P. STRAGIOTTI.

MICRO RECEIVER OR TRANSLATOR.

APPLICATION FILED AUG. 11, 1908.

953,107.

Patented Mar. 29, 1910.

2 SHEETS—SHEET 1.

Fig. 1.

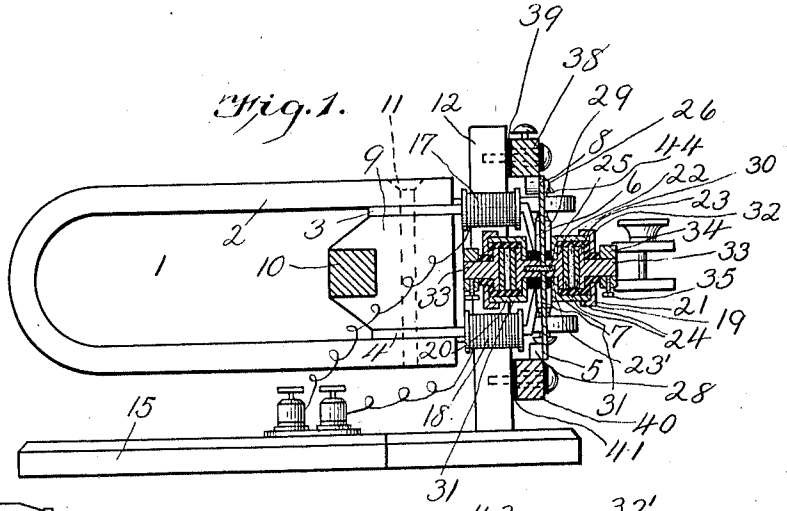
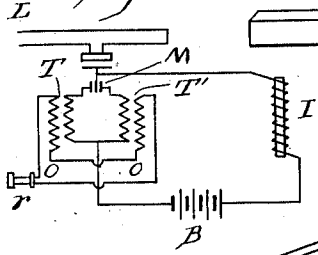


Fig. 2.



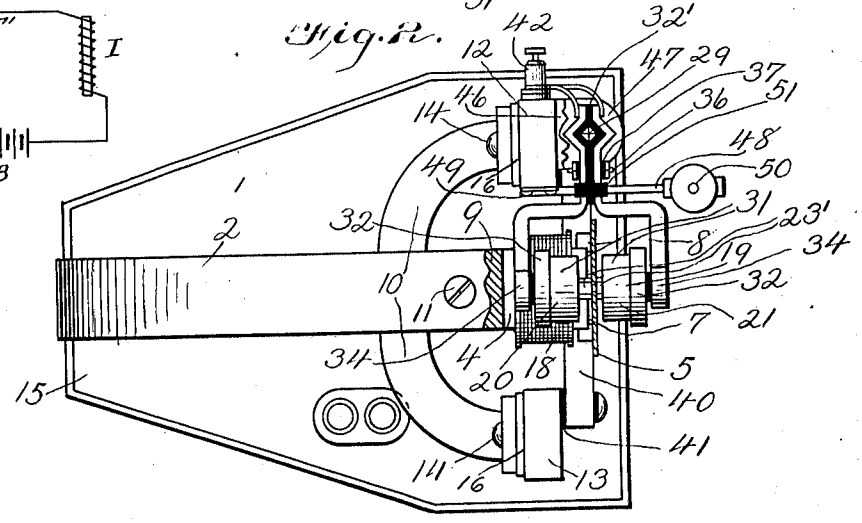
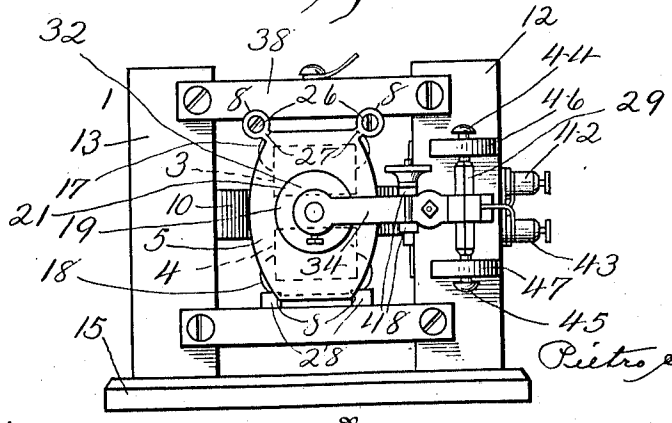


Fig. 3.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 1.

