DOMESTIC.

EAST AFR. PROT.
UGANDA
GENERAL

No. 134

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Office or Individual

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1907.

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Last previous Paper.

(Subject.)

Italian Electric Transport Train

Transmits copy desp: from Military Attaché at Rome respecting and suggesting that such a train might be useful in Uganda & E.A.P.

Mr Antrobus (Minute.)

This invention seems to have hardly emerged from the experimental stage.

We might send a copy to Mr Pentlage & Mr [illegible] & the D.P.W. of Uganda & E.A. [illegible] who are on leave & ask for [illegible] views.

[illegible]

Tropical Africa is not [illegible] there is already [illegible] of these kinds [illegible] the money [illegible] [illegible]

other [illegible] have [illegible]
the [illegible]

W.A. Just.

WTD at [illegible].
5/11

WINCHESTER HOUSE,
ST. JAMES'S SQUARE, S.W.

190

The Director of Military Operations presents his
compliments to
and begs to

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Rome M.A.
2 450 07

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British Embassy,

R o m e .

15.12.1906.

Enclosure in Sir Edwin Egerton's No.220 of Dec.15.06.

From Lieut-Colonel Delme-Radcliffe, Military Attache.

To Sir Edwin Egerton, G.C.M.G., K.C.B.

Sir,

I have the honour to forward for your information and transmission to the War Office, the attached report on the Cantono Electric Transport Train.

It has been difficult to obtain some of the particulars and I regret that the report is not more complete. I hope however later on to obtain from the inventor himself more particulars and photographs and drawings to better illustrate the details.

I would beg to be allowed to suggest that the details of this train may be brought to the notice of the Foreign Office and of the Colonial Office. It appears to me, after several years service in countries where railways are scarce and metalled roads do not exist, that this particular Train has very many features marking it out as being likely to be of the greatest value in such countries. No doubt experience would show

that

[illegible] features might be improved upon for the special purposes of one region or the other. No doubt also the ingenuity of British Engineers will find means to effect the improvements which may be desired.

Throughout Uganda and British East Africa I believe that a train on these principles and built specially for the service would be of immense value.

A contrivance such as this certainly would, in the language of advertisement, "fill a distinct want" in those countries, to the great benefit of commerce, the revenue and the spread of civilization. It could be relied upon to work with regularity as the only vulnerable part, practically, is the petrol motor and good petrol motors nowadays may be relied upon if properly looked after.

If I might suggest it, an ideal use for such a train would be to maintain a service between Entebbe on Lake Victoria and Butiaba on Lake Albert. The road is quite good enough, though perhaps the bridges would require strengthening and the worst gradients on the portion between Hoima and Butiaba would require improving.

I have the honour to be,

Sir,

Your very obedient Servant,

(Sd.) C. Delme Radcliffe.
Lieut-Colonel,
Military Attache.

The Contono Electric Transport Train.

In 1901 Captain Doubet suggested the following idea:

"Let us take a generator of electric energy and place it upon an electric automotor waggon. Let us connect this waggon, with the source of energy, with other automotors by means of flexible metallic cables and we shall have a train similar to one which might be formed with a road locomotive; but with the difference that the successive vehicles would not be rigidly connected and with the advantage that each vehicle draws its own load; we shall have, in conclusion, a system of similar character but without its capital defects."

By this scheme each waggon would be supplied with all the elements of an ordinary independent electric waggon except that it would not produce power.

Each vehicle would have a driver who would start it and regulate the speed taking care not to exceed a certain distance from the preceding waggon. All the waggons could also be set in motion successively provided that the power required to move the whole train did not exceed the maximum required at the most difficult periods in the road. Hence it would only be necessary to take count of these periods to fix the potentiality of

of the main generating station, which consequently might be kept within fairly low limits.

The fundamental idea indicated above was made practical use of by Captain Cantono of the Engineers in the Italian Army. A train on similar principle seems to have been used in the Borax mines of Death Valley in California. Certain journals published in 1904 gave some particulars of this train.

In Captain Cantono's train the waggons, instead of being separated, are coupled to each other about 5 feet apart by a double tubular link held together by collars and end plates. Through the end plates a coupling pin is passed joining the link to the fork in front of each waggon. The links are strong steel tubes about 2½ inches in diameter. Through the tubes the electric cable passes and is connected with the motors on each front wheel stub - another cable between the tubes passes from waggon to waggon and is connected with the steering gear. By means of these connections the traction power for the whole train is divided equally among all the motors or at any rate so that the small differences in their working mutually compensate each other.

This also avoided the disadvantages of the flexible connection such as the increased space between waggons

[illegible] and the necessity for excessive watchfulness on the part of the drivers to keep within the limits of distance between the waggons.

The Daimler Operator consists of a four-wheeled waggon carrying a Fiat benzine, 4 cylinder, magneto ignition, 75 H.P. engine with honeycomb radiator and ventilating fan beneath the car. This ensures the cooling of the water even when the vehicle is motionless, or moving slowly.

