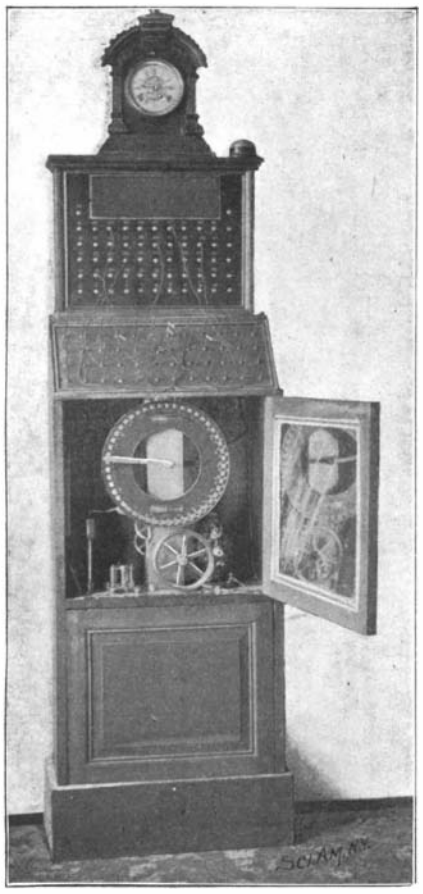
ELECTRIC CALL.

A matter of considerable importance in a hotel, and one usually dependent upon the memory of the clerk, is the calling of guests at desired hours. Negligence in this particular might put a traveler to serious inconvenience, such as the missing of an important train, with its attendant complications. No such unfortunate circumstances can arise in a hotel equipped with the automatic electric call which is illustrated herewith. This machine is under control of a clock, and will automatically ring a bell in the room of a guest at any time set. The diagram of the parts clearly shows the electrical connections and the operations of the machine. A small electric motor, *A*, serves to operate a cam, *B*, and the contact finger, *C*, through the medium of a train of gearing which reduces their speed of rotation. The finger, *C*, which is electrically connected to one element of the battery, *D*, rotates intermittently, and, consecutively, at intervals of a quarter of an hour, engages the contact points on the disk, *E*. These contact points are respectively connected to a series of pins, *F*, extending upward from the top of the casing. Adjacent to these pins are a series of terminals, *G*, connected respectively with the alarm bells in the various rooms. Any of these terminals, *G*, may be connected to any pin, *F*, by a plug and cord connection so as to sound the corresponding alarm as soon as the finger, *C*, engages the contact point which is connected to that pin.



AUTOMATIC MACHINE FOR CALLING GUESTS IN HOTELS.

The motor, *A*, is controlled by the clock at the top of the machine. The striking hammer of this clock is actuated at every quarter hour to momentarily depress the spring-yielding contact piece, *H*, against contact, *H'*. This completes the circuit of battery, *D*, through magnet, *J*, energizing the latter and causing it to attract armature, *K*, which is thus brought into electrical engagement with contact post, *L*, a spring-catch, *M*, serving to temporarily lock the armature, *K*, in this position. An electric current now flows from battery, *D*, through post, *L*, armature, *K*, to brush, *N*, of the motor, *A*, thence through brush, *O*, back to the battery. The motor thus actuated operates the train of gearing which causes cam, *B*, to slowly rotate. The lever, *R*, which rests on the periphery of this cam, is rocked, causing the contact, *S*, to close on contact, *S'*, and contact, *T*, to close on contact, *T'*. By this act magnet, *U*, is energized, which draws back its armature, *M*, releasing the armature, *K*, and breaking the circuit through post, *L*. The motor, however, still continues to receive power through the contacts, *S* and *S'*, until the cam, *B*, makes a half turn, when the lever, *R*, rocks to its normal position and the circuit is broken. The contact points along the periphery of disk, *E*, are forty-eight in number, one for every quarter hour, and the contact finger, *C*, is so geared as to make 1-48 of a rotation while the cam, *B*, is making a half turn, so that but one contact point is engaged at each operation of the motor. Now supposing a guest in room No. 10 desires to be called at 1:30. Connection is made between the terminal for room 10 and the contact pin marked 1:30. At 1:30 o'clock the finger, *C*, would have reached the contact piece marked 1:30, and a current would flow from battery, *D*, through finger, *C*, pin, *F*, and terminal, *G*, to the alarm bell in room 10 and thence back through wire, *W*, to the battery. Since the finger, *C*, is rotated very slowly, the alarm will continue to sound for a considerable length of time, which of course may be controlled by the gearing employed. The inventor of this machine is Mr. John Salmon, 240 West 23d Street, New York city.

