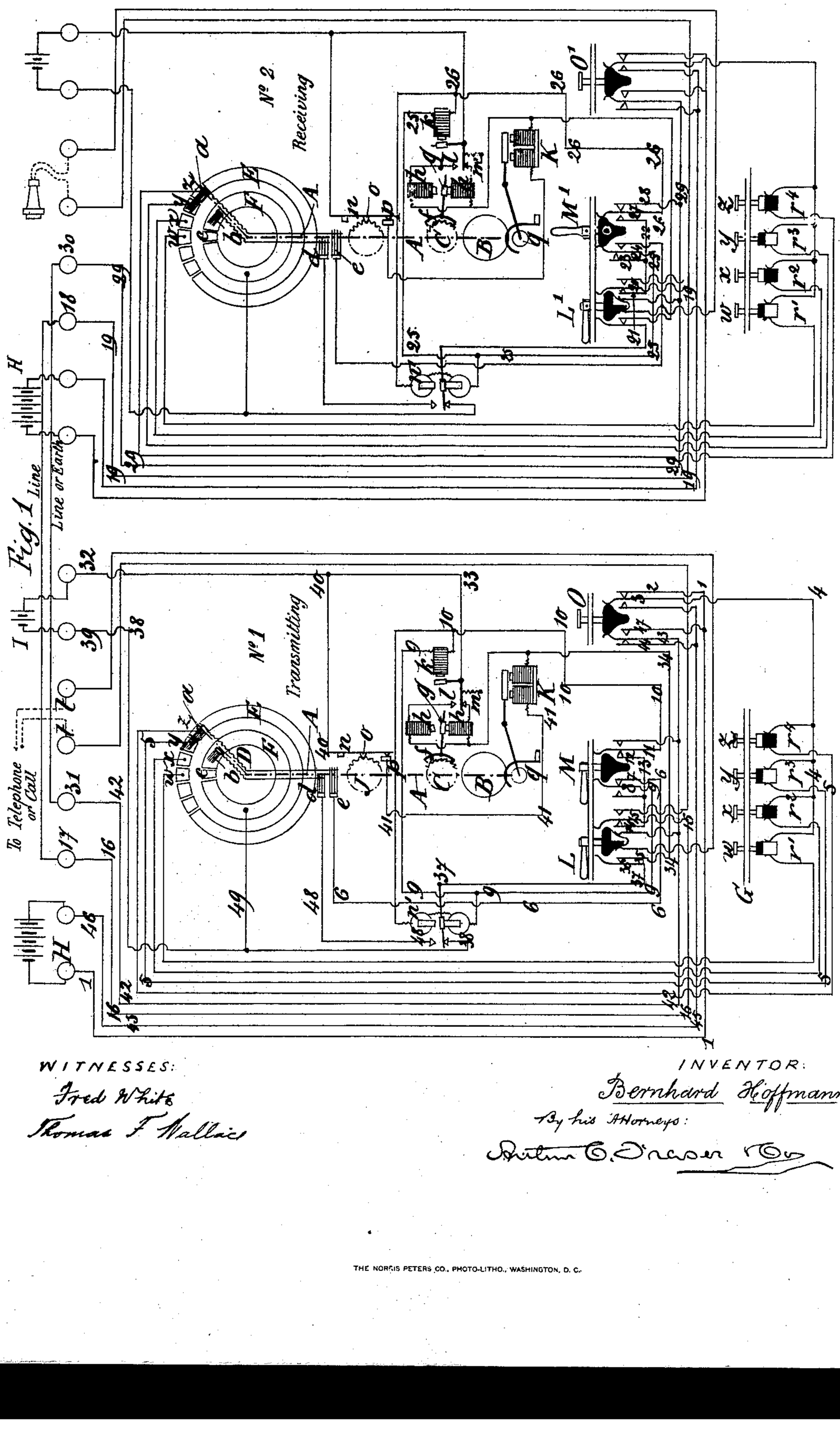
No. 608,333. Patented Aug. 2, 1898.

B. HOFFMANN.

TELEGRAPHIC TRANSMITTING AND RECEIVING APPARATUS.

(Application filed May 5, 1897.)

(No Model.) 4 Sheets—Sheet 1.



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No. 608,333. Patented Aug. 2, 1898.

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(Application filed May 5, 1897.)

(No Model.) 4 Sheets—Sheet 2.

