A. LAMBOT.

AUTOMATIC ELECTRIC RECORDING DEVICE.

APPLICATION FILED JULY 8, 1910.

1,072,474.

Patented Sept. 9, 1913.

6 SHEETS—SHEET 1.

Fig. 1.

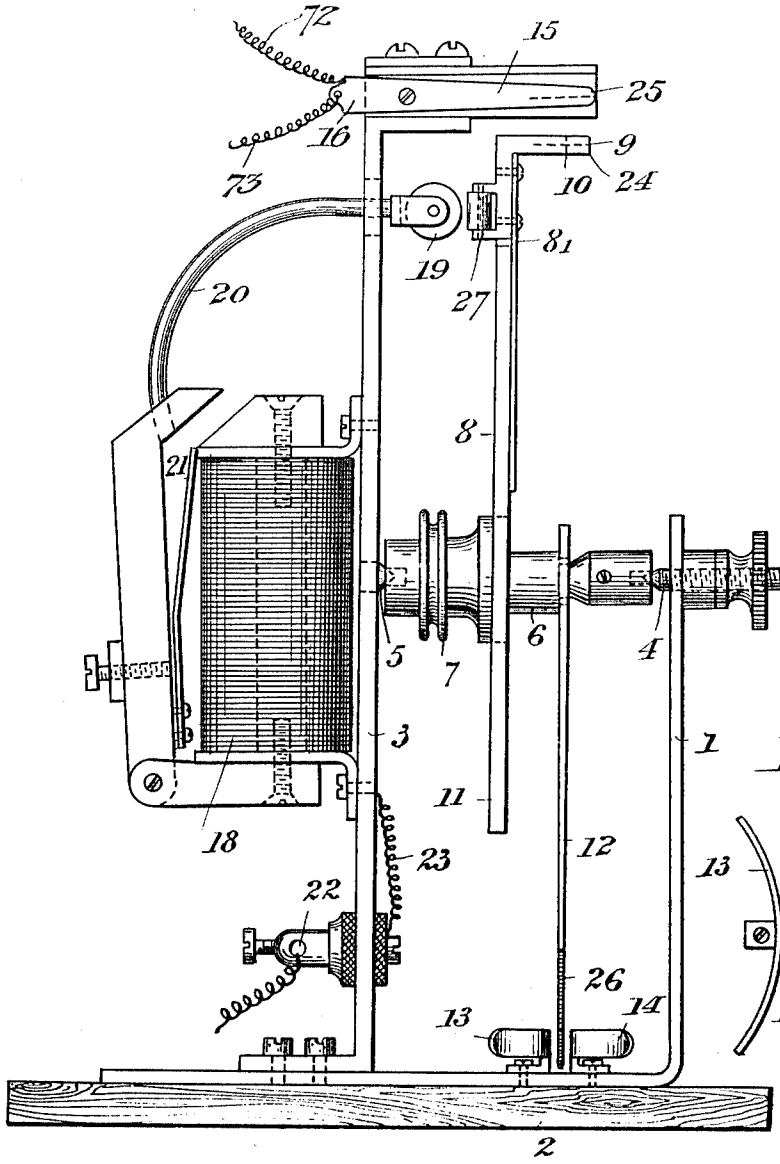
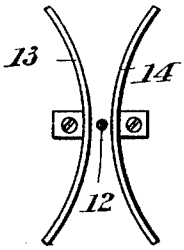


Fig. 1.



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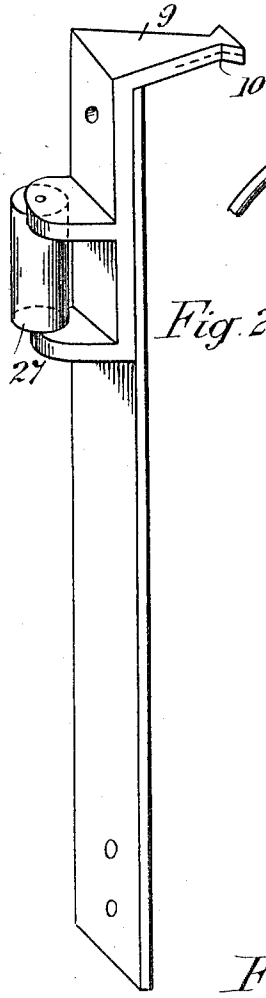


Fig. 2.

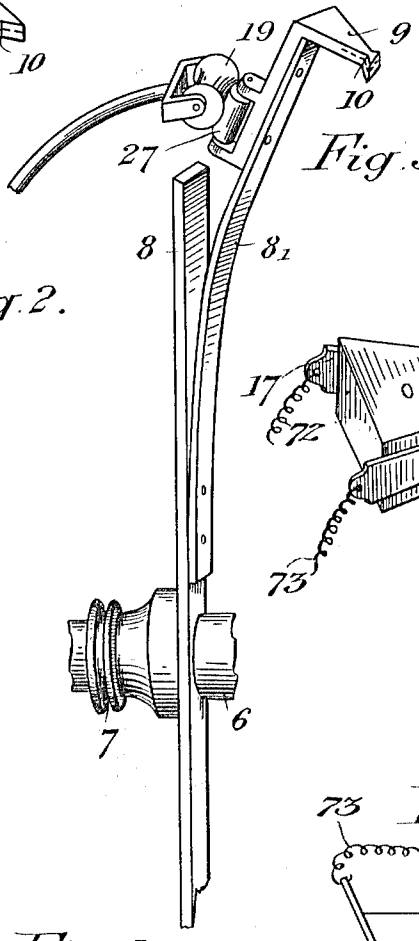


Fig. 3.

