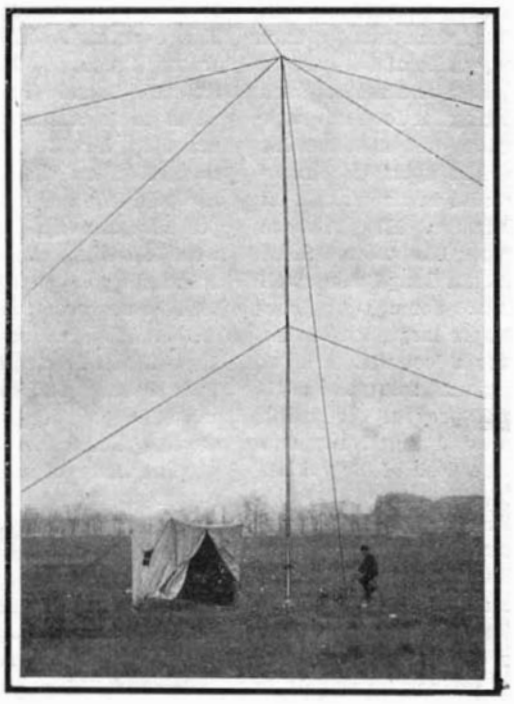
A MILITARY WIRELESS TELEGRAPH EQUIPMENT.

BY A. FREDERICK COLLINS.

The importance of wireless telegraphy in the game of war has been amply demonstrated in the past, especially in the Russo-Japanese conflict, and as a result of its acknowledged strategic value in military and naval operations, the powers of the world are alert for new suggestions in this regard, and are constantly testing improved methods and systems.

The first attempt to employ wireless telegraphy in actual warfare was made very early in the beginning of the art by Marconi, who at the request of the British War Office designed some special sets of instruments capable of withstanding rough usage for the British-Boer war. It was the intention of the War Office to establish wireless communication between the base of supplies and the railways, but when the inventor's assistants arrived at the scene of action the officers were exceedingly anxious to have the apparatus sent to the front, for it was fully realized that such service would prove exceptionally advantageous, for here was a factor that was wholly unknown to the Boer commanders. The operators and the equipment arrived in South Africa in December, 1899, and were subsequently conveyed to De Aar, where one of the stations was to be temporarily located; but it was soon found that no arrangements had been made to supply the mast, and as the country at that point was quite barren of trees the means for elevating and sustaining the aerial wire was not forthcoming and the whole project was about to be abandoned. Major Baden-Powell saved the day by suggesting the use of kites, and with Capt. Kennedy's aid he constructed a number of these devices and communication was finally established.

The transmission, however, was not wholly successful, for the wind was variable and constantly shifting, and under these conditions it frequently occurred that when there was a dead calm at one station there would be a gale blowing at the other, with the result that the kites could not be flown at either place; on the other hand, on days when the atmospheric conditions were such that the kites could be raised and maintained, messages could be easily sent and received between the De Aar and Orange River stations, a distance of 70 miles. The lessons taught by this experiment stimulated Marconi to design an outfit that would eliminate the troublesome aerial, and this he did by substituting for it a metal cylinder twelve or fifteen feet in height; this cylinder was mounted on top of a petrol-driven automobile and was so arranged that it would lie flat on the roof of the machine when it was being transported across the country. With this form of apparatus and aerial, he was able to transmit messages a distance of about 20 miles.



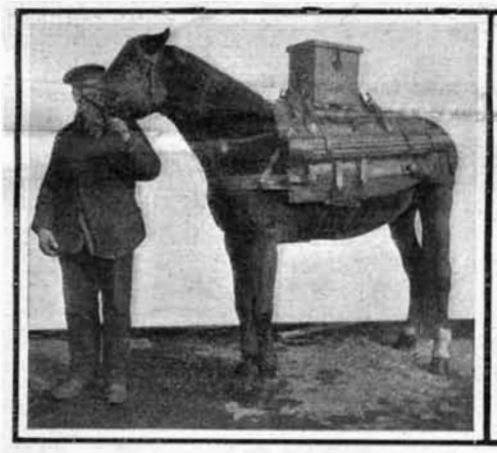
The Complete Field Equipment Installed.