Fig. 2

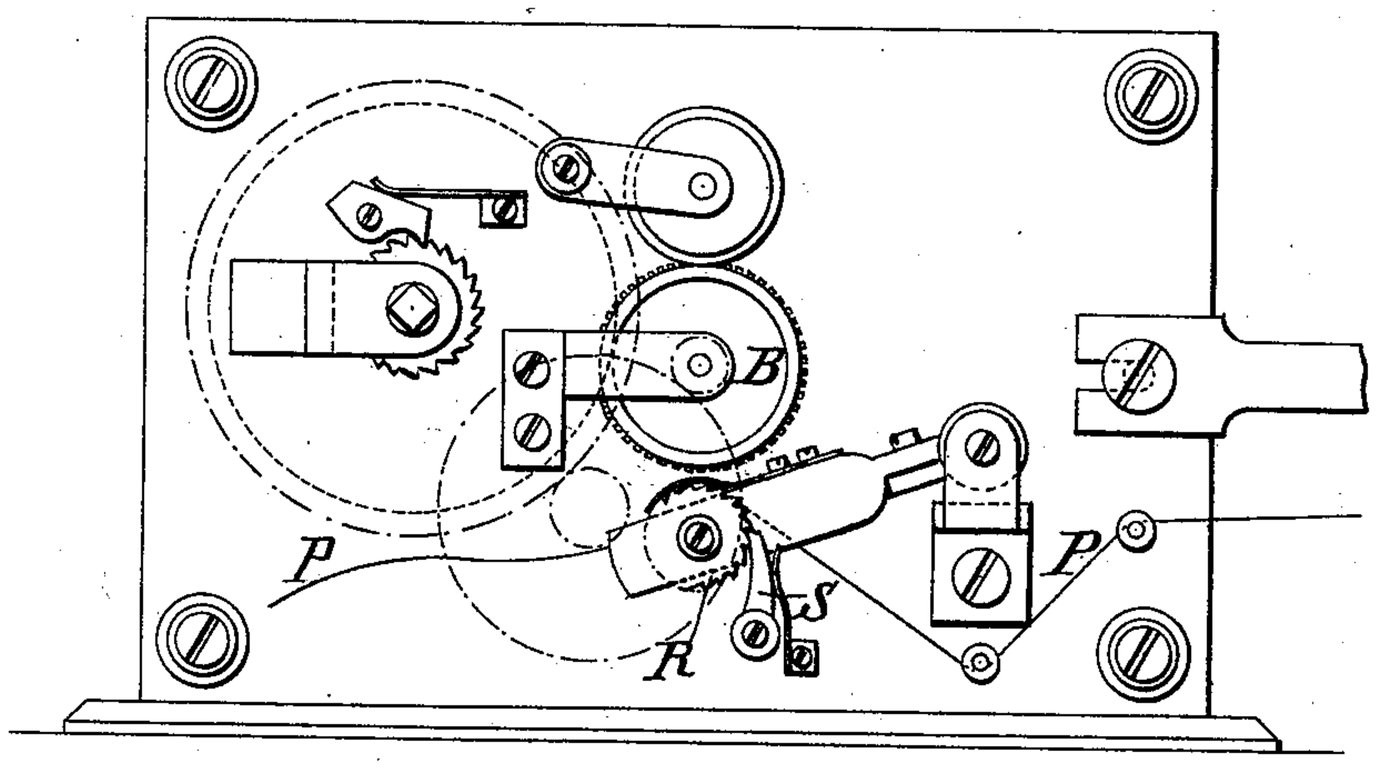
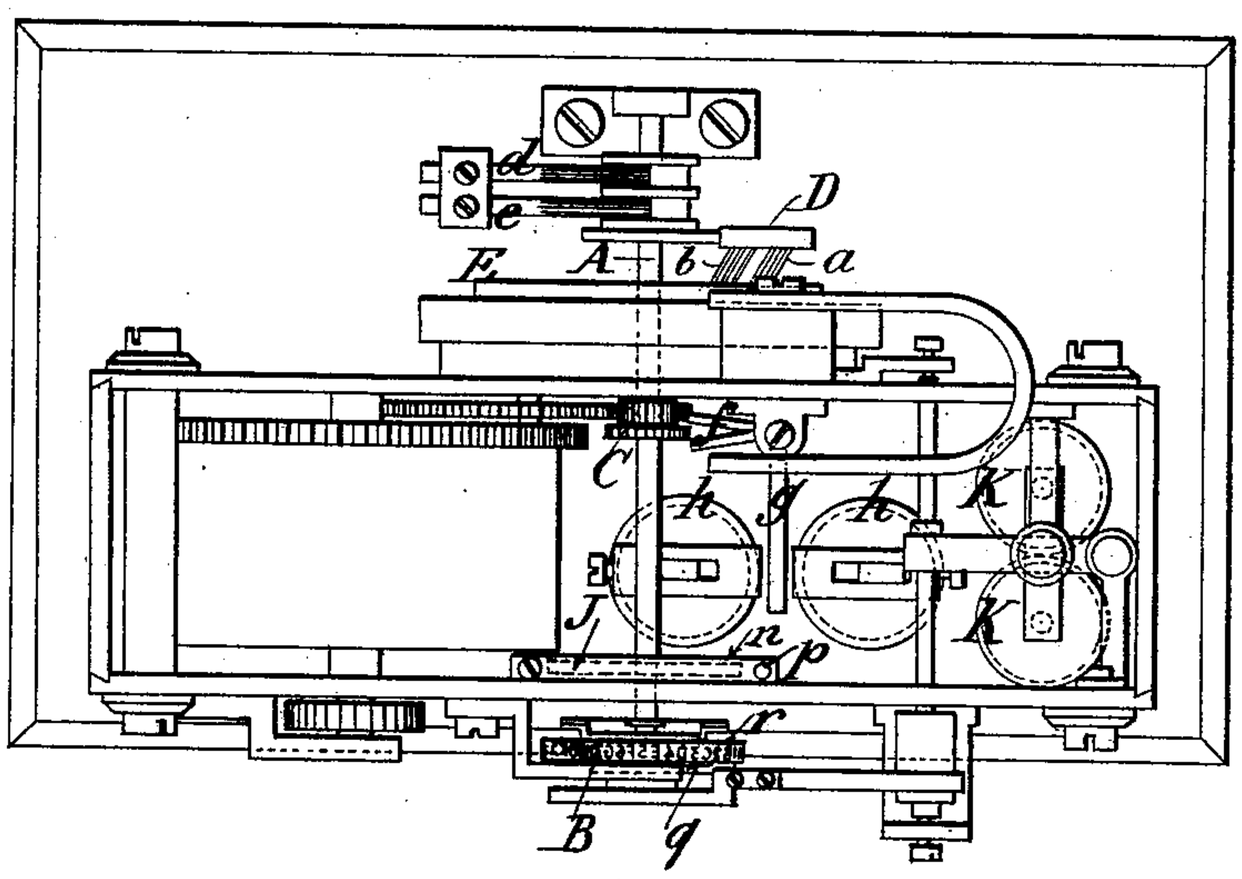


Fig. 3



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(No Model.) 4 Sheets—Sheet 3.