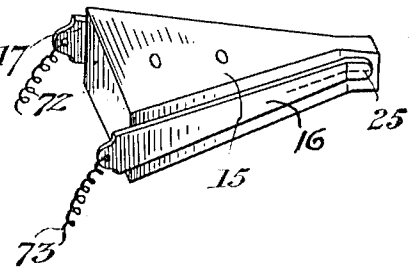


Fig. 4.

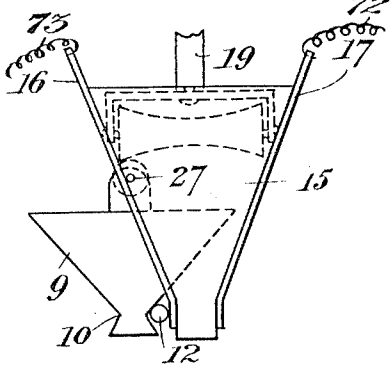


Fig. 5.

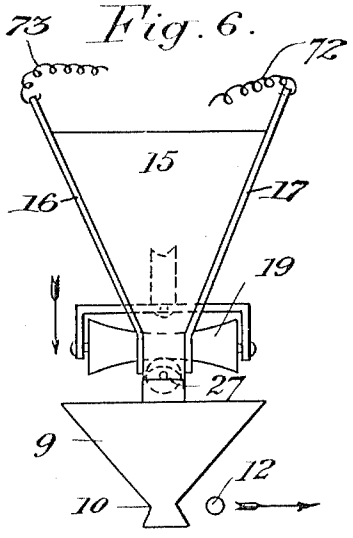


Fig. 6.

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6 SHEETS—SHEET 3.

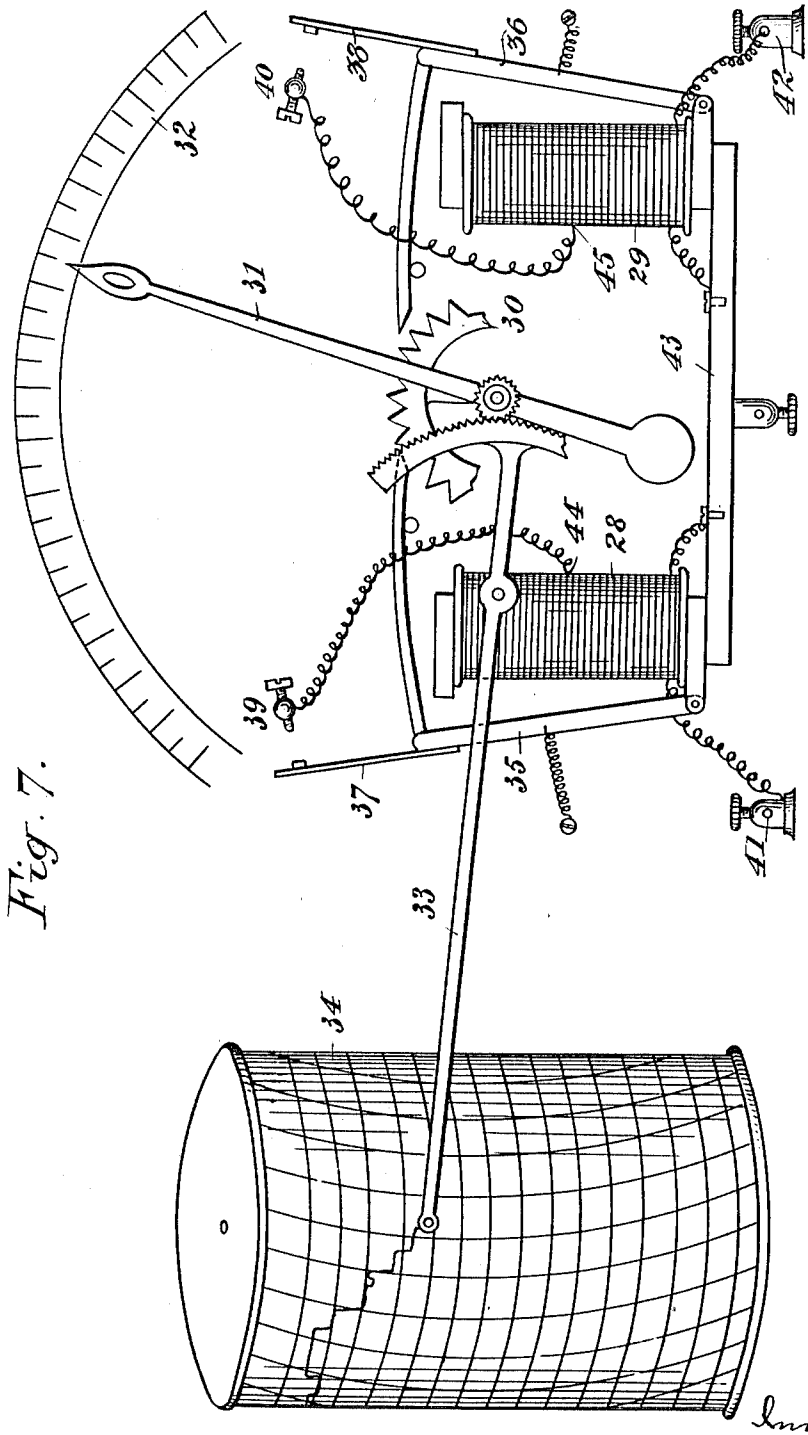


Fig. 7.