There is also a ventilating fan attached to the roof at the front part of the car, for the sake of the men in hot weather.

The waggon also carries a 50 H.P. dynamo, an accumulator battery and 4 electric motors to act upon the wheels of the waggon itself.

The accumulator battery is divided into four sections; 2 are situated over the left wheels. The other two sections are at the rear end of the waggon. This arrangement is made to distribute the weight better. The right side of the car is reserved as a passage way for the man in charge of the engine.

The motor has a Canteno starting-gear connected with its main shaft.

The motor is attached axially, tandem fashion, to the dynamo by shafts placed on end and connected by

an

an elastic, [illegible] friction joint.

The generating dynamo has compound excitation in series and in shunt but, contrary to usual practice, the series circuit is wound in opposition to the shunt circuit. Hence the mechanic torque opposed by the dynamo to the motor which drives it remains roughly at a constant value, even when the intensity of the electric current rises to the point required to start the electric motors. From this on the tension of the delivered current decreases in proportion as the product of the current and the tension together varies within the limit representing the power transmitted by the benzine motor to the dynamo.

This diminution in power is on the other hand favourable to the gradual and smooth starting of the electric motors. Thus are avoided complicated controllers, difficulties in handling for the manœuvre charge and the necessity for [illegible] Therefore very [illegible]

[illegible] the dynamo [illegible] easily [illegible] a current [illegible] sity, the current may reach 400 [illegible] course a proportionate increase [illegible] tension [illegible] plate.

[illegible] this

This current passes from the dynamo to a controller from which two metallic transmitters issue which run the whole length of the train. One transmitter serves for the flow and the other for the return of the current. Between the cars, the transmitters pass through the tubular links which form the fixed connections.

The accumulator battery serves as a regulator and controller in one (which acts as a fly-wheel in mechanics) for the electric generating group. It is charged from the dynamo at the moments when all the current is not being absorbed by the electro motors. It may also be charged by the electro motors when the train is running on downhill sections of the road, that is to say when the electro-motors are not absorbing current, but, by the motion of the train, are producing it.

This battery serves to supply current when additional power is required to surmount steep slopes.

Each of the four wheels of the generating automobile is actuated by an electromotor. If desired the two rear wheels may be excluded and then the train is moved only by the front wheels.

Automotor-cars. Each one consists of an ordinary transport waggon in which a 6 H.P. electric motor is

applied to each front wheel, and a hand-brake to each rear wheel. The equal or different velocities of the two motors, and attached wheels, is at any moment determined by an electric steering-gear, which is worked by the driver in charge of every car. The driver's seat is on a little platform with a foot guard at the front of the waggon, and he has in front of him the wheel of the electric steering-gear, the lever for the three positions of the controller, and the pedal for the hand-brake.

Moving the wheel of the steering gear the driver can easily make the waggon follow the track of the car in front and also move it from side to side within the limits of the fixed connection between the waggons, that is to about ½ yard each way which is sufficient to enable crowded streets to be threaded or to avoid the ruts made by preceding vehicles.

The electric steering gear invented by Capt. Cantono has been used with the best result, with accumulator waggons and with an electric omnibus and has always proved itself to be reliable.

The turn of the wheel actuates, by means of a driving chain similar to that in a bicycle, a cogged gearing and crank which shifts a lever completing the circuit from side to side in the motors and admitting the current to either side as desired.

Its

Its object is to alter the current, running through all the electric motors, to be, at the will of the driver, admitted more or less into one or the other the motors and so to enable one wheel to be made to turn more rapidly than the other. These changes of direction require no effort on the part of the driver which would not be possible without the use of this steering-gear. It also allows the axles to be kept rigid, thus avoiding the necessity of using axle-spindles joined to the axle by rotation pins, as in ordinary motor-cars.

For this reason curved axles can be retained such as are used in horse vehicles. Thus the vehicle has all the characteristics of an ordinary waggon. Therefore, also, as the weight is only increased by 4 cwt by the transformation, the waggon can be easily dragged by a pair of horses during the operations of forming or breaking up a train whenever this may be convenient.

The [illegible] protecting the electro- [illegible] with the wh[illegible] [illegible] steel cast[illegible] dust and ir[illegible].

The ordinary turntables [illegible] waggon [illegible] retained and also the [illegible] horse [illegible] in case the [illegible]

Fig.

Capt. Cantone has invented a wheel of iron with raised rims between which lies a thin solid rubber tire and above this another outer tire consisting of several turns of a stout tarred hemp roping. The system is said to be very convenient and economical from the repairing and safety point of view. It has been used on an ambulance, but it is not used on the Transport train as at the low speeds of the train the metal tires are more practical and complicated wheels are unnecessary.