Fig. 4

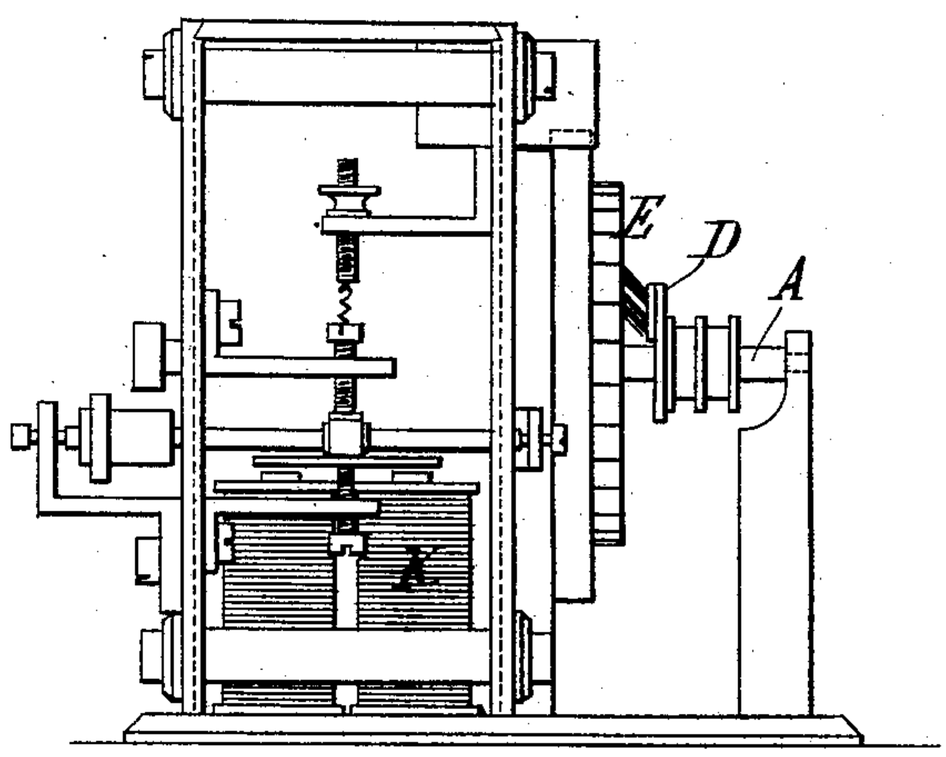


Fig. 5

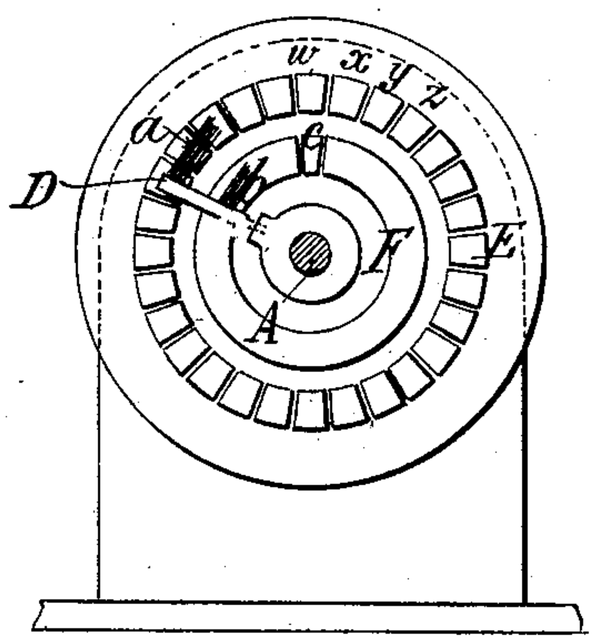


Fig. 6

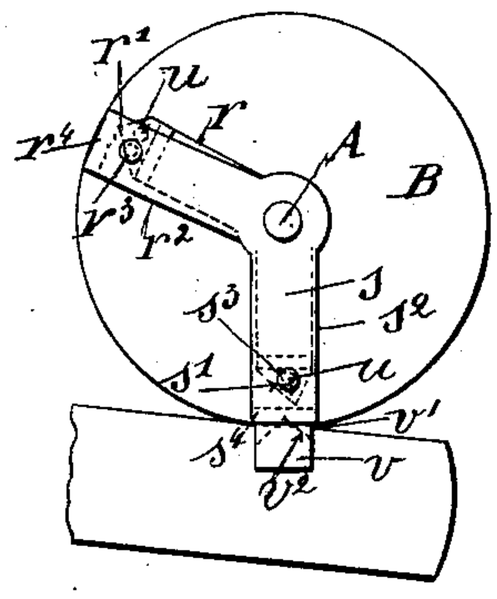


Fig. 7

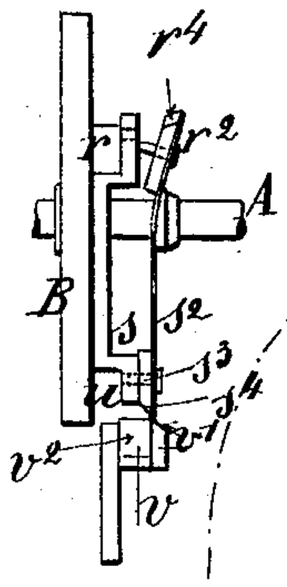


Fig. 8

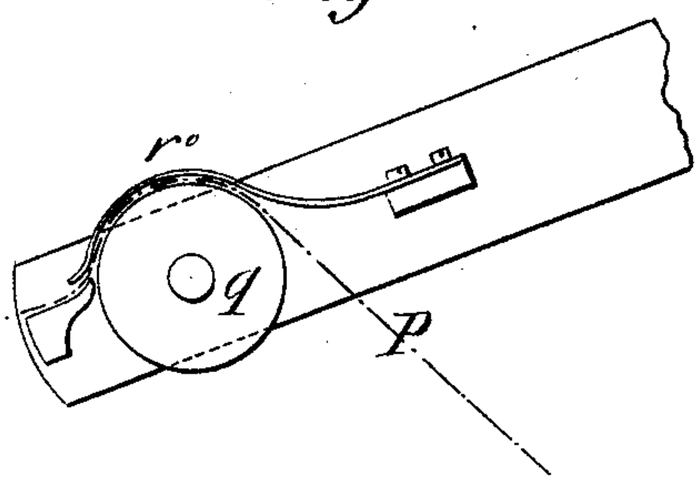