The Sending and Receiving Apparatus.

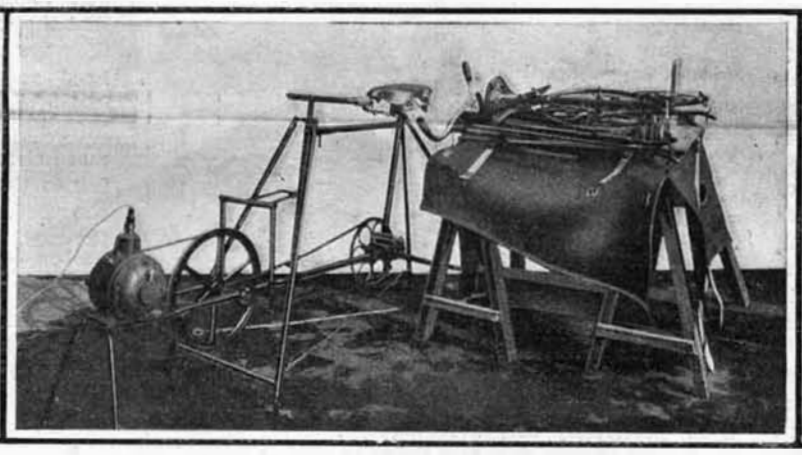
In 1902 the Braun-Siemens & Halske Company designed a wireless telegraph equipment for the German army maneuvers, and this was placed in charge of the Royal Military Airship Battalion. The instruments of this portable military outfit were similar to those of the stationary sets then manufactured by the above company in so far as the transmitter and the receptor were concerned, and these were mounted on regulation gun carriages. The transmitter consisted of a small gasoline engine, belted to a dynamo. The latter supplied the energy for operating the induction coil, and these appliances, together with the accessories, were affixed to one of the gun carriages and formed the transmitting unit. The receptor embraced a coherer, relay, tapper, and Morse register, and these were likewise mounted upon a second gun carriage and formed the receiving unit. The carriages were placed in tandem and drawn by six horses.

A valuable addition to the equipment was a small hydrogen balloon for elevating the aerial wire in calm weather, and this permitted the telegraph to be operated on days when light airs prevailed. The gas for inflating the balloons was compressed in cylinders and carried on the carriage with the receiving apparatus.

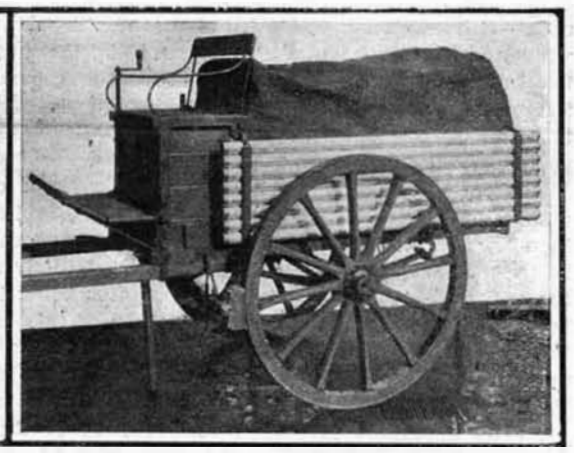
During the trials of this portable apparatus, which were witnessed by the German Emperor, forced marches under the strenuous conditions of actual warfare and hard runs across country at breakneck speed were made. These tests were so successful that a large number of the outfits was purchased by the Russian government and used during its recent war with the Japanese. Since this memorable conflict many changes have been made in the design of wireless telegraph apparatus, and much that was considered good practice then is completely out of date at the present time. One of the requirements for a military set of instruments is that it shall be readily transportable so that it can follow the movements of the troops in the field, and it must furthermore be possible to carry it on the backs of horses or even by the soldiers should occasion arise for such transport.



The Receiver and Accessories Packed Upon a Horse.

