Automatic Printing of Wireless Messages.

ONE of the recent developments in wireless telegraphy, which, as we have already announced briefly, was demonstrated by Mr. A. A. Campbell Swinton during his address on November 17 to the Royal Society of Arts, is the automatic printing of wireless messages in roman type. Several systems of printing telegraphy are in use on ordinary lines, but the ingenious method designed by Mr. F. G. Creed is, we believe, the only one that has been adapted to the printing of wireless messages. High-speed wireless reception in various forms is being used to an increasing extent, and Morse code messages are recorded by optical and mechanical methods, as well as by an instrument analogous to a phonograph; but the actual printing of the words in ordinary type on a paper strip presents obvious and very great advantages.

That this result has been rendered possible of achievement is mainly due to the greatly improved methods of amplification of the signals received now available, which have enabled current impulses of sufficient strength for the actuation of the necessary relays to be obtained from the minute oscillations in the receiving aerial. Briefly, the system consists in a combination of the existing printing telegraph apparatus designed by Mr. Creed with the latest arrangements of groups of thermionic valves such as those devised by Capt. L. B. Turner and other workers, who carried on important researches in this direction during the war.

In the Creed system, whether for wireless or line transmission, the message is first translated into the Morse code by punching a perforated strip of paper in an apparatus, with a typewriter keyboard, so contrived that each key perforates the strip, by a solenoid operated mechanism, with the Morse equivalent of the letter in question. This strip, exactly as in the case of automatic Wheatstone working, is passed through the transmitting instrument, which sends out current impulses in the ordinary way in the dots and dashes of the Morse code. These, in ordinary telegraphy, go direct into the line, but in wireless working they are used to actuate a special transmitting contact maker, forming the equivalent of a high-speed relay-operated Morse key. Messrs. Creed and Co. have developed several sizes of transmitters for this purpose, including one suitable for very powerful installations, worked by an electro-pneumatic relay arrangement, and capable of dealing with as much as 300 kw. This has eight sets of contacts in parallel, each breaking under a powerful air-blast.

The waves at the receiving station are picked up by a thermionic-valve receiver, and considerably amplified by a number of valves in cascade in the manner employed in connection with other methods of recording. Current impulses are thus supplied to the relay magnet, forming part of the apparatus known as the Creed receiving perforator. This is of the same form as that used in line telegraphy, and, as employed hitherto for wireless reception, is worked by compressed air, although the company is now developing an electrically driven pattern on a mechanical principle, which is simpler and more compact, and dispenses entirely with compressed air. The Creed air-engine relay used in the instrument is a very interesting piece of apparatus. The tongue of the electrical part of the relay, instead of operating electrical contacts, actuates a very small slide valve controlling a little auxiliary piston, which moves the slide valve of the larger main piston. This, by moving in one direction or the other, drives forward one or other of the perforating punches, through a system of levers.

A very ingenious device arrests the motion of the strip while the holes are being punched. The strip from the receiving perforator, which is still in the Morse code, is the exact counterpart of that used at the transmitting station, with holes side by side to indicate dots and staggered to represent dashes, and a continuous row of holes down the centre for feeding purposes. The arresting action is effected by a plunger being thrust forward between the teeth of a spur-wheel on the shaft of the feed-sprocket. The holes are punched opposite each other if the second punch moves forward soon enough after the first for this wheel not to have advanced a whole tooth pitch, so that the arresting plunger, in reaching the bottom of the space between the teeth, really brings the paper back a little way. On the other hand, if the wheel has advanced by a whole tooth pitch or more, the plunger engages in the next space, and the second perforation is advanced beyond the first. A Creed receiving perforator is seen in the centre of Fig. 1.

The perforated strip is then passed on to the Creed printer. The great feature of this remarkable piece of apparatus is that it forms an automatic typewriter controlled entirely by the position of the holes in the perforated strip, and translates Morse code into printed characters. It is impossible here to do more than to indicate the general principle on which the instrument works, although it is on the perfection of the design of details that much of its success depends. In Fig. 1 the strip from the perforator is seen passing direct to the printer, and a printer by itself is shown in Fig. 2.