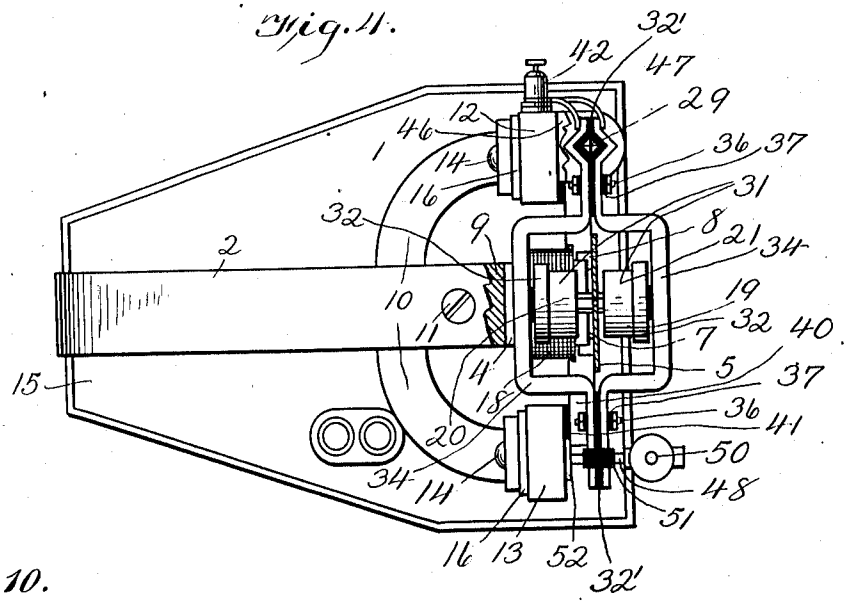


Fig. 10.

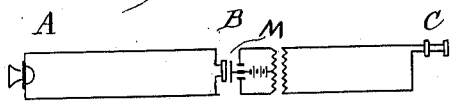


Fig. 5.

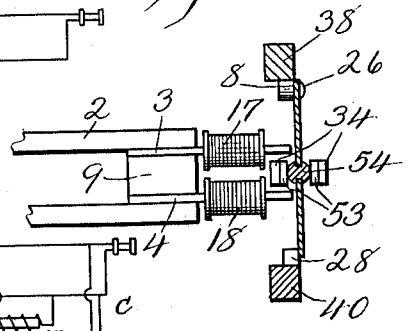


Fig. 11.

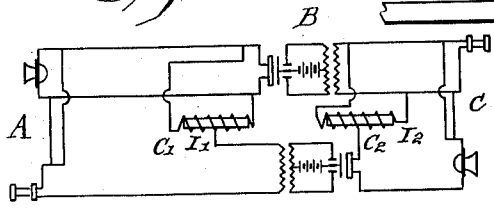


Fig. 6.

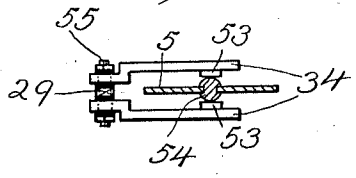


Fig. 7.

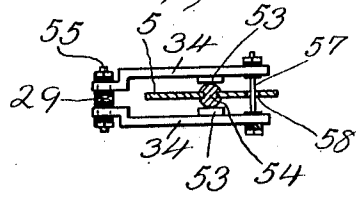
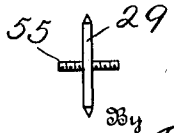


Fig. 8.



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UNITED STATES PATENT OFFICE.

PIETRO STRAGIOTTI, OF HURLEY, WISCONSIN, ASSIGNOR OF ONE-FOURTH TO GRIFFITH THOMAS, ONE-FOURTH TO JOSEPH VERCELLINI, AND ONE-FOURTH TO FRANK MARTA, OF HURLEY, WISCONSIN.

MICRO RECEIVER OR TRANSLATOR.

953,107. Specification of Letters Patent. Patented Mar. 29, 1910.

Application filed August 11, 1908. Serial No. 448,024.

