed above high water. Here the animals were watered.

One, and subsequently two condensers were erected at the end of the pier at Zula, and one on an artificial island, which supplied water for the use of the men. These together gave about 50 tons of water daily. Each man was limited to $1\frac{1}{2}$ gallons per day for the first four months.

Condensers
and water
pipes applied
for from
England.

Water was at first obtained in some wells dug in the bed of the Haddas, but these quickly ran dry. At the time Sir Robert Napier landed in Annesley Bay, the vessels were supplying about 150 tons of water daily to the troops and animals on shore.* On the 11th January the whole of the animals at Zula were fully watered for the first time. The source of supply was, however, precarious, as a gale of wind might have blown all the vessels out of the harbour, and left the troops without any resource. Commodore Heath telegraphed to England for three Normandy's condensers, and for iron piping to bring water from Weah or Kumayli, and made efforts to obtain a reserve of water in tanks on shore. The three condensers were sent from England round the Cape, but not arriving before the conclusion of the Campaign, were intercepted and employed at Aden.

A detailed list of the water pipes and fittings supplied from England will be found at the end of Chapter IV.

Norton's
tube wells
recom-
mended.

The Director of the Royal Engineer Establishment at Chatham, on the 25th September, 1867, recommended that Norton's tube-wells should be sent to Abyssinia. A description of the well and apparatus will be found below; the experience of the Campaign proved it to be an exceedingly ingenious method of boring into any material short of solid rock or very large boulders. It was simple of application, the whole weight of the boring apparatus being only about 150 lbs. Not included in the boring apparatus were the pipes which constituted, as it were, the linings of the wells, and which weighed about $2\frac{3}{4}$ lbs. to the foot, and the pump for drawing from each well, which weighed about 24 lbs.

The following is a description of Norton's American Tube Well:—

Description
of Norton's
tube well.

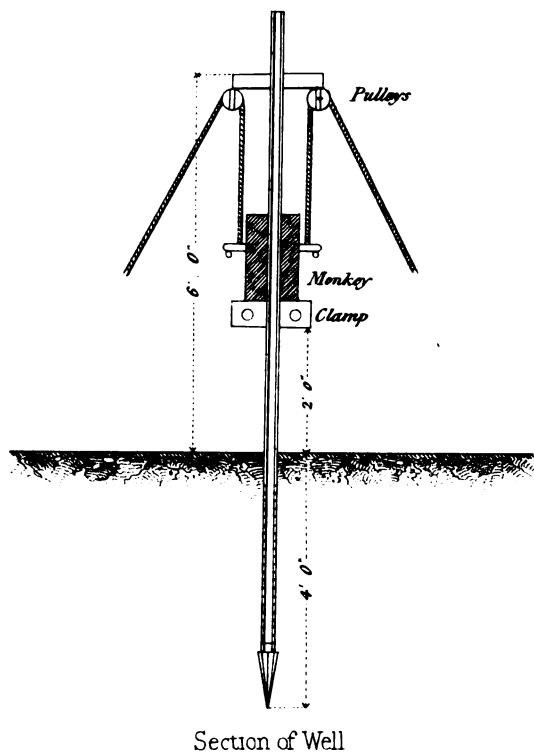
"This well consists of a hollow wrought-iron tube, the lower end of which, being provided with an eight-square point, and perforated with a number of small holes, is driven by means of a monkey, or weight, into the ground.

"The lower length is 11 feet long over all, of which the solid point is 10 inches long, and, being welded two inches into the lower end of the tube, leaves the hollow part of the tube 10 feet long. The holes extend up the tube in six parallel rows $1\frac{1}{2}$ inch apart,

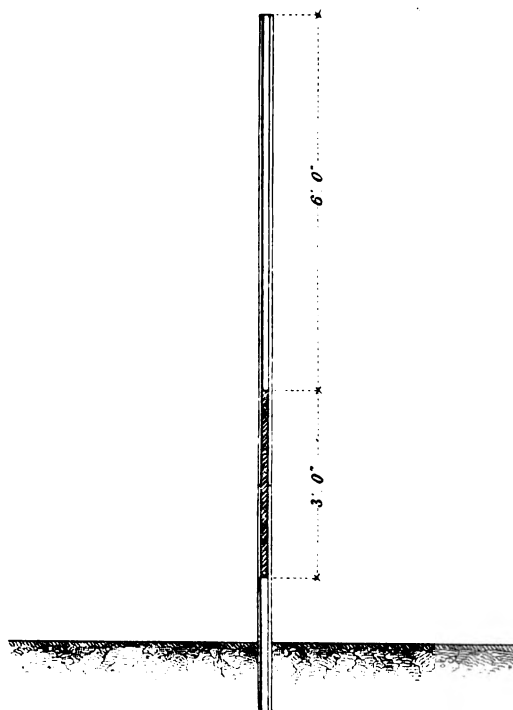
* One ton of water equals 250 gallons.

NORTON'S TUBE WELL.

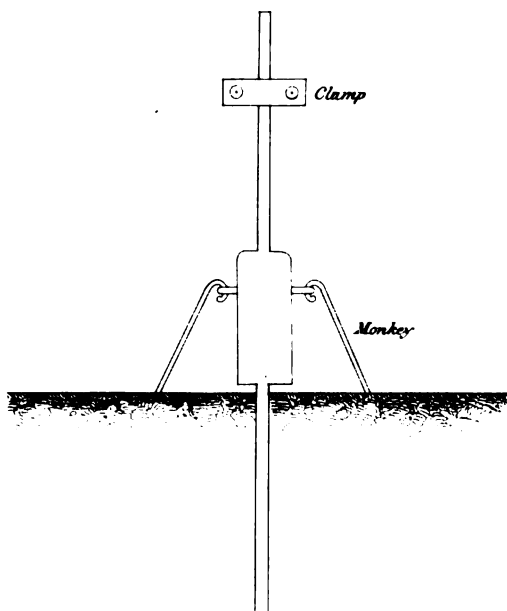
SKETCH A



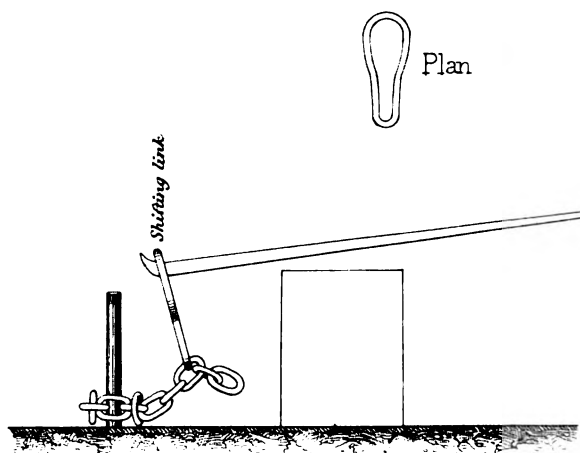
SKETCH B



SKETCH C



SKETCH D



Scale $\frac{1}{3}$ Inch = 1 Foot

Lith at the TOP^t DÉPÔT of the WAR OFFICE.
COL^t SIR H JAMES R E DIRECTOR.

“ for a length of $2\frac{1}{2}$ feet, their total area being about $1\frac{1}{2}$ times that of the internal diameter of the tube, which is $1\frac{1}{4}$ inch, while its exterior diameter is $1\frac{1}{8}$ inch.

“ The weight per foot is about $2\frac{3}{4}$ lbs. The tubes sent down from London were in various lengths, from 3 feet to 9 feet, and, having a screw thread cut in each end, can be jointed together by means of iron collars 2 inches long, screwed over the ends, the joints being made good by means of white lead. Driving the well.

“ The position for the well being selected, a hole is made with a crowbar, perfectly vertical, in which the tube is inserted. A clamp of cast-iron, faced on the top and inside with steel, having a groove in the centre of the size of the exterior diameter of the gas-pipe, with a screw thread cut roughly inside so as to lay hold of the pipe, made in two pieces capable of being tightened up by means of two screw bolts, is placed on the tube at a height of from 18 inches to 2 feet from the ground, according as the soil is difficult or easy, and screwed in firmly, care being taken to tighten each bolt equally.

“ The monkey, consisting of a hollow iron casting weighing about 75 lbs., with a couple of lugs projecting one on either side, is next placed on the pipe; and lastly, a couple of pulleys are clamped to the tube as high from the level of the ground as a man can conveniently reach, usually about 6 feet, a rope being rove through each pulley, and secured to the lugs on the monkey. (See Sketch A.) The monkey is raised by two men, who should work steadily together, and pull the ropes at the same angle with the pipe, so as not to cause a tendency to it to lean over on one side more than on the other. The monkey may be steadied and assisted in its descent by a third man, who, standing on one side, forces it down at each descent. On the clamp reaching the level of the ground, the monkey is raised while the clamp is unscrewed, and raised a height of 18 inches or 2 feet up the tube, and again screwed up. The monkey is then lowered into the clamp, and the pulleys are fastened higher up the tube.

“ The tube, during its descent, should be occasionally turned round in the ground, so that the position of the angles of the edges of the point may continually be altered. The same man who does this should pay particular attention to the clamp, to see that it does not move on the tube, tightening up the bolts at the first appearance of any slipping.

“ When the tube is driven so far into the ground that its upper end is not sufficiently high to carry the pulleys, a piece of pipe about 6 feet long (see Sketch B), having a piece of tube 3 feet long, of the same exterior diameter ($1\frac{1}{4}$ inch) as its internal diameter, brazed for a length of 18 inches into one end, and consequently projecting a length of 18 inches, is placed in the upper end of the tube, and the pulleys clamped into it at a convenient height. The driving is continued until the first tube is driven all but two or three inches, when the clamp, monkey, &c., are removed, and an additional length screwed in by means of a collar. This length is driven as before, care being taken to turn round the tube in the boring to tighten up the joints, which become loosened by the jarring of the monkey.

“ Before screwing in an additional length of pipe, the well is sounded by means of a small lead line, to ascertain the depth of water or character of rubbish which penetrates through the holes in driving.

“ As soon as it appears that the well is driven deep enough, a pump is screwed in at the top, and the water drawn up. It usually happens that the water is at first turbid, but after a short time, as the chamber at the bottom of the well becomes enlarged, this turbidity ceases, and the water becomes pure.

“ When sinking in gravel or clay, the bottom of the well frequently becomes filled up, and it is necessary to remove the obstruction before a pure supply of water can be obtained.

"To do this a pipe of small diameter is lowered down the well (the pump being attached to its upper extremity) to within about 1 inch of the solid material, as ascertained by the lead.

"Water is then poured down the outer tube, and jumped up the inner one, gradually washing away the surface of the material until the well is cleared out to the bottom, as ascertained by the length of the inner tube, which can then be removed, and the pump screwed on to the well.

"The pipes, when sunk, can be drawn at pleasure in two or three ways.

"1st. The monkey is placed on the head of the pipe, and the clamp screwed on near the top. By raising the monkey, and striking the clamp a series of blows, the pipe is started and gradually drawn, the position of the clamp being shifted as required. (Sketch C.)

"2nd. A chain is passed once or twice round the pipe, one end passing through a ring at the other. A moveable link is then placed on the chain, and a lever or hand-spike inserted into the link, which, tightening the chain round the pipe, gradually lifts the well, the position of the chain being altered as required. (Sketch D.)

Stores
required.

"The stores required for sinking a well, in addition to pipes, pump, &c.* were:—
"1 File. 4 Gas tongs, pairs ($1\frac{1}{2}$ ", $1\frac{1}{4}$ ", $\frac{3}{4}$ ", $1\frac{1}{2}$ "). 1 Crowbar, 5 feet. 1 Spanner, for clamp. 1 Wrench, for clamp of pulleys. 1 Chain, 3 feet, and link. †1 Monkey. †1 Clamp. †1 Pair of pulleys and clamp. 1 Tool (6 feet gas-pipe, with piece welded in.) And Gas-pipe $1\frac{1}{4}$ inch, weighs about $2\frac{3}{4}$ lbs. per foot.

Men
required.

"Five men are required for driving a well quickly, allowing two men in two reliefs for working the monkey, while the fifth (a non-commissioned officer) steadies the monkey in its descent, attends to the clamp, and moves it and the pulleys as required. Three men could drive a well very well, although requiring more time, as the labour of working the monkey is rather severe, unless reliefs are provided.

"Two wells were bored at Chatham on the 22nd of September, and one at Wouldham on the following day, each by a different party of men, who consequently knew nothing previously of the process; Mr. Norton's agent, Mr. Hawkesley, and two American gentlemen, being present on all three occasions.

No. 1 well.

"The first well was driven in soil consisting of clay, gravel, and large stones.

"First pipe, 11 feet long, was driven in 30 minutes.

"The second length, 9 feet long, in 39 minutes.

"Water was now tried for and found, but not in sufficient quantities.

"An additional length of pipe, 6 feet long, was then attached, and the driving continued, several hard strata being passed through until at 24 feet from the surface. For the next foot the driving was easier, and at 25 feet a copious supply of water was found, at first very thick, as if containing gravel or clay, but afterwards becoming whiter, leaving a slight deposit of chalk. If the pumping had been continued, the well would probably have cleared up. The point of the lower tube in being drawn was found uninjured.

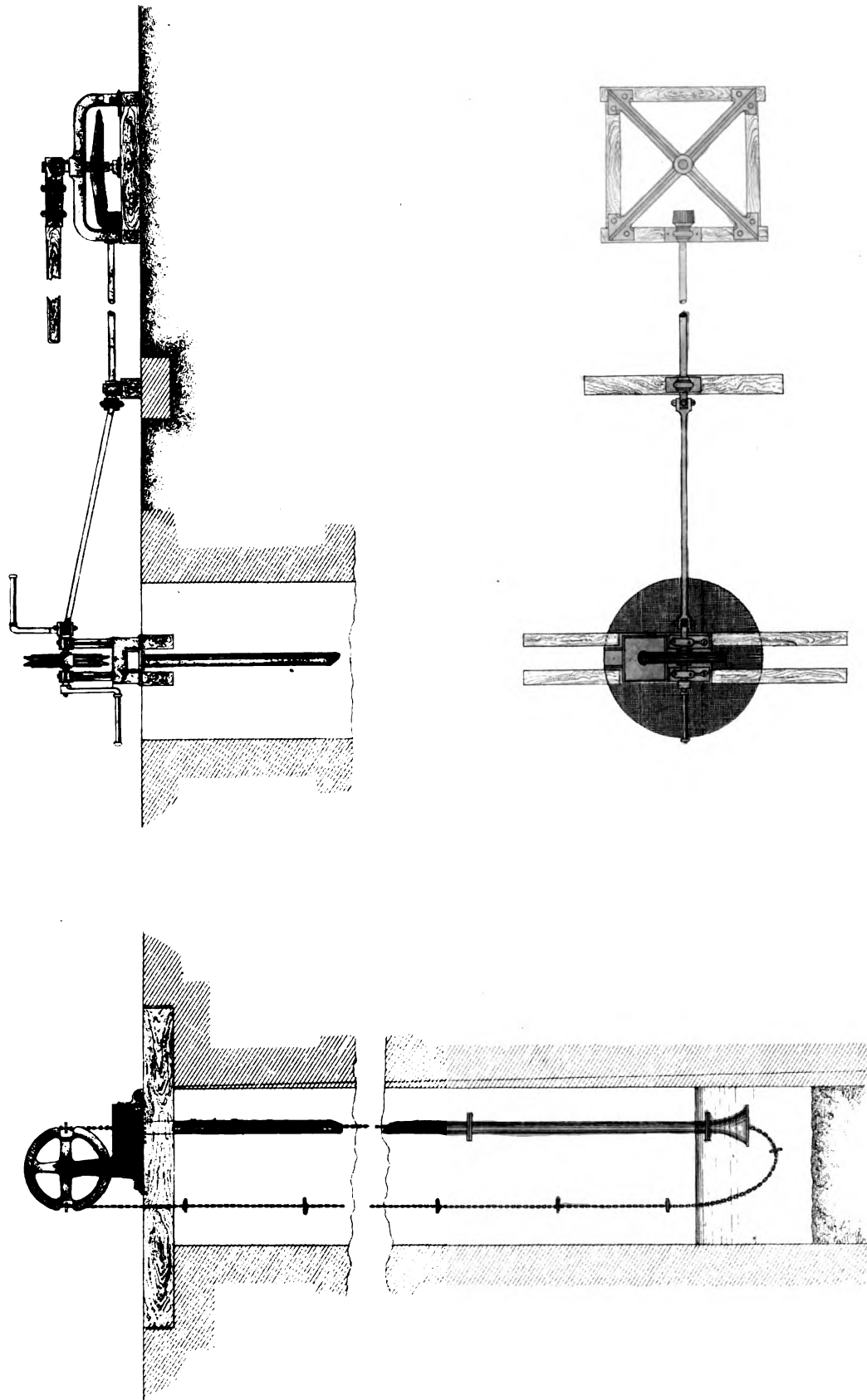
No. 2 well.