The perforated paper strip is fed past a group of spring selecting needles, ten on each side, and when it is momentarily at rest with the portion corresponding to a letter opposite the needles, a certain number, forming a pattern corresponding to the letter, protrude through the holes in the strip. Each needle which has thus advanced causes, in a way indicated later, a change in the position of one of a pack of thin steel strips or sliding valve plates. These valve plates lie between two fixed perforated plates, and are themselves perforated in such a way that the position assumed for each combination of the selector

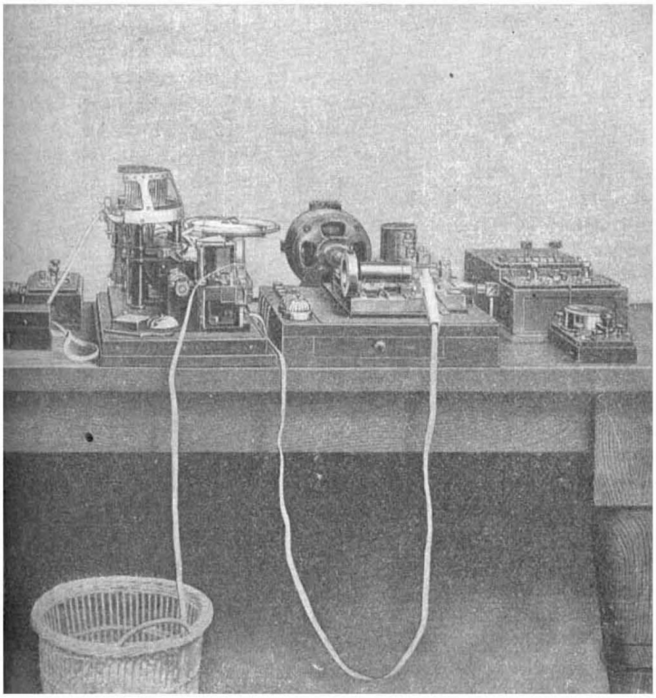

FIG. 1.—Complete receiving-p inting apparatus, including receiving perforator with relay and printer.

needles corresponding to a letter in Morse on the strip causes coincidence of the perforations at one point only, so that there is a clear aperture through the whole pack in a position corresponding to a letter. The bottom plate is supplied with compressed air at the moment in the cycle of operations corresponding to the printing of a letter, and each aperture in the fixed top plate communicates with a small cylinder, in which moves a piston actuating one of the type bars, through levers like those of an ordinary typewriter. Thus a letter is printed corresponding to the position of the coincidence of the valve-plate apertures.

The arrangement whereby a variable feed is given to the strip, according to the length of the letter, is combined with that for actuating the valve plates in accordance with the selection made by the needles. A reciprocating feed-rack is provided, which, when required, can gear into a spur-wheel on the same shaft as the feed-sprocket. The length of its downward travel while out of gear depends upon the point where it is arrested by the projection of one of a group of spacing levers. Normally, these levers are pushed out of the way by the selecting needles, but where neither of a pair of selecting needles advances—*i.e.* where there is a space signal—a space lever continues to stand out, thus limiting the movement of the rack to the length of the letter. A sideways movement is then given to the rack, putting it into gear and causing the perforated strip to feed forward, by exactly the length of the letter just dealt with, during its return journey. Each selecting needle, as it advances, causes a hinged piece on the corresponding valve-plate extension to move forward and to form a shoulder by the side of the feed-rack, so that the sideways movement of the feed-rack is also the actual cause of the shifting of the selected valve plates. It was mentioned above that there are only ten valve plates, whereas twenty selecting needles are provided. It is only the lower group of ten needles that controls valve plates, but the remainder are required to actuate spacing levers. Although more selecting needles may pass through the strip than those corresponding to the letter in question, only the proper number of slide valves are acted upon by the rack, on account of the limitation of its travel by the spacing levers. There are several other features, including the method of withdrawal of the selecting needles and the timing of all the various operations by means of cams, which we cannot dwell upon. The whole apparatus, including a small attached air-compressor, is driven by an electro-motor, so that no external source of compressed air is required.

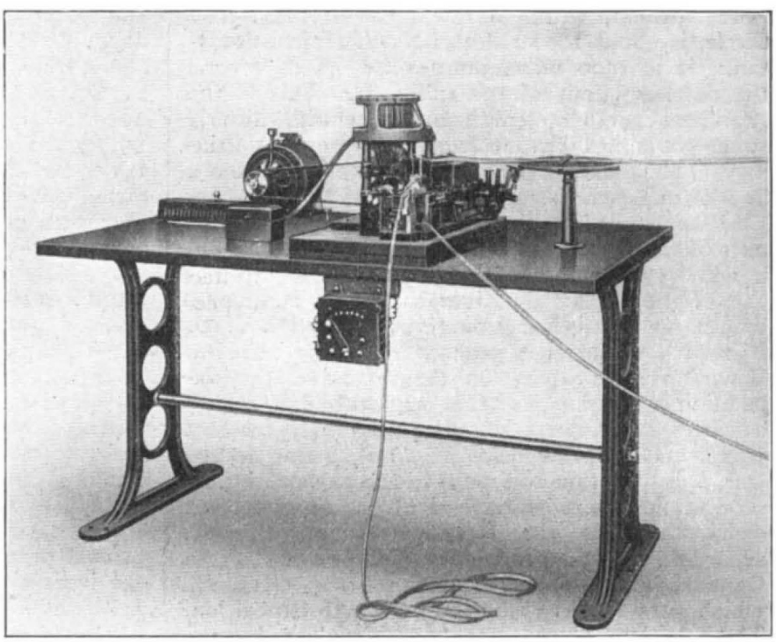

FIG. 2.—Creed type printer translating from perforated Mors strip.