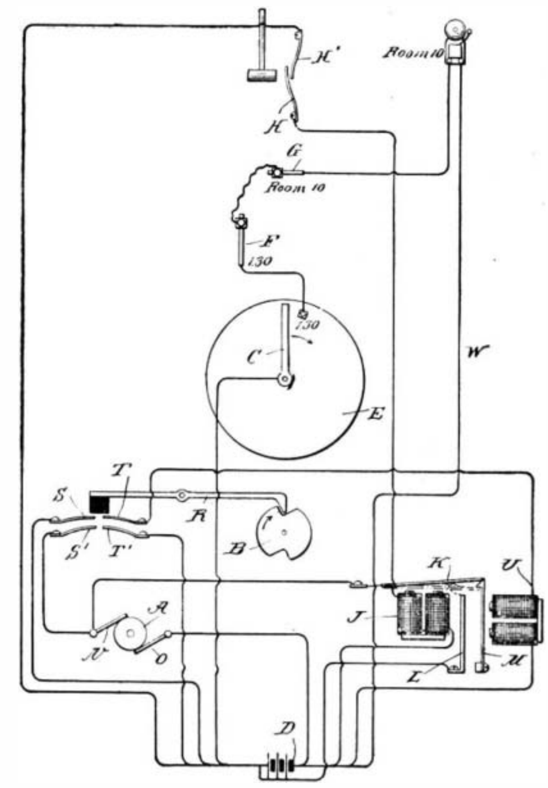


DIAGRAM OF CONNECTIONS IN THE ELECTRIC CALL

MODERN PILE DRIVERS.

BY WALDON FAWCETT.

A very marked advance has been made during the past few years in the construction of pile-driving machinery. The evolution which has resulted in the production of the modern automatic steam pile hammer can scarcely be said to have been as rapid as that which has characterized development in certain other branches of the engineering field, but progress has been along lines no less revolutionary. It was inaugurated with the introduction of the main features of the old English Nasmyth hammer combined with an improved valve gear. Later a type of hammer made its appearance in which the number of parts was greatly reduced and the valve actuated by steam; but difficulty was found occasionally with the steam-moved valve, and this style of hammer was gradually supplanted by the most modern types, which are designed to combine effectiveness, strength, simplicity and positiveness of action.