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6 SHEETS—SHEET 4.

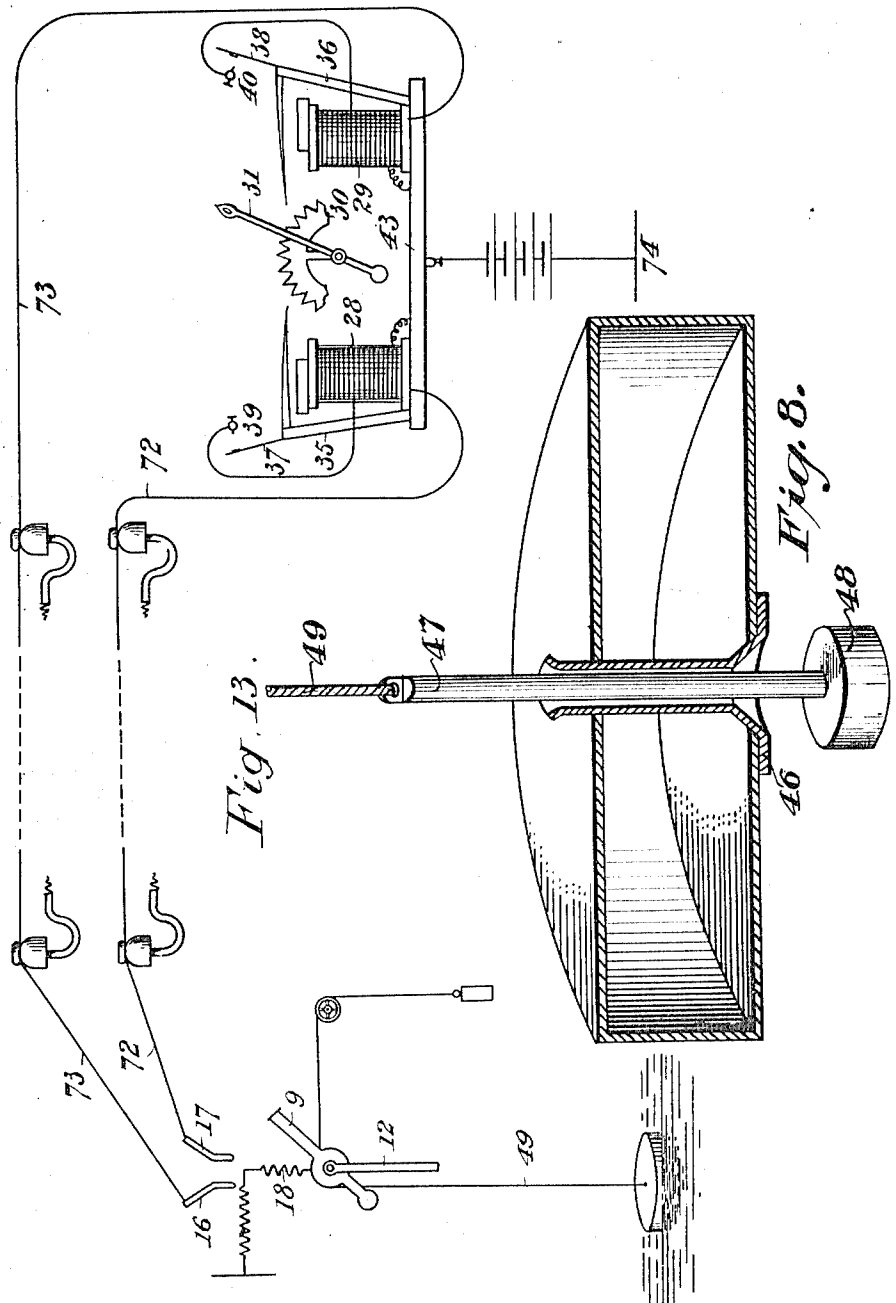


Fig. 13.

Fig. 8.

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6 SHEETS—SHEET 5.

Fig. 9.

