

this be so it is only one more instance of the deleterious effect of red tape in this country, of which we have just received, in the case of the War Office, so impressive, we may say so humiliating, a lesson. Others may ask: Why could not Prof. Gregory have shown a more trustful spirit and sailed in the *Discovery*, believing all things and hoping all things? There are limits even to faith. Had the commander of the expedition been a man distinctly his senior, already accustomed to scientific voyages, with some experience of polar exploration and those special problems which may be solved by the Antarctic expedition, Prof. Gregory might have ventured to dispense with securities and to feel confident that the interests of science would not be subordinated to the more showy work of adding new capes and islands to the map. But is this the case? The commander of the *Discovery*, we are informed, was, not many months ago, torpedo-lieutenant on a man-of-war, has had no experience in either Arctic or Antarctic seas, is no doubt well versed in those subjects of which a knowledge was demanded by his former post, may possibly be thoroughly competent to direct magnetic observations, but he has not as yet won the slightest reputation as a naturalist, a geologist, or an investigator of glacial problems. The last two qualifications are of exceptional importance in this expedition. They cannot be acquired on the voyage out, even by the help of a tutor; they demand, not only book learning, but also much practical experience. This Prof. Gregory possesses in an exceptional degree. He knows where a search for fossils will be the most hopeful and what will be of most value to palæontologists. He has mastered the literature of glacial questions, and he has studied glaciers themselves, in the Alps, Spitsbergen and elsewhere. He has travelled much, and on his notable expedition to Mount Kenya displayed powers of organisation, calmness in critical circumstances, physical endurance and moral courage which gave him at once a high place among explorers. He has a reputation to lose. Can he be expected to imperil that by absolute surrender to one who is probably his junior and is without experience in the branches of science of which he is a master? As Prof. Gregory truly remarks: "The position gives no power to secure a fair opportunity for work to the man who would have to bear the blame for scientific failure." It was not the position which he had originally consented to accept, it was not that which was agreed upon when he left England last February; so, perceiving that he was no longer supported by those whom he had regarded as representing the interests of science, he promptly withdrew from an untenable position.

The action of those representatives (or rather the majority of them) is inexplicable. They have worked, we hear it said, in the interests of peace. But there are occasions when even peace may be too dearly bought. "There must be give and take," one of them pleaded at a notable crisis. Certainly, but it has been all give on the one side and all take on the other. "The Council of the Royal Geographical Society," it was urged, "were acting within their rights when they rejected the instructions, as modified by their secretary." Certainly, so is one nation doing when it breaks off diplomatic relations with another, and in this way their action should have been regarded by the Council of the Royal Society. That body, or its representatives, seem to have adopted, at least during the present year, "a peace at any price" policy. In consenting to the appointment of a committee of arbitration they meekly accepted a snub, and in designating its members they exposed themselves to defeat. We have the highest respect for their nominees individually, but not one of them is a recognised expert in those branches of science the interests of which were most at stake. The other half of the court consisted of geographers—that is, of

men who were really counsel for that side—and yet this court called no scientific experts to plead before it, though this had been virtually promised, but promptly gave its decision. Time would be saved if this practice were imitated in our law courts, but whether justice would be promoted is another question.

It has, however, been asserted that the Royal Geographical Society ought to be allowed a preponderant influence in the organisation of this expedition, because it had provided, directly or indirectly, most of the funds. This difficulty, however, is so obvious that it should have been foreseen at the outset, and the Royal Society have been careful to protect itself from being forced into a false position by inequality of contribution.

But we may go on to ask, does the Royal Geographical Society flatter itself that the Government would have made that grant of 45,000*l.* if its application had not been so energetically and heartily supported by the Royal Society? We venture to be sceptical on this point, and so to affirm that it was the duty of the latter body, at any rate after the rejection of the amended instructions by the Council of the Royal Geographical Society, to have announced that, while wishing all success to the Antarctic expedition, it could no longer be responsible for the guidance of its scientific work or the expenditure of public money. Now it must be content to follow whither the geographers lead. It will receive little honour for any successes, but will have to bear much of the blame if the scientific results are of small value. Its representatives have not afforded, as Prof. Poulton complained, to "the claims of the scientific chief in an expedition undertaken to do scientific work . . . that unflinching, undivided and resolute support" which not only he, but also those who set science above even geographical exploration, had expected and desired.

THE TELEGRAPHONE.