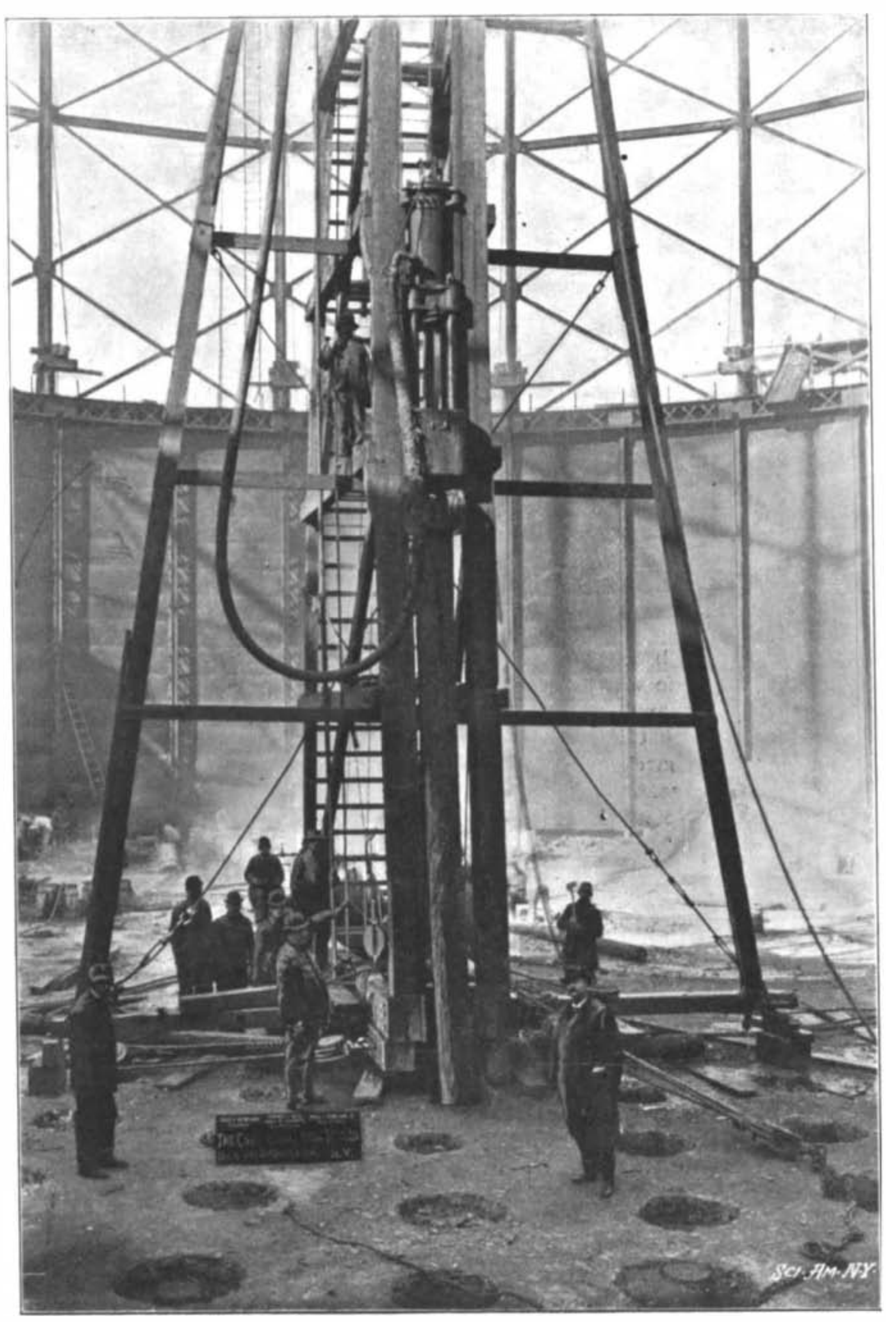
Some of the chief characteristics of the latest approved model in pile-driving machinery embrace a simple and positive valve gear; a short steam passage and a quick and wide opening of exhaust, the latter enabling the avoiding of back pressure during the drop. In such a pile driver turned columns are provided connecting the cylinder and base and serving to guide the ram. The guide holes in the ram are bored by the use of a "jig," and unfair strains on the piston rod are avoided. The piston is forged on its rod, and channel bars are attached on each side to enable the hammer to drive below the bottom of the leaders.

In order to perform the best work, a pile driver must be regular and continuous in its action. The machines now in use are capable of driving any kind of pile, hard or soft, straight or crooked, and any pile may be driven in the hardest kind of driving sand or hardpan without injury to the head of the pile. Indeed, in the case of piles of spruce, bass and pine, the timber most frequently used, they may be driven without the use of bands. The operation of the modern steam hammer is simple in the extreme. The hammer is raised in the leaders—this being the only duty of the engine aside from hoisting the pile—and is allowed to rest its full weight upon the pile. Steam is then turned on, and the hammer pounds automatically until the pile is driven to the required depth.

The steam pile hammer of this type, which is used for foundations, docks and piers and other classes of heavy work, weighs almost 10,000 pounds, is 12 feet in length, has a normal stroke of 42 inches and is fitted with striking parts weighing 5,000 pounds. The hammer most extensively used in railroad work weighs 6,500 pounds, has a stroke of 3 feet and striking parts weighing 3,000 pounds. There are various intermediate sizes, and the smallest hammer of this general type has lately been provided especially for the purpose of driving fish-stakes for pound-nets along shore. This hammer weighs but 1,350 pounds, with a normal stroke of 2 feet and striking parts weighing 550 pounds. For the two largest size hammers engines of 40 and 25 horse power, respectively, are required.

Perhaps the severest exactions which have ever been imposed upon pile-driving machinery had to be met during the driving of piles for the Chicago post office. In order to fulfill the requirements of this governmental contract, the piles had to be driven to a depth of 70 feet below the surface in very hard material. Naturally an enormous number of blows had to be given—in some cases as many as 1,800 to one pile—and the problem of preserving the pile heads became a grave one. A steel plate was found advantageous for purposes of protection, and when it was discovered that there was more or less danger from this plate slipping and injuring the workmen, a hood with a recess was designed to hold the plate, forming a safe protector for the pile.