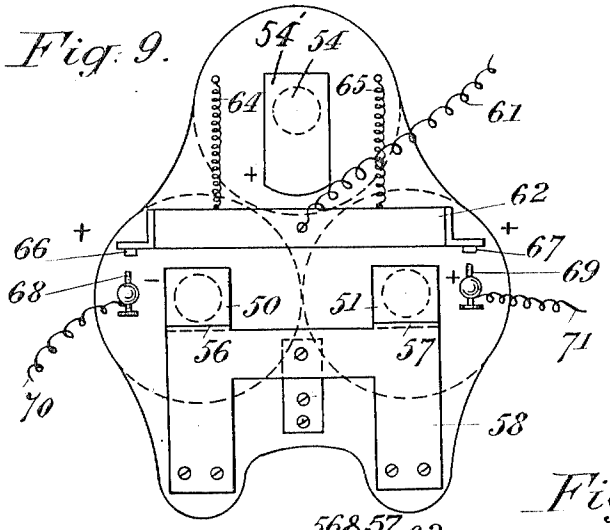


Fig. 10

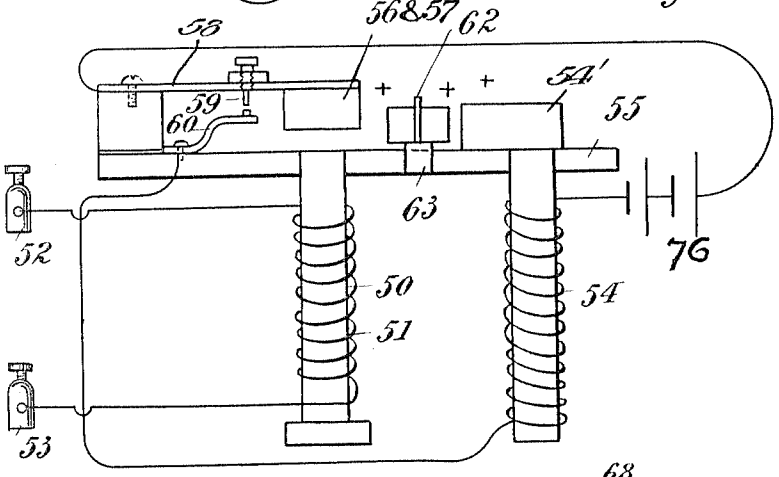


Fig. 11

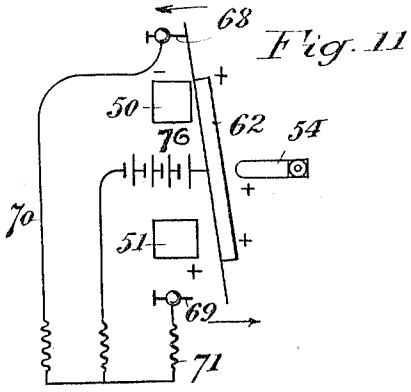
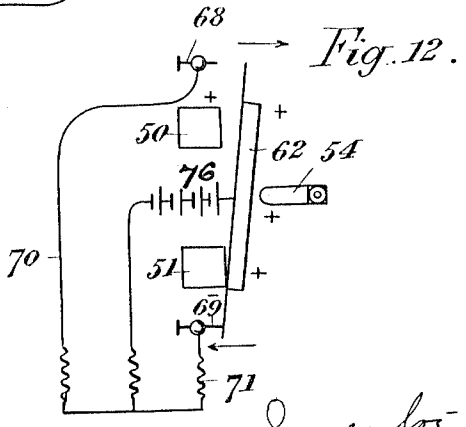


Fig. 12.



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APPLICATION FILED JULY 8, 1910.

1,072,474.

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6 SHEETS—SHEET 6.