A DESCRIPTION of the telegraphone—the remarkable recording telephone invented by Herr Poulsen—was given in these columns in August last (vol. lxii. p. 371). At that time the instrument was on view at the Paris Exhibition, and though we were able to explain the principle upon which it was designed we could give no detailed description of the actual instrument, nor had we ourselves been able to test its powers. Since then it has been brought to England and has been exhibited at the Royal Society and at other places, where it has deservedly attracted a very large amount of attention. A further description may, therefore, in the circumstances be acceptable.

Herr Poulsen's invention fully deserves to be called one of the most astonishing that have been made of late years. That the delicate vibrations of the human voice could be changed into variations of an electric current and thus be transmitted over a distance and reproduced at the far end came as a surprise to men of science a quarter of a century ago. With no less surprise do we learn to-day that these telephonic currents, small though they are, can yet be used to create permanent magnetic fields in a steel wire, which will thus be made to serve as a tablet on which to write one's speech. It is not to be wondered at that when first Herr Poulsen's discovery was announced many were incredulous as to its genuineness; the invention is precisely of the kind that one does not believe could be practical until one has actually seen or heard it in operation. That it will have the effect of putting the phonograph on an entirely new basis no one who has heard it can doubt. The speech reproduced by the telegraphone is almost as much superior to that reproduced by the wax cylinder phonograph as are the living pictures of the kinematograph to those of the zoetrope. There is none of the very unpleasant twang inseparable from the

ordinary phonograph ; the speech is as clear and distinct as that transmitted through a good telephone.

In Fig. 1 is shown a photograph of one form of the telegraphone, in which the steel wire that is intended to receive the record is wound in a spiral on a drum, this drum being rotated either by a small motor or by hand, as shown. The little magnet which imprints the records on the wire is seen on the front of the drum with the wires leading from it to the transmitting or receiving telephone. The magnet is mounted on a small carriage, which slides on a bar going from right to left of the instrument at the top. At the back, attached to the same carriage, is a small plough, which engages with the steel wire on the drum and thus acts as a guide. When it is desired to speak to the instrument the magnet is started at the right hand side and the plough made to engage with the wire. The drum is then rotated, and as it turns the magnet moves from right to left, the wire passing all the time between

was taken away from Copenhagen ; though the song had been repeated a very great number of times it still seemed very distinct, though, being in Danish, we cannot venture to express any opinion on the articulation. If, however, it be desired to wipe out the record, a steady current is passed through the magnet coils as it travels from end to end of the recording wire ; this effectually destroys all the existing record and leaves the wire ready to receive a fresh one. This form of instrument is comparable to the ordinary phonograph in that it can only receive a record of one or two minutes' duration ; but, quite apart from its greater clearness, it is superior to the phonograph because the records can be so easily wiped out and fresh ones made.

Another form of telegraphone is shown in Fig. 2. In this a steel ribbon is used instead of a wire to receive the record. The ribbon is wound on two drums so that it can be unrolled from one on to the other. As it goes