Although many advantages are claimed for the steam hammer over the old-fashioned drop hammers, the latter are still in use to a considerable extent, and the machines of this type have innumerable improvements over those in



A MODERN AUTOMATIC STEAM PILE DRIVER.

use a few years since. For one thing, the hammer is much longer for given weight than the older forms, thus avoiding the sidewise throw when the hammer strikes near one edge, and it is so guided that instead of striking directly on the pile it works on an independent piece of wood which is inserted in an iron socket, so that the stroke of the hammer falls on the intermediate block, which transmits its force to the pile. This intermediate piece of wood can be changed when it splits, and by its use the head of the pile is preserved. The drop hammers range in weight from 75 to 5,200 pounds. In most cases they are concave in the bottom, although flat hammers are sometimes provided.

In the case of what is known as the "township" pile driver—a machine designed for use on small bridges and other light driving and fitted with a drop hammer weighing from 500 to 1,200 pounds—the hammer is usually raised by horse power, the smaller sizes being hoisted direct, that is, without a purchase block, and the larger sizes having one end of the line fastened to a suitable post, driven into the ground, when the other end is passed through a tackle-block which is fastened to the main hoisting line and leads to the whiffletree direct. In some instances use is made of a winch which is bolted to the ladder. Tackle-blocks can also be used instead of sheaves at the top and bottom.

The more powerful drop hammer outfits have usually of late years been used with friction engines. In an up-to-date equipment of this kind it is customary to provide woodwork of Norway pine and a head block of Georgia pine, oak or maple. In connection with drop hammers there is now used extensively a protecting cap which displaces the familiar pile band and has the advantage over the latter in that no time is consumed in its removal and there is practically no danger of the breakage of the device.

Many contracting engineers predict that the steam hammer will ere long almost entirely displace the drop hammer for pile-driving operations. While the stroke of the steam hammer is limited, yet the frequency of the blows, together with the constant weight of the machine on the pile, gives results that are surprising to persons whose experience has been limited to drop-hammer pile drivers. As an indication of the economy of time rendered possible by a steam hammer under certain conditions, it may be cited that recently, while contractors were driving piles for the L. & N. Railroad at Pensacola, Fla., fifty minutes' time was required to drive with a drop hammer a pile 75 feet in length, there being utilized 120 blows from the top of 75-foot leaders. The next pile, the same length and located but three feet from the one mentioned, was driven to the same depth by a steam hammer, which delivered the 130 blows required in ninety seconds.