To all whom it may concern:

Be it known that I, PIETRO STRAGIOTTI, a subject of the King of Italy, residing at Hurley, in the county of Iron and State of Wisconsin, have invented certain new and useful Improvements in Micro Receivers or Translators; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to the class of telephony, but more particularly to a micro-receiver and micro-translator, having for its object to detect very feeble alternating currents, making new ones of the same nature but of much greater intensity, thus increasing the telephonic current.

A further object of my invention is to provide a micro-translator by which the distance of the telephonic service becomes unlimited.

With these objects in view my invention consists in the construction of the micro-receiver and micro-translator, and particularly in the construction and arrangement of the micro-phone, which micro-phone comprises a differential micro-phone made of two separate micro-phones as will be hereinafter described.

My invention further consists in the construction and arrangement of the electrodes of the micro-phone.

My invention further consists in the arrangement of two external electrodes connected to a support and arranged to turn freely around a vertical axis.

My invention further consists in providing a micro-receiver comprising a differential micro-phone having three electrodes, one of which is solidly connected with a plate vibrating under telephonic currents, the two other electrodes being supported in such manner as to turn freely around an axis.

My invention further consists in certain other novel details of construction and in combinations of parts, all of which will be first fully described and afterward specifically pointed out in the appended claims.

Referring to the accompanying drawings: Figure 1 is a longitudinal vertical sectional view through the micro-receiver and micro-translator. Fig. 2 is a top plan view partly in section. Fig. 3 is a front elevation. Fig. 4 is a top plan view partly in section illustrating a modification. Fig. 5 is a fragmentary view illustrating a modification. Fig. 6 is a plan view partly in section of a modification. Fig. 7 is a plan view of a modification. Fig. 8 is an elevation of one construction of the pivot for the micro-phone, and Figs. 9, 10 and 11 illustrate specific systems of wiring.

Like characters of reference indicate the same parts throughout the several figures in which;

1 indicates a device which comprises the permanent magnet 2 to which the two iron nucleuses 3 and 4 are connected, the magnetic circuit of the permanent magnet passing through said nucleuses 3 and 4 and through a small air stratum behind the plate 5; consequently the said plate 5 becomes attracted to the faces 6 and 7 of the nucleuses 3 and 4 which attraction assures the adherence of the plate to its point of support 8. In order to hold the two iron nucleuses 3 and 4 in proper position and to guarantee their adherence with the poles of the permanent magnet 2, a block of brass 9 or of any other suitable non-magnetic material is provided, said block having two arms 10 to hold in place the magnet and its accessories. The magnet 2 and the two nucleuses 3 and 4 are fixed to the block 9 by a screw 11 passing through the magnet and the block, while the two arms 10 are connected to the vertical supports 12 and 13 by means of screws 14, said vertical supports 12 and 13 being arranged on the base 15 as clearly shown. In order to regulate the position of the two arms 10 on the supports 12 and 13 I provide two rubber cushions 16 which are compressible, allowing for a correct and proper adjustment of the arms 10 on the supports 12 and 13. Two coils 17 and 18 inserted in the telephonic line are wound around the two iron nucleuses 3 and 4 so that the grouping of the magnet 2 and of the two coils 17 and 18 becomes an ordinary telephonic receiver.

19 indicates the differential micro-phone, said differential micro-phone comprising two separate micro-phones 20 and 21, the

micro-phone 20 being arranged between the two coils 17 and 18, while the micro-phone 21 is arranged on the opposite side of the plate 5. Each of the micro-phones 20 and 21 is made with two electrodes 22 and 23, the electrode 22 comprising a metal plate supported on a stem 23′, each plate being covered with the hard and smooth carbon 24. The stem 23′ behind the plate 5 is a little longer than the corresponding stem 23′ in front of the plate 5 in order to give room to the polar expansion of the nucleuses 3 and 4, the two stems 23′ being internally threaded and the exterior being square in cross section; a screw 25 entering the two stems 23′ as clearly shown in Fig. 1 in order to secure the stems together, said screw 25 passing through the plate 5 as clearly shown.