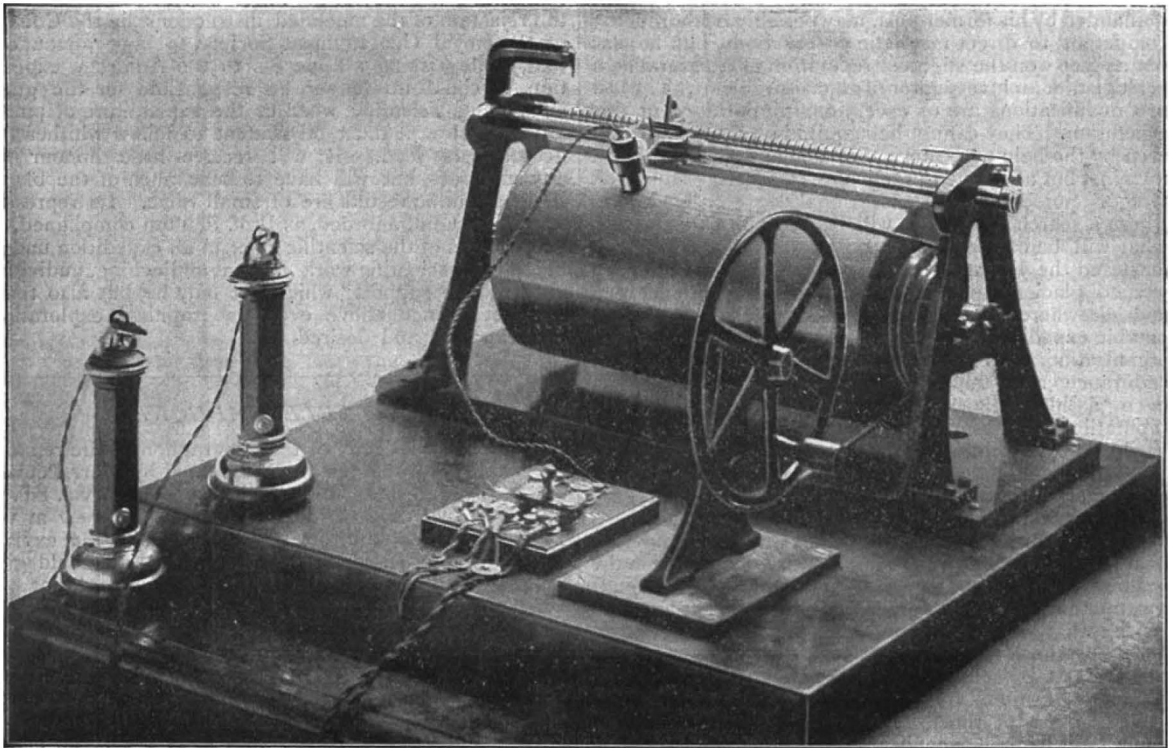


FIG. 1.—Steel Wire Telegraphone. (From the *Electrician*.)

its poles. During this motion any words spoken into a telephone connected to the magnet will be recorded as a series of magnetic fields on the wire. When the magnet arrives at the end of the wire the mechanical trip on the left of the instrument lifts the plough off the recording wire and makes it engage with a wire wound in a wide helix, which can be seen at the back ; this causes the carriage and magnet to return quickly to the starting point. To reproduce the record the magnet is connected to a telephone receiver and is again made to travel along the spiral ; as the now magnetised wire passes between its poles it sets up currents which reproduce the recorded speech in the receiver.

The record can be left on the wire and used over and over again ; it is not certain how long the record will last, as sufficient time has not yet elapsed to test this point. We heard a song in Danish which had been sung to one of these instruments some months ago, before it

from one drum to the other it passes over the poles of the recording magnet, which is connected, as before, with the telephone receiver or transmitter. It is remarkable that although the convolutions of the ribbon when wound on the drums lie closely one above the other, the magnetic fields on one turn do not seem to interfere with those on another. With this arrangement it is easily possible to cut off any length of ribbon holding a particular record which it is desired to preserve.

A very ingenious apparatus has been devised by which a message may be transmitted simultaneously to any number of stations, an arrangement which should prove very useful for many purposes, for example for Press messages, &c. A diagram of this apparatus is shown in Fig. 3. An endless steel ribbon, R, passes round two pulleys, A and B, driven by a motor. This ribbon, after it leaves the pulley, A, comes to a strong permanent magnet, P, which wipes out any record existing on it. It then comes to a

magnet, M, connected with the microphone transmitter, and from this it receives a record of any words spoken. The ribbon, now carrying a record, next comes to a series of magnets, $M_1, M_2, M_3 \dots$ each of which is connected to

From this arrangement is derived the telephonic relay to which we referred in our last article. Let the series of magnets $M_1, M_2 \dots$ instead of being connected to distant receiving telephones be connected to a series of recording