"This was sunk in solid chalk without accident, a depth of 17 feet being obtained in 1 hour 25 minutes. No water was obtained at that depth, and as it was then dark

* Estimated weight of stores	..	142 lbs.
Weight of pump ..	..	24 "
Weight of tubing for 20 foot well	..	56 "

† The stores marked thus could be carried on the tool (the whole weighing about 100 lbs.) by two men.

BASTIER'S CHAIN PUMP.



Scale, $\frac{1}{4}$ Inch = 1 Foot

Lith at the TOP: DEPOT of the WAR OFFICE,
COL: SIR H. JAMES, R.E. DIRECTOR

W. Wagner Lith

" the pipes were drawn, the point being slightly turned, but to so small an extent that
 " after being filed up for five minutes it was again used for No. 3 well.

" This well was sunk at Wouldham, three miles from Rochester, in the valley of the No. 3 well.
 " Medway. The well was commenced and the apparatus working within 10 minutes of
 " arriving on the ground.

" The first 4 feet was driven in a few minutes through a fine loam ; the next 7 feet
 " required 47 minutes to drive ; and after this, the strata becoming much harder, the
 " progress was slower, as, one of the screws of the clamp pulley having broken, time was
 " lost in procuring one to replace it.

" A total depth of 18 feet was attained in two hours, and 4 feet of water found in
 " the well on plumbing it. Driving was then continued, and at 22 feet from the surface
 " 8 feet 6 inches of water was found in the pipe. On the pump being applied, the water
 " came up with difficulty, and was thick and discoloured. In half an hour the quantity
 " increased, and the water became purer. After pumping three hours, but a small
 " quantity of chalk was brought up in solution, and the water was drinkable. The supply
 " was at the rate of 10 gallons per minute, and, instead of diminishing, appeared to
 " increase. This well was left in the ground."*

On the above Report, and at the recommendation of the Director of the Royal Engineer Establishment, it was decided that a supply of Norton's tube wells should be sent with the Force, and Lieutenant A. Le Messurier, R.E., was appointed to superintend the well-sinking apparatus in Abyssinia. Under his orders were one serjeant and twenty-six rank and file of the Royal Engineers, who were incorporated in the 10th Company, R.E. Lieutenant Le Messurier and his party were sent from England in the "Mendoza" in November with 50 Norton's wells completely equipped. To these 50 more were subsequently added and sent from England in the "Leith."

Norton's
tube-wells
ordered.

Another description of pump adapted for lifting water from wells, tanks, rivers, &c., and suited, from its cheapness, durability, and portability, to accompany troops on the line of march, was also sent to Abyssinia, and supplied by Messrs. J. Jackson & Co., 17, Gracechurch-street, London, E.C. This was "Bastier's patent chain pump." It could be worked by one man with a pipe 2½-inch diameter, in lengths amounting to 40 feet, and was said to be capable of raising 12 gallons of water per minute.† Its cost, with spare lengths, washers, &c., ready packed for shipment, was under 50*l.*; its weight not more than 150 lbs.; and, being capable of easy removal, and requiring no cleaning, care, or attention, it proved to be a most useful description of pump for such a campaign as that in Abyssinia. It could be fixed in a few minutes, and by a simple arrangement adjusted for any depth ; and it was wisely considered that the flow of water from the discharge pipe of such a pump would do away with the perpetual water-drawing which always occurs in tropical climates where the supply is derived chiefly from the rudely-constructed wells of the country. A larger description of Bastier's pump, with a pipe 6 inches diameter, gave a supply of 180 gallons a minute. Its motive power was a camel or a pair of bullocks ; and its cost, ready for shipment, about 80*l.*

Bastier's
chain pumps.

Description.

The Bastier's pumps sent to Abyssinia were—

Five	2½-inch diam.	×	35 ft. deep.
Six	" "	×	31 "
One	6-inch	×	35 "

Number
ordered.

* Report by Lieutenant W. B. Hurst, R.E.

† For the result of the experiments in Abyssinia with the Bastier's chain pump, see page 298. With 40 revolutions a minute 50 gallons of water were raised ; with 30 revolutions, 36 gallons.

Means of
working.

By the Bastier's patent chain pump the water is lifted through vertical tubes. At every interval of 50 yards a contracted part, or working barrel, is inserted, smaller in diameter than the main pipe, one of which is always placed at the lower end. An endless chain passes over the driving wheel at the top, going down free, and coming up through the tube, into which it enters by a bell-shaped mouth-piece. On this chain are fixed India-rubber discs, smaller in diameter than the main pipe, but fitting tight in the working barrels, so that all the water that enters is forced up and carried through the main pipe. The discs being free all round from the pipe for nine-tenths of the whole distance, the friction is reduced to a minimum. Eighty-seven per cent. of the whole area of the tube is lifted in water. A $3\frac{1}{2}$ -inch pump has lifted 120 gallons per minute, from a depth of 270 feet, with 10.75 indicated horse-power; other sizes in proportion.

c/ Kantahal in 1871
p. 39

In Abyssinia, the general management of the inland water supply was entrusted to Lieutenant Le Messurier, working under the Quartermaster-General's Department, and constant reference to the water supply arrangements will be found in the preceding chapters, and in the fortnightly Reports submitted to the Quartermaster-General at the Horse Guards, by Captain Holland, Assistant Quartermaster-General.*

At the conclusion of the campaign Lieutenant Le Messurier submitted the following general Report on the whole water supply arrangement under his immediate control in Abyssinia:—

Lieutenant
Le Messu-
rier's general
Report on
water supply
arrange-
ments in
Abyssinia.

"The tools, implements, and stores taken to Abyssinia were distributed in loads of rather more than 200 lbs. Ten sets of driving apparatus, 50 wells complete, and a few reserve articles were shipped with the detachment from England, and an additional 50 were despatched a month or two later.

"List of tools, stores, implements, &c., despatched with the American tube wells, distributed under the following heads:—

- A. Driving apparatus.
- B. Wells.
- C. Reserve.

A.

Driving
Apparatus.

"Articles for one set of driving apparatus:—

"No. I. MULE.

1 monkey, with ropes. .	..	..	81 lbs.	} 101	Total load 202 lbs.
1 crow bar, 5 inches long	..	..	20 "		
1 wrought-iron clamp. .	..	..	26 "		
1 pair of pulleys and clamps	..	..	6 "		
1 extension pipe	..	..	16 "		
1 extra clamp and screw	..	..	26 "	} 101	
1 set of cleaning tubes, viz.—					
4 ft. 6 ins. }	length of $\frac{1}{2}$ in. pipes		27 "		
1 ft. 6 ins. }					
with reducing socket.					

* See pages 5, 20, 73, 89, and 109.

" No. II. MULE.

Packed in a box.	1 water barrel, 3 gallons	..	..	40 lbs.	106	212 lbs.
	1 leather bucket	..	..	5 "		
	1 pump for cleaning	..	..	25 "		
	Available for personal necessities	..	..	36 "		
	1 set gas tongs $\frac{1}{2}$, $\frac{3}{4}$, $1\frac{1}{4}$, and $1\frac{1}{2}$	..	..	16 lbs.	106	
	2 spanners	..	..	8 "		
	1 pair of stocks	..	..	$13\frac{3}{4}$ "		
	1 set tube cutters	..	..	$7\frac{1}{2}$ "		
	1 10-in. half-round file	..	..	10 oz.		
	1 lifting chain	..	..	3 lbs.		
	1 gallon tin of oil	..	..	10 "		
	1 oil can with trap nozzle	..	..	1 "		
	1 tin white lead	..	..	10 "		
	10 spare nuts and screws for clamp	..	..	19 "		
	1 plumb-bob	..	..	6 oz.		
	2 iron caps	..	..	$1\frac{3}{4}$ lbs.		
	2 spare collars	..	..	$1\frac{1}{2}$ "		
2 spare washers	..	..	1 oz.			
5 leathers for pumps	..	..	3 "			
2 spare monkey rings	..	..	1 lb			
Box with hasp and lock						

" B.

" Articles for two tube wells to be carried on one mule :—

1 well tube, 6 feet long, $1\frac{1}{4}$ in. diameter..						Wells.
Solid iron point, steel tipped, 10 feet long	22 lbs.	103	206			
3 6-foot lengths, $1\frac{1}{4}$ diameter ..	48 "					
1 3-foot " " "	8 "					
1 pump	25 "					
Second well	..	103				

" C.

" The reserve consisted of—

11 sets of tube wells 1'6" length, $1\frac{1}{4}$ inch, with solid iron points.		Reserve.
Each consisting of 3'6" foot lengths $1\frac{1}{4}$ inch, one 3 foot length, $1\frac{1}{4}$ -inch.		
10 6 foot lengths $\frac{1}{2}$ -inch tubes for cleaning out.		
100 bolts and nuts for clamp.		
100 lbs. white lead.		
1 vice.		
1 portable forge.		
2 reducing sockets.		

" The above distribution enabled an officer to carry one set of driving apparatus and
 " six wells on five mules, but the nature of the campaign was such that these loads had to

Means of
packing.

" be lessened considerably; and the list shown in another part of the Report will, I trust, contain all that may be necessary for the perfect field equipment of this branch.

" The weight of the Otago pack-saddle, with bridle, is 45 lbs.

" For shipment by sea the driving apparatus, including water barrel and bucket, was packed in one case.

" The tools, in a box, provided with hinges, hasps, and padlock, and ready for transport on mules. The tubes were packed separately, four sets in a case.

" The pumps, on account of their liability to break, were packed separately, the handles being taken off.

" The labels on the cases correspond with the words in italics.

" All cases containing these were marked with the broad arrow in blue paint.

" The Store Dépôt was at Zula.

" The works for the water supply of the army from Kumayli to Antalo (200 miles) were more or less of a permanent nature, supplemented by a few tube wells driven in the best positions for drinking purposes.

" Between Antalo and Magdāla, the wells were driven, on arrival, at the camping grounds, and were drawn out again about 9 P.M. the same evening.

" The experience of the campaign has shown that the pump will not work satisfactorily with a lift beyond 20 feet, and the delivery, varying with the depth, does not exceed eight gallons per minute.

Reduced
mule
equipment.

" *Equipment.*—After a few marches, on account of the scanty food and scarcity of water, the mules were unable to carry their loads, and the subjoined list shows the reduction and distribution of all articles necessary for full equipment, the unnecessary articles being omitted, and a few added.

" A.

" Articles for one complete set of driving apparatus:—

" No. I. MULE.

Monkey, with ropes, with sticks attached	..	82	} 165 lbs.
1 crow bar	20 lbs.		
1 single wrought-iron clamp	20 "		
1 pair of pulleys and clamps	6 "		
1 extension pipe	16 "	83	
1 set of cleaning tubes:—			
3 6-foot .. }	lengths of ½-in. pipe..	21 "	
1 3-foot .. }			

" The cleaning tubes should be strapped together.

" The wrought iron clamp and the pulleys should be slipped over and clamped to the extension pipe, to which the crowbar should also be attached. These are best carried in a salita of stout sacking slung over a saddle of the Punjab Mule Train pattern, consisting of stout pads, with breast-plate and breeching.

" No. II. MULE.

To be contained in stout canvas bag.	Tin of white lead	25 lbs.		
	Extra set of ropes and sticks ..	2 "		
	4 iron caps	3 "		
	4 spare collars	3 "		
	12 spare washers, with clock for ..	12 oz.		
	12 leathers for pumps	8 "		
	2 spare monkey rings	1 "		
	$\frac{1}{2}$ gallon tin of oil	5 "		
To be contained in a stout canvas, similar to a soldier's hold-all.	1 oil can, with trap nozzle ..	1 "		
	2 reducing sockets	1 "		
	Sets of gas tongs, $\frac{1}{2}$, $\frac{3}{4}$, $1\frac{1}{4}$, $1\frac{1}{2}$..	16 "		
	2 spanners	8 "		
	1 pan stock and dies	18 "	12 oz.	
	1 set of tube cutters	7 "	8 "	
	2 10-in. half round files	1 "	4 "	
	1 small spanner for pulleys ..	2 "		
For a stout canvas hold-all.	1 plumb-bob		8 "	
	4 spare nuts and screws for clamp ..	8 "		
	The most useful carpenter's tools, such as saw, hatchet, plane, hammers, bill hook			

78

156 lbs.

78

" Boxes are objectionable, and the above will travel well in a salita over a Punjab saddle.

" B.

" Articles for tube wells, to be carried on one mule :—

" No. III. MULE.

2 well tubes 6 in. long, $1\frac{1}{4}$ in. diameter, with solid iron point, tipped, 10 in. long.	32 lbs.		
2 6-foot lengths, $1\frac{1}{4}$ in. diameter	32 "		
2 3-foot lengths, $1\frac{1}{4}$ in. diameter	16 "		
Second well same as above			

80

80

160 lbs.

" The extra steel-tipped length enables four pumps to be at work should water be within 14 feet of surface. The tubes to be bound by short stout straps, with rings attached to them to fit on to the hooks of the Otago pack-saddle, which is well adapted for this load.

" No. IV. MULE.

3 leather buckets	15 lbs.		
3 pumps	75 "		
3 leather buckets	15 "		
3 pumps	75 "		

90

90

180 lbs.

" The buckets should be made just large enough to receive the pumps, which must be carried in them for protection. Buckets.

" The buckets, three on a side, can be carried in a stout canvas salita, upright in packets, and the saddle should be of the Punjab pattern.

" The screw-headed bolt that secures the handle to the pump should be done away

“ with, and a plain steel bolt of larger diameter substituted, with a shot at the end to receive a double-tongued porce of iron. The bolts continually work loose and are lost. The friction also on the bolt is so great that in a few days a new one is required. The lower leather, with the clock on the valve, shrinks in the hot climate. The body of the pump rests on this leather, and there is only one small screw connecting the body of the pump with its base. There should be two projecting tongues from the body of the pump, to pass under the lip of its base, and tightening screws, to prevent the escape of air, which invariably occurs at this point.

“ The space between the body and the tip will always require packing with tow and white lead.

“ The saddle and salita to be the same as for No. I.

“ C.

“ Extra tube wells, to the extent of 15 per cent., may be considered as a reserve. No extra cleaning-out tubes required.

“ Extra bolts and nuts are unnecessary, as not more than five or six of those in use failed.

“ 30 lbs. of white lead and the Vice and Portable Forge can only be of use where there is direct and quick communication with the dépôt.

Working of
well-borers
in Abyssinia.

“ 5. *Working*.—The detachment of Royal Engineers from England consisted of—

“ 1 Serjeant,

“ 4 Corporals,

“ 16 Men ;

“ and this is a good proportion, giving four squads of four men, with a corporal in charge of each. The distance between Kumayli and Antalo was divided into three divisions, their extent (about 70 miles) being fixed by the position of the three large dépôts—Senafè, Adigrat, and Antalo. An officer of Engineers, with one squad of the detachment, was left in charge of each division, to develop and store the supply at the larger stations by means of such labour as was available, and to make and keep in order the roads and drinking-places for the beasts of burden at the passing stations. The four squads accompanied the 1st Division in its advance from Antalo to Magdāla ; one squad will be found sufficient for each column, and with them they require tubes, imple-

“ 1 Mule, as No. I.

“ 1 Mule, as No. II.

“ 2 Mules, as No. III.

“ 1 Mule, as No. IV.

“ According, therefore to the number of columns and distances from the base of operations, so will the number of squads be, with their complement of five mules to each squad. A spare mule, if possible, should be allowed.

“ The transport of tents and personal necessities for the men has not been included. The practice of stringing the mules one to the other is objectionable, and, with care, they can be made to follow their leader independently. On the march each man walks by the side of a mule, and the corporal in rear.

Boring
apparatus.

“ The position for the well having been selected, the steel-pointed tube is placed vertically in a hole made by the crowbar. The clamp is fixed on the tube, about 3 feet from the ground ; the extension-pipe is inserted after the monkey has been placed on

“ the clamp. The pulleys are then fixed to the extension-pipe, and stout sticks should be
 “ attached to the ropes, to save the man's hands from cuts during the process of
 “ driving.

“ The monkey may be steadied and assisted during its descent by one of the men
 “ forcing it down at each descent.