The plate 5 by vibrating causes the central electrode 22 of the differential micro-phone to vibrate, and in order to make the polar ends act on points as central as possible of the vibrating plate in order to maintain the greatest sensibility and efficiency the two ends of the iron nucleuses 3 and 4 converge toward the center line terminating in flat faces 6 and 7 very close to the said plate 5 as clearly shown in Fig. 1. As the plate 5 is not intended to produce the voice but to have the greatest vibration at the central point where the central electrode 22 of the micro-phone is fixed, the surface of the plate 5 is much narrower than that of the usual receiver as will be clearly seen from Fig. 3. By reason of this construction the elastic vibration of the plate 5 will have a much less disturbing influence than in the ordinary receivers.

The plate 5 is fixed at 8 by means of two screws 26 which pass through the plate in order to properly maintain the same in position; but in order to allow the greatest amplitude of vibrations of the plate and to have the plate act just as if it were supported without being fastened, the said plate is greatly reduced at the points 27. The lower edge of the plate 5 can be secured in the same way or it may be allowed to rest against the two short projections 28 as clearly shown in Fig. 3. The attraction of the magnet holds the plate always adherent, and the micro-phone is differential and self compensating, because it may turn freely around the vertical axis 29. On account of this should the attracting force of the magnet undergo any variation no initial strain could be found between the plate 5 and the micro-phone. In other words the plate is always entirely free on account of the ease allowed by the granular carbon 30 in each of the micro-phones and is always enabled to vibrate harmonically with the telephonic currents acting upon it.

Each of the micro-phones forming the differential micro-phone comprises a cup 31 through which the stems 23′ pass, each cup 31 being provided with a cover 32 through which each of the stems 33 of the outer electrodes 23 pass, the said electrodes being insulated from the cover and cup as clearly shown in Fig. 1, in order to prevent any electric conductiveness from these electrodes to the central electrode 22 except through the granular carbon 30.

As will appear from Fig. 1 each of the stems 33 passes into an arm 34, which arms 34, (as will appear from Fig. 2) support the whole micro-phone, a small set screw 35 fastening each of the stems 33 in position within the arms 34 as shown in Fig. 1. These arms 34 are connected together by a screw 36 and clamp the axis 29 rigidly, around which axis 29 the whole micro-phone may oscillate. No communication is had between the two arms 34 because of the insulating material interposed at 32′; also between each of the arms 34 and the screw 36 is arranged a suitable insulating material 37. After the micro-phone has been fixed to the plate 5 and the stems 33 are arranged within the arms 34 the pressure of the electrodes on the granular carbon may be increased by means of the screw 36 as is of course apparent.

The current comes to the transversal bar 38 (Fig. 3) which is insulated from the rest of the device by insulating material 39, the current passing from the said transversal bar to the plate 5, the other transversal bar 40 being insulated in the same manner by insulating material 41. From the plate 5 the current passes to the two central electrode faces, thence forking through each micro-phone passes to the binding posts 42 and 43 and from there to the transformers. The axis 29 is carried in the screws 44 and 45 (Fig. 3) supported by the arms 46 and 47 on the vertical support 12; while to the same support 12 the two steel springs 48 are screwed at 49, which springs when fastened by the screw 50 hold the micro-phone in place, avoiding the interference of any rotation strain around the axis 29 and without introducing any electric connection between the two arms 34 by reason of the insulation 51 on the springs 48, said springs 48 being for the purpose of maintaining the electrodes in the position of greatest efficiency.

When by the electric current in the coils 17 and 18 the plate 5 vibrates the electrode 22 will undergo the same vibration and the current will oscillate between both micro-phones. The vibrations of the electrode will be more easily obtained on account of the fact that the differential micro-phone is not acting with any initial force on the plate 5, because the rotation of the differential micro-phone around the axis 29 allows the micro-phone to assume such a position that no initial force can exist. Furthermore by