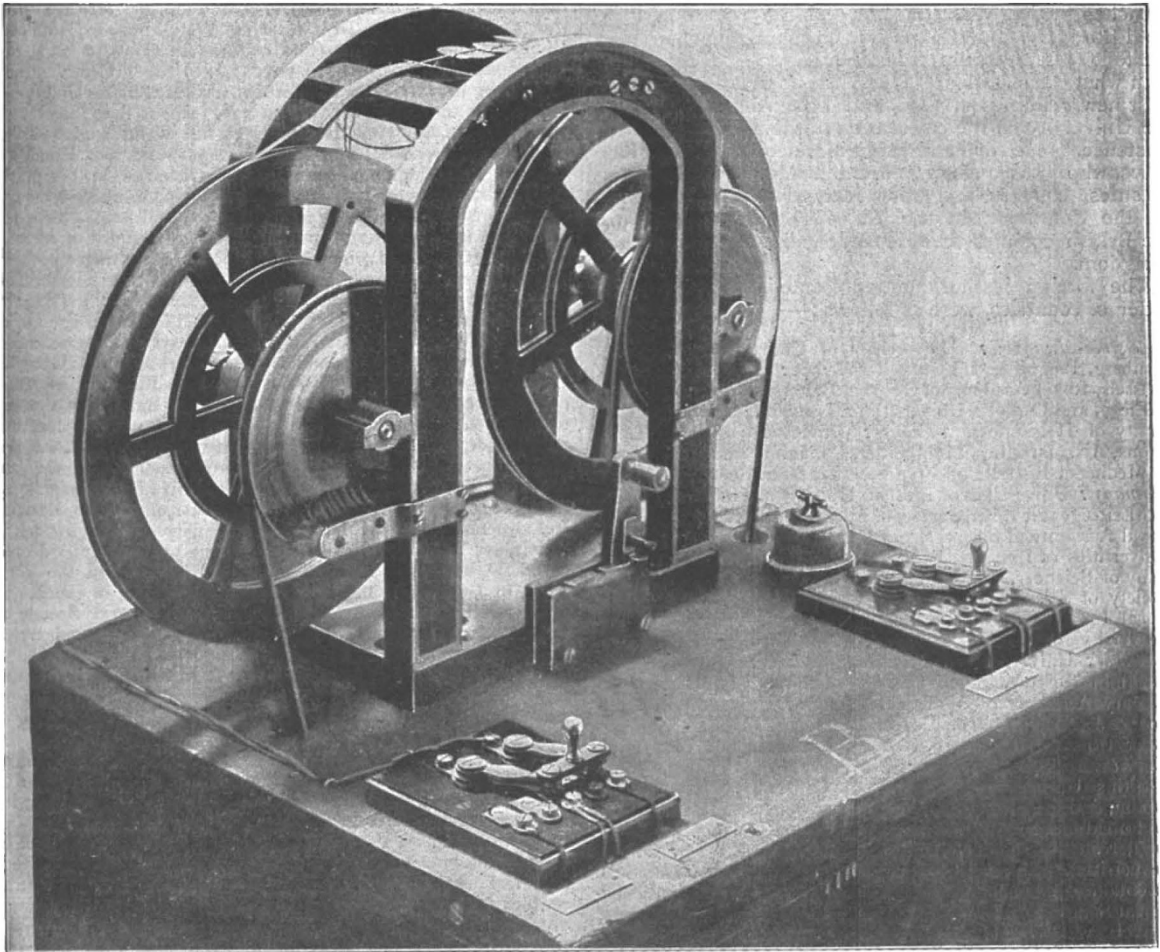


FIG. 2.—Steel Ribbon Telegraphone. (From the *Electrician*.)

a different circuit. The message is thus transmitted by the magnets, $M_1, M_2 \dots$ to any number of distant stations at the same, or practically the same, moment. The ribbon after leaving the last magnet comes round again

magnets which are used to produce records on a number of steel tapes. If all these steel tapes be made to repeat their record at the same instant to a single receiving telephone the loudness of the speech will be increased in proportion to the number of ribbons used.

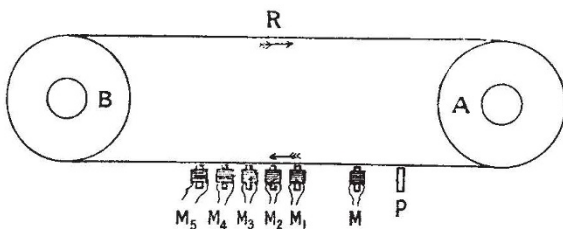


FIG. 3.—Distributing Telegraphone.

in due course to the permanent magnet, P, by which it is cleaned to receive fresh magnetisation; thus messages of any length can be sent by this means.

We understand that successful experiments have been carried out on these lines, but that no actual relay has as yet been constructed. It is to be noted that as the energy is derived from the motion of the ribbons, and therefore from the motor used to drive them, there is theoretically no limit to the loudness that could be attained. If Herr Poulsen is really successful in constructing a telephonic relay, as there seems to be every prospect of his being, he will have accomplished a feat of immensely greater importance than the invention of an improved phonograph, or even of a satisfactory recording telephone. So far as this last point is concerned we learn that very successful trials have been carried out in America between Boston and New York. The ordinary telephone lines were used, the telegraphone being substituted for the receiver at one end; a good and clear record of the transmitted speech is said to have been obtained.