“ When the clamp reaches the ground, the monkey is raised, the clamp unscrewed,
 “ and, after readjustment, the driving is continued until the screw-thread at the top of the
 “ tube is within a few inches of the ground. The extension-tube is then taken away with
 “ the monkey, and the clamp unscrewed; a small iron cap is then screwed on to the
 “ thread of the driven pipe and joint, being white leaded. A second tube is then screwed
 “ into the upper portion of the iron cap: the clamp is then attached, and the monkey
 “ passed on over the head of the pipe—a matter sometimes of difficulty, but it is not
 “ advisable to reduce the length of the tubes to obviate this. The extension tube is
 “ again applied, if necessary, and the driving is continued till water is reached. The
 “ plumb-bob should be lowered at the times of fitting on fresh tubes. The depth of water
 “ can thus easily be told, and the cup at its base enables the men to judge of the quality
 “ of the soil. The gas tongs are useful in screwing the tubes round as they are being
 “ driven; and it was found advisable to continue the driving until the plumb-line showed
 “ at least 5 feet of water in the pipe. The clamp should be carefully watched, and as
 “ soon as it shows signs of shifting the screws must be tightened.

“ When the well is driven deep enough, the pump is screwed on at the top, and the
 “ water drawn up, this operation being greatly facilitated by filling the pump-head and
 “ tubes with water. The water at first is generally impure, but after a short time, as the
 “ chamber at the bottom of the well enlarges, it becomes pure. In fine gravel or clay the
 “ bottom of the tube becomes choked, and the matter is removed by inserting the
 “ cleaning-out tubes and lowering them to within about one inch of the solid material,
 “ and the pump-head is fixed to them by means of the reducing socket. Water is then
 “ poured down the larger tubes, and pumped up through the smaller ones, gradually
 “ ashing away the surface of the material until the well is cleaned out to the bottom,
 “ when the inner tubes are removed, and the pump screwed on to the well. In swampy
 “ and marshy ground, the cleaning-out tubes were of no use. The ground round the
 “ wells should, if possible, be metalled with stones to a depth of 6 inches, and a rough
 “ wall built round them for protection against cattle.

“ In drawing the tubes, the process of driving was reversed. A tube is not complete Drawing.
 “ unless there is one iron collar screwed to it, and as the thread on the other end of the
 “ tube often gets damaged on the march, it is advisable to fit the tubes and collars ere
 “ the driving is commenced. The side openings in the base of the pump require to be
 “ enlarged, as there is difficulty in working the tongs when screwing the pump to the
 “ tube.

“ 6. *General Remarks.*—The requirements of a column on the march would neces- General
 “ sitate an extraordinary number of the wells, and for operations in the field these wells remarks.
 “ must be considered merely as an auxiliary, and for the provision of a certain supply of
 “ pure water for drinking purposes after the streams and pools become soiled by constant
 “ disturbance. Time and circumstances would possibly not admit of their being used to
 “ their greatest advantage: viz., in searching for water.

“ A description of the works carried out at the chief stations follows, as there may Description
 “ be some points which may prove useful hereafter. of works.

“ At Zula, about four miles from the shore, water of a temperature of 119°, at a depth Zula.
 “ of 50 feet, was obtained from a well dug by the Punjab Pioneers: yield about eight

“gallons a minute. Others were sunk to a greater depth in the vicinity, but with less satisfactory results.

Kumayli.

“At Kumayli the supply was obtained from wells sunk in the bed of the river and from the tube wells. Finally 10 wells were at work, three of them fitted with Owen and Clinton's double-action pumps, one with a Bastier $2\frac{1}{2}$ -inch chain-pump, one with two-tube wells fixed, and five with portable hand-pumps, besides two tube wells driven into the bed of the river, and four dipping wells, reserved for the Shohos.

“On the 19th January, 1868—

“20 Elephants,

“2,380 Camels,

“879 Ponies,

“2,646 Mules,

“300–500 Convoys,

“400 Commissariat bullocks,

“in addition to troops and followers, were watered here.

“A large chunamed reservoir was also made for the use of troops on the march, and the supply of the railway was sent in water carts filled by two portable force-pumps from this reservoir.

“The drinking-troughs were all built into stout stone walls, and the entrances protected by stone barriers, at which guards were placed to prevent more than a certain number of animals entering at one time. Watering generally occupied about four hours twice a-day, and the wells for drinking purposes were in constant use. The whole of the wells were protected by a dry stout toe-wall.

Suru.

“At Suru, in a narrow gorge, a spring which issued from the rock, gave the supply. Two-tube wells were fixed in a small sandy pool for drinking purposes, and lower down the Pass 18,000 gallons were stored in tanks built up against the side of the rock. Biscuit boxes and barrels were fixed alongside, and these were filled by buckets from the tanks, the muleteers filling for their own beasts. A side road was walled off to prevent a block between the beasts going to and returning from water.

Undul Wells.

“At Undul Wells—dividing a march of 30 miles—water had to be found, and the supply was at first obtained from a well 24 feet deep, in which two of the tube-wells were fixed, and supplemented finally by a well, 30 feet deep, built of solid masonry, which carried a Bastier chain-pump.

“After repeated trials, one tube was driven 29 feet but with no result; a third well, 31 feet deep, was excavated, and gave a fair supply for drinking purposes.

Rahagedi.

“At Rahagedi, in the Pass, the sources of some springs were thoroughly cleaned out, and stone wells built; from these the supply ran into six tubs, which afforded good drinking water, and thence, under the road, in stone drains to a stone reservoir built by the road side, and from this again, by gravity, into troughs and biscuit barrels built into stone. The Pass being only 15 feet wide did not admit of any other plan being carried

Senafè.

“out. Some tubes were also driven at the foot of the Senafè Ghat. At Senafè, six Norton's tubes were driven for drinking water, near a dry watercourse leading to two ponds about 9 feet deep. Drains were cut in all directions through the swampy ground leading to the ponds, and filled with broken stones. The water in the ponds was dammed back, and the overflow carried off by a stone duct to the drinking-troughs below; eight Norton's tubes were driven alongside the troughs, and were worked by muleteers during watering hours. A large drain, lined with stone, fed also from the ponds, led to a large reservoir, and this supply was pumped through tubes into casks, for the horses. A Bastier chain-pump was fixed over a well lined with stone, and

“supplied other troughs for the use of the Transport Train. At Guna-Guna, the Guna-Guna.
 “drinking water was provided by means of the tubes, and the water for the drinking-
 “troughs was led off from an irrigating channel, and regulated by means of a small
 “sluice.

“At Focada water was found draining over rock, about 5 feet below the surface. Focada.
 “Reservoirs had to be excavated to catch this drainage, and portable hand-pumps were
 “fixed. The reservoirs being filled up with stone, Norton's tubes were fixed in them.

“At Adigrat a small stream flowed through the field work, emanating from a Adigrat.
 “swampy pool outside. Rock was met with at 5 feet below the surface, which prevented
 “the tubes being driven for a supply. The pool, in a few days, became so puddled from
 “animals walking into it, that it became necessary to clear it out and fill it with stones.
 “A trench was dug in the direction of the stream and filled with stone, and at three
 “different spots tubes were fixed in excavated wells. The channel was enlarged, and
 “lined throughout with stone, and the water dammed back at three different places in its
 “length. The overflow followed the natural channel, which was dammed again lower
 “down, and the water taken off through sluices to troughs and tubs for the animals.

“At small passing stations tubes were driven for drinking water, and metalled Small
 slopes made into pools and streams for the animals. stations.

“The supply at Antalo was derived from a succession of pools, drinking water being Antalo.
 “procured from the tubes driven in their vicinity, and metalled slopes down the steep
 “banks made into the pools, enabled the animals to drink. Mules and horses will rush
 “in out of their depth, if not prevented by stout poles fixed across the drinking places,
 “at about five feet from the water's edge. Beyond Antalo the pumps were driven daily,
 “but in many cases it became absolutely necessary to dig small wells and fill them with
 “stone before fixing the pump. In all these cases portable hand-pumps would have
 “answered equally well, and, after long marches, the labour of erecting them would have
 “been much less. On the Wadela and Talanta plateaus, the supply was derived from a
 “few pools, and the water generally was within a few feet of the surface, draining over
 “basaltic trap, and no increase of supply was to be obtained by increased depth.

“In the vicinity of Magdāla water was obtained from small holes dug in the ground, Magdāla.
 “which, after exposure for 12 hours, became so bitter and tainted as to be useless. A
 “tube was driven at the foot of Fahla with moderate success, but the quantity of water,
 “until dammed back below the tube, was scarcely sufficient to work the pump.

“7. *In Conclusion.*—The experience of the Campaign has shown that one squad with
 “five mules equipped, as shown above with Norton's tube wells, will be sufficient to
 “accompany a column on the march, but to these should be added at least six of the
 “portable hand-pumps, with boxes complete.

“That a reserve of 50 of the tubes will be found sufficient for a campaign.

“That for all depôts Owen and Clinton's double-action pumps are admirably suited.

“That the Bastier chain-pumps are also very useful, but the weight of the pipes,
 “and also of the wheel, are drawbacks, and the wear of the washers, unless the pipes are
 “set exactly plumb, is very great.*

“The portable force-pumps will also be found extremely useful for filling from tanks
 “into water carts.”

From the experience of the Abyssinian Campaign the following deductions were General
 made :— deductions
 from the
 experience
 of the
 Campaign.

* Since the date of this Report, the weights have been much reduced.—(Ed.)

Drinking
arrange-
ments
desirable.

The first essential after pumps and troughs have been put up is, that the number of animals allowed to approach and drink out of the troughs at one time should be limited in exact relation to the supply of the pump, *i.e.*, the water level in the trough should remain a constant 4 or 5 inches in depth. If this is carried out the animals not only drink more quickly but, having their muzzles well buried, have an instinctive feeling that there is plenty of water and remain quiet. The reverse is the case when the drinking capacity of the animals is in excess of the supply furnished; the water is soon reduced to a mere film running over the bottom of the trough and then occur scenes such as those daily witnessed both at Zula and Kumayli.

Troughs.

The troughs should be strongly fixed into cradles or trestles, and backed up with stone: they should range from 2 to 4 feet in height, be about 2 feet wide, and 6 to 7 inches in depth, and have a length, if possible, of 120 feet.

Entrances and exits should be built to admit and pass out only four animals, at one time; the entrance of a continuous 120 feet of trough should be at each extremity, and the exits from the centre, where a wall to partition off the trough into two separate portions should be built.

The animals are thus collected at the extremities (mules and asses at the lower, camels and horses at the higher), where there is plenty of space.

At the centre the space is not required as the animals are walked off after having had their draught, and are quieted with their fill of water.

Capabilities
of Norton's
and Bastier's
pumps.

A Norton tube pump cannot draw water over 25 feet from the surface, and at that depth its supply is very small. At 20 feet from the surface it yields—two men relieving each other—about 4 gallons per minute. At 16 feet about 5 gallons per minute, equal to the watering of about 100 mules per hour; at 12 feet nearly 6 gallons, and will supply about 120 mules in the hour.

It cannot be driven through soil in which boulders or hard rock abound. In only one such instance, and that a fortuitous one, did it succeed at Kumayli. It had struck a stone and had been twisted just as it reached water, at the luckily small depth of 11 feet. At the foot of the Senafè Ghat it was unsuccessful, and wells had to be dug in which the tubes had to be placed in all places below the Ghats. In all positions where the dry bed of a stream runs through alluvial soil, the tube can be successfully driven, and where there is a plentiful supply of water it will furnish sufficient for three mules at one time.

From actual experiments at Kumayli, it was ascertained that the water supply of a "Bastier" chain pump was equal to that of 12 Nortons. At Kumayli one kept 45 mules regularly drinking, the Norton's only three at one time and four the next alternately, each worked by one man. The "Bastier" once in position is difficult to injure, and the suckers, which wear out in time, can be renewed in a few minutes.

In trying the "Bastier" chain pump, working hard 40 revolutions per minute, a result was obtained of 8 cubic feet of water per minute, equal to 50 gallons. With 30 revolutions, 5.765 cubic feet, equal to 36 gallons were obtained. The "Bastier" hence gives on an average about 2,200 gallons per hour, two men working.

Results of
experiments
on animals
drinking.

The following experiments on animals were also tried at Kumayli:—

32 camels and 8 mules began to drink at 3.28 p.m., had finished at 3.30 p.m., and had drank 1" of water in the trough, equal to 148 gallons, to which must be added 72 gallons of Bastier time of working, equal to 220 gallons, which will give nearly 6 gallons each for camels and 4 for mules.

Again next day, 4.5 p.m., 21 mules and 40 camels drank; in two minutes they had

finished and the water in the trough was reduced $1\frac{1}{8}$ ", equal to about 250 gallons, giving $5\frac{1}{2}$ gallons for camels and $3\frac{1}{2}$ for mules.

Before the Bastier pump was received, some men, with assistance of a bucket and pump, were able to fill 1 inch of trough, equal to 11 cubic feet or 69 gallons, in seven minutes; and the following data were obtained by Captain Hills, R.E., who superintended the operations, and to whom we are indebted for some of the preceding deductions.

" $12 + 13 + 14 + 15 + 14 + 17 = 85$ mules drinking in lots as above took fifteen minutes = $2\frac{1}{2}$ minutes each lot, and reduced the water in the trough 2" in depth, showing the numbers were too great.

" (1.) $A = 22 + \frac{15}{7}$ of 11 feet = 45 cubic feet of water, then $15 + 16 + 10 = 41$ mules took 9 or 285 gallons to drink water $\frac{3}{8}$ " diminished.

" (2.) $A = \frac{3}{8} \frac{11}{4} + \frac{9}{7}$ of 11 = 116 gallons.

" $12 \times 12 + 8 + 10 + 9 + 13 + 8 + 9 + 11 + 9 + 10 + 10 = 121$ mules took 24 minutes to drink and left water exactly as it was at the commencement.

" (3.) $A = \frac{24}{7}$ of $11 + 22 = 60$ cubic feet = 375 gallons.

" That 37 mules in eleven minutes left trough as before—

" $A = \frac{11}{7}$ of 11 cubic feet = 17.3 cubic feet = 108 gallons.

" We have—

			Gallons.
" (1.)	85 mules drink	285 =	3.3
" (2.)	41 " "	116 =	2.8
" (3.)	121 " "	375 =	3.1
" (4.)	37 " "	108 =	2.9
			<hr/>
			12.1
			<hr/>

3 gallons.

" Gives a rate of 3 gallons per mule.

" 140 camels emptied the trough in 42 minutes, 11 drinking at a time.

" $A = \frac{42}{7}$ of $11 + 66 = 825$ gallons,

" about 6 gallons per camel—these had not had water for three days.

" The following experiments were taken to test the quantity of water necessary for cattle. They were for the supply offered for Zula, and were watered only once a-day at 12 o'clock, when all the transport animals were clear.

			Gallons.
" 25 drinking took	4 minutes	=	127
" 22 " "	4 " "	=	120
" 22 " "	3 " "	=	112
" 30 " "	$0\frac{3}{4}$ " "	=	163
" 36 " "	$3\frac{3}{4}$ " "	=	173
" 36 " "	$3\frac{1}{2}$ " "	=	170
			<hr/>
" 171 " "	$28\frac{1}{2}$ " "	=	865
			<hr/>

" Almost exactly 5 gallons each. The numbers were increased as the Bastier at first gained and, latterly, lost."

At Kumayli the water derived from wells sunk some 10 to 12 feet in the bed of tor-

rent, through rock of metamorphic formation, was raised by dipping and examined, November 12, 1867, by Assistant-Surgeon Martin, M.D., who reported as follows on it:—

“*Physical Qualities.*—When first drawn, slightly turbid. The turbidity passed off “when allowed to stand; sediment, sandy; no peculiarity of taste or smell; reaction, “neutral; organic matter, absent; lime, some present; chlorine, a slight trace; sulphuric “acid, a trace. This water was considered excellent and wholesome.”

Analysis of
water by
Assistant-
Surgeon
Martin.

When passing through Kumayli, December 30, 1867, Dr. Martin examined the physical qualities of some water raised by the American pump, and reported the water perfectly clear and good. He further reported as under.

“At Suru the water was derived from a running stream, and from a spring at the “head of the Pass. Rock formation, metamorphic gneiss and schists. Water was “examined November 5, 1867: physical qualities, perfect; reaction, neutral; organic “matter, absent; lime, some present; chlorine, a trace; sulphuric acid, a trace. This “water was considered by Dr. Martin excellent and fit for use. At a subsequent period, “owing to bad management, the water was rendered turbid by the traffic; but afterwards “this point was attended to and the water was very good.

“At Rahagedi the water was derived from a beautifully clear running stream. For- “mation metamorphic. It was examined November 8, 1867. Physical qualities, quite “clear; very slight sediment when allowed to stand 12 hours; no peculiarity of taste or “smell; reaction, neutral; organic matter, absent; lime, some present; chlorine, a trace; “sulphuric acid, a trace. This water was considered by Dr. Martin excellent and whole- “some.

“The water at these three places closely resembled each other, which might be easily “imagined as the rock formation was metamorphic throughout. It is laid down as a “general rule by Professor Parkes that the water derived from metamorphic regions is “generally very pure.”