reason of the small pressure of the granular carbon and of the mass of the whole system, particularly to the central vibrating part, it may be said that the central part only is vibrating while the balance is almost at rest. In order to further insure the said immovability the arms 34 are formed as shown in Fig. 4 and the two springs 48 which hold the arms in position are fixed to the support 13 being fastened at 52. The arms 34 can be greatly reduced and simplified as shown in Figs. 5, 6 and 7, and in this construction two small carbon plates 53 are carried on the arms 34 as shown in Figs. 5, 6 and 7, which carbon plates 53 are in contact with a small sphere 54 of platinum or other suitable hard metal, said sphere 54 being connected with and carried by the plate 5. A well smoothed sphere of carbon may be employed; then the plates 53 being of platinum. In this system the reciprocal conditions between the tangential planes and the sphere 54 cannot change from geometrical conditions. The two arms 34 in this instance are made of aluminum, and the whole mass of the micro-phone is so small that it may oscillate around its axis 29 harmonically with the vibrations of the plate 5. The horizontal diameter of the sphere 54, which unites the two contact points between the sphere and tangential planes, passes through the center of oscillation of the whole micro-phone relatively to the axis 29 in such manner that the greatest correctness and sensibility are obtained, because the whole system is acting as if it were entirely free of any tie except the action of the plate 5. In this condition the whole micro-phone undulates following the plate without any vibration of its own, because no elastic force on its supporting points is had, and the changes of velocity which it undergoes, react with pressure variations on the tangential points of the sphere, thus producing the most correct result in the micro-phone. In order to regulate the initial pressure of the two small plates 53 on the sphere 54 the screw 55 is provided, which screw 55 and the pivot or axis 29 are integral as shown in Fig. 8, said screw 55 being insulated as shown in Fig. 6 in order to avoid any electrical connection between the two arms 34.

In Fig. 7 is shown a construction from which is obtained a more correct regulation of the initial pressure between the small plates 53 and the sphere 54, a small bolt or stem 57 uniting the two ends of the arms 34, said bolt or stem being insulated from the arms as shown in Fig. 7, said bolt passing through a perforation 58 in the plate 5.

Referring now to the wiring diagram: I indicates the inductive reactance which is a very material part of the system and by which the differential micro-phone reaches a very great sensibility and energy and becomes more efficient. The inductive reactance consists of a reactance coil in which the current produces a very strong field of self-induction, so that the said current cannot undergo any sensible variation of its medium value.

B indicates the battery and M is the micro-receiver and T and T′ are the two transformers, reference being had to Fig. 9. The current coming from the battery passes through the inductive reactance, goes to the central electrode of the micro-receiver where it forks, each branch passing through the primary of one transformer. As the two transformers are equal, so result two identical derived circuits; the secondaries are connected at the same end *o—o* and in this way result in series. Therefore to any induction in the same direction on the two primaries, induction forces in the opposite direction correspond on the secondaries, so that to the equal increasing or diminishing of the current in the two primaries the secondary induction current remains zero, but when under the influence of the micro-receiver M the comparative relation of the two primary currents varies by the increasing of the one and the equal contemporary diminishing of the other (which must happen under the effect of an inductive reactance of sufficient energy) then there are induction forces in the secondary which sum together, and a current is produced in the said secondary proportioned to the variation of the difference which is forming between the two primary currents.

Only one transformer may be used instead of two with its primaries in opposite winding, so that they are neutralized under equal currents; but two distinct transformers are preferable, because when distinct the iron is always magnetized in the same direction; consequently the magnetic permeability is more nearly constant allowing a more correct transmission of the wave to the secondary. The oscillating current which passes in the line L makes the diaphragm of the micro-receiver or micro-translator vibrate, producing a differential variation of resistances in the two parts of the micro-phone, and the production of new oscillating currents in the secondary circuit of the transformers will be the final effect, the said currents being entirely analogous to the currents coming from the circuit L, but much more energetic. Therefore if the said secondary circuit passes through a usual receiver *r* very feeble telephonic currents may be heard with this disposition, providing they are sufficiently energetic to make the diaphragm of the micro-receiver vibrate.