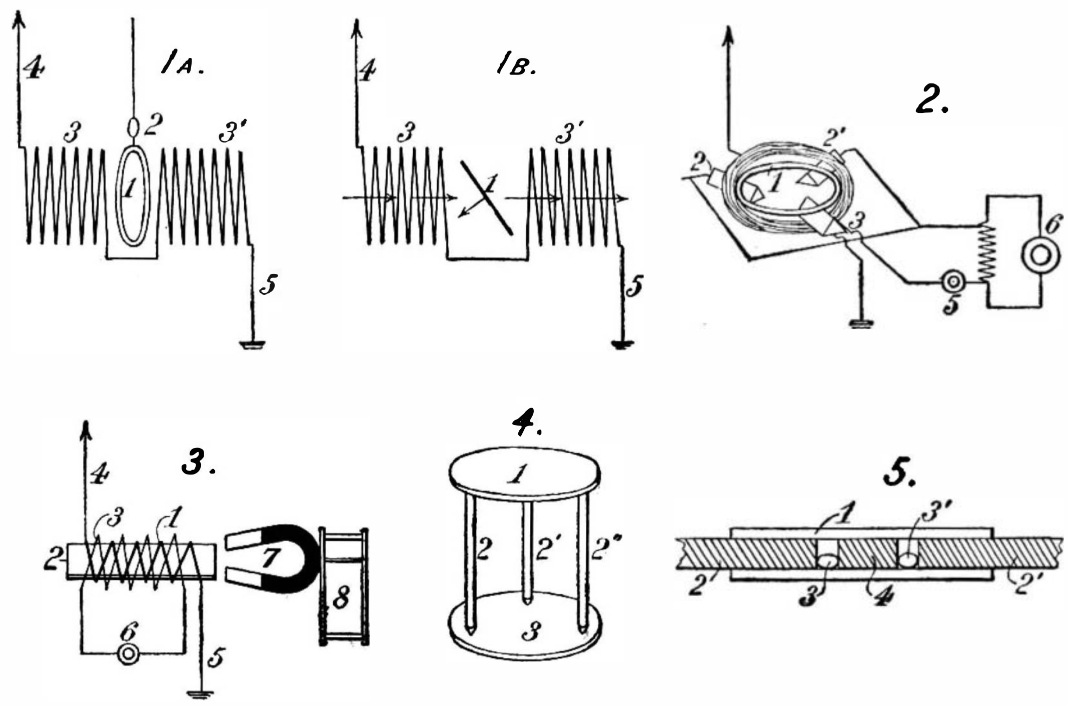


Fig. 1 A.—Fessenden Detector (Elevation). Fig. 1 B.—Fessenden Detector (Plan). Fig. 2.—Magnetic Detector. Fig. 3.—Marconi Magnetic Detector. Fig. 4.—Branly's Tripod Coherer. Fig. 5.—Castelli's Coherer.

SOME NEW DETECTORS FOR WIRELESS TELEGRAPHY.

BY A. FREDERICK COLLINS.

Invention, like all evolutionary progress, travels in cycles. Wireless telegraphy is no exception to this rule, as a review of the results achieved will show, for yesterday the workers were madly striving for syntonic effects, while to-day electric wave detectors are engaging their attention, and to-morrow—only to-morrow will reveal the popular thought.

Of electric wave detectors there are two distinct types: (1) The familiar coherer in its many and varied forms; and (2) devices which depend upon the increase and decrease of magnetic permeability by the impinging electric waves setting up oscillating currents in the resonator system.

Mr. Marconi, Prof. Fessenden and others have taken up this latter type of detectors, since it offers not only a wide field for research, but it has been shown from theoretical considerations that in magnetic detectors as they are called, all the energy could be utilized, whereas in the coherer type only that portion of the energy could be utilized which is required to raise the potential to the critical point necessary to break down the maximum resistivity and the rest of the wave value is therefore lost.

To Prof. Elihu Thomson is given the credit of having first proposed the general principle embodied in electric wave detectors of the magnetic type. In Fig. 1, *A*, the simplest arrangement is shown in outline representing an elevation, and in Fig. 1, *B*, a plan of the magnetic detector is shown. In this form a silver ring, 1, is suspended by a quartz fiber, and above the ring is attached a small mirror, 2, so that readings may be taken by means of a lamp and telescope just as in an ordinary reflecting galvanometer. The system is thus free to revolve between the parallel coils of wire, 3 3′, which are connected in series. The opposite and free terminals of 3 3′ of the coils are extended to or connected with the vertical wire, 4, and the ground wire, 5.

When the electric waves impinge on the antenna or vertical wire, 4, they set up high-frequency oscillatory currents, and these passing through the coils, 3 3′, join a rapidly-alternating field between them; these magnetic lines cut through the suspended ring, and currents are induced in it, and these have a tendency to turn at right angles to the coils creating the magnetic field; and in following out this law of repulsion the ring describes an arc equal to the opposing forces. This was the form of detector Prof. Fessenden employed in his tests prior to his work for the government.

To bring this detector into a more practicable form, so that a telephone receiver could be employed instead of the reading telescope, the instrument is somewhat differently designed and constructed from that shown in Fig. 1, though the principle is the same.

In this case the metal ring, 1, Fig. 2, rests upon three inverted wedges, 2 2′ and 3; 2 2′ are of metal, but 3 is of carbon. One terminal of a non-inductive resistance, 4, is connected to the inverted metal wedges, 2 2′, and the opposite terminal is connected in series to a telephone receiver, 5, and this in turn to the carbon wedge, 3. The electric wave system is formed by connecting the vertical wire to the metal wedges and the earthed wire to the carbon wedge. With these arrangements completed an alternating current from the dynamo, 6, is switched through the circuits; this produces a continuous vibration of the diaphragm of the telephone receiver, but when the electric waves impinge on the vertical wires the resistivity of the carbon wedge is varied and any change in it is registered by the telephone.

In Mr. Marconi's recent paper he describes a new form of detector which likewise depends upon a varying magnetic field produced by high-frequency oscillations transmitted from a distant point in the form of electric waves; but the electrical feature which places the stamp of originality on this new detector is the fact that it calls into action magnetic hysteresis.