These rough analyses were made before there was a possibility of organic contamination by camp followers and transport animals.

CHAPTER XXXI.

MEDICAL DEPARTMENT.

THE details of the equipment of the hospital ships furnished from England, with their establishments, stores, and medical comforts, are fully shown in Chapter IV., pages 78 to 84.

British Service.—Dr. S. Currie, M.D., C.B., with the local rank of Inspector-General, was the Head of the British Medical Department, and Principal Medical Officer of the Expedition, with Staff Assistant-Surgeon W. T. Martin, as Secretary. Composition
of the
Medical
Department.

In addition to the Regimental Medical Officers, the General Medical Staff consisted of a Sanitary Officer, three Staff Surgeon-Majors, ten Staff Assistant-Surgeons, and, besides the Medical Staff ashore, there were three Staff Surgeons and three Staff Assistant-Surgeons employed in the Hospital Ships. British
Service.

Indian Service.—There were two Deputy Inspector-Generals of the Indian Service, one was stationed at Zula, and the other accompanied the 1st Division in advance. There were two Field Surgeons, one to each division, and two Medical Storekeepers, as well as a Surgeon in charge of the General Hospital at Zula, and two in charge of hospital ships. Indian
Service.

SECTION I.—BRITISH SERVICE.

The general medical arrangements have been shown in detail in the preceding Chapters, and the following extract from the Report of Dr. Currie, shows the working of the Department during the campaign :— Dr. Currie's
Report.

“ *Cooking Utensils.*—Those for the troops were of the kind in common use in Indian cantonments, and it is difficult to conceive anything more unsuitable for campaigning in a mountainous country like Abyssinia, where it was a matter of pressing necessity to reduce the weight and bulk of baggage to the lowest possible extent. Cooking
utensils.

“ The canteen equipment of hospitals was equally ill-adapted for field service.

“ It was unfortunate that an adequate supply of field canteens had not been sent out from England for the Abyssinian Expedition.

“ *Clothing.*—The clothing of the troops was well adapted to the climate and service. This consisted of serge and Kakee suits, flannel shirts and belts, woollen socks, boots and leggings, the bedding of blanket and waterproof sheet. The bedding and spare clothing of each soldier was packed in a painted canvas bag, the whole weighing 25 lbs. Clothing.

“ *Rations.*—The scale of rations for the troops at Zula, and on the highlands as far as Antalo, was nearly the same as that in use in India, with the exception of the daily issue of two ounces of compressed vegetables and the increase of meat to 1½ lbs. Rations.

“ The following scale was laid down for the troops which went beyond Antalo :—

“ Flour or biscuit 1 lb.	“ Sugar 1½ oz.
“ Meat 1½ lb.	“ Ghee 2 ozs.
“ Salt 0¾ oz.	“ Compressed Vegetables .. 2 ozs.
“ Tea 0½ oz.	“ Rum 1 dram.

"As a matter of fact the troops were very fairly fed until they arrived at the River Takazzie, when the native transport broke down, and upon which the Commissariat mainly depended for the forwarding of their supplies from the Central Dépôt at Antalo.

"The effects of the failure of Commissariat supplies, and of the exclusive use of beef and flour rations, will be noticed hereafter in connection with the health of the troops at this period.

Sick
carriage.

"*Sick Carriage*.—In every climate and country where war has been carried on, the subject of the best description of carriage for the sick and wounded has proved of great difficulty, and regarding which great diversity of opinion has prevailed.

Ambulances.
Cacolets.

"For the Abyssinian Expedition, ambulance carts were provided, but for obvious reasons they were not of the smallest use. Cacolets were also furnished, but they were not brought into play. The large Spanish mules which were alone suited to cacolets were required for other purposes, such as the carrying of the mountain batteries, and the transport of Stores in Maltese carts to the Highlands.

"It was fortunate that circumstances prevented cacolets being taken to the front, inasmuch as the narrow and precipitous mountain paths would have rendered their use extremely unsafe; and the same objection applied to camel kujavahs, of which a considerable number were supplied.

"The carriage which proved the most useful was the dhooly for severe cases of disease, and the pad-mule for convalescents, or slight cases.

Dhoolies.

"Of the dhooly three kinds were provided, viz., the common Indian dhooly, the Madras dhandy, and the MccGuire field hammock. In considering the relative merits of these it may be observed that though the dhooly has the advantage of forming a comfortable bed in camp it is objectionable on account of its great weight, which varies from 90 lbs. to 120 lbs.

Dhandies.

"The Madras dhandy is merely a light description of dhooly, and weighs about 46 lbs. This also forms a comfortable bed, and is comparatively light, and easily carried.

MccGuire's
hammock.

"The MccGuire field hammock is constructed by lashing the hammock to an ordinary dhooly-pole, and the weight is only 21 lbs.

"Though light, and easily carried over mountains, the hammock has the disadvantage of not forming a bed for the patient in camp, and the canvas invariably becomes slack and baggy in the centre. The objections to the MccGuire hammock might be got over by fitting inside the canvas a light wooden frame with tape bottom, &c.

"For the dhooly and dhandy eight bearers at least are required, whereas for the MccGuire hammock six efficient bearers suffice.

Dhooly-
bearers.

"The work of dhooly-bearers is very hard, and, consequently, a large number of them knock up; it is, therefore, very difficult to maintain in anything like efficiency this description of sick-carriage.

"In the Abyssinian Campaign the inefficiency of the bearers was greatly increased by the nature of the country, and their physical deterioration from poor fare and privations.

"A dhooly-bearer is an animal hired to carry sick soldiers, and is not expected to fall sick himself, and if he does, in nine cases out of ten he is supposed to be a schemer.

"From what has now been stated it will be apparent that a really good description of carriage for sick and wounded, in mountain warfare more especially, has yet to be invented.

" The proportion of dhooly carriage allowed in the first instance was five and then three per cent., and soon after arriving on the highlands the scarcity and difficulty of transporting supplies rendered a further reduction of private and public followers imperatively necessary. The sick carriage was, therefore, fixed at one dhooly and two pad-mules per 100 fighting men, and 15 dhoolies to field hospitals.

Proportion
of sick
carriage.

" This small proportion of sick carriage necessitated the formation of dépôt hospitals along the line of route, these will be more particularly referred to hereafter.

" *Medical Stores.*—A large supply of medical stores was dispatched from Bombay, and two dépôts were established, one at the base of operations and the other at Antalo, eventually a small dépôt was moved forward to Dildi.

Medical
stores.

" *Medicine Chests.*—For board ship use, between India and Annesley Bay, two small medicine chests were supplied, numbered 1 and 2, the former contained medicines and the latter instruments and appliances.

Medicine
chests.

" For the field, regiments were supplied with a double set of chests of a larger size, numbered 3 and 4. Wings of corps and batteries of Artillery with one pair.

" The chests marked '3' contained medicines only, and those marked '4' surgical instruments and appliances.

" The field medicine chests were made and fitted up in Bombay, according to the scale laid down for field panniers in the 'Medical Regulations.'

" The supply of medicine which they contained was sufficiently large and varied, and the only objection that could be taken to them was on account of their excessive weight. A pair of chests complete weighed from 180 to 200 lbs.

" The best description of field chests in the Expedition were sent with the Cavalry and Punjab regiments from the Bengal Presidency. The Bengal chests or panniers were made of cane-work, and rendered waterproof by a painted canvas cover. The weight of a pair did not exceed 100 lbs. Two pairs would suffice for a European regiment.

" *Medical Comforts.*—A very ample supply of medical comforts in the mixed or assorted form was provided and packed in wooden boxes, weighing 80 lbs. Each regiment on leaving Zula was supplied with four, and batteries of Artillery with two cases, and a considerable reserve stock was carried to the front by the Commissariat.

Medical
comforts.

" *Hospital Clothing.*—This consisted of 20 suits of the ordinary Indian clothing for a regimental or field hospital, and half that quantity for a battery of Artillery; the deficiency of land transport rendered it necessary to minimize the hospital and every other equipment to the lowest point compatible with the efficiency of establishments.

Hospital
clothing.

" *Instructions to Medical Officers.*—Before the departure of the Expedition from the base of operations, a Circular Memorandum was issued for the purpose of directing the attention of officers of the Medical Department to the various points of interest which would probably present themselves in the course of the campaign; and to the duties of Medical Officers generally on field service.

Instructions
to medical
officers.

" In General Orders rules were published for the conservancy of standing camps.

" *General Medical Arrangements for the Expedition.*—The regimental hospital system, which is so much in favour in our service, was maintained in all its efficiency; and the other arrangements for the sick, on the general hospital plan, to which I am about to refer, may be considered as subsidiary to it.

General
medical ar-
rangements.

" At the base of operations ample and excellent hospital accommodation was provided for European officers and soldiers in three hospital ships, carefully fitted up in England, and provided with a staff of Medical and Purveying officers and Army Hospital Corps men.

- Hospital Ships. "These three ships were calculated to accommodate 58 officers and 600 men, and " they were placed under the superintendence of a Staff Surgeon-Major, who was also " charged with the administrative duties at Zula.
- Hospitals. "One Staff Surgeon-Major was appointed to each division of the force, and the " Sanitary officer was also of the same rank.
- "For the sick of the Indian troops two sailing-vessels were fitted up as hospital " ships, and a large general hospital was established on shore for the reception of camp " followers, and one for a similar purpose was organized at Kumayli, at the foot of the " Pass.
- "In the Pass itself, 49 miles in length, three small hospitals, in charge of Staff " Assistant-Surgeons, were established for the reception of Europeans and camp followers " employed in the Pass.
- Depôt Hospitals. "On the highlands, one field and two depôt hospitals, with full establishment of " Medical Officers, and 1st and 2nd class servants were organized.
- "The 1st depôt hospital was established at Senafè, the 2nd at Antalo, and the field " hospital accompanied the advance column, and duplicates of those establishments " were organized for the native troops.
- "This, the original programme, was fully carried out; but circumstances subsequently " led to a much larger development of the depôt hospital system than was originally " contemplated, and the means at my disposal fortunately enabled me to carry it out to " the extent necessary to meet the requirements of the Service. In consequence of the " sick carriage having been reduced to one dhooly and two pad-mules per 100 fighting " men, the only way of meeting any difficulties that might arise in regard to the sick was " to organize depôt hospitals at the different posts on the line of route.
- "Thus in the 120 miles between Senafè and Antalo, one was established at Adigrat; " and in advance of Antalo hospitals were extemporised for the reception of both Euro- " peans and native sick at Dildi, north of the Wandatch Pass, at Sindee, on Wadela " Plain, and the last on the Talanta Plateau, on the right bank of the Bashilo.
- "The depôt hospitals were both convenient and useful; they relieved the advancing " column of a heavy encumbrance, and the sick derived benefit from the rest and comfort " of stationary hospitals.
- Field Hospitals. "For the attack on Magdala, the two field hospitals of the British and Indian Services " were reserved. These were efficiently equipped, and received the wounded on the 10th " and 13th April; and on the return march to the coast they picked up the sick of the " depôts established at 10 different posts on the line of 400 miles between Magdala and " Zula.
- Arrival at Zula. "The troops composing the force began to arrive in Annesley Bay early in December; " the 33rd, from Kurrachee, was the first European corps to arrive, and the 26th Came- " ronians the last.
- "With the exception of the 3rd Dragoon Guards, all the corps destined to proceed " beyond Antalo had arrived by the beginning of February.
- "A large camp was formed on the sandy plain at Zula, and for several weeks the " force assembled there was of considerable strength.
- "The conservancy of the camp was well attended to, dead camels and mules were " removed to a distance and burnt, offal destroyed, and the latrines kept in good order.
- Climate. "At that season of the year the climate of the lowlands, though at all times to " a certain extent enervating, was tolerably good, the nights were pleasantly cool, but the " mid-day sun was powerful, the thermometer rising to 85° and 90° in tents.
- Fatigue duties. "The fatigue duties were heavy and involved much exposure to the sun; large parties

“ were employed daily in various ways, such as pumping condensed water out of the tanks
 “ into the troughs, for watering many thousand horses and transport animals, removing
 “ sleepers for the Zula and Kumayli railway, &c. &c.

“ The health of the troops while encamped here was very satisfactory ; slight bowel Health at
 “ complaints were somewhat prevalent, especially among new arrivals. Zula.

“ These attacks were probably induced by exposure to the sun, and drinking too
 “ copiously of condensed water, which was sometimes rather brackish.

“ The great sickness and mortality which at first prevailed on the lowlands amongst Advance to
 “ mules and horses, caused the 3rd Cavalry and Artillery horses to be early sent up to the plateau.
 “ Senafè ; the European and Native troops soon began to follow, but at first in small
 “ detachments, on account of the scarcity of water and provisions.

“ At this early stage, the great difficulty was the forwarding to Senafè Com-
 “ missariat supplies in sufficient quantity to form a depôt there. While the road through
 “ the Kumayli Pass was being made, stores were forwarded from Zula to the foot of the
 “ pass on elephants and camels, and thence to the plateau by mules and bullocks.

“ Although great exertions were made in this way, no great amount of success was
 “ attained until the Pass was made practicable for wheeled vehicles.

“ On the 24th January, the first convoy of bullock carts, each carrying 750 lbs., left
 “ Zula for Senafè ; the experiment proved entirely successful, and from that moment the
 “ great difficulty of transporting supplies from the seaboard to the highlands was sur-
 “ mounted.

“ Convoys of bullock carts, and of Maltese carts drawn by Spanish mules, and of
 “ Shoho bullocks, were now leaving Zula daily, and a large Commissariat store was soon
 “ established at Senafè ; and from thence supplies were forwarded to Antalo, partly by
 “ our own transport mules, but chiefly by Abyssinians, who contracted to carry them on
 “ mules, donkeys, men, women, and children, at so much per package.

“ From January to March, troops were continually moving up to Senafè, and in the
 “ same manner passed on in succession to Antalo, which is about half-way to Magdala.

“ The first five marches to Senafè proved of infinite advantage to the efficiency of the Description
 “ advancing force, inasmuch as the difficult nature of the road through the Pass at once of route.
 “ tested the physical capabilities of the troops, and, enabled us to eliminate those who were
 “ sickly or unfit for hard work.

“ The mountainous aspect of Abyssinia was alone sufficient to convince anyone that
 “ none but men in the highest state of health were fit to campaign in such a country ; and
 “ the small experience already gained enabled Medical Officers to select from the different
 “ corps, as they passed through Senafè, 100 men, who were either sick, or too weak for field
 “ service. Those were left at the Senafè depôt, and, with others of the same class left at
 “ Zula, were eventually sent home by the overland route.

“ The Shohos, the Mussulman inhabitants of the country extending from the seaboard
 “ to Senafè, are a thin wiry people of middle stature, of Caucasian and not unpleasant
 “ features ; the hair on the sides of the head is worn in short corkscrew ringlets, and
 “ frizzled on the top of the head ; their clothing is a scanty calico garb, and personally
 “ they are extremely dirty.

“ The province of Tigré, the capital of which is Adoa, commences at Senafè, and
 “ extends to some distance south of Antalo.

“ At Senafè the first Christian village is seen. On arriving at Senafè, 7,400 feet
 “ above the level of the sea, a great change was experienced in the climate. In January
 “ and February, the nights were cold even to the freezing point, and the days were
 “ generally hot, the daily range of temperature often amounting to 45° and 50°.

" At Adigrat, 37 miles in advance of Senafè, a military post and a dépôt hospital were established. In this, the first section of the road on the plateau, the villages are small, and the houses constructed of stone and mud, and flat roofed.

" After passing Adigrat, the true Abyssinian type of house becomes universal, viz., circular walls of stone, or long reeds, and long conical grass roofs, resembling exaggerated bee-hives.

" The country between Senafè and Antalo is entirely volcanic, and either undulating or hilly, and always rocky and barren.

" Grassy plains were occasionally seen, and large herds of cattle. Scrub jungle, and the stiff candelabra-shaped kolquoll, a cactiform euphorbia, are seen on every mountain, while the mimosa, sycamore, cornida, wild olive, rose, and aloe, occupy the less elevated localities.

" At Senafè, a plentiful supply of good water was obtained by means of Norton's American tubes; but on the line of march to Antalo not a drop was procurable anywhere except at the encamping grounds, and then only in moderate quantity, from stagnant pools or ditches, for no wells were seen in Abyssinia.

" The advanced column arrived at Antalo early in March, and the head-quarters of the 3rd Brigade, a large central Commissariat dépôt, and dépôt hospitals for Europeans and Native sick, were established here.

" The European troops continued to enjoy a high degree of health, and after the weeding they had lately undergone at Senafè there were not more than 30 sick and weakly men to leave behind at Antalo.

" Bowel complaints, as heretofore, continued to be the prevailing disease, but few were of a serious nature.