Fig. 9

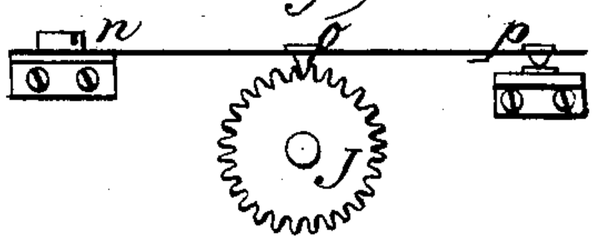
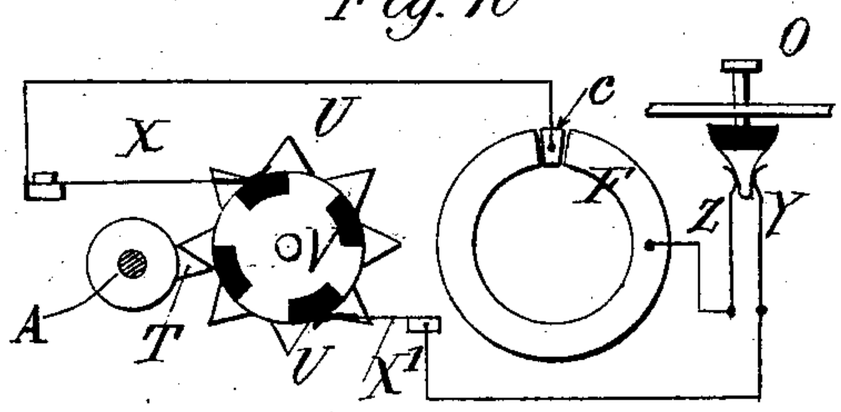


Fig. 10



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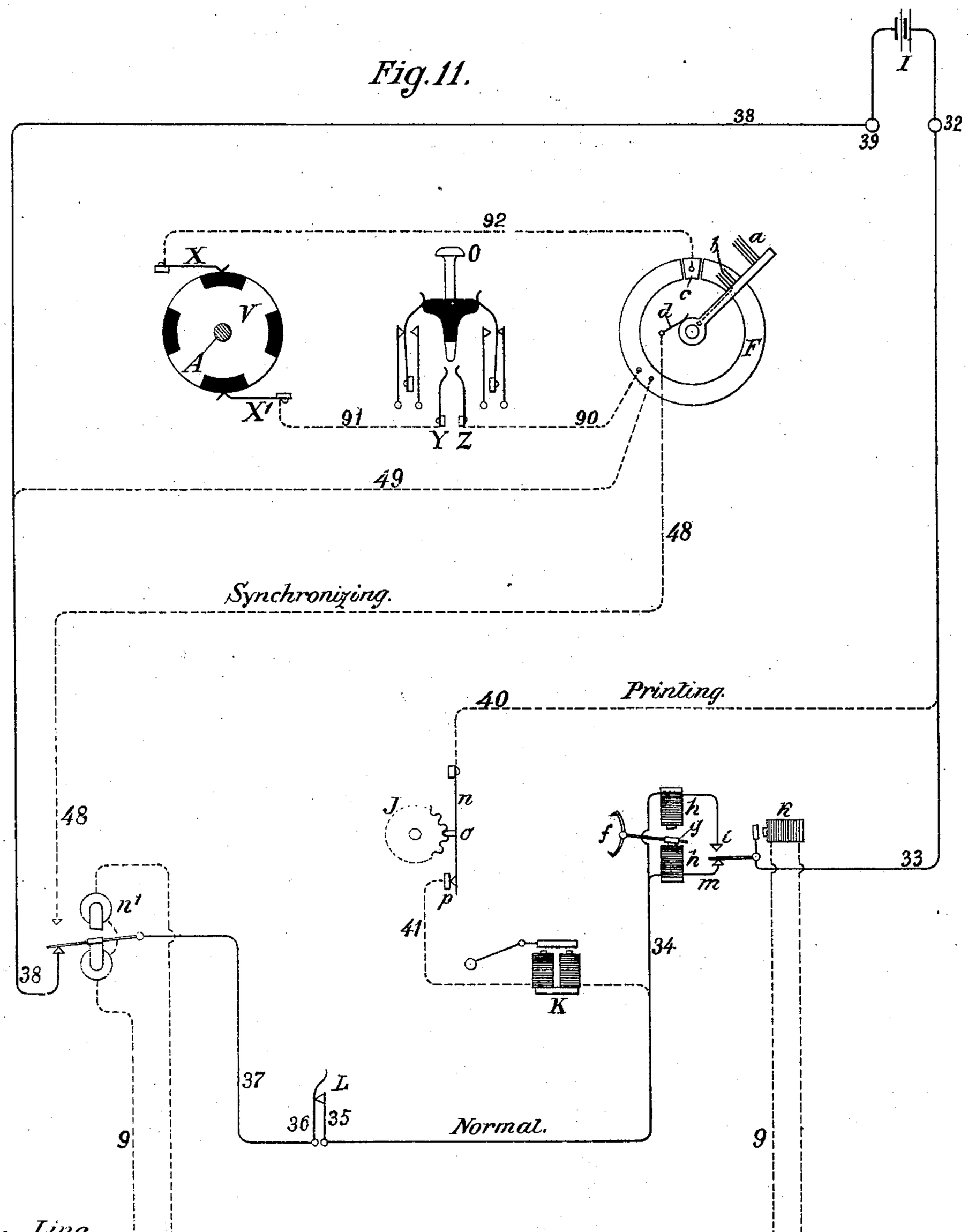
TELEGRAPHIC TRANSMITTING AND RECEIVING APPARATUS.