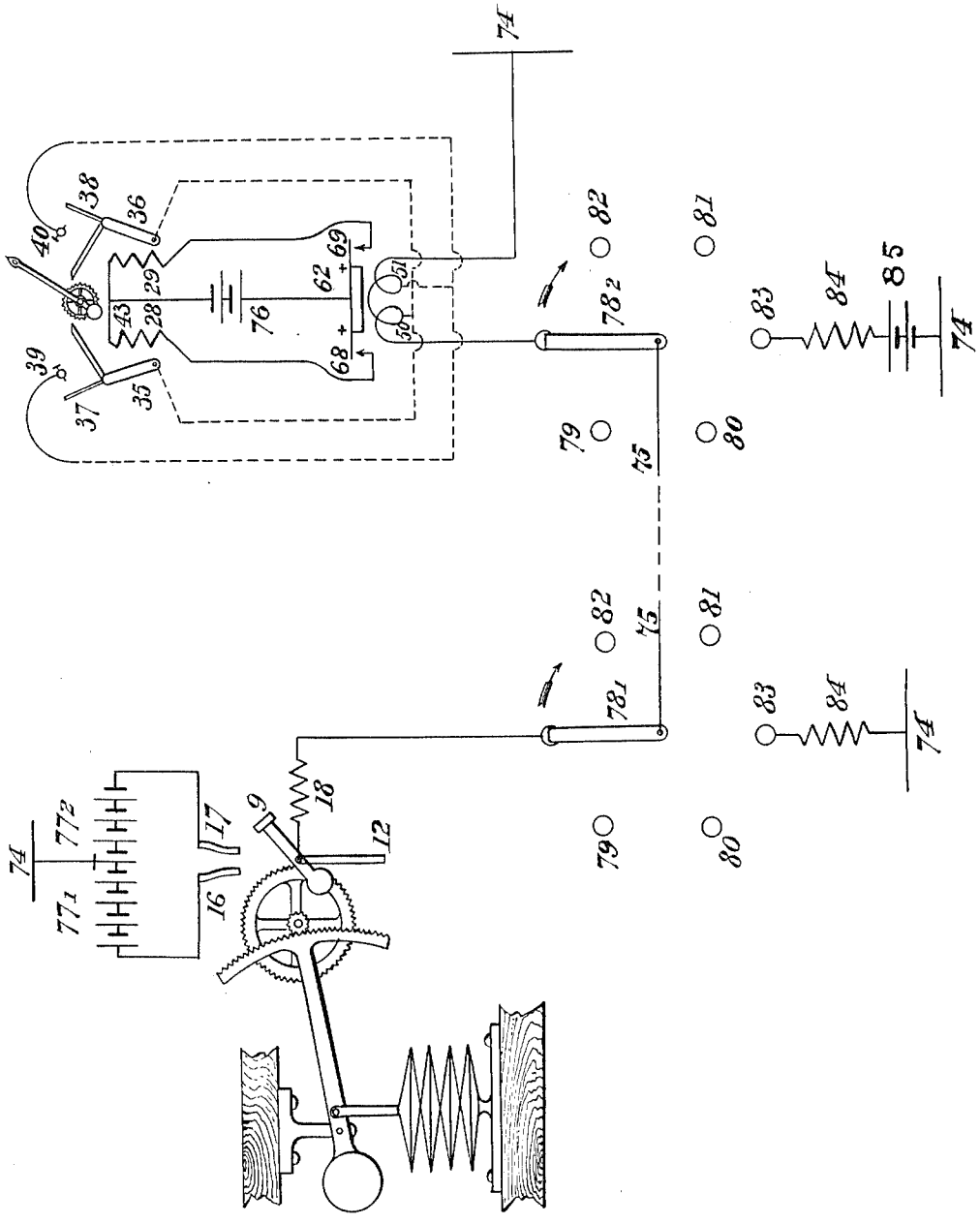


Fig. 14.

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UNITED STATES PATENT OFFICE.

ALBERT LAMBOT, OF BRUSSELS, BELGIUM.

AUTOMATIC ELECTRIC RECORDING DEVICE.

1,072,474. Specification of Letters Patent. Patented Sept. 9, 1913.

Application filed July 8, 1910. Serial No. 571,036.

To all whom it may concern:

Be it known that I, ALBERT LAMBOT, engineer, a subject of the King of the Belgians, and resident of Rue du Marché aux Porcs 27, Brussels, Belgium, have invented certain new and useful Improvements in Automatic Electric Recording Devices, of which the following is a specification.

The well known devices for recording at a distance are of complicated construction and very clumsy and unreliable in their action.

This invention relates to a simple, economical and reliable automatic electric device for recording at a distance, by means of which indications of several different measuring apparatus can be simultaneously transmitted by a single electric conductor.

The invention chiefly consists in the transmission device being provided with a tongue controlled by the measuring apparatus, which periodically moves a loose needle or tongue controlled by one or more electromagnets and makes or breaks the circuits, if desired, with the assistance of a "connection-float" or the like.

Another characteristic feature consists in the receiver being provided with a resistance, the short circuiting of which operates the transmission device after recording of each indication.

Another characteristic feature of the invention consists in the use of a self-polarizing selective relay.

In the drawing, Figure 1 is a side elevation of a transmission device mounted on a water gage indicator. Fig. 1′ is a plan of the guides for a movable needle shown in Fig. 1. Fig. 2 shows on an enlarged scale, in perspective the spring of the tongue belonging to the measuring device. Fig. 3 shows in perspective the tongue of the measuring device, and Fig. 4 is a perspective view of the contact part for the tongue of the measuring device. Figs. 5 and 6 show in plan the relative positions of the different parts. Fig. 7 shows a receiver with two electro-magnets provided with specially extended armatures. Fig. 8 is a cross-section of a float. Figs. 9 and 10 are plan and front elevation of a selective relay without permanent magnets. Figs. 11 and 12 show in plan two positions of the selective relay shown in Figs. 9 and 10. Fig. 13 shows diagrammatically electric connections when two conductors are used. Fig. 14 shows diagrammatically the working both for an ordinary polarized relay and for a new selective relay with automatic polarization.

In Fig. 1, a metal bar 1 bent at a right angle is secured to a support 2. Another metal bar 3 bent at its ends in opposite directions, is secured to the horizontal portion of the bar 1. On the vertical portion of the bar 1 is provided a pivot pin 4, and on the bar 3 a pivot pin 5. The pivot spindle of the device is marked 6. A roller 7, or any other desired transmission part, is mounted on the pivot spindle 6 and connected to the measuring or indicating device. On the spindle 6 is further mounted a specially shaped tongue 8. To the tongue 8 is secured, by means of a spring 8′, an angular part with a dove-tail 9, the narrowest portion of which is at 10 and which can oscillate on the tongue 8. The balance weight is marked 11. A needle 12 is movably mounted on its spindle, and when the said tongue is at rest, it can be held in the plane of rotation through the point 10 by the guides 13, 14. In the construction illustrated, there is further a triangular part 15 with two insulated contacts 16, 17 from which start wires 73, 72. A switching out electromagnet is marked 18. A specially shaped hammer 19, which, if desired, can be provided with a rotatable portion, is intended for reinforcing its action. The said hammer is mounted at the end of the extension 20 of the armature of the electromagnet 18. When no current passes through the electromagnet, a spring 21 keeps the armature away from the core. One end of the wire 23 of the electromagnet is connected to an insulated binding screw 22, while the other end is connected to the frame of the device. The parts 24, 25 and 26 are covered with a non-oxidizable metal, so as to insure that they should always remain good conductors. A roller 27 enables the blow of the hammer 19 to give its greatest effect.

In Figs. 2–6 the same parts are provided with the same reference numbers in accordance with Fig. 1.

Fig. 5 shows the relative positions of the angular part 9, of the movable needle 12, of the triangular part 15 and the hammer 19 when no current is flowing through the electromagnet 18. Fig. 6 shows the corresponding positions of these parts at the moment when the armature of the electromagnet 18 is attracted.