In mechanical construction the Marconi detector is comparatively simple, consisting as it does of a layer of fine insulated copper wire, 1, Fig. 3, wound on a core, 2, made of thin iron wires; a second layer of fine insulated wire, 3, is wound over the first, forming a secondary coil. The ends of the inner coil are connected with the vertical wire, 4, and to the earth, 5. The terminals of the secondary coil are connected in series with a telephone receiver, 6, or other suitable receiving instrument. Up to this point it will be observed that there is but little difference in Marconi's device and those heretofore described, and all of them are based on the researches of Prof. Joseph Henry, who produced with a single spark from the prime conductor of a frictional machine an oscillatory current at a distance of 30 feet, sufficient to magnetize steel needles. But in applying the principle of hysteresis an entirely different detector results, and to understand this process the better, let it be known that the ascending and descending curves described in magnetic tests of iron do not coincide, and this being true it is self-evident some work is done, and this takes the form of heat; although practically it is so small as to be negligible; this process of hysteresis, it now appears, has the curious property of accentuating mightily every charge, however small, in oscillatory currents, set up in a resonator by the incoming electric waves.

Now in order that the bundle of fine iron wires forming the core of his detector may be constantly following a cycle of increased and diminished magnetization or continued hysteresis, Marconi causes a horseshoe magnet, 7, to revolve before the pole of the core by clockwork, 8. The magnet should be revolved very slowly—at the rate of one revolution every two seconds; the speed of course varying for the different qualities of iron employed; and in this way a slow and constant change with successive reversals of the magnetization results.

It might be supposed that the changes of polarity of the core would induce currents in the secondary coil of the detector which would be rendered audible by the slow motion of the magnet, and that if it were revolved at a high rate of speed better results would be obtained. This, however, is diametrically the opposite of what takes place in practice. The writer had occasion to make some experiments with an inductor type of alternator. With a telephone receiver in series with one of the windings, it was noted that when the rotor was turned by hand the reversals of the current were not noticeable and articulate speech exceedingly clear; but when the rotor was coupled to a gas engine and revolved rapidly a continuous hum in the receiver was apparent. These cases are identical.

The great advantage of the magnetic detector, as Mr. Marconi has pointed out, lay in its self-restorative qualities, and that its resistance is practically the same at any moment, whereas in a coherer before and after tapping there is always a wide and variable resistivity affecting the working of the registering instruments. It is claimed for this new detector that it is exceedingly sensitive and more reliable than the coherer, the latter being especially desirable in connection with syntonic wireless telegraphy.

While these points are advantageous, yet it would seem that the wide divergence between resistivity and its reciprocal, which is necessary in a detector to enable a relay to be operated, is in the magnetic detector lacking, and the limit of its usefulness will be confined to the telephone as a receiver; this may be of greater advantage than otherwise, since by means of the telephone wireless message may be read more rapidly and at a greater distance than when the more cumbersome, costly and slower Morse register is used. Let this be as it may, experimental research is still going on with the type of detector that first made wireless telegraphy possible—the coherer.

Mr. Edouard Branly, of Paris, in his paper on "Variations of Conductivity," published in 1900, showed for the first time the effect of electric sparks on powdered metal inclosed in an ebonite tube; this tube he termed a *radio-conductor*, and was the first real coherer; and now he has given the results of his further researches in the form of a new coherer. To a metal disk, 1, are attached three metal rods, 2 2′ 2″, Fig. 4, with their points resting on a second disk of polished steel, 3. The points of the rods are oxidized. The success of the Branly coherer depends entirely on the oxidation of the metal points and the polish of the steel disk. The film of oxide may be preserved for a considerable length of time. Like Marconi, Branly has searched for a detector of stability greater than that offered by the ordinary coherer, in which the multiplicity of contacts gives rise to miniature trains of electric waves; in the Branly tripod form this is largely avoided. It requires a slight tapping to decohere it.

The details of another new coherer, designed by Signor Castelli and used in the Italian navy, and which is said to have been employed by Marconi in his recent transatlantic tests, have been made public. The Castelli coherer consists of a tube, 1, Fig. 5, having its two terminal conductor plugs, 2 2′, oppositely disposed in the coherer tube and separated by two pockets, 3 3′, the interior plug being made of iron, 4. Into the pockets are inserted globules of mercury. The tube is self-restoring and in practice stands up well for regularity and rapidity.

The recent developments in wireless telegraph instruments would not seem to indicate the need of