(Application filed May 5, 1897.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 11.



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UNITED STATES PATENT OFFICE.

BERNHARD HOFFMANN, OF PARIS, FRANCE, ASSIGNOR TO SOCIÉTÉ THE INTERNATIONAL TELESCRIPTOR SYNDICAT, LIMITED, OF LONDON, ENGLAND.

TELEGRAPHIC TRANSMITTING AND RECEIVING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 608,333, dated August 2, 1898.

Application filed May 5, 1897. Serial No. 635,107. (No model.) Patented in Luxemburg March 20, 1897, No. 2,789.

To all whom it may concern:

Be it known that I, BERNHARD HOFFMANN, a subject of the Emperor of Austria-Hungary, residing in Paris, France, have invented certain new and useful Improvements in Telegraphic Transmitting and Receiving Apparatus, (the same being the subject of Letters Patent in Luxemburg, No. 2,789, dated March 20, 1897,) of which the following is a specification.

This invention has reference to telegraphic transmitting and receiving apparatus, and has for its object to simplify and improve the construction and operation of apparatus of the character described in my United States Letters Patent No. 574,994, of January 12, 1897. This object is attained by the improved and modified apparatus hereinafter described, which will be fully understood from the following description and from the annexed drawings, in which—.

Figure 1 is a diagram showing two apparatus connected up, the one being in the transmitting position and the other operating as a receiver. Fig. 2 is a front elevation, Fig. 3 a plan, and Fig. 4 a side view, of an apparatus constructed according to the present invention. The other figures show details. Fig. 5 is a face view of the commutator. Figs. 6 and 7 are face and edge views of the type-wheel. Fig. 8 is a detail of the impression-roller. Fig. 9 is a detail of the circuit-closer for the printing-magnet. Fig. 10 is a diagram. Fig. 11 is a diagram showing the local circuits simplified to make clear the means for synchronizing.

Upon the spindle A, which is driven by a clockwork-movement, is a wheel B, which I will call the "type-wheel" and which carries on its periphery the different signs or characters to be transmitted. On the same spindle is mounted an escapement-wheel C, allowing of the intermittent rotation of a clockwork-movement which drives this spindle. An arm D, carrying two metallic brushes *a* and *b*, is mounted on the opposite end of the spindle A to that which carries the wheel B and rotates with an intermittent movement in front of a commutator or distributing-crown E. The brush *b* rubs upon a second contact-ring F, interrupted at *c*, the purpose of which will be explained later.

The brush *a* in its rotation rubs successively over a series of sectors *w x y z*, &c., twenty-eight of which are shown in the drawings, Fig. 5, these being normally insulated from each other and respectively connected with the keys of the keyboard of the machine.

The brushes *a* and *b* are respectively connected to the rubbers *d* and *e*, which bear upon insulated collars, to which they transmit the current.

The keys of the machine are alternately in communication with one of the poles of the line-battery H by springs r' r^3 r^5 r^7, &c., or insulated from that pole by the springs r^2 r^4 r^6. Upon depressing one of the keys in communication with the battery this latter is cut out of the circuit, because the corresponding contact-springs are thereby caused to press against an insulated portion of the key. On the other hand, by depressing one of the insulated keys the battery is placed in communication with the line.

The movement of the wheel C is controlled by any suitable escapement *f*. In Fig. 1 of the drawings it is shown as a double-pallet escapement. The escapement *f* is carried by the armature *g* of an electromagnet *h*, the solenoids of which are arranged to act independently of one another and to attract the armature *g* either to the right or to the left. The armature is polarized, and in order that it may be attracted to the one side or the other it is necessary to develop in the solenoids opposite polarities to those of the said armature. When the coils of this electromagnet are alternately traversed by a current, the escapement-pallet oscillates between the escapement-teeth, and the wheel C escapes one tooth at each movement, and the brush *a* then turns to the extent of one division of the commutator E.

There is a relay-electromagnet *k*, the object of which is to send currents alternately into each of the coils of the electromagnet *h*. For this purpose the armature of the relay *k* is connected with the one pole of a local battery I, while the other pole of this battery is connected to earth. The two contacts

l m between which this armature moves are connected, respectively, to the two coils of *h*. The spindle A also carries a wheel J, provided with curved teeth, say twenty-eight in number, this number being equal to that of the contacts of the commutator E. Above this wheel is a spring *n*, carrying a finger *o*, which is lifted each time a tooth of the wheel J passes beneath it. This spring *n* is connected at one end to the local battery I and carries at its other extremity a pin which may be in communication with a contact connected to the printing-electromagnet K. Every time the finger *o* falls into a gap of the wheel J the current from the local battery is closed in the electromagnet K; but by reason of the rapidity of the operation of the apparatus the spring is thrust back and the contact is only established for a period which is too limited to allow the electromagnet K to act. Practically this spring rarely touches its bearing. It is only when a character is printed and the apparatus stops that the finger *o* can enter sufficiently into the gap of the wheel J and the duration of contact becomes sufficent to allow the electromagnet K to operate. The apparatus also comprises two commutator keys or switches L and M and a button O of a pole-changer, these being situated above the keyboard and acting upon springs in order to effect the different communications between the parts of the machine and between the apparatus which are in communication with each other by the line.