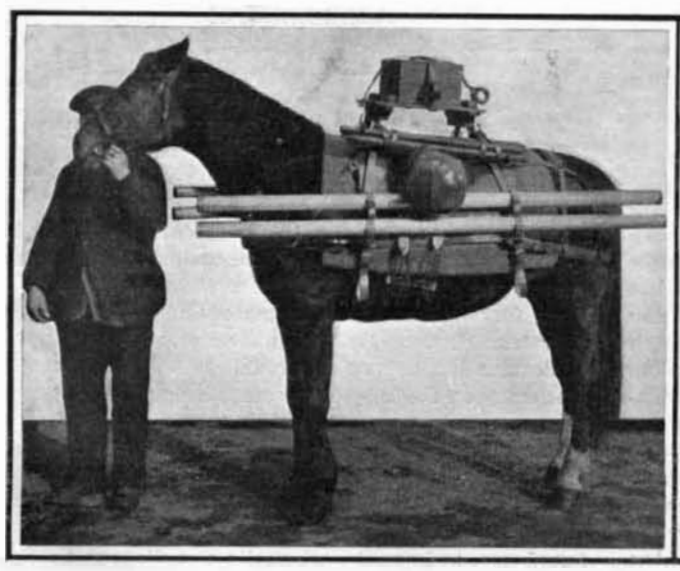


The Pedal Motor Generator Set, Showing the Outfit Ready for Use and Packed for Transport.

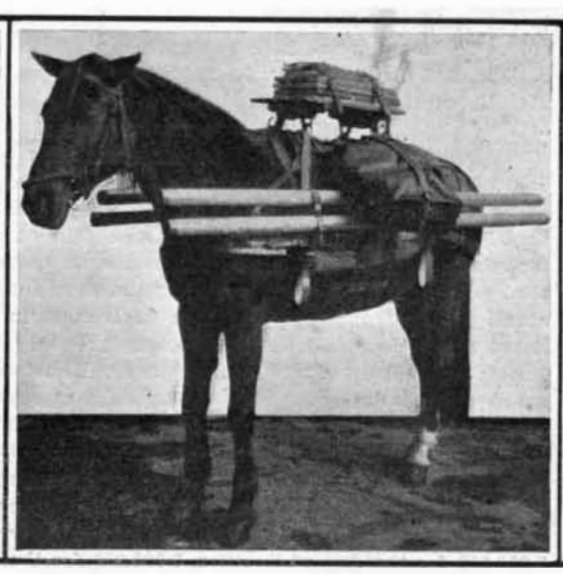


The Apparatus for Two Stations Packed Upon a Cart for Field Service.

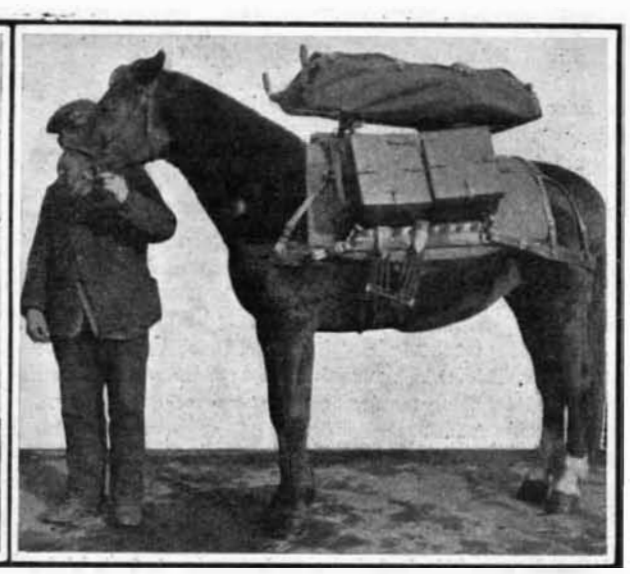
While kites and balloons are still used in the army for wireless signaling, both are hardly satisfactory in actual warfare, for the former require almost constant attention, and both, if carried to any considerable height, will expose the position of the troops to the enemy; hence masts are usually preferred if the range to be covered is not too great. Again, gasoline cannot always be obtained for the engine, and consequently another means of generation is desirable.



The Transmitter and Accessories Packed Upon a Horse.



Knockdown Stand and Aerial Wire Equipment Mounted Upon a Pack-Horse.



Pedal Motor Generator Ready for Transport Over Rough Country.

A MILITARY WIRELESS TELEGRAPH EQUIPMENT.