In Fig. 7, 28 and 29 are two electromagnets, and 30 is a toothed wheel which drives the index or hand 31 of the indicator 32 and the writing lever 33 of the recording device 34. The armatures of the electromagnets 28 and 29 are marked 35 and 36. The contact springs are marked 37 and 38, and the contact screws 39 and 40. The binding screws are marked 41 and 42, and a metal part 43. The points of the coils from which shunts are taken, are marked 44 and 45.

In Fig. 8, a pipe or tube is marked 46, and a rod 47 is movable in the said tube, the said rod being provided with a balance weight 48. A suspension of any desired kind is marked 49.

In Figs. 9–12, the coils of an electromagnet with one or two branches or arms are marked 50 and 51. 52 is a supply terminal and 53 a discharge terminal. 54 is the coil of a magnet arranged on the right hand side. 54′ is a piece of soft iron and 55 an insulating plate. 56 and 57 are soft iron parts, and 58 a plate made of springy non-magnetic metal. 59 is a contact screw, and 60 is a contact bar while 61 is a local battery. 62 is a prismatic soft iron which is rotatable on a spindle 63. 64 and 65 are springs, 66 and 67 contacts, 68 and 69 contact screws and 70 and 71 given circuits.

In Fig. 13 similar parts are provided with the same reference numbers. 72, 73 and 74 in this figure show certain conductors, and 16 and 17 are contacts.

The working of the parts is as follows: In the construction shown in Fig. 7, one of the two electromagnets 28 and 29 is used for feeding forward and the other for feeding backward. The two armatures of the two electromagnets are extended by means of pawls acting in different directions on a toothed wheel 30. The latter drives the hand 31 of the indicating device 32, and the writing lever 33 of the recording device 34. The new feature of this arrangement consists in the extension of the armature 35 and 36 of the electromagnets 28 and 29 by means of contact springs 37 and 38 alternately engaging with the contact screws 39 and 40. The current from the conductor passes into one or the other coil through the terminal screws 41 and 42, while the ends of the coils are connected to the metal part 43 connected to the armatures. At 44 and 45 there is arranged at each coil a shunt connected to the contact screw 39 and 40 and when the armature 35 is attracted, the part of the coil between 43 and 44 is short circuited. The same happens with the part between 43 and 45 when the armature 36 is attracted.

When using a selective relay and a single conductor wire, one end of the resistance which is to be switched out of the circuit with reference to the part 43, is connected to the armatures 35 and 36 while the other end of the said resistance is connected to the two contact screws 39 and 40, in such manner that the circuit is short-circuited whenever one or the other armature is attracted.

The working of the float shown in Fig. 8 is as follows: When the roller 7 (Fig. 1) becomes for some reason stationary, the rod 47 and its balance weight 48 keep the suspension passing over the roller 7 in tension, while the float can continue to rise freely.

The working of the constructions shown in Figs. 9–12 is as follows: As soon as the current passes through the electromagnet, the latter attracts the non-magnetic metal plate 58 by means of the soft iron parts 56 and 57 which represent then the polar pieces of the cores of the electromagnet, whereupon the contact screw 59 engages with the bar 60. The current of the local battery 61 which always flows in the same direction, is guided through the said bar 60 into the electromagnet 54 and polarizes the soft iron part 54′ which in its turn polarizes the prismatic soft iron bar 62 rotatable about the pin 63 and held when at rest at equal distances from the polar pieces 56 and 75 by the springs 64 and 65 (Fig. 9).

The bar 62, shown in Figs. 9 and 10, has only its center part opposite the face of the piece 54^1, which latter constitutes a projecting part of the electro-magnet 54. When this piece 54^1 is charged with positive magnetism, the center part of the bar 62 will be negatively polarized, while the two ends of this same bar 62 will be positively polarized, as indicated in Fig. 9. The sign + of Fig. 10 represents thus the positive polarization of the polar projection 54^1 of the electromagnet 54 and the ends of the bar 62, as shown in Fig. 9. This magnetic bar 62 is connected to the source of local current and provided with two contacts 66 and 67.

According to the direction of the current passing through the soft iron parts 56 and 57, one or the other contact 66 or 67 comes into contact with one of the contact screws 68 or 69 which send the current of the local battery 61 into one or the other circuit 70 or 71, as in the case of ordinary polarized relays.

Figs. 9 and 10 on the one hand and Figs. 11 and 12 on the other hand relate to different arrangements. Fig. 10 has for its object to especially show the way in which the polarizer 54 acts on the bar 62, as has been explained above, when a line current flows through the coils surrounding the cores 50 and 51. On the other hand, Figs. 11 and 12 show diagrammatically the whole of the device in which are represented two circuits 70 and 71, which are worked separately and alternately by any polarized relays, the polarizing piece of which would be 54, 54′, whether it be a permanent electro-magnet or

one similar to the one represented at 54 in Fig. 10. The battery 61 represents either any local source of electricity and it can be used simultaneously to work the whole of the device represented in Figs. 11 and 12 and the electro-magnet 54, shown in Fig. 10; or the battery 61 shown in Fig. 10 can be independent and different from the two batteries indicated by the same numeral in Figs. 11 and 12. In these Figs. 11 and 12, the circuits 70 and 71 represent namely the individual circuits of the electro-magnets 28 and 29 of Fig. 13.

It follows from the above arrangement that, whenever the transmission device sends a current into the one conductor in one or in the other direction, the receiver registers one division of the measuring device forward or backward.