In the following description it is supposed, as an example, that the apparatus is combined with a telephone branched on the same line when the keys L and M are raised. This telephone is in communication with the apparatus by the terminals *t t*.

Referring to the scheme of Fig. 1, in which apparatus No. 1 is in the transmitting position and No. 2 in the receiving position, the path of the currents will be as follows: The current passes over the lead 1 to the springs 2 and 3 of the button O, the wire 4, the springs r^3, for example, wire 5, contact *y*, brush *a*, rubber *c*, wire 6, springs 7 and 8 of key M, wire 9, electromagnet *k*, wire 10, springs 11 and 12 of key M, connection 13, springs 14 and 15 of key L, wire 16, and terminal 17 of the line-wire. At the receiving-station No. 2, the key L′ being alone depressed, the current arrives by the terminal 18, wire 19, springs 20 and 21 of key L′, connection 22, springs 23 and 24 of M′, wire 25, relay-electromagnet *k*, wire 26, springs 27 and 28 of M′, wire 29, and terminal 30, connected to a second line leading to terminal 31 of the transmitting apparatus or preferably to earth, this latter terminal being then situated at earth. In each of the two stations the armature of the electromagnet *k* is attracted, its lever comes into contact with one of the two contacts *l* or *m*, closes the local circuit by 32, 33, *l*, or *m*, electromagnet *h*, wires 34, springs 35 and 36 of key L, wire 37, armature of electromagnet *n*′, wire 38, and returns to the battery I by the terminal 39. The armature *g* of electromagnet *h* being attracted causes the escapement-pallets to move, the ratchet-wheel C escapes one tooth, and the brush moves forward upon the commutator E. The following sector *z*, for example, being insulated, the line-current is interrupted, the electromagnet K allows its armature to return to rest, the local circuit is closed through the second solenoid of *h*, the armature *g* is attracted in the opposite direction, and the escapement operates afresh. There has thus been obtained at the two stations a synchronous forward movement of the brushes *a*, and consequently of the type-wheels B.

Suppose now that the brush *a*, leaving a a sector in connection with the line-battery II, comes upon the following sector, which, instead of being insulated, is also put in communication with the battery by the depression of the key which corresponds with it on the manipulating keyboard. The armature *k* remains attracted, the local current passes into the same coil of *h* as at the previous moment, and the escapement ceases to act, and the mechanism stops. The same things occur in identically the same way if the brush *a*, leaving an insulated sector, comes upon the following one, which has just been insulated by depressing the corresponding key. The armature of *k* not being attracted at this moment remains at rest and sends, as at the preceding instant, a local current into the same coil of *h*. The escapement no longer acts. At this moment the spring *n* bears upon the contact *p*, because the finger *o* enters into the gap of the wheel J, which has followed the movement of the brush *a*. A local current passes through 32, 40, *n*, *p*, and 41 and electromagnet K and returns to the battery by 34, 35, 36, 37, 38, and 39. The electromagnet K attracts its armature and brings the roller *q* and the paper which it carries in contact with the type-wheel. The printing is effected at this moment and the character corresponding to the key depressed appears on the paper. The current coming from the earth terminal 31 follows the lead 42 through the springs 43 and 44 of the pole-changing button O, the wires 45, and the second terminal 46 of the line-battery, completing the circuit. If the button O is depressed, the current coming from the terminal 1 passes through the springs 47 and 43, then returns by 42 to the terminal 31 of the line. The current is thus reversed by this operation. This reversal of current is utilized to obtain synchronous starting of the two apparatus at the commencement of a communication or even in the course of same. For this purpose the relay *n*′ is polarized. Its armature, connected with the electromagnet *h*, as already explained, carries a contact-piece, by means of which it is further put into communication with the local battery I either by the wire 38 and terminal 39 or by the wire 48 and the

brush *d* through the one or the other of the contacts between which it vibrates. There is a branch wire 49 from wire 38, which establishes communication between the latter and the continuous portion of the contact-ring F, and the contact *c* of this latter is insulated. So long as the current flows in the normal direction—that is to say, so long as the button O is raised—the armature of the electromagnet *n'*, which is in the line-circuit, remains in contact with the lower contact 38, which connects *h* with the local battery; but as soon as the current is reversed by the depression of the button O, as before explained, the armature of *n'* comes against the other contact and puts *h* in communication by 48 with the rubber *d*. The current returns by the latter through *b*, F, 49, 38, and 39 to the local battery. When in consequence of the rotation the brush comes upon the contact *c*, which is insulated, as above stated, the current from the local battery is cut off from the electromagnet *h*, which ceases to act, and the whole arrangement stops in this position.

To send a call, the bell-call button of the telephone is pressed, the keys L, M, and O of all the stations being raised.

To transmit, the transmitting-station depresses L and M, and to receive the receiving-station depresses L' only, as seen in Fig. 1. In this position the transmitting-station by depressing the key O sends a current of reverse direction to the normal into the two apparatus in order to establish their synchronism.

Suppose the receiving-station to be in advance of the transmitting-station. The apparatus work together until at the receiving-station the brush *b* comes upon *c*. At this moment the whole arrangement at the receiving-station stops, and the transmitting-station continues to work until its own brush *b* also comes upon its sector *c*. Pressure is then removed from the key O, and the two apparatus work synchronously together. If, on the contrary, it is the transmitting-station which is in advance of the other, the two apparatus stop when the brush *b* comes upon the insulated sector *c* at the transmitting-station, since it is the latter which produces the emissions and interruptions of the line-current. It is then only necessary to lift for an instant the key O. The two apparatus have then advanced together to the extent of one contact; but it is now the receiver which is in advance of the transmitter. By at once depressing the key O the apparatus are again set in operation, and the case is the same as the preceding—the receiver stops first. It is therefore desirable before commencing to transmit to press twice upon the button O to insure the synchronous starting of the two apparatus.