These untoward features led to the design of the sets by the Telefunken Wireless Telegraph Company, of Berlin, in which light, jointed metal masts are used instead of kites and balloons, manually-operated dynamos are employed instead of motor-driven generators, and auto-detectors and telephone receivers are substituted for the old-style coherers and Morse registers.

The new type of portable sets are especially useful for cavalry and infantry scouting service, as well as on the fighting line. The source of energy consists of a small direct-current, shunt-wound dynamo geared to a pedal arrangement and attached to a bicycle frame; it is made up of ten pieces and can be put together in five minutes. One man can easily drive the dynamo at a speed of 1,300 revolutions per minute, when it will develop one ampere at 45 volts. The driving gear and the dynamo complete weigh about 100 pounds.

The transmitter comprises the dynamo with a pilot lamp, the induction coil with its interrupter and condenser, a plug switch, and a Morse key, while the closed oscillation circuit includes the spark-gap, Leyden jar condenser, the secondary of the induction coil, and a tuning inductance coil. Finally, the open oscillation circuit is formed of the aerial wire net, a counterpoise net, or artificial ground, and an extension coil. The weight of the transmitter with its interrupter and condenser is less than 73 pounds.

The receptor includes the aerial wire systems, an oscillation transformer, an adjustable condenser in series, and an electrolytic detector with a fixed condenser in parallel. In the internal circuit there are inserted three choke coils, a head telephone receiver, an adjustable resistance, and three or four dry cells. The conductors leading to the high-frequency circuit are insulated with especial care and are silver plated to reduce the losses by damping to the greatest possible extent. The receptor weighs complete about 22 pounds.

The mast is made of magnalium, is 50 feet in height, and is built up of eight sections each of which is 6.25 feet in length. This carries an aerial wire net formed of six phosphor bronze stranded wires 8.25 feet in length. When set up, the mast is insulated from the earth and serves as a conductor to carry the high-frequency currents to the aerial wire net.

The counterpoise, which is the equivalent of the usual earth connection, is formed of six radiating aerial wires and is attached to a ring surrounding the mast but insulated from it three feet above the ground. The mast weighs 73 pounds and the aerial wire system weighs 110 pounds. The total weight of the equipment is about 440 pounds.

The portable station when set up has a range of over 30 miles across level territory or about 18.5 miles in a mountainous country; the entire apparatus can be packed in a two-wheeled transport cart, if desired, the entire weight of the cart and apparatus being in the neighborhood of 1,900 pounds. This cart is intended to carry the apparatus for both stations to a point where the officers in command have taken up their position and where the first station is to be set up. The apparatus for the second station is then mounted on the pack saddles of horses which advance with the troops. The entire weight carried on each horse does not exceed 110 pounds.

A field staff of seven men is required, an officer, a non-commissioned officer, and five men for erecting the mast and two men to hold the horses. The entire station can be erected in twenty minutes, and then one man is sufficient to operate the transmitter and receptor, while two men are needed alternately to drive the pedal dynamo. Should the infantry use the equipment and the nature of the ground will not permit the apparatus to be moved by horses, bamboo frames are provided from which the heavier parts are suspended, and these are carried by eight men.

NAOSAURUS: A FOSSIL WONDER.

(*Continued from page 368.*)

perhaps the high back crest resembled the branches of some shrubs then growing, and served to conceal the animal in a bushy region, affording a sort of protective covering and hiding place to screen him from sight when pursued by enemies. Then, again, it is thought that the lofty fin may have been employed at times as a sail, whereby the creature navigated the Permian lakes; the latter, however, is not to be taken seriously.