Fig. 13 shows diagrammatically the arrangement of the circuits of the general installation, by way of example. The tongue 8 controlled by any desired measuring or indicating device, drives by means of the point 10 of the dovetailed part 9 the movable needle 12 and brings it into engagement with one of the contacts 16 and 17 (Fig. 13). This results in producing a contact between the non-oxidizable parts 24, 25 and 26 (Fig. 1.) and a current is sent either through the conductor 72 or the conductor 73, so that either the electromagnet 28 for forward moving or the electromagnet 29 for backward movement is influenced one or the other of which acts then on a tooth of the toothed wheel 30 (Figs. 7 and 13) and correspondingly controls the hand 31 or the writing lever 33. It is obvious that any other arrangement can be used which brings about such circuit switching. This current flows in the present case without affecting the electromagnet 18 with a resistance which is weak compared to that of the circuit.

The electromagnet 18 becomes operative only under the action of a current, the strength of which has been increased, after the armature of one of the electromagnets 28 or 29 has been attracted and short-circuits a great portion of the conductor resistance. At that moment, the armature of the switching out electromagnet 18 is violently attracted, and the hammer 19 strikes the part 9 which it moves away from the tongue 8. This results in the movable needle 12 being advanced and forced to leave the contact parts so that the circuit is thus broken. The movable needle remains then in the plane of rotation of the system, and the method of working described is periodically repeated.

The cord of the float provided at its other end with a balance weight, is guided over the roller 7. (Fig. 1). In the present case it may be assumed that the circumference of this roller is $2r\pi=10$ cm. Accordingly, at each movement of the float in one direction to the extent of 10 centimeters, the roller 7 will make a complete revolution. In the construction shown in Fig. 13, the device 11, 6, 8, 8′, 27, 10, 9, 24 secured to the roller 7 and shown in detail in Fig. 1, drives therefore during the said rotation the loose needle 12 (Figs. 1 and 13) seizing the same by means of the recess or notch 10 (Figs. 1, 2, 3 and 5) and, according to the direction of rotation, bringing it to one or the other contact bar 16 or 17 (Figs. 1, 4, 5 and 6) representing the ends of the two contacts and conductors 16—73 and 17—72 (Fig. 13). The device would be, therefore, locked if at the same time there was not produced an electric circuit. The electric current sent through the contacts and conductors 16—73 or 17—72 (Fig. 13) acts, however, first on one of the electromagnets of the receiver, which are provided with very sensitive coils with numerous windings, and in that way brings about the movement forward or backward of the indicating needle or of the pencil shown in detail at 31, 34 (Fig. 7.) The electromagnet system 18 (Fig. 1) shown diagrammatically at 18 in Fig. 13, is, however, much less sensitive, as it consists of a coil with a smaller number of windings and has not yet become operative. As soon, however, as the contacts 37—39, 38—40 (Figs. 7 and 13) have been closed after the action of the receiver, a large part of the resistance is cut out (by the short circuiting) and thereby the strength of the electric current is increased to an extraordinary extent, so that the separating electromagnet system becomes operative in the manner hereinafter described and produces a release by breaking the circuit and thus preventing any current from flowing in the conductor. This resistance, utilized for short circuiting, can be any desired resistance introduced into the conductor. It can be for instance constituted by a large portion of the electromagnet coil of the recording receiver, or of the conducting electromagnet of the selective relay.

As soon as the separating electromagnet system of the transmitter 18 (Figs. 1 and 13) has been excited in the manner described, the armature extended by a specially shaped hammer (as a cross or as a greatly recessed roller 19 Figs. 1, 3, 5 and 6) strikes strongly and instantaneously the part 9, 10 (Figs. 1–6) whereby the part in question is quickly pushed forward, while the part 9, 10 owing to its triangular shape, also quickly advances and acts in the direction of rotation on the loose needle 12 (Fig. 1) which passes in front of the part 15 (Figs. 1, 4, 5 and 6) on which are mounted the fixed contact bars 16, 17, (Figs. 1, 4, 5, 6 and 13). The needle is thus brought out of reach of the contacts in the plane of rota-

tion, even if its weight is sufficiently great and falls back into a vertical position. It is not seized again, and moved toward one or the other of the contacts 16 or 17, until the cord of the float or the movement of the gear of any desired measuring apparatus produces a rotation of the device in one or in the other direction. The electric circuits instantaneously produced at the receiver are shown in Fig. 13: As soon as the level of the liquid has risen, the following circuit will be produced: return or earth wire 74, separating electromagnet 18, loose needle 12, conductor 73 and contact, electromagnet 29 of the receiver, metal part 43, battery and return or earth conductor 74. When the level of the liquid falls: earth or return conductor 74, separating electromagnet 18, loose needle 12, conductor 72, electromagnet 28 of the receiver metal part 43, battery and return or earth conductor 74.

Fig. 14 shows an arrangement illustrating the working both for an ordinary polarized relay and for a new selective relay with automatic polarization. In this construction, the fixed transmitter consists of the box or casing of a barometer or pressure gage, and a system of rotary commutators is used for multiple transmissions of current through a single wire.

The contacts 16 and 17 represent the different poles of the two batteries 77′ and 77″ instead of forming extensions of the two conductors connecting the transmitter to the receiver, the said poles having one and the same earth conductor 74. The separating electromagnet 18 is connected to a single wire 75 connecting the transmitter to a selective relay 50, 51, 62 (Figs. 11, 12 and 14) while the electromagnets for the movement forward and backward are connected to the contacts 68 or 69 (Figs. 11, 12 and 14) and their return conductor, or the metal part 43, to a local battery 76 (Fig. 14) the other pole of which is connected to the oscillating armature 62 (Figs. 11, 12 and 14).