Referring now to Fig. 10 we will consider that B is the farthermost station from A where it is possible to hear clearly. If at B a micro-receiver is placed, which in this in-

stance I term a micro-translator, new electric oscillatory currents with the same energy as the original current in A are produced and are therefore able to reach C, said new electric oscillatory currents being produced in the new line from B to C. More than one of the translators can be inserted, and thereby the length of the telephonic line will be very much increased according to the number of translators employed. To be certain of the correct action, two separated lines are needed, namely, one carrying the voice from A to C with translation in B where the micro-translator is under the influence of the line A—B, while the connected transformers command the line B—C, and another independent line which carries the voice from C to A with a special micro-translator in B under the influence of the line B—C and commanding the second line B—A. As the ground is excluded from the long distance lines a system with three wires (Fig. 11) can confer an independent circuit to the transmission of the voice. For this purpose a line from A to C, for instance according to the established system with two wires is first made; and as for the line from C to A an entirely independent wire is employed, and instead of the fourth one the two wires of the preceding line are employed establishing connection between them and the third wire by the interposition of the self-induction coils C^1, I^1, and C^2, I^2 where the circuit of the third wire is attached at the middle of the winding of the coil, and the coil undergoes such a self-induction as to oppose any telephonic current not exactly of the same intensity in the two branches and not in the same exact phase. The said impedance of the coil ceases when the telephonic current is exactly divided in the two branches and in the same exact phase, because with this condition the effects of the inductance are suppressed. Therefore the currents circulating on the third wire and through its apparatus, must divide into two equal parts, and are of no influence on the apparatus inserted in the line formed with the two wires.

Having thus fully described the several parts of my invention what I claim as new and desire to secure by Letters Patent of the United States, is:

1. A differential microphone comprising two separate microphones, means for solidly connecting one electrode of each microphone with one electrode of the other microphone and constituting the central electrode of said differential microphone, a plate to which said central electrode is connected, a polarized electromagnetic coil for permanently attracting said plate, said plate vibrating under the influence of oscillatory currents which flow through said coil.

2. A differential micro-phone comprising two separate micro-phones, each of said separate micro-phones comprising two electrodes arranged in a casing of insulating material, and a layer of carbon dust arranged between each of said electrodes, one electrode of each micro-phone being solidly connected with one electrode of the other micro-phone constituting a central electrode, a plate vibrating under the influence of electric currents connected to said central electrode, a support connected to the other electrode of each of said micro-phones, said support being formed of two arms electrically separate, and an axis for said support around which the said two micro-phones are free to oscillate.

3. A micro-receiver comprising a differential micro-phone having three electrodes, a plate carrying the central electrode to which said plate said central electrode is connected, the two other electrodes being provided with a hard smooth surface, a support carrying each of said last mentioned electrodes, said support comprising two parts electrically separate, and an axis for said support around which the said electrodes are free to turn.

4. A micro-receiver comprising three electrodes, a plate carrying the central electrode of the three, and means for allowing two of the electrodes to freely turn on an axis.

5. A micro-receiver comprising a differential micro-phone, said differential microphone having three electrodes, a plate carrying the central electrode of the three, and means for pivoting the other two electrodes in such manner that they are free to turn on an axis.

6. A micro-receiver comprising three electrodes, a plate carrying the central electrode of the three, a support for two of the electrodes, means for pivoting the support in such manner that the two electrodes carried thereby are free to turn on an axis, and means for regulating the pressure between the electrodes.

7. A micro-receiver comprising three electrodes, a plate carrying the central electrode of the three, a support for two of the electrodes, an axis for said support to allow said support to turn so that said electrodes can obtain the position of greatest efficiency, and means for preventing further rotation of said support and electrodes from the position of greatest efficiency.

8. A micro-receiver comprising three electrodes, a plate carrying the central electrode of the three, a support for two of the electrodes, means for pivoting the support in such manner that the two electrodes carried thereby are free to turn on an axis, said plate being supported at its four corners.

9. A micro-receiver comprising three electrodes, a plate carrying the central electrode of the three, a support for two of the elec-

trodes, means for pivoting the support in such manner that the two electrodes carried thereby are free to turn on an axis, and means for regulating the pressure between the electrodes, the electrodes forming the central electrode being connected together and connected to the plate, and a fastening for said electrodes, said fastening passing through the said plate.

10. A micro-receiver comprising a differential micro-phone having three electrodes, the central one of which is adapted to vibrate under the influence of telephonic current, transformers, a self induction coil, a local circuit the current of which flows through said self induction coil to fork at the central electrode of said micro-phone in two parts passing through each of the other electrodes, and through the primary windings of said transformers.

In testimony whereof, I affix my signature, in presence of two witnesses.

PIETRO STRAGIOTTI.

Witnesses:

C. M. FORREST,

C. HUGH DUFFY.