The train in Rome, which up to the present is the only one which has been constructed, consists of the Generating Station car or Engine car and 5 waggons. The Engine car, with its dynamo, accumulators, etc, was built entirely at the Army Engineers workshops in Rome. The electric motors were constructed in the Engineer workshops in Pavia. The waggons are simply the old Italian Army pattern springless transport waggons weighing empty 1 ton 4 cwt., transformed by the addition of the electric motors, transmission and steering gear. This is an addition of about 4 cwt to their weight. They are in all other respects unchanged. They can carry two tons each.

The Station car weighs 2 tons about and has been

...ch built of excessive strength with the experience gained with this first car to guide him. The inventor tells me that he could reduce the weight by 2 tons 16 cwt., or, keeping within the present limit of weight could have a very much more powerful generating station and accumulators. But a 160 H.P. motor would be used with the same dynamos and accumulators as now and the increase in weight as compared to the 80 H.P. motor would only be 1 cwt and the consumption of petrol would be about 40 litres per hour.

The first motor in use was only an ordinary four cylinder engine not designed in any way for the purpose it is applied to in this car. For a new station car a specially designed motor would of course be used and would give much better results. The inventor told me that he was strongly of opinion that power should be applied to all four wheels of the trailing goods waggons instead of to the front wheels only as at present. Not only would the train be much more powerful, [illegible] With the existing type of [illegible] the weight would be increased by 1 cwt. for the extra pair of wheels. The inventor states that the new type of Italian Army Transport [illegible] weighing 22 cwt., against 24 of the present one, and is much more satisfactory in his train but that he does not trust

construct a waggon of the same [illegible] nickel steel lighter [illegible] 16 cwt with 1 pair [illegible]rs. It might be convenient also on bad roads to increase the width of the tire tracks in proportion. [illegible] officers state that they think the present arrangement with 4 motors on the whole best as being the simplest and also that for military purposes it is more practical to have the train composed of units not heavier than the present Army Transport waggons loaded, and that heavier individual waggons and loads would be a mistake except where hard roads can be relied on. There is much to recommend this view. The train is designed solely to convey heavy military loads over bad roads. 4 miles per hour - average continuous speed - is guaranteed over roads of almost any degree of badness where it is possible for vehicles to progress at all. Gradients of 12 % with full loads are ascended perfectly easily. At very steep places some of the waggons might be detached and the engine go up with one waggon at a time.

The turning circle is small. The whole train can traverse on a radius of 9 feet. A road 21 feet wide allows the train to turn in the opposite direction with perfect ease. It was manoeuvred in this way in the Forestale Rome while I was on the train. The train is

kept in an empty balloon shed into and out of which it goes with its own power, coiling up like a snake in a very small space inside.

25 litres of petrol are consumed per hour with full loads. The cost in Italy is therefore about 12/- per hour. The price in England for petrol would reduce this to about 6/- per hour. This works out to, roughly, 1½d per ton-mile with a full train of 6 waggons. There are no other expenses except trifles for lubrication, etc. A skilled chauffeur is required in charge of the Station car, one man to watch the engine and a driver on each of the transport waggons. The latter need not be skilled men and can be taught in an hour to steer the waggons.

In addition to the capabilities of the Generating Station car for Transport purposes, the inventor pointed out that it could be made use of for numberless other military objects. It has been used to supply current for enough arc lamps for a large camp and can keep five 60 ampere search lights at work simultaneously. The power can be used for cutting timber, hauling on harnesses, pushing heavy road-making rollers, and in many other ways.

In case of an accident to any of the motors, the pair can be cut out and the train continue as before only in this case the work of the steering gear

if the waggon without power would be heavy for the man in charge and he would require relief occasionally. The whole train can be driven without any men in charge of the Transport waggons by attaching the cars to each other as in the Renard system but this is very much inferior as the cars cannot be independently steered.

With a good petrol motor in the Station car the risks of breakdowns are very small. The chief point to direct attention to is the perfect lubrication. The electro-motors, the dynamo and the accumulators are almost invulnerable. On first looking at the train the tubular link connection between the waggons seems very weak but it is stated there is little or no strain at pulling or compression on the link and that there is no risk of their breaking. Being made of strong steel they are capable also of resisting much more than their appearance would lead one to suspect. The criticism made of weakness in this respect is not well founded. In constructing a new train with special material and arrangements throughout, the links and gear under the waggon bodies would be kept well off the ground - probably higher wheels would be used throughout.

Other Governments - notably the German - are making enquiries considering this train. Krupp's works

are endeavouring to procure a train for conveying guns and ammunition, etc. about their practice grounds. The inventor however states that he cannot attend to the business of contracts etc; until the big works he is building are completed.

The price of a mobile Power-station can be puts at about 25,000 to 30,000 lire (£1,000 to £1,200) and each transport waggon would cost about 8,000 to 10,000 lire (£320 to £400). The nickel-steel waggons referred to above would cost, of course, considerably more.

(Sd) C. Delme-Radcliffe.

Lt.Colonel.

Military Attache.

Rome.

15.12.1906.