The parts of the apparatus shown in Fig. 1 are indicated by the same letters of reference in Figs. 2, 3, 4, and 5, Fig. 5 showing the distributing ring or commutator.

I will now proceed to describe certain details of construction.

It has been seen that the type-wheel is arranged to rotate by intermittent movements each of one twenty-eighth of a revolution. In order to increase the facility of working the apparatus, this wheel is adapted to print a number of characters twice as great as the number of contacts of the commutator E. For this purpose the characters or signs engraved on this wheel are arranged in two series alternated in one row peripherally of the wheel—for example, in the following order: A 1 B 2 C 3, &c. The type-wheel turning one twenty-eighth of a revolution at each movement of the brush *a*, the characters are presented in the order A B C D 1 2 3 4, according to the position of this wheel with respect to its axis—that is to say, that in order to produce the one or the other of these two series it is necessary to turn the wheel forward or backward one fifty-sixth of a revolution with respect to its spindle. The arrangement which is employed for this purpose is represented on a larger scale in rear elevation, Fig. 6, and in side view, Fig. 7. The letters of the alphabet, alternated with the figures and the signs of punctuation or expression, are engraved upon the periphery of the disk B. There are in all fifty-six divisions, fifty-two of which are allotted to the letters, figures, and signs and the four others to the spaces for the letters and to the spaces for the figures. The same key of the keyboard therefore allows of printing two different characters, according to the position of the disk. Behind the disk B and loose on the spindle A are arranged two arms *r s*, each formed with a hole *u* and a beveled nose *r' s'*. Above these arms are springs r^2 s^2, each carrying a pin r^3 s^3. The two arms *r s* are at any suitable angle to each other, this being determined by the position on the disk of the blank spaces for the letters and for the figures. The angle of r^2 s^2 differs from that of *r s* by one fifty-sixth of a revolution, in such a manner that never more than one of the pins r^3 s^3 may take into the corresponding hole. The springs r^2 s^2 have beveled pieces r^4 s^4. A piece *v*, having a bevel *v'* and an angular nose v^2, is fixed behind the lever which carries the printing-roller *q*. When the key which corresponds on the keyboard to one of the spaces is depressed, the printing-lever rises, the bevel *v'* lifts the spring r^2 or s^2 which is opposite it and disengages the corresponding pin. At the moment this pin is disengaged the nose v^2 strikes the extremity of *r* or *s*, whichever is opposite it, and causes this to be deflected and to carry with it the disk B to the extent of one fifty-sixth of a revolution. On the other hand, the spring, being fixed on spindle A, remains in place, and the second pin r^3 or s^3 enters into its hole, thus firmly securing the spring, and consequently the spindle, with the disk B. The paper P from an ordinary reel passes

over a roller *q*, provided at its circumference with fine sharp teeth. A spring-fork r^0, Fig. 8, presses the ribbon of paper upon the roller, space being left between the forks of the spring for the periphery of the type-wheel. The forward movement of the paper is effected as follows: A ratchet-wheel R is secured on the roller *q*, a pawl S being secured on one of the plates of the casing of the apparatus and gearing with the ratchet-wheel. When the printing-electromagnet operates, the arm which carries the roller *q* rises, the pawl rides over the ratchet-wheel R, and the impression is produced. When the current ceases in the electromagnet K, its lever returns to its original position, and the pawl being in gear with its ratchet-wheel causes it to rotate with the roller *q*, and consequently moves the paper forward a distance determined by the construction of the apparatus.

Fig. 9 represents in elevation the wheel J with curved teeth, provided with its spring *n* and finger *o*. The current from the local battery arrives at the base of the spring at 40, Fig. 1. It passes to the printing-electromagnet by the contact *p*, when the finger *o* enters completely into a gap between two teeth of the wheel J.

It has been before explained that in order to establish synchronism with certainty between the two apparatus it suffices to twice depress the normal-current-reversing button O; but the second depression of this button should be effected immediately it has been allowed to rise, and this is extremely difficult in view of the rapidity of rotation of the brush *a*. To obviate this difficulty, there is arranged a small accessory part which allows of stopping the apparatus at synchronism without being limited by a shorter or longer interval between the two manipulations of the button O. This arrangement is shown separately in Fig. 10.

Upon the spindle A of the type-wheel is fixed a cam T, which at each revolution causes rotation of a star-wheel U to the extent of one tooth. This star-wheel carries a drum V, divided into an even number of alternately conducting and insulated sectors. The conducting-sectors are in electrical connection with each other. Two springs X X′ bear upon the surface of the drum V at two diametrically opposite points in such manner that they are in electrical connection with each other when they bear upon metallic sectors of the drum. One of these springs X is in electrical communication with the sector *c* of the synchronizing commutator or crown, the other with a spring Y of the button O, which in this case is provided with a metallic contact-piece at its lower part. (See Fig. 11.) Another spring Z of the button O is in electrical communication with the full part F of the synchronizing-ring. When the button O is up, the contact *c* remains insulated, as in Fig. 1, but when the button is depressed the contact ceases to be insulated. When the two springs X and X′ bear upon metallic sectors of the drum V, being then connected to the ring F by wires 90 91 92, Fig. 11, at the next revolution of the spindle A, and therefore of the cam T, the contact *c* will be insulated, because the two springs X and X′ bear upon insulating portions of V. It is only at this moment that the transmitter stops. At the receiving-station, the button O not being depressed, all takes place as if the star-wheel and its accessory parts did not exist. By means of this arrangement synchronism will only be effected at the transmitting-station once in two revolutions, while at the receiving-station it is enabled to be effected at every revolution. The receiving apparatus will await the stoppage of the transmitter, so that the two apparatus may recommence working together.