Messrs. Creed and Co. have also developed an improved form of printer, in which compressed air is dispensed with, and the type characters are mounted on a circular disc and hit from behind by a little selecting hammer which is caused to stop at the part of the revolution corresponding to a letter by a circular group of selecting levers. This form of the apparatus is much more compact than the original instrument, and has a much higher printing speed; but we understand that it has not yet been adapted to wireless reception.

The Creed system with compressed-air working, as adapted to wireless reception, is capable of a speed of transmission of about 180 words a minute, which is in excess of the speed of the printer; so that, in order to obtain the full capacity, two printers would have to be installed for one receiving perforator. The improved printer, however, will be capable of keeping up with the receiver, even in its improved form, and will be able to deal with something like an increase of 50 per cent. in the speed of transmission. Apart from considerations of traffic, high transmission speeds present advantages in that there is more chance of the message being completed without interruption by atmospherics or other extraneous effects. Very successful experimental working has been carried out between Cologne and the War Office station at Aldershot, and a wireless printing equipment of this kind is to be adopted between Brussels and a large station in the Congo district.

The New Oilfield of Northern Canada.

By W. JONES.

CONFIRMATION has now been received from Canada of the news that an important oil-well has been obtained in the North-West Territory of Canada. The full significance of this event is only gradually being realised by the public. It is probable that this is the commencement of the development of the largest oilfield in the British Empire—possibly one of the largest in the world.

For several years it has been known that geologists had found a land of much promise in the north, but until now, owing to the difficulties of transportation, no drilling operations had been attempted. The well, which is situated on the banks of the Mackenzie River, 48 miles beyond Fort Norman, within a few miles of the Arctic Circle, is about 1000 miles N.N.W. from Edmonton. It is 1300 miles journey by water beyond the northern limit of the railroads. This is the "farthest north" oil-well in the world, and is some 500 miles distant from any previous drilling. (The nearest producing oil-wells are those in Alaska.)

Little detailed geological information about this part of the North-West Territory is available, but it will be remembered that a geological exploration of the Mackenzie River basin was conducted by a party of English geologists, led by Dr. T. O. Bosworth during the year 1914, on behalf of a Canadian syndicate. On the return of the expedition it was reported that a great oilfield region had been determined. At that time much interest was aroused by the discovery, but, owing to the war, less attention was paid to the prospects than they would otherwise have received. The present development is the long-delayed sequel, for, according to the particulars now received from Canada, the well is located on the oil-claims which were "staked" by the Bosworth expedition. These claims have since been acquired by the Imperial Oil Co., the geological department of which has been headed by Dr. Bosworth for a number of years.

The drilling machinery was sent north in 1919, and the well has been drilled on the site which was chosen in 1914 for the crucial test. The drillers stayed at their post throughout last winter, and the actual drilling commenced in the spring of this year. In the first 200 ft., useful quantities of a very high grade oil were struck, and at 800 ft., according to the report of the drilling party, the oil gushed up from the 6-in. casing in a column which rose 15 ft. above the top of the derrick. After half an hour the drillers capped the well, so that the oil may be preserved until storage tanks can be constructed. Until that time the well's exact yield will not be measured, but it is probable that it will produce a thousand, and possibly several thousand, barrels of oil a day.

According to the brief statement made in 1915 by Dr. Bosworth to the Institution of Petroleum Technologists (Journ. Inst. Pet. Tech., March, 1915), and also in the *Petroleum World* (February, 1915), abundant seepages of oil were found throughout a very large region occupied by the Devonian rocks, and "in that region all the geological evidences of oil conspicuously occurred." The source of the oil was a thick deposit of "black bituminous shales and limestones, which cover an area of enormous extent." "In some places the black shales were actually undergoing combustion at the present time, and in several places oil was seeping out into the water for distances of several miles." The structure also was favourable, for the region is traversed by a system of mountain building anticlines. In Dr. Bosworth's opinion "the discoveries which had been made were of the greatest importance," and "fields of the utmost promise had been marked out, bearing all the indications and evidences that an unexploited field could be expected to show."

The foregoing remarks, together with the splendid result of the first test well, are significant. On studying a geological map of North America it will be seen that the Devonian forma