" The country in the vicinity of Antalo was found so be more productive of supplies than any place we had yet seen; a market took place daily, and flour was purchased in considerable quantities. This proved of great service to us, and it was forwarded with our own imported provisions chiefly by native agency. Hitherto the laborious operation of road-making had been performed by the Native troops; but after passing Antalo the Europeans had to take their share of the work.

" The 1st Division, consisting of the 1st and 2nd Brigades of Infantry, Cavalry, and Artillery, comprised all the troops destined to proceed beyond Antalo.

" These now began to move forward, and the Commander-in-Chief left on the 12th March.

" Soon after passing Antalo the province of Lasta, ruled by Wagshum Gobazi, is entered, and there the mountains are higher, and the country more difficult and impracticable than any in Abyssinia.

" After crossing the Alaji and Debar Passes, both 10,000 feet high, Lake Ashangi was arrived at.

" This lake is a fine sheet of water, about five miles in length and the same in breadth, and surrounded by an amphitheatre of lofty hills. The depth of Lake Ashangi was ascertained to be 102 feet.

" The line of route then carried us to Lat and Dildi, where another military post was established, and where a dépôt hospital was likewise organized for Europeans and Natives, but fortunately there were not many of either class to drop here. At this post too the large reduction of camp equipage and personal baggage previously adverted to, took place, and from this point on to Magdāla no troops could have possibly been in lighter marching order.

" On the 26th March, the head of the column ascended the great Wandach range of

“ mountains, 10,500 feet in altitude, and about 80 miles from Magdāla. On attaining
“ the top of this Pass, a heavy storm of hail and rain took place, and in consequence of
“ the tents not having come up, through the slippery state of the steep ascent, the troops
“ were exposed to its fury during a long and bitterly cold night.

“ I may mention that the famous koussoo tree (*brayera arthelmintica*), one of the
“ Rosacæ, was seen here in great abundance, in the sheltered valleys on both sides of the
“ Wandach range.

“ The koussoo is a tall handsome tree, leaves light green, branches wide spreading,
“ and from the upper ones dry flowers of a brownish colour were seen hanging like
“ branches of blighted grapes.

“ The bark of the tree resembles the elm, thin, and peeling off in successive layers.

“ After passing the Wandach Mountains, the country beyond, and to within a
“ a short distance of Magdāla, was open, fertile, and comparatively level; but natural
“ difficulties of another description had now to be encountered, viz., the passage
“ of the formidable chasms of the Takazze, Jedda, and Bashilo Rivers.

“ On the 28th March, the Takazze was crossed by the leading brigade. The river
“ here, comparatively near its source, is but a small stream, but it afterwards assumes
“ very large proportions, and becomes one of the principal tributaries of the Nile.

“ The descent from the right bank is tolerably easy; the ascent of the left bank, on
“ the other hand, is excessively steep and difficult, and 2,700 feet high. On the face of
“ this our Pioneer Force constructed a narrow zigzag bridle path, three miles in length, and
“ by which the troops and baggage were enabled to ascend to the Wadela Plain. Our first
“ encampment on this plain was 10,450 feet above the level of the sea, and the cold at
“ night was very intense, 7° below freezing point.

“ During the progress of the Expedition through the province of Tigré and Lasta, Climate.
“ the climate proved very favourable to the health of the troops, though the nights were
“ often intensely cold, and the mid-day sun scorching hot. The daily range of tempera-
“ ture was so great that the nights might, without much exaggeration, be described as
“ Siberian, and the days tropical. Notwithstanding these great extremes of temperature,
“ the troops were very healthy, and this may be mainly ascribed to the remarkable dry
“ state of the atmosphere, and the fine climate of Abyssinia at that season of the year.

“ The long ascents and descents of mountain passes and formidable ravines were
“ excessively fatiguing, and demanded greater physical exertion and endurance than
“ British troops have probably ever undergone. The effect of this severe training was
“ shown in their increased capability of making long marches day after day with com-
“ parative ease to themselves.

“ At Sindi, on the Wadela Plain, another dépôt hospital was established, but
“ the health of the troops continued so satisfactory that the number of sick left here did
“ not exceed 20 Europeans, and about double that number of Natives.

“ It was about this point that we joined the King's Road, as it was called, the road
“ which Theodore's army had lately made for his big guns marching from Debra Tabor
“ to Magdāla, and on arriving at the great Jedda Ravine, we found on both sides of it
“ a well-made road, 30 feet wide.

“ The descent from the right bank was 3,000 feet, and very steep, and in the bed of
“ the river there were only a few pools of bad water. During the rains the Jedda is
“ said to be a large river.

“ The ascent of the left bank was 2,800 feet, and very steep, the distance from
“ the right to left bank was about 10 miles. The Talanta Plain, which commences
“ here, is about 12 miles broad, and extends from the Jedda to the Bashilo. The soil
“ is black, and the supply of water scanty and bad.

Scantiness
of supply.

" In consequence of the failure of native transport in our rear, supplies now began to run short, and the Force was delayed several days in this plain, until the natives were prevailed upon to bring in supplies from the neighbouring district.

" At this time the weather became sultry, and thunder storms, with heavy falls of rain, occurred daily.

" The duties of the troops, from the time they crossed the Takazze, were heavy, and outlying pickets without tents necessitated much exposure to rain. The camp followers were still worse off, as few of them had tents, or were protected from the weather in any way. Bowel complaints, produced by bad feeding, bad water, and exposure to rain, now became prevalent, both amongst Europeans and Natives. Fortunately the nights were less cold, otherwise the troops and followers would have suffered in health more than they did.

" Orders having been issued for crossing the Bashilo, the last dépôt hospital for the reception of sick and weakly men was established on the Talanta Plain, near the bank of the river; and early in the morning of the 10th April, the 1st Brigade descended to the Bashilo, and the remainder of the Force followed a few hours later.

" The descent to the river was 3,900 feet, and excessively steep. The road lately made by Theodore was wide and in good order. The river itself was a muddy stream, about 2 feet deep.

Magdāla.

" Magdāla is about 10 miles from the Bashilo, and the troops emerged from the latter by a valley leading to the highland. The stronghold of Magdāla consists of three high mountain forts; and, on approaching from the north, 'Fahla' is first come to on the right, then 'Selassie' on the left, and Magdāla itself is seen behind, and between the two more advanced posts.

" In the forenoon of the 10th, the 1st Brigade advanced from the Bashilo, for the purpose of making a close reconnoissance of 'Fahla,' and before which it arrived about four o'clock, after making a detour over a steep and difficult country in a very hot day.

" No sooner had the brigade arrived in that position than a battery of heavy guns opened fire on our troops. Theodore himself was on 'Fahla,' and directed their ineffectual cannonade.

" This preliminary operation was soon followed up by his troops rushing down from 'Selassie' and 'Magdāla' to attack us on the open country, and in doing so they bravely attempted to charge our guns and turn our flank; but the fire to which they were exposed from our rockets, steel guns, and Snider rifle was so deadly that, after a short resistance, the Abyssinian troops were completely beaten and dispersed.

" The loss which they sustained was calculated at 700 killed, and 1,200 wounded, including many of their chiefs and leaders. This was the first time that the Snider rifle had been tried against a living target; and in the opinion of everyone, it proved itself a very effective weapon. On our side only one officer and 19 rank and file were wounded, and of these six were British soldiers.

" This engagement disorganized the Abyssinian Army, and the King himself then saw the necessity for coming to terms with us, and with this view he despatched two of the prisoners into our camp to sue for peace. In reply, the Commander-in-Chief demanded the release of the prisoners, and the unconditional surrender of the King himself.

" The first demand was complied with. On the evening of the 11th, the English prisoners and German missionaries were released, and on the 12th the Foreign artisans and their families were sent into the British camp, making a total of 62 captives, including men, women, and children.

" 'Fahla' and 'Selassie' were soon after abandoned, and the greater number of Theodore's army laid down their arms. This army, together with followers (men, women, and children), assembled there, amounted to about 30,000 people.

" But the proud spirit of Theodore refused to submit to the conqueror, and he, with a small remnant of his army and a few desperate followers, shut himself up in Magdāla, and which was bombarded, stormed, and captured on the 13th.

" 'Magdāla,' in Abyssinia called an 'Amba,' or natural fort, is a flat-topped mountain 9,000 feet in height, the sides of which are precipitous basaltic rocks, varying from 300 to 700 feet high, and is a place of great natural strength, and accessible by a steep, narrow, and rocky path, which leads to an outer gate.

" After an hour or two of cannonading, chiefly for the purpose of breaking open the gate, the fort was stormed by the British troops, and the dead body of the King was found inside the second gate. He had often declared that he would not be taken alive, and, true to his word, he died by his own hand.

" In this operation against Magdāla, only one officer and seven men were wounded. Losses of European troops.

" On the two occasions, viz., 10th and 13th, in which our troops were engaged, the First and Second Field Hospitals were on the ground, and the wounded received immediate attention.

" In the fort of Magdāla there were about 1,000 huts or houses, and a large number of Abyssinian prisoners in chains, all of whom were immediately released.

" During the next four days Magdāla was occupied by a portion of our troops, and the remainder were encamped on the lower ground in front of 'Selassie' and 'Fahla.' In both situations water was procured from a great distance in small quantity, and of the worst conceivable quality. Forage and grain were equally scarce, and the troops had to submit to many privations.

" All the public property in the shape of valuables, books, and arms, having been collected, on the 17th the troops were withdrawn, and 'Magdāla, on which so many victims had been slaughtered, was committed to the flames, and now only remains a 'scorched rock.'

" The troops present at the attack were, in round numbers, 3,470, of which 1,726 were European, and 1,744 Native troops.

" The object of the Expedition having now been completely attained, the troops began their retrograde journey to the coast, by recrossing the Bashilo on the 18th April. Return of the Expedition.

" During the four weeks the Expeditionary Force was south of the Takazze, the troops were badly fed, chiefly or perhaps entirely in consequence of the failure of the native transport, by which supplies were intended to have been forwarded to the front from Antalo and intermediate depôts. During the time referred to the troops were almost entirely deprived of such necessary articles as sugar, rum, ghee, compressed vegetables, and limejuice. Biscuit and rice were issued occasionally. Scantiness of necessary articles of food.

" Abyssinian beef, which every expeditionist will remember to the latest day of his life, was excessively poor, tough, and hard; the ration of it was now increased to 2 lbs., and native flour, a mixture of wheat, barley, and bageree was generally issued. This was made into chupatties, and used instead of bread. 'Gogo,' or native bread, thick circular cakes, also made of this flour, was largely used by the troops, but it was insufficiently baked, and very indigestible.

" The part of Abyssinia through which the Expedition travelled was wretchedly poor, produced no vegetables; eggs and fowls were scarce and dear; milk and butter were occasionally procurable, and honey also; the latter was used as a substitute for sugar. Poorness of the country.

" Mutton was sometimes issued instead of beef, but less frequently than the flocks of sheep seen in the country would have led us to expect. The reason assigned for this was that the inhabitants of the country were unwilling to part with their sheep.

" Limejuice, on account of the scarcity of transport, was seldom issued to the troops on the advance to Magdāla; but from Takazze, on the return march, limejuice was issued regularly.

Sickness
increasing.

" The hardships of being restricted to such poor and monotonous fare as beef and flour was beginning to tell sensibly upon the health of the troops; bowel complaints were on the increase, and every man felt that he was losing substance; when fortunately the Takazze was arrived at, and the dépôt of Commissariat supplies found there gave new life to everyone.

" With better rations, and the luxury of a dram of rum daily, both European and Native troops rapidly improved in health.

" Muleteers, dhooly bearers, and other public followers who had been exposed to greater hardships than fighting-men, continued sickly, and as we came along large numbers were picked up at the dépôts, and carried on, for none could be or were left behind in the country. By the time the Expedition had returned to Senafè, on the 4th May, the sick in camp amounted to nearly 300, and of this number about three-quarters were Natives, chiefly camp followers.

" Though this (April and May) was the hottest season of the year, we found the climate delightfully cool and pleasant.

Supply of
water.

" In another part of this Report I have adverted to the scanty supply of water which the province of Tigré generally afforded. In Lasta, water was more abundant; small mountain streams were frequently met with, and the quality of the water was generally good.

" In the Wadela and Talanta Plains the supply of water was exceedingly scanty, and even worse in point of quality, I think, than in Tigré, while at Magdāla water was procurable with much difficulty, and the quality was abominably bad. It is true that every soldier was provided with a pocket filter, but I fear they were not made much use of.

Natives of
Abyssinia.

" Before taking leave of the highlands of Abyssinia, I may observe that the natives, though extremely poor and mercenary, were uniformly quiet and civil; they are proud of the distinction of being Christians, and never fail to display the blue cord which they wear round the neck, the emblem of their creed.

" In features the Abyssinians do not differ much from the Shohos, and, though the national costume—if it deserves the name—is somewhat different, they are equally dirty in their persons; and this will be easily understood when it is mentioned that their ablutions are only performed once a-year, viz., on St. John's Day.

Men.

" The men are of middle stature and thin, for I never saw a stout Abyssinian, or one even approaching to obesity; they either wear no beards, or short beards and whiskers; the hair short, or long and plaited in rows over the head, and tied behind.

" A pat of butter in process of liquefaction is often seen on the head, but whether it is put there for an ornament or useful purpose I never heard.

Women.

" The women, whose looks are passably good, wear the hair much in the same style as the men, either short, or more frequently, elaborately plaited.

" The leathern petticoat, so universally worn, though probably a durable one, is by no means a becoming garb.

Children.

" The child is always carried on the back with its small head projecting out of a leather bag. Abyssinians use animal food largely, both in the raw state, called

“ ‘brundo,’ and also cooked. ‘Gogo,’ a heavy kind of bread made of mixed flour, is eaten with butter and red pepper. The more aristocratic bread, called ‘teff,’ is light and spongy. This is also eaten with red pepper.

“ The national drink is tedge, a fermented liquor made from honey, and which is rather pleasant to the taste, something between cider and ginger beer. National Drink.

“ When the Force had returned to Senafè in the end of May, Kassai, Prince of Tigré, came from Adoa for the purpose of seeing the Commander-in-Chief, and our troops, &c.

“ This chief, who might have disturbed our communications in his territory where our line was weak, was now rewarded for his friendly conduct by receiving large presents of arms and ammunition, some mortars, and a battery of mountain guns.

“ Soon after the advance column began its retrograde march to the coast, orders were given for the re-embarkation of the stores and munitions of war which had accumulated at Zula, and the troops at that end of the line began to embark on the 15th May. Re-embarkation.

“ The European portion of the Force, consisting of four companies of the 45th Regiment, at Antalo; 26th Cameronians, at Adigrat and Senafè; and 5th Battery 25th Brigade, Royal Artillery, left early, and were amongst the first to embark.

“ The Magdāla troops marched from Senafè by column daily, and on arriving at Zula they went straight on board the transports allotted to the different corps. The embarkations were so expeditiously managed that the last European detachment, viz., the 10th Company Royal Engineers, embarked on the 5th June.

“ It was very desirable to get the troops away with the least delay possible, for the heat was then very intense. At Kumayli, at the foot of the Pass, the thermometer in tents stood at 114°, and at Zula at 105°. Heat apoplexy was of frequent occurrence amongst the shipping, and several soldiers were cut off by it.

“ A few Native troops remained some time longer to enable the Commissariat and Ordnance Department to remove the last of their stores, and on the 19th June, Zula was finally evacuated by the British.

“ Mr. Dufton, who was unfortunately killed by the Shohos in the Kumayli Pass, when returning to the coast with the Expedition, remarks, in his book of ‘Travels in Abyssinia,’ ‘Soldiers will not believe what a climate Abyssinia is until they have passed through the purgatory of the Lowlands, upwards and upwards, to the Paradise of the Highlands.’ While admitting the correctness of the above description of the lowlands, I am not prepared to endorse to the full extent the opinion expressed in regard to the highlands. At the same time, I have no hesitation in saying that the climate of the latter far surpassed our expectations. Remarks on the climate of Abyssinia.

“ Our experience of the climate extended over the cold and hot seasons, and, though the power of the sun is often too great to be pleasant, its influence appears to be modified by the great altitude of the highlands, inasmuch as it has not the same prejudicial effect on health that a tropical sun usually has.

“ I have already mentioned the great daily range of the thermometer in the cold months; but in April and May, which may be considered as the hot season, the range of the thermometer was much less, and the midday sun was not then sensibly hotter than it was in the previous months, when the nights were so intensely cold.

“ Our experience led us to the conclusion that Abyssinia was a very healthy country for Europeans, and this favourable opinion was formed, notwithstanding the hardships of making long and fatiguing marches, exposure to cold, rain, and sleet, and the habitual use of coarse and indigestible food.

Remarks on
the prevail-
ing diseases
and wounds.