There is absolutely no plausible theory or definite use known for this back elevation; it may have been employed in some manner as a means of defense and protection against the attacks of adversaries, who nearly always pounced upon the back of their victims, or possibly it was an ornament simply. It is believed that Naosaurus was one of the dominant and most formidable monsters of his time. The specimen here pictured was 8½ feet long and nearly 4 feet high. While his habits are not fully known, yet from the structural make-up of the skeleton it is thought he was an awkward, slow-moving creature with a small brain, his actions being chiefly automatic, reflex, with little or no intelligence and cunning. It is probable that the animal could not raise his body far above the ground, and moved or crawled along after the fashion and gait of a crocodile. The tall spines were most likely covered with muscle or membrane. The feet were supplied with sharp claws, two inches long. The head was enormously large in proportion to the body. The legs and neck were short, the tail exceptionally so, being 2½ feet long. The hind feet were smaller than the fore feet which is just the opposite of the case in modern lizards. The eyes were large and set far back near the top of the head. In foraging for food the rapacious lizard was not a vegetarian, but satisfied his appetite and waged constant warfare upon the numerous animals of his day, which varied in size from that of a salamander to a Florida alligator. His jaws had an extensive battery of sharp tiger-like teeth. Some of the front tusks, nearly 3 inches long, were well adapted for his flesh-eating habits. Some of the contemporary animals, like Eryops, were large, with broad flat heads, 20 inches long and over a foot wide; one of these is here shown. This giant salamander is thought to have formed the chief prey of the lizard. The sharp tooth mechanism indicated that Naosaurus probably tore off and swallowed the flesh of his victims whole without chewing.

Prof. Osborn, in a forthcoming Museum Bulletin, devoted to a preliminary technical description of the present skeleton, says: "The reader will, therefore, thoroughly understand that the assemblage is largely composite. It serves, nevertheless, to give us for the first time an adequate conception of the unique and imposing characters of these great extinct forms. It is probable that Naosaurus was a somewhat more robust animal, but otherwise much like Dimetrodon. The limbs and feet used in this assemblage may fairly represent Naosaurus, but more probably belong to a large species of Dimetrodon. We are struck by the enormous and powerful head, which was supported by ligaments attached to the stout neural spines of the anterior cervical dorsals; the elongated back, from which radiate like the rays of a fan the greatly elongated neural

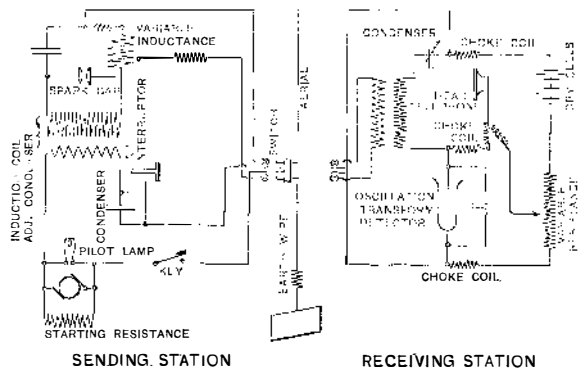


DIAGRAM OF THE WIRELESS APPARATUS.

spines, the transverse bars of which suggested the name Naosaurus or 'ship lizard' to Prof. Cope. Anteriorly the spines almost overhang the back of the head, posteriorly they are sharply retroverted into a horizontal plane. The fore limbs supported by a very powerful shoulder girdle, with relatively large and more powerful hind limbs. The horizontal position of the humerus and femur and the sharp angulation of the ankle joints are conditioned by the peculiar position of the articular facets. The pose is taken from a careful study of some of the existing lizards. The skull is modeled from a comparative study of several Pelicosaur skulls in the American Museum, with the assistance of one loaned by Prof. S. W. Williston from the University of Chicago. It is probably substantially correct. The neural spines of the anterior dorsals are directed upward, and partly expand at the extremities to support the stout ligaments attached to the occiput of the skull. As we pass backward the spines become more slender and assume a vertical, an oblique, and finally a curved retroverted position, horizontally overhanging the sacrum and anterior portion of the tail. The vertebral formula is approximately: Rib-bearing cervicals, 5; rib-bearing dorsals, 19; sacrals, 5; caudals, 25."

For want of a better descriptive word the term "fin back" has been employed to designate this animal, though in a somewhat misleading sense, as the only similarity to a fish's fin is one of appearance, and not at all in construction. This high back crest in the lizard was undoubtedly a rigid and bony growth. Both Naosaurus and its allied contemporary, Dimetrodon, stand out absolutely unique as the only representatives of the whole animal world possessing this astonishing and immense growth of the spines.