As the printing-electromagnet does not operate when pressure is applied to O, it is possible to bring the apparatus to synchronism at any time, even in the middle of a word.

Whenever a transmission is finished, it is desirable to twice establish synchronism, keeping the button O depressed, (to prevent the restarting of the apparatus.) When the apparatus stops for the second time and it is desired to leave it in the receiving position, the lever M is lifted. If it be desired to substitute the telephone for the telegraphic apparatus, the two levers are lifted. In the latter case the local battery is cut out. No part of the apparatus works.

I claim as my invention—

1. In a printing-telegraph comprising an escapement mechanism controlled by an electromagnet, circuit-closing means for alternately closing and breaking a circuit to operate such magnet and escapement, transmitting-keys, and a line-battery, means for synchronizing the transmitting and receiving instruments consisting of a pole-changer for reversing the current of said line-battery, polarized magnets or relays at both stations, a local circuit at each instrument controlled by said polarized relay, and means for breaking the local circuit to stop the instruments, consisting of a revolving brush and sector, included in said local circuit, the sector having a break at the synchronizing or starting position adapted when the brush reaches said break to open said circuit, substantially as set forth.

2. In a printing-telegraph comprising a commutator having segments connected to keys which are alternately grounded and open-circuited, and each adapted to establish the reverse position when depressed, a revolving brush traversing said segments, a polarized electromagnet, and a connection from said brush normally through said polarized magnet to line, the improved synchronizing means consisting of a pole-changer for reversing the current from the line-battery, and a local circuit divided into two branches controlled respectively by said polarized magnet, one of said branches closed with a current of

normal direction, and the other closed when the current is reversed, with a commutator brush and sector connected in the latter branch, and the sector having a break corresponding to the synchronizing position, whereby when the current is reversed on reaching the synchronizing position, the local circuit is broken, and the instrument stops until by the manipulation of said pole-changer the current of normal direction is restored, substantially as set forth.

3. In a printing-telegraph, the combination with transmitting and receiving instruments having rotary spindles turning in unison, of a pole-changer at the transmitting station and a polarized magnet in connection with each instrument and means controlled thereby for stopping the instruments at a given point in the rotation of their spindles when the normal current is reversed to enable synchronism to be effected, of means for suppressing such stoppage except at wider intervals than once to each revolution, comprising a short circuit in connection with the synchronizing-circuit, a circuit-breaker in said short circuit, and means for operating said circuit-breaker geared to the printing instrument at such ratio of speed as to establish the synchronizing condition of said circuit at intervals less frequent than once to each revolution, substantially as hereinbefore set forth.

4. In a printing-telegraph comprising transmitting and receiving instruments each having a type-wheel rotated intermittently through an escapement, which in turn is controlled by an electromagnet in connection with a line-circuit, a synchronizing means consisting of a pole-changer for reversing the direction of the current from the line-battery, a polarized magnet at each instrument, a local circuit operating the escapement-magnet thereof, and divided into branches controlled by said polarized magnet, a revolving brush and sector included in a synchronizing branch of said circuit, said sector interrupted by an insulated segment at the synchronizing position for breaking said circuit and stopping the instrument, and means for connecting said insulated segment in said branch circuit except at predetermined intervals, substantially in the manner set forth.

5. In a printing-telegraph instrument, the type-wheel of which carries a double series of characters disposed in alternate order around its periphery, and capable of displacement upon its spindle to an extent equal to half the advance of the spindle at each movement, mechanism for shifting and locking the type-wheel, consisting of the combination with the type-wheel and spindle of two spring-catches adapted to lock the type-wheel and spindle together, in their two respective positions, the type-wheel formed with engaging surfaces in positions corresponding to shifting blanks or spaces, and the printing-lever having a projection adapted in either of said positions to disengage the spring-catch, thereby unlocking the type-wheel, and having a projection adapted thereupon to engage the corresponding engaging surface on the type-wheel to displace the latter to its other position, whereupon the other spring-catch engages and again locks the type-wheel and spindle together.

6. In a printing-telegraph instrument, the type-wheel of which carries a double series of characters disposed in alternate order around its periphery, and capable of displacement upon its spindle to an extent equal to half the advance of the spindle at each movement, mechanism for shifting and locking the type-wheel, consisting of the combination with the type-wheel and spindle of two spring-catches adapted to lock the type-wheel and spindle together, in their two respective positions, inclines carried on the type-wheel in two positions corresponding to shifting blanks or spaces, and the printing-lever having a bevel adapted in either of said positions to disengage the spring-catch, thereby unlocking the type-wheel, and having a nose adapted thereupon to engage the inclines upon the type-wheel and turn the latter to its other position, whereupon the other spring-catch engages and again locks the type-wheel and spindle together, substantially as hereinbefore set forth.

7. In a printing-telegraph instrument the type-wheel of which carries a double series of characters disposed in alternate order around its periphery, and capable of displacement upon its spindle to an extent equal to half the advance of the spindle at each movement, mechanism for shifting and locking the type-wheel consisting of the combination with the type-wheel and spindle, of a spring-catch consisting of a spring attached to the spindle and movable in direction perpendicular to the type-wheel in locking or unlocking, an incline carried on the type-wheel in a shifting position, and the printing-lever having a bevel adapted in said shifting position to displace said spring-catch, and having a nose adapted thereupon to engage the incline upon the type-wheel and displace the latter, substantially as hereinbefore set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

BERNHARD HOFFMANN.

Witnesses:
EDWARD P. MACLEAN,
AUGUSTE MATHIEU.