" Fortunately our service in Abyssinia came to an end before the rainy season set in, but there was abundant evidence of the rainfall being very heavy, and, according to reports which we received, malarious diseases are then prevalent, especially near the great rivers.

" Our Abyssinian experiences did not bring us in contact with many of the dangers against which the Expedition had been duly cautioned.

" Wells were said to become a repository for the ova of certain insects, and further, that the water of wells was often impregnated with poisonous principles which exude from the leaves of plants hanging in the water. Such may be the case elsewhere, but we saw no wells. Flies were not unusually numerous, nor their bite particularly troublesome. Snakes were rarely seen, and the hippopotami were evidently afraid of British lion.

" The average strength of the British Troops of the Expeditionary Force during the 25 weeks they were employed in Abyssinia was 2,674; and as will be seen on referring to the accompanying Summary Sick Return, the total admissions into the hospitals on shore were 1,332, the latter being in the ratio of 49·81 per cent. to strength.

" The total deaths in the Force, including 12 which occurred amongst the transfers to the hospital ships, were 35, equal to a death rate of 1·30 per cent.

" I may observe that, though the figures above given show only the amounts of sickness and mortality amongst the European troops, yet there was a remarkable concurrence both in the prevailing diseases and extent of sickness and mortality between the European and Indian troops. The only notable difference was, that while the former did not suffer from scurvy at all, the latter did so, but not to a large extent.

" The prevailing diseases amongst the troops in Abyssinia were confined to fevers, chiefly intermittents, and bowel complaints; the former accounted for 260 admissions, or in the ratio of 19·51 per cent. of the total sick admitted, and the latter for 343 admissions, equal to 25·75 per cent. of the total admissions.

" It thus appears that to fever and bowel complaints were due nearly one-half of the whole of the admissions into hospital.

" It is impossible to state, with any degree of accuracy, what number or proportion of the cases of intermittent fever originated in Abyssinia, or where relapses of the disease previously contracted in India, from which every corps had come direct. It is probable there were many of both classes; at any rate, it is certain that the great extremes of temperature, cold nights and hot days, were eminently calculated to produce relapses of this disease. But the diseases of greatest prevalence and fatality in Abyssinia were bowel complaints, either in the mild form of diarrhoea, or dysentery. As already mentioned, 343 admissions were for bowel complaints, and of the 35 deaths from all causes that occurred in the campaign, 18 resulted from dysentery.

" I was not able to ascertain whether the natives of the country suffered much from bowel complaints, but the prevalence of this class of diseases was not confined to the European portion of the Force, for it was observed that the Indian troops were affected nearly in the same proportion. The only peculiarity worth mentioning regarding the dysenteric form of the disease, was the rapid progress of bad cases to a fatal termination, and in all such, dissection revealed ulcers in an advanced state of ephacelation.

" It seems probable that the prevalence of bowel complaints amongst the troops was attributable to a combination of causes, the more efficient of which were

" great alternations of temperature, bad water, and coarse and insufficiently-cooked food.

" *Tænia*.—That tapeworm is very prevalent amongst the inhabitants of Abyssinia Tænia.
 " is beyond all doubt, and they themselves believe that the great prevalence of this
 " parasite is due to one cause, viz., the habit of eating raw meat or 'brundo,' and this
 " opinion is corroborated by the fact of the European prisoners who indulged in this
 " habit having suffered from tapeworm.

" Raw meat, or 'brundo,' is eaten by every Abyssinian, either immediately after
 " the animal is killed and the flesh still warm, or when not more than 24 hours old;
 " meat that has been longer killed is cut up into long sausage-like strings, dried in the
 " sun, and afterwards cooked.

" Though a few cases of tapeworm occurred amongst the troops, it is doubtful that
 " they were contracted in Abyssinia; no doubt some length of time is requisite for the
 " development of the parasite; it is therefore possible that tapeworm may yet show
 " itself amongst the troops that composed the Expeditionary Force.

" The ova of tapeworm, which observers in India report having seen in ration beef
 " there, floating in a jelly-looking fluid, were not detected in Abyssinia.

" The ethereal extract of male fern, a liberal supply of which was sent to the
 " Abyssinian Expedition, on the recommendation of Professor Christian, of Edinburgh,
 " is certainly the most efficacious on the lininitic that I have seen used.

" *Insolatio*.—In the months of April and May, the heat at Zula and Annesley Bay Insolatio.
 " was very intense. Cases of heat apoplexy were of frequent occurrence amongst the
 " shipping in the bay, and two officers and six soldiers succumbed to it.

" *Wounds*.—The surgical history of the campaign is easily told. In the actions of Wounds.
 " the 10th and 13th April, two officers and 13 British soldiers were wounded; of the
 " former, one was slightly the other severely wounded; the wound which the latter
 " sustained was from a musket-ball, which passed through the left elbow-joint. An
 " attempt was made to save the limb, but the circumstances were unfavourable; the
 " daily marching and motion of the dhooly lighted up, after a time, inflammation in the
 " seat of injury, and it became necessary to amputate the limb.

" When this officer embarked for England, the stump, though not quite healed, was
 " doing well.

" One soldier was shot through the arm, breaking the humerus about the centre.
 " This case likewise did well. Another man was wounded in the head by a spear, and
 " three others were shot through the extremities by musket-balls.

" A memorandum will be appended to this Report, showing the sickness and mor-
 " tality in the Force during the entire campaign.

" *Invalids*.—333 men, equal to 12·45 per cent., were sent home; of this number Number of
invalids;
European
troops.
 " upwards of 200 were sent to England by the overland route, in the month of March,
 " and the remainder, consisting partly of corps returning to India, and partly of sick and
 " weakly men whose corps were going home overland, were sent round the Cape in one
 " of the hospital ships at the close of the campaign.

" The climate of Zula was so trying to health that every soldier who was sick or
 " too weak to proceed to the front, was sent away as soon as possible.

" A large proportion of the men thus sent home for change of climate will shortly
 " rejoin their corps.

" Before concluding this Report, I will add a remark or two about the hospital ships, Hospital
ships.
 " 'Golden Fleece,' 'Mauritius,' and 'Queen of the South.'

" These fine large steamers were fitted up in England for hospital ships in an

“ admirable manner, and the accommodation which they afforded was very good ;
 “ though reported to be capable of accommodating 420 sick in cots, and 184 in ham-
 “ mocks, the former number was quite as large as they could comfortably accommodate
 “ in a tropical climate.

“ The cots on the single tier and swinging principle is a great improvement on the
 “ bunks with which the hospital ships sent to China in 1859 were provided.

“ In the Abyssinian Expedition, the hospital ships were simply invaluable, and the
 “ sick had the benefit of everything that could possibly minister to their comfort.

“ As hospital ships now form an important part of the equipment of every expe-
 “ dition, I trust I shall not be thought hypercritical if I endeavour to point out in what
 “ respects these ships, in my opinion, were not altogether satisfactory. I am aware it
 “ can be shown that their ventilation was amply provided for by several distinct and
 “ separate systems, and no doubt it was sufficiently so for a temperate climate, but for
 “ an intensely hot place like Annesley Bay or the Red Sea, something more active than
 “ mere ventilation is required.

“ Punkahs agitate the air, but they alone are not sufficient, some kind of appliance
 “ is required that will produce a current of air (if cooled, so much the better) sufficiently
 “ strong and generally diffused as to make a decided impression on the feelings of the
 “ inmates.

“ An apparatus on the principle of the Indian thermantidote would have this effect.”

The following Memorandum shows the amount of Sickness and Mortality among
 the British Troops of the Force during the entire Campaign :—

Sickness and mortality among British troops.	Average strength		2,674
	Total admissions		1,332
	Ratio per cent. admissions to average strength		49·81
	Total deaths		35
	Ratio per cent. deaths to average strength		1·30
	Total invalided		333
	Ratio per cent. invalided to average strength		12·45

CASUALTIES.

Casualties.

Officers	.. {	Highlands	..	..	7
		Lowlands	..	..	4
	Total		..	..	<u>11</u>
Men	.. {	Highlands	..	..	17
		Lowlands	..	..	18
	Total		..	..	<u>35</u>

OFFICERS' Deaths, caused as follows :

Diseases.	No.	Remarks.	Officers' Deaths.
Dysentery Acuta	1	Accidental drowning. 1 accidental ; 1 suicide.	
Febris continua	1		
Apoplexia	1		
Morb. valv. cordis	1		
Hepatitis acuta	1		
Angina pectoris	1		
Emersio	1		
Insolatio	2		
Vulnus sclopetarium	2		
	11		

MEN'S Deaths.

Diseases.	No.	Remarks.	Men's Deaths.
Dysentery acuta	16	Suicide. Overdose of chlorodyne from private supply.	
„ chronica	2		
Febris intermittens	0		
„ remittens	2		
„ typhoid	1		
„ continua	1		
Paralysis	1		
Aneurisma	1		
Hepatitis acuta	1		
Nephritis	1		
Nephria	1		
Insolatio	6		
Vulnus sclopetarium	1		
Venenatio	1		
Total	35		

DISTRIBUTION of Casualties by Corps.

Corps.	Officers.	Men.	Distribution of Casualties by Corps.
Royal Artillery	1	5	
„ Engineers	1	2	
3rd Dragoon Guards	..	2	
1st Battalion 4th King's Own Royal Regiment ..	1	11	
26th Cameronians	..	3	
33rd Regiment	3	4	
45th Regiment	1	8	
Medical Staff	2	..	
Military Store Staff	1	..	
Veterinary Staff	1	..	
Total	11	35	

It would be tedious and unprofitable to enter minutely into the accounts of every transaction on board the hospital ships. The following report from Dr. Roch, in charge of the "Golden Fleece," will serve as a sample. It also will show the views of that officer with regard to improvements which might be made in hospital ships :—

Report of the Medical Transactions on board Hospital Ship "Golden Fleece."

Report by
Dr. Roch on
the hospital
ship
"Golden
Fleece."

Prevailing
Diseases in
December.

" On December 17, 1867, we opened hospital on board the 'Golden Fleece,' in Annesley Bay, Abyssinia.

" The prevailing diseases during the remainder of this month were bowel affections, principally diarrhœa, with two cases of dysentery. The attacks were mild in character, readily yielding to treatment, and their cause (*cæteris paribus*) may be imputed to drinking impure water.

" In the absence of the men's medical histories' sheets, some difficulty was experienced in selecting the cases which might be considered strictly sporadic, primarily contracted in the country without a constitutional predisposition to the disease, the result of former attacks in India or elsewhere; and in making the selection I have included the cases of dysentery with those of intermittent fever, as diseases in which a previous attack or attacks may be considered as acting the part of a predisposing cause, from the susceptibility of old healed ulcerations to re-open and disintegrate.

" This impression, whether right or wrong, is the result of personal observation at the *post-mortem* examinations of cases who have died of relapses of dysentery after an interval of years, where the old healed, thickened, ulcerated patches were found re-opened, and in some cases perforated, though the course of the fatal attack was in many instances remarkably short.

" For the sake of simplicity, the following tabular Form is adopted; and though strictly only intended to apply to intermittent fever and dysentery, the other zymotic diseases, where they occur, are for convenience noted in the same Table :—

Diseases.	Primary Attacks contracted in Abyssinia.	Had previously suffered in India or elsewhere.	Doubtful Cases.	Total.
Febris, inter.	..	2	..	2
Dysentery	1	1	..	2
Diarrhœa	3	2	..	5
Total	4	5	..	9

" The weather during this period was calm and fine, with occasional light northerly and north-westerly breezes, which generally commenced during the afternoon and died away towards evening.

" The average temperature in the shade, as registered by Fahrenheit's thermometer (taken in gangway on upper deck) was, at noon, 84.22°; at midnight, 81.66°.

" The temperature of the sea-water by the ship's side, was, from 15 feet to surface, 80° Fahr., containing 5 ounces per gallon of saline constituents, and boiling at 213° Fahr.

" *January, 1868.*—Of the three cases of dysentery shown as treated during this month, one only would appear to be a primary attack contracted in the country; the others were relapses of former attacks in India.

January.

" The majority of cases admitted were from the 33rd and 1st Battalion 4th Regiments, at the time in transports awaiting disembarkation, and were not contracted in Abyssinia.

" Six cases of ulcers of the lower extremities were treated during this month, and rapidly healed under the application of Condry's solution of permanganate of potass, in various strengths adapted to the condition of each sore. One part in eight of water was found most generally applicable.

" Occasionally the pure fluid was used instead of caustic to repress superfluous granulations, while sometimes one drachm to eight ounces of water was found to be conveniently strong.

" This is worthy of note, as some of the above cases, and many subsequently received, obstinately resisted treatment by other agents; and its adoption, at my suggestion, on board some of Her Majesty's ships of war then lying in Annesley Bay, was followed by the happiest results. A piece of lint saturated with the solution was applied to the sore, covered with gutta-percha tissue, and kept in situation by a roller which also gave support to the limb. Such was the mode of application adopted in the 'Golden Fleece.'

Diseases.	Primary Attacks contracted in Abyssinia.	Had previously suffered in India, or elsewhere.	Doubtful Cases.	Total.
Febris, int.	1	2	..	3
Dysentery	1	2	..	3
Diarrhœa	6	..	..	6
Total	8	4	..	12

" During this month, light north-north-easterly and north-north-westerly variable airs and light winds prevailed.

" The atmospheric temperature taken in the shade, in gangway on upper deck, was, at noon, 85·55°; at midnight, 80·12°.

" The temperature and density of the sea at the ship's side continued the same as that of December, viz., 80° Fahr.; the boiling point being 213° Fahr., containing 5 ounces per gallon of salt.

" February 1868.—The majority of the patients admitted during this month were composed of weakly men of the 1st Battalion 4th and 45th Regiments, on their arrival at Annesley Bay. February.

" Six cases returned under the head of phthisis incipiens were admitted amongst the above, and subsequently invalided to England *via* Suez.

" Of the five cases of dysentery noted as admitted during this month, but one of acute and two of chronic would appear to have been sporadic.

" One of the cases returned under the head of dysentery proved fatal in the short period of 42 hours. The patient, Private W. H., 45th Regiment, had on the 5th of this month a paroxysm of intermittent fever, and was sent on board the 'Golden Fleece' the following day, on the night of which he was seized with violent cramps, vomiting, and purging, quickly followed by collapse and death after the interval stated (42 hours).

" One case of typhoid fever occurred and proved fatal, in the person of Private W. O., 1st Battalion 4th Regiment, who was admitted, suffering from diarrhœa, on the 12th of the preceding month. He improved and continued convalescent until the 8th February, 1868, when typhoid symptoms developed themselves, with the characteristic

‘petæchia over the surface of the body. Peritonitis supervened, and the patient gradually sank until 11 P.M., 22nd instant, when he expired.

“The *post-mortem* examination disclosed extensive ulceration of the small intestines, with perforation at the lower portion of the ilium, which doubtless was the immediate cause of death.

“The only case of sporadic ophthalmia that came under my notice during the Expedition occurred this month, in the person of Serjeant R., Transport Train, admitted on the 26th instant.

“The disease was contracted at the Suru Pass, and is supposed to have been caused by exposure to wet, &c. The patient, still under treatment, was invalided to England *via* Suez, in the ‘Simoom.’

“The cases of intermittent fever and remaining diseases were not sporadic, the patients having contracted them in India.

Diseases.	Primary Attack contracted in Abyssinia.	Had previously suffered in India or elsewhere.	Doubtful Cases.	Total.
Febris, int.	..	13	..	13
Febris, typhoid	2	..	..	2
Dysentery	3	2	..	5
Diarrhœa	..	9	..	9
Ophthalmia	1	..	..	1
Total	6	24	..	30

“From the 1st to the 14th of this month, light airs, with variable north-north-west, north-west, and north-easterly breezes prevailed; and from this date to the 19th the weather was characterised by heavy squalls from the northward, with passing rain and lightning.

“The atmospheric temperature, taken in the companion, averaged, at noon, 78°44'; at midnight, 76°58'.

“The temperature, saline contents, and boiling point of the water by the ship's side, continued the same as in last month's Return.

March.

“*March*, 1868.—Seventeen cases of dysentery were admitted during the month, of which eight are recorded by me as sporadic, it not having appeared that they ever suffered from this disease previously.

“The others were contracted in the country, but had previously suffered from this affection in India. It was supposed to have been produced by the combined influence of insufficient rations, impure water, sudden transition from heat during day to cold during night, and exposure to wet, &c. Most of the cases occurred on the journey from Kumayli to Antalo.

“The great bulk of the patients treated during this month was composed of weakly men weeded from the various regiments destined to form the Advanced Force; and the entire number, 187; were sent in the ‘Golden Fleece’ to Suez on the 19th March, and proceeded to England in the ‘Simoom.’