In estimating the age of this creature according to geological reckoning, figuring the Permian epoch as half of the Age of Amphibions, viz., 2,500,000 years, 7,000,000 for the Age of Reptiles, 3,000,000 for the Age of Mammals (the 50,000 years of the Age of Man being negligible), it is probable that Naosaurus trod the primeval lands and roamed around the shores of the great Permian lakes of Texas about 12.000,000 years ago. This animal therefore flourished millions of years before the huge dinosaurs like Brontosaurus and others became dominant in the Age of Reptiles, being twice as old as the latter, and five times older than Eohippus, the little catlike four-toed horse of the Lower Eocene Age of Mammals. The Wichita Red beds of northwest Texas, in which the ancient remains of this land vertebrate were found, attain a thickness of 2,000 feet. The Permian beds are said to extend for 600 miles across Kansas, Oklahoma, Indian Territory, New Mexico, and Texas. The reader's special attention is called to the splendid and ideal front page drawing, executed by Mr. Charles R. Knight, who is universally recognized as the leading artist in this country in the painting and modeling of extinct animal life. The probable life appearance of this remarkable animal, with its high, sail-like fin or armored crest, characteristic pose, etc., is strikingly portrayed. The external shape was completed only after very careful and critical examination of the skeleton and its structure, as well as other related forms, under the direction of Prof. Osborn, and consequently is based upon accurate scientific points. Both the painting and clay model of this and other animals, however, represent the present state of paleontological knowledge known in regard to them, and are subject to modifications and changes by future discoveries. The writer acknowledges his indebtedness to Prof. Henry F. Osborn for special courtesies extended in obtaining illustrations and material for this article.

Is There Water on the Moon?

Some striking photographs made by Prof. W. H. Pickering of the volcanoes in the Hawaiian Islands serve to point out certain characteristics which they have in common with the craters on the moon. One photograph of a long crack, extending some miles, in the lava crust at Hawaii serves to emphasize Prof. Pickering's belief that water or water vapor exists on the moon, and by irrigating cracks on the moon's surface gives rise to vegetation in them, just as trees and shrubs have sprung up in the Hawaiian lava crack. In studying Erastothenes in 1904, Prof. Pickering found its interior seamed with numerous fine cracks. Watching some of these cracks soon after the sun arose on them he was able to see them broaden out and change gradually into canals. It is his belief that the cracks gave out water vapor, which fertilized the vegetation along their sides and in their neighborhood, and that it was the growth of this vegetation which produced the appearance of a canal. A further inference is that the canals on Mars, which become more clearly visible at some periods of the year, owing to the melting of the Martian polar ice cap and the flooding of the waterways, are similar cracks on the surface of Mars. Cracks of the kind occur on the moon. The largest of them is that known as Sirsalis, which is 400 miles in length. It is possible also that they exist on the earth, though they are not readily discernible. It has sometimes been supposed that terrestrial volcanoes lie along subterranean cracks.

Fritz Gold Medal Presented to Alexander Graham Bell.

In the course of the exercises which marked the formal opening of the building of the United Engineering Society, the John Fritz gold medal was presented to Alexander Graham Bell, for the invention and introduction of the telephone. This is the third medal of the kind awarded. The first was given to Lord Kelvin for his work in cable laying and the second to George Westinghouse for perfecting the air brake. Mr. Bell will depart for England in a few days and will receive the degree of doctor of science from the University of Oxford. Commemorative medals were given to R. W. Pope, secretary of the American Institute of Electrical Engineers; Rossiter W. Raymond, secretary of the American Institute of Mining Engineers, and Mr. Hutton.

Prizes for Safety Devices.

The American Institute of Social Service announces that in addition to the Scientific American medal, Francis H. Richards has offered a gold medal to be awarded annually by the Institute for the best invention for safeguarding life, to be exhibited at the museum relating to automobiles and motor boats, also an anonymous gift of $5,000 from a city outside of New York, for the American Museum of Safety Devices and Industrial Hygiene. It was announced also that Dr. L. L. Seaman has offered an annual prize of $100 for the best essay on the subject of safeguarding life.

The growing popularity of interlocking rubber tiling is shown by its invasion of new fields, being extensively used in kitchens, vestibules, and bathrooms of the better sort; in fine ocean liners, lake steamers, ferryboats, and yachts, where its non-slippery character and the fact that it remains unaffected by constant wrenching strains render it very valuable, and now it may be seen in one of the finest cathedrals in the country and in one of the largest of our public art galleries.