It will be seen from the preceding description that at each rotation in one direction, the driving device 9 brings the needle against one of the contacts 16 or 17 and sends a current into the conductor in a given direction, which current, in passing through the relay 50, 51 (Figs. 11, 12 and 14) attracts one of the ends of the polarized armature 62 and repels the other end, whereby one of the contacts 68 or 69 is closed, and one or the other electromagnet of the receiver 28, 29 according to the direction of movement, is excited by the local battery 76. At that moment, one of the contacts 37—39 or 38—40 (Fig. 14) short-circuits a large resistance which can be constituted by a portion of the electromagnet of the relay 50, 51 (Fig. 14). In that way, the strength of current in the separating electromagnet 18 (Fig. 14) is increased to a very great extent and breaks the circuit in the manner hereinbefore described. The automatically polarized selective relay acts, therefore, like the relays which are polarized by artificial magnets, as is usual in telegraphy or in signaling devices in order to save one conductor. The arrangement according to this invention has, however, the advantage that, as it is not polarized by an artificial magnet, it cannot be depolarized, like the other, by an outer or earth or atmospheric current. Moreover, its polarity for the same reason, cannot be reversed, and in that way a movement of the devices in the opposite direction produced. As the selective relay is also less sensitive than relays polarized by artificial magnets, and as the speed of its action can be adjusted at will, it is not sensitive to the action of current oscillations (lighting) or alternating currents. It does not give any false indications due to instantaneous outer discharges (lightning etc.). For that reason, it can be used, as it can be made nonsensitive to alternating currents, when it is desired to use telephone wires at the same time for transmitting measuring indications.

Simultaneous transmission of different indications by a single wire is obtained by the use of a system of rotating commutators working synchronously, which periodically connect the transmitter connected to a given measuring device, to the receiver of a suitable kind, in circuit.

In Fig. 14, the cranks 78′ 78″ represent two rotating commutators connected by the conductor 75, which at that moment connect the transmitter for pressure gage or barometric indications, to the receiver for the said devices. The other contacts 79, 80, 81, 82 are intended for other suitable apparatus, while the contacts 83 can connect, at each revolution, the electro-magnets 84 and the battery 85 for producing synchronous working of the commutator system.

I desire it to be understood that in using the designation "recording device" in the foregoing description and in the claims, I do not intend to limit this patent to an embodiment of the invention with any particular type of means for reading the results of the operation, since any means may be employed which permits a reading of such results.

Having now fully described my invention, what I claim is:

1. In an automatic electric recording device comprising a transmitter, a circuit and a receiver; a tongue coöperating in the closure of the electric circuit, mounted on the said transmitter and suitable operating means controlling said tongue and rotating it; a scale whereon indications of said recording device are readable; a loose needle

adapted to close and to open the said circuit, carried around by said tongue at each of its rotations, and electro-magnetic means adapted to release said loose needle when it reaches the contact position and making it cut the circuit.

2. In an automatic electric recording device comprising a transmitter, a circuit and a receiver; a tongue coöperating in the closure of an electric circuit mounted on said transmitter and suitable operating means controlling said tongue and rotating it; a scale whereon the indications of said recording device are readable; a loose needle adapted to close and to open said circuit, carried around by said tongue at each of its rotations, and loosely mounted on said transmitter; electro-magnetic means adapted to release said needle when it reaches the contact position, and means on said receiver for closing and opening said circuit in cooperation with said needle.

3. In an automatic electric recording device comprising a transmitter, a circuit and a receiver; a tongue coöperating in the closure of an electric circuit mounted on said transmitter and suitable operating means controlling said tongue and rotating it; a scale whereon the indications of said recording device are readable; a loose needle adapted to close and to open said circuit, carried around by said tongue at each of its rotations; an electro-magnet for said transmitter adapted to release said needle, when it reaches the contact position; a pair of electro-magnets forming resistance in the receiver, armatures for said receiver electro-magnets, and a shunt on each of said receiver electro-magnets for cutting out a part of said resistance, when the armature of said transmitter electro-magnet, having for its object the releasing of the loose needle in the transmitter, is influenced in such a way as to remove said needle from the contacts and to cut said circuit, immediately after the instantaneous working of the receiver.

4. In an automatic electric recording device, comprising a transmitter, a circuit, and a receiver; a tongue coöperating in the closure of an electric circuit, mounted on said transmitter and suitable operating means controlling said tongue; a loose needle adapted periodically to close and to open the circuit, carried around by said tongue at each of its rotations; an electro magnet for said transmitter; a pair of electro-magnets forming resistance in the receiver, armatures for said receiver electro-magnets and a shunt on each receiver electro-magnet for cutting out a part of said resistance when the armature of said transmitter electro-magnet is attracted, whereby said needle-releasing electro-magnet is influenced in such a way as to remove said loose needle from the contact, and to cut the circuit, immediately after the instantaneous working of the receiver; a selective relay with automatic polarization requiring the use of one wire and the earth for a return, the said selective relay having an electro-magnet, whereby objectionable action of all exterior currents is prevented.

In witness whereof I have hereunto set my hand in presence of the witnesses.

ALBERT LAMBOT.

Witnesses:
E. MEY,
GREGORY PHELAN.