Diseases.	Primary Attack contracted in Abyssinia.	Had previously suffered in India or elsewhere.	Doubtful Cases.	Total.
Febris, int.	..	..	30	30
Dysentery	8	9	..	17
Diarrhœa	11	..	..	11
Ophthalmia	..	..	5	5
Total	19	9	35	63

“ The average temperature in Annesley Bay, up to the period of our leaving it on the
 “ above date, was, in Surgery main deck, at 8 A.M., 80°; in companion on upper deck, at
 “ noon, 81·23°; at midnight, 79·34°. Calm, light north and north-westerly airs and
 “ breezes characterised this period, with an occasional light wind from the southward
 “ towards evening.

“ The temperature of the sea-water by ship's side, up to 19th instant, was 80° Fahr.,
 “ its boiling point 213·3° Fahr., and contained 5 ounces per gallon of saline ingredients
 “ as before.

“ April, 1868.—From the 19th March to the 19th April, the ‘Golden Fleece’ was April.
 “ absent from Annesley Bay, engaged in the voyage to and from Suez, where she was
 “ sent with invalids, remaining a short time to fill up with coals and water. This voyage
 “ was useful as testing by experience,—

“ 1st. The applicability of the newly-erected latrines for use at sea.

“ 2nd. The impossibility of cooking, in a tropical climate, for more than a
 “ limited number of men, with our cooking galley in its present position,
 “ viz., immediately in front of the engine-room and funnel.

“ 3rd. The advisability of having such coals chosen for hospital ships as will
 “ produce least smoke, or, better still, smoke-consuming furnaces.

“ We opened hospital again on the 26th of this month, from which date to its
 “ termination ten patients were received, eight of whom were discharged to duty, while
 “ two—one of chronic dysentery, and one of syphilitic rheumatism—remained as invalids
 “ to be sent to England, *via* Cape of Good Hope.

Diseases.	Primary Attack contracted in Abyssinia.	Had previously suffered in India or elsewhere.	Doubtful Cases.	Total.
Dysentery	..	..	2	2
Diarrhœa	1	..	..	1
Total	1	..	2	3

“ Light northerly and north-westerly airs and calms prevailed up to the 30th instant.
 “ The atmospheric temperature, taken in Surgery on main deck, averaged, at noon, 85°;
 “ at midnight, 84·5°.

“ The temperature of the sea-water by the ship's side was considerably raised,
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May.

“ registering 85° Fahr., the boiling point being 213·3°, and the saline constituents
 “ 5 ounces per gallon as before.

“ *May*, 1868.—From the 1st to the 31st of this month 78 cases were received, the
 “ prevailing diseases being dysentery (18), principally contracted on the march to
 “ Magdāla, and picked up by the returning column from the detachment hospitals.

“ The 12th of this month was characterised by the admission, from the Camp Zula,
 “ of the first case of ‘insolatio;’ and from the 26th to the 28th instant five additional
 “ cases occurred amongst ‘convalescents’ on board this ship, all proving fatal.

“ The increasing frequency of this disease induced me to write an urgent letter to
 “ the authorities, with a recommendation that the ‘Golden Fleece’ might be sent to sea
 “ for a few days, to cause a better circulation of air through her hospital decks. My
 “ recommendation was acceded to, and we left Annesley Bay on the morning of the
 “ 29th, returning on the afternoon of the 31st.

“ This had the effect of checking the disease, which did not again appear until the
 “ day before we sailed for England (4th June), when another case occurred, of which,
 “ together with the foregoing, mention will be made in special notes on this disease
 “ appended to this return.

Diseases.	Primary Attack contracted in Abyssinia.	Had previously suffered in India or elsewhere.	Doubtful Cases.	Total.
Febris, int.	..	..	4	4
Dysentery	..	..	19	19
Diarrhœa	7	..	..	7
Ophthalmia.. . . .	..	..	2	2
Total	7	..	25	32

“ From the 3rd to the 20th of this month dark gloomy weather prevailed, with occa-
 “ sional heavy squalls from the south-south-west, accompanied by forked lightning,
 “ thunder, and rain. These squalls generally set in soon after 4 o’clock P.M., and some-
 “ times lasted for some hours.

“ From the 20th to the morning of the 29th the weather became calm and cloudy,
 “ with an oppressive stagnant state of the atmosphere, and occasional light variable airs
 “ from the northward.

“ From the 1st to the 15th the average range of the thermometer, taken in the
 “ Surgery, was, at 8 o’clock A.M., 86·6°; and from the 15th to the end of the month a
 “ marked increase occurred, viz., at 8 o’clock A.M., 88·75°; at noon, 90·5°.

“ There was a corresponding increase in the temperature in the water at the ship’s
 “ side, which this month rose to 90° Fahr., at which it continued until we left Annesley
 “ Bay for England on the 4th of the following month.

June.

“ *June*, 1868.—From the 1st of this month to the date of departure from Annesley
 “ Bay, 63 cases were received on board, composed principally of patients transferred
 “ from the hospital ship ‘Mauritius.’ The aggregate of this number, with that of the
 “ admissions in May, amounted to 141, of which 119 were sent to England *via* the Cape
 “ of Good Hope, together with 15 of the Royal Navy, and 14 invalid officers (one of
 “ whom disembarked at Aden), a total of 148 invalids.

“ Of the casualties of the voyage, notice will be taken in a separate Return.

“ From the foregoing statement, the following statistical facts, as shown in appended

"Return, may be deduced, viz. : that of a total of 52 cases of dysentery treated on board this hospital ship during the Abyssinian Expedition, but 13 could be considered as primary attacks; and of 57 cases of intermittent fever treated during the same period, but one was a primary attack. Of nine cases of ophthalmia, but one could be considered as a strictly zymotic disease. Of the 49 cases of diarrhœa noted, almost all (38) were primary cases contracted in the country, from the impure water and vicissitudes of climate, &c.

"Both cases of typhoid fever were contracted in this hospital, and the most fatal disease we had to deal with was "insolatio." All the cases that occurred in Annesley Bay proved fatal.

"The average range of the thermometer was, at 8 o'clock A.M., 88·75°; at noon, 90·5°.

"Its appearance amongst the men was no doubt mainly attributable to the stagnant condition of the atmosphere at the time.

"In conclusion, I shall only observe that from the date of opening hospital in Annesley Bay on the 17th December, 1867, to that of our leaving it again for England on the 5th June, 1868, a period of over six months, 486 soldiers, 37 officers, 60 Royal Navy, and 27 Transport Service, a total of 610 patients, were treated on board the hospital ship 'Golden Fleece.'"

From the experience Dr. Roch had in medical charge of the 'Golden Fleece,' he submitted the following outline of what he considered a Model Hospital Ship :—

"The class of vessel best adapted for this purpose would appear to be an iron ship, not less than 10 feet between decks (*i.e.* between the upper and main deck), lined with wood on the outside down to the watermark, with a non-conductor of felt between the wood and iron, pierced along the sides with large square ports, 3 feet by 3 feet. Two large central ports on each side, flush with the deck, and sufficiently large (8 feet by 8 feet) to admit readily a wounded man on a hospital stretcher or dhooly, when raised out of a sick boat by a tackle. These ports should be furnished with gangways and ladders for the accommodation of the sick.

"The lesser ports should be furnished with slides—one for glass, the other for Venetian blinds—and should have side ventilators to catch the breeze from the bow.

"An iron ship is chosen as less likely to absorb and retain poisonous miasma or contagion; and lining the outside with wood, &c., will overcome the objection of the iron being the greater conductor of heat and cold.

"*Upper Deck.*—The upper deck should be furnished with nettings instead of bulwarks arising flush from the deck; or should bulwarks be deemed necessary for safety at sea, they should be so constructed as to be capable of being removed when at anchor, and nettings substituted in their stead, otherwise a great source of ventilation will be lost, and short ventilators rendered comparatively useless.

"The saloon and latrines of the officers constituting the staff of the hospital, together with those of the officers of the ship, should be on this deck if possible; or in the event of space not admitting this arrangement, I would recommend a portion of the bow or main deck to be fitted for this purpose, where I would also have any cabins for sick officers placed, viz., next in front of the sick soldiers, the object of this distribution being to obviate the danger of contagious miasma passing from the sick to the healthy staff of the hospital.

"Of the houses on this deck, the cooking galley for the sick should be the most forward, as from the number of diets to be cooked, and consequent fires necessary, the

" temperature rises to an extreme degree. (On board the 'Golden Fleece,' during the Abyssinian Expedition, in cooking galley it varied from 130° to 150°.)

" The cooking galley for the saloon, bakehouses for the sick and saloon, cooking galley for the sailors of ship, and wash-house for sick, should follow in rotation backwards towards the funnel,—the object being to place those deck-houses or galleys where the greatest heat is generated in the relatively coolest position.

Wash-hand
Basin.

" Wash-hand basins and waterclosets for convalescents and Army Hospital Corps should be placed one on each side of this deck. The latrines to overhang the water with a direct drop. Those on the leeward side to be used only.

Latrines.

" The advantages of overhanging latrines, contrasted with those constructed inboard, both for use at sea and in harbour, has been sufficiently proved by the experiments in the 'Golden Fleece.'

Main Deck.

" *Main Deck.*—For the hospital, one main deck running fore and aft, without bulkheads, ventilated and lighted from above by skylights, one on each side, extending the entire length of the deck, large enough to admit windsails when necessary, and fitted with sliding windows at the sides, same as for the ports; the top to be solid, capable of being raised to catch the breeze, or lowered in bad weather, and made available for seats when the patients can come on deck.

Quarter
Galleries.

" The "quarter galleries" to be used as latrines, so fitted as to overhang the water directly, and at such distance as to dispense with the necessity of pipes. Other latrines might be placed at the bows, of the ordinary description, supplied with water from tanks on deck. Any further waterclosets or urinals that might be deemed necessary should be placed as nearly as possible opposite the engines on each side, and an auxiliary engine should be fitted to keep them constantly flushed with water, and which might also be made available for turning a pair of 'thermantidoles,' one at each side of this deck, or for keeping 'punkas' in motion, should they be considered necessary. The baths for the patients should also be placed in this position, and should contain a constant supply, from the engine-room, of cold and hot water. This last is essential, as the coppers in cooking galley being almost always in use for the preparation of diets, there is often a difficulty in obtaining this agent when required.

Lower, Fore,
and After
Decks.

" *Lower, Fore, and After Decks.*—A portion of this deck (the lower after-part for instance) should be allotted as a hospital for the sailors of the ship, another part should be fitted for the Army Hospital Corps, and a portion for the sleeping berths of the petty officers and sailors of the ship.

Orlop Deck.

" *Orlop Deck.*—Portions of this space should be allotted for the various hospital and Purveyor's stores, ship's stores, &c.

" From this deck it is in my opinion highly essential that tube ventilators should be fitted as outlets for the foul air and gases which must arise from the stores, and for the escape of the heated air arising from the recently-filled water-tanks.

Water
Tanks.

" *The Water-Tanks* should be close to the bottom of the ship, and fresh-water condensers fitted of sufficient power to supply water at as low a temperature as possible.

" The tanks to be cased in wood, and fitted with air-tight manhole doors to prevent the escape of moisture, and air-pipes to open outside the ship, to let heated air escape as tanks become filled.

Bilge.

" *Bilge.*—There should be a free communication between all parts of the ship's bilge, and it should be so arranged that it could be flushed from either bow or stem, and pumped out as dry as possible. There should also be fitted along the ship's side a concave sheef or segment of a funnel, to prevent the bilge running up ship's side as she rolls, by throwing it back upon itself. This should extend the entire length of the bilge-well, and as far further as necessary.

Awnings.—Great care should be devoted to the proper adjustment of awnings for hospital service. They should be double, having separate ridge vosses; and when set they should be separated not less than 3 feet from the bulwark or outside edge, and not less than 4 feet at the centre, in order to permit a free current of air between them, either from the side, should the ship be swung across the wind, or fore and aft, should the vessel be lying head to wind.

As each upper and lower awning, from their great size, becomes unwieldy and difficult to take in, in the event of a sudden violent squall, not an uncommon occurrence in the tropics, I would suggest that each should be composed of separate conveniently-sized portions, fastened to sliding rings on their respective ridge-ropes, and so arranged at the centre with blocks, &c., as to be capable of being drawn together or 'brailed in' when occasion required.

All windsails and outlet shafts should open above the upper awning when practicable; and one of the Dantan fire-engines should be so fitted with a hose and rose as to be capable of damping occasionally the awnings, by which the temperature beneath would be reduced, and the dry parching nature of the atmosphere, often experienced in the tropics, to some extent mitigated.

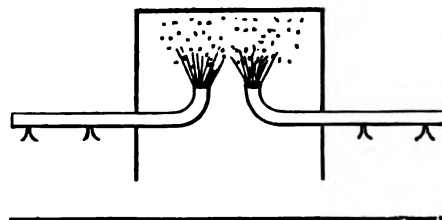
Ventilators.—In addition to the means already noted in speaking of the hospital deck, the following may be adopted with advantage as additional means of ventilation:—

1. Dr. Edmonds' ingenious and now generally adopted system, comprising the advantages of the heated coil and blast; but in constructing or surveying this apparatus, care should be taken that the steam supply-pipe leading from the boiler should be of sufficient area to supply with full effect its branches, viz., the blast and heated coil, it having been found, in the case of the 'Golden Fleece,' that a greater volume of air was eliminated when using the blast alone than when its strength was divided between the blast and coil, in consequence of the main steam-pipe not having been sufficiently large.

2. A modification of Dr. Edmonds' system might in some cases be adopted with advantage, dispensing with the heated coil by conveying a metal tube or shaft from either end of the hospital deck (main deck) along the ceiling to the funnel, one from the stem, the other from the bow, having openings at regulated distances fitted with two slides, one of perforated zinc, the other a plain piece simply to close the aperture altogether: thus all may be used open simply as free outlets, or the current might be modified by the use of the perforated zinc slides, or some might be closed altogether occasionally, which would have the effect of concentrating the draught at the remaining open ones, should such be deemed advisable.

As all hospital ships will require the condensing engine to be constantly at work, both for the supply of water and the other purposes already noted, there will always be a sufficient blast in the funnel to keep the above simple arrangement (a sketch of which is appended) in operation.

3. Tube ventilators, except as outlets, have in my experience not been so effective as windsails, perhaps owing to the greater height to which the latter can be raised, catching the upper current of air, as well as to the greater spread of their wings. The disadvantages arising from tubes passing into and through the hospital decks are a considerable loss of cubic and superficial space, leakage consequent on the decks being cut for their admission, &c.



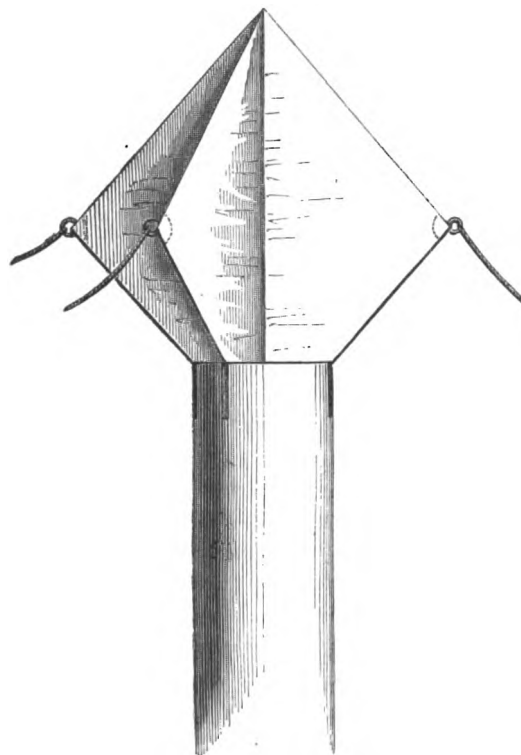
Tube Ventilators,

"Great inconvenience was felt from this cause in the 'Golden Fleece,' the water penetrating from the upper deck in spite of all attempted remedies, producing in bad weather a most unsanitary condition of the hospital, and destroying the bedding.

"The advantages of tube ventilators become therefore problematical, and the only portion of the ship in which their use is without doubt beneficial, is in the orlop deck, as indicated in my remarks under the head of 'Orlop Deck.' Tube outlet shafts should, if possible, open either above or between the double awnings.

Metal Deck
Vents.

"The short metal deck ventilators (Government pattern), as used in sick officers' cabins, 'Golden Fleece,' answer pretty well with nettings instead of solid bulwarks; but they would be much improved by the addition of a lip round the top, curving outwards and downwards (as recommended for the bilge well) to prevent the water splashing over while washing decks, and by increasing the length of the projecting cowl to prevent rain, &c., from entering.



Whitewash
and Paint.

"A nearer approach to a mushroom shape would in my opinion be an improvement. Windsails might with advantage be made to fit inlet tubular shafts, and to avoid the inconvenience of constantly resetting them. Self-adjusting windsails with four wings (a sketch of which is annexed) might be used for this purpose.

"*Whitewash v. Paint.*—The advantages of whitewash over paint, as a non-conductor of heat, are now pretty generally acknowledged; and experiments have shown a decrease in temperature, in favour of this agent in tropical climates, of 3° below white paint, of 7° below buff, and 15° below black.

"All hospital ships for tropical service should therefore be whitewashed on the outside; and I strongly advocate its adoption for the inside hospital decks, as more cheerful, cheaper, more readily renewed, and a more sanitary agent than paint.

"It was adopted with the happiest results in the 'Golden Fleece,' both inside and outside, during the Abyssinian Expedition, and greatly improved the light in, and cheerful

aspect of, both the officers' saloon and hospital decks.

"For internal use, it was simply prepared by mixing the lime with thickish rice-water, no size or other agent being used.

"Paint must be washed clean and free from grease before this wash is applied over it.

Matting
round Ship.

"*Matting round Ship.*—Bamboo matting was tried in the 'Golden Fleece,' projected on bamboos from the ship's side, as a sort of shade or verandah, but the result was not satisfactory. It was constantly getting smashed by sailing-boats coming alongside, and in high winds it was liable to be blown away altogether. A better mode of application, particularly in the case of wooden ships painted black, would be to have it tacked along the sides, leaving or cutting spaces for the ports, when it might be occasionally wetted with the hose, and thus act beneficially in cooling the ships in very hot weather."

A REGISTER of the Thermometer was kept in the Surgery on the Main Hospital Deck of the "Golden Fleece," and the following was the result.

Station.	Dates.	Therm. at 8 A.M.	Station.	Dates.	Therm. at 8 A.M.	Station.	Dates.	Therm. at 8 A.M.	Station.	Dates.	Therm. at 8 A.M.	Thermome- trical Obser- vations on "Golden Fleece" main-deck at 8 a.m.
<div> <div>Annesley Bay.</div> <div>Conveying invalids to Suez.</div> </div>	Mar. 1	76	<div> <div>Returning from Suez to Annesley Bay.</div> <div>Annesley Bay.</div> </div>	April 1	64	<div> <div>Annesley Bay.</div> <div>On a cruise at sea.</div> </div>	May 1	86	Annesley Bay.	June 1	89	
	2	78		2	63		2	87		2	89	
	3	80		3	60		3	85		3	91	
	4	79		4	60		4	87		4	91	
	5	81		5	56		5	86		5	91	
	6	82		6	55		6	85				
	7	82		7	59		7	86				
	8	78		8	69		8	87				
	9	79		9	68		9	84				
	10	79		10	67		10	88				
	11	76		11	63		11	89				
	12	77		12	63		12	88				
	13	80		13	70		13	88				
	14	81		14	75		14	87				
	15	83		15	79		15	87				
	16	83		16	82		16	90				
	17	81		17	84		17	89				
	18	84		18	82		18	88				
	19	83		19	85		19	89				
	20	81		20	86		20	89				
	21	82		21	88		21	88				
	22	81		22	89		22	89				
	23	76		23	86		23	89				
	24	75		24	83		24	88				
	25	75		25	83		25	88				
	26	68		26	82		26	89				
	27	67		27	84		27	89				
	28	66		28	84		28	89				
	29	65		29	85		29	89				
	30	63		30	86		30	89				
	31	67					31	89				
		77			72.2			87.7				90.2

The following was the Register of the Thermometer on the Companion Gangway of the same ship.

Observations
on the
Companion
Gangway,
"Golden
Fleece," at
noon and
midnight.

1867.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1868.				1			
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SECTION II.—INDIAN SERVICE.

As three hospital ships were sent from England for the use of European troops, the Government of Bombay decided upon equipping a hospital ship at Bombay for the use of native sick. This vessel was the "Star of India," of 1,045 tons, with a height of seven feet between decks, with a superficial space of 4,560 feet available between decks for patients. Another ship was afterwards also allotted for this purpose in Annesley Bay.

Hospital
Ships for
Native
Troops.

Medical comforts and medical stores were sent in accordance with Indian regulations, and the rank of the officers of the British and Indian Medical Departments regulated according to the following extract from the General Orders of the Government of India, dated June 6th, 1867 :—

"When troops are assembled for field service all medical arrangements, for the formation of dépôt hospitals, the supply of medical stores, the transport of the sick, &c., will rest with the medical officer of either Service, who may be specially appointed Principal Medical Officer to the Force."

Rank of
British and
Indian
Medical
Officers.

By the time Sir Robert Napier arrived, a general hospital had been established at Zula for the treatment of the sick from among all classes of camp followers. A Surgeon was in medical charge of this hospital, with two assistant surgeons, and a suitable establishment of hospital subordinates serving under his orders. Arrangements had been made to send, as soon as carriage and warm clothing were procurable, a Field Hospital Establishment, a Staff Hospital and Medical Store Dépôt, to Senafè, for the purpose of establishing another General Hospital for all camp followers at that post.

Medical
arrange-
ments on the
arrival of
Sir R. Na-
pier at Zula.

The sanitary arrangements at Zula had been satisfactorily carried out by Surgeon Lumsdaine.

Sanitary
Arrange-
ments.

There was a medical officer at each of the five posts between Zula and Senafè, three of whom belonged to the British Medical Service. Their duties were to attend to the sanitary state of their respective posts, and to give professional aid to any troops or followers who might be unable to continue their march.

The sanitary condition of the road was further provided for by the appointment of two Medical Officers of the Indian service to the duty of frequently patrolling the line of road between Zula and Senafè, to see that the bodies of all dead animals were removed and buried, or otherwise disposed of. One officer superintended the work between Zula and Upper Suru, and the other from that post to Senafè. They were each provided with tools, and as good a working establishment as was procurable.

At Senafè the sanitary arrangements were, in the absence of a special sanitary officer, performed by the Senior Medical Officer of the station.

The Medical Establishment of the Indian Service has been given at page 301. The medical arrangements generally have been shown in the preceding chapters, describing the march of the Force, and the following Report* from Deputy Inspector-General Pelly gives all the remaining information on record regarding the working of the Department in Abyssinia :—

Dr. Pelly's
report.

* Dated 27th August, 1868.

Number
treated.

“ The total number treated, as per my Returns, and including only those between
 “ Annesley Bay and Antalo, was 14,137. Deaths for the same portion of the Force, 284
 “ More than half the admissions were for five diseases, as follows:—

Diseases.

Fever	3,608
Dysentery	1,410
Rheumatism	1,271
Diarrhoea	881
Scurvy	584
	<hr/>
	7,753
All other diseases	6,384
As above	7,753
	<hr/>
Total	14,137

“ The deaths were as follows:—

Fever	70
Dysentery	32
Rheumatism	3
Scurvy	3
Diarrhoea	8
All other diseases	168
	<hr/>
	284

Causes of
disease.

“ The above admissions include of course those sent away as invalids; but the deaths
 “ only include those who died in the country. As yet I have been unable to ascertain how
 “ many died on the voyage to Bombay, or afterwards at the hospital establishments there
 “ for their reception; but the number must be very considerable, as during my stay there
 “ I heard of their dying often at the rate of six or eight per diem. Even these, when
 “ ascertained, will fail to give the total of deaths caused by the Expedition, as many
 “ invalids went to Egypt, Aden, &c., who will never be heard of again, and many of
 “ them preferred endeavouring to reach their homes on arrival in India to going to
 “ hospital. There were a large number of cases of ulcer treated, but many of these were
 “ included in the returns under the head of scurvy. This disease (scurvy), though seldom
 “ making the appearance as a purely primary disease, was by degrees extensively spread
 “ throughout the whole Force, notwithstanding that all available means were resorted to
 “ with a view of keeping it in check, so much so that serious complications of otherwise
 “ tractable diseases arose, and in many cases death, though not recorded under this head,
 “ was certainly hastened, if not caused by it.

“ The chief causes of disease were deficiency of suitable clothing and shelter, whereby
 “ the men, especially the followers, were exposed to cold and damp, and even to heavy
 “ rain as well as dew; scarcity of water, and that which was supplied being sometimes of
 “ unwholesome quality, as at Zula, from the holes in the Huddas River; food, which
 “ though generally abundant and good of its kind, was not of the nature and variety to
 “ which the men had been accustomed in the Bazaars of India; excessive fatigue and
 “ exposure to intensely hot solar rays; malaria; and overcrowding. To these may be added
 “ as predisposing to disease, debility, and a natural unfitness for service on a campaign;
 “ and, lastly, as tending to aggravate diseases which at first were of small importance,
 “ the intense clouds of dust which almost daily covered the ground between Annesley
 “ Bay and the mountains.

“ The diseases produced by the above courses presented no peculiarities which are not well known to the medical profession.

“ The Sanitary Department was very satisfactory, both at Zula and Kumayli, where thousands of animals were always congregated, and where the daily mortality was very large; the arrangements were so ably carried out that it was very rare for anything offensive to the senses to be left for any length of time where it could be an annoyance or source of disease; in the Passes, too, the arrangements were very well kept up under the vigilant supervision of Assissant-Surgeon Lalor, Sanitary Officer to the Force. This is the more creditable to the Medical Officers immediately concerned, as it could not have been effected without great and constant extra labour and exposure to the sun. Each Medical Officer in charge of a station being expected to ride six miles on either side of his post almost daily.

“ As regards the general plan of sanitation for the Force, the details were drawn out by Surgeon Lumsdaine, who was the officer first nominated ‘Sanitary Officer, I.M.D.’

“ The hospital ship ‘Star of India,’ though of undoubted benefit in some cases, was not found to be so generally useful as had been anticipated. This, too, not being in any way attributable to its construction or establishment, but simply to the strong prejudice entertained by the Hindoo portion of the Force to cooking on board, owing also to the difficulties raised regarding the supply of food to Europeans, whether officers or others, numbering, as shown above, 700 men, none could be admitted on board. All sick European officers and followers were therefore sent to the hospital ships provided for the reception of the British troops. The use of the ‘Star of India’ was thus restricted to the reception of Mahomedans; and to them, under the skill and good arrangement of Surgeon Partridge, the vessel proved of very considerable benefit.

“ His Excellency Sir R. Napier having issued an Order that all the sick who were not likely to become fit for duty in fifteen days should be sent out of the country, enabled the Medical Department to remove all chronic cases, and thus there was never at any time any approach to overcrowding in the hospital ship.

“ The above are extracts from a Report I am sending to the Inspector-General, Indian Medical Department. Should Lord Napier wish for the Report *in extenso* I shall be happy to furnish a copy. I think, however, unless a detailed account of how the several causes acted in producing disease is wished for, there is very little of importance in my Report besides the above.

“ The meteorological registers were kept by Drs. Cook and Nicolson. The latter died in the Red Sea, and I fear his registers will not be forthcoming. I saw the thermometer in the sun one day at 184°. It was often 104° in my tent before breakfast, and rose to 117° during the day.

“ I have ascertained the number of Native troops and followers invalided from Abyssinia during the late campaign. It is as follows:—

“ Native troops, 570. Followers, 5,486. Total, 6,056.

“ Of the followers, after leaving Zula, there died as the result of the campaign,—

“ In Bombay	171
„ Aden	5
„ Kurrachee and Kotree	53
	<hr/>
	229
Before reported	283
	<hr/>
Total	512

Deaths.

Meteorological register.

Numbers of Native troops invalided.

“ The above numbers, however, only give the deaths recorded in our hospitals ; but
“ it is far from improbable that many more occurred, both from among the 1,220 invalids
“ who went to Suez, as also from among those who returned to Bombay, but preferred
“ going direct to their own homes up country to remaining in the hospital established for
“ their accommodation at this Presidency.”

CHAPTER XXXII.

VETERINARY DEPARTMENT.

THE rank and names of the Veterinary Surgeons attached to the Force have already been shown.* The maximum number of animals under their charge was 51,000; the average mileage over which each Veterinary Surgeon had to do duty was 40 miles; and the number of animals in each Veterinary Surgeon's charge was about 5,000.†

Number of
animals.
Distribution
of Veterin-
ary charge.
Duties of
Veterinary
Surgeons.

The duties performed by the Veterinary Surgeons in Abyssinia were extraordinary, for not only had they to conduct their ordinary duties, but they had to attend to several kinds of animals, as well as to render professional aid to the sick animals, the property of officers and gentlemen attached to the Force.

The epizootic which raged so virulently at the commencement of the campaign, demanded the time and attention of every officer of the Department. The disastrous effects of want of food and water, together with excessive work, upon all transport and other animals, likewise entailed heavy additional work, which was at all times cheerfully undertaken.

The result of our veterinary experience, regarding the epizootic which prevailed during certain months of the year on the eastern coast of Africa, was considered satisfactory, inasmuch as it was proved that, with care, Cavalry and Artillery could be landed on the highlands of Abyssinia with only ordinary loss.

Veterinary
experience
satisfactory.

The casualties resulting from ordinary causes were few; those resulting from extraordinary causes were, on the other hand, numerous. The "extraordinary causes" were,—want of food and water, excessive and continued work, work at great altitudes, the epizootic disease.

Casualties.

Principal Veterinary Surgeon J. H. B. Hallen on the 4th May, 1868, recorded the following opinion as to the amount and nature of the work performed by the horses and mules belonging to the Force, the grain, grass, and water they had had, and also the effects both the work and forage had had upon the animals,—

Reports by
Principal
Veterinary
Surgeon
Hallen.

"1st. That the horses and mules (some of them whilst still suffering from the effects of the epizootic which prevails in the lowlands along the eastern coast of Africa) have had to perform extraordinary work almost ever since they were landed in Abyssinia,

Work.

* See Chapter VI, page 185.

† Principal Veterinary Surgeon Hallen's Report, dated 7th June, 1868.

"nearly five months since, by making long marches on account of the scarcity of water
 "in many parts of the country through which the Army has passed, by ascending and
 "descending mountains from 1,000 to 4,000 feet in height, very often over tracks difficult
 "even for man to travel over without falling, and so impassable for some animals that
 "they have fallen over precipices and been killed, whilst others have dropped down dead
 "from over exertion and sheer exhaustion, when endeavouring to continue their arduous
 "journey at great altitudes.

Forage.

"2nd. That grain and grass have been given to the animals to the fullest amount
 "procurable. Notwithstanding that fabulous sums were offered and paid for both, they
 "have been with such difficulty obtained that generally the horses and mules have been
 "on half rations of grain of indifferent quality and indigestible kind, and occasionally on
 "much less than half rations. The grass has not been obtainable in sufficient quantity,
 "and such as has been received has often been of bad quality, the animals having had
 "frequently to graze off the scanty herbage of the steep hills or parched plains.

Water.

"3rd. That the water found was on some occasions little in amount and of very bad,
 "indeed almost poisonous, quality; and when the Force was before Magdāla, the animals
 "were more than seventy hours without water, and during that time almost continuously
 "at work.

"4th. The effect of this very hard work and insufficiency of food and water is that
 "many horses and mules have died, and others became so diseased and crippled that they
 "had to be destroyed, from sheer inability to walk. Of the animals now remaining, nearly
 "all are suffering from the causes above detailed; and some will, I fear, succumb, whilst
 "many will, I believe, be permanently debilitated or incapacitated for further service."

The following Report is from the same officer on the subject of the epizootic disease
 commonly called African glanders, of which so many horses and transport animals
 died at the opening of the campaign:—

Report on
the epizootic
disease.

"The Danakil equine typhus fever is a disease of the epizootic class, at all seasons
 "prevailing on the eastern coast of Africa in the Danakil country, and from the coast
 "generally to the highlands. It assumes its most malignant form after the rains that
 "periodically fall, generally in the months of January, February, June, and July.

"The equine race is most subject to this fever, but it is said that cattle and camels
 "also are attacked with a disease similar to, if not identical with it.

Description.

"The fever is of a typhus type, associated with a highly depressed state of the nervous
 "system, at times of very malignant form and rapid course; at other times of a com-
 "paratively mild and protracted course. The circulatory system or lungs are the parts
 "generally involved during the progress of the disease, and in some cases the stomach is
 "found more or less affected. It is contagious, but not so contagious as might be
 "expected amongst the horses and mules of this Army, as they are of course kept in the
 "open; but probably the disease would be highly infectious amongst horses and mules
 "in a confined atmosphere. The period of incubation is from a few hours to twelve or
 "fourteen days.

Causes.

"The causes may be classified under the heads, exciting and predisposing.

"The exciting cause doubtless rests with some particular state of the atmosphere in
 "the localities where the disease prevails. It does not seem to be dependent on impure
 "water or bad forage, as animals solely fed on condensed water and the best imported
 "forage have become affected with the malady, and when contagion could not have been
 "the cause of the disease.