No. 681,617. Patented Aug. 27, 1901.

S. G. BROWN.

TELEGRAPHIC APPARATUS.

(Application filed Mar. 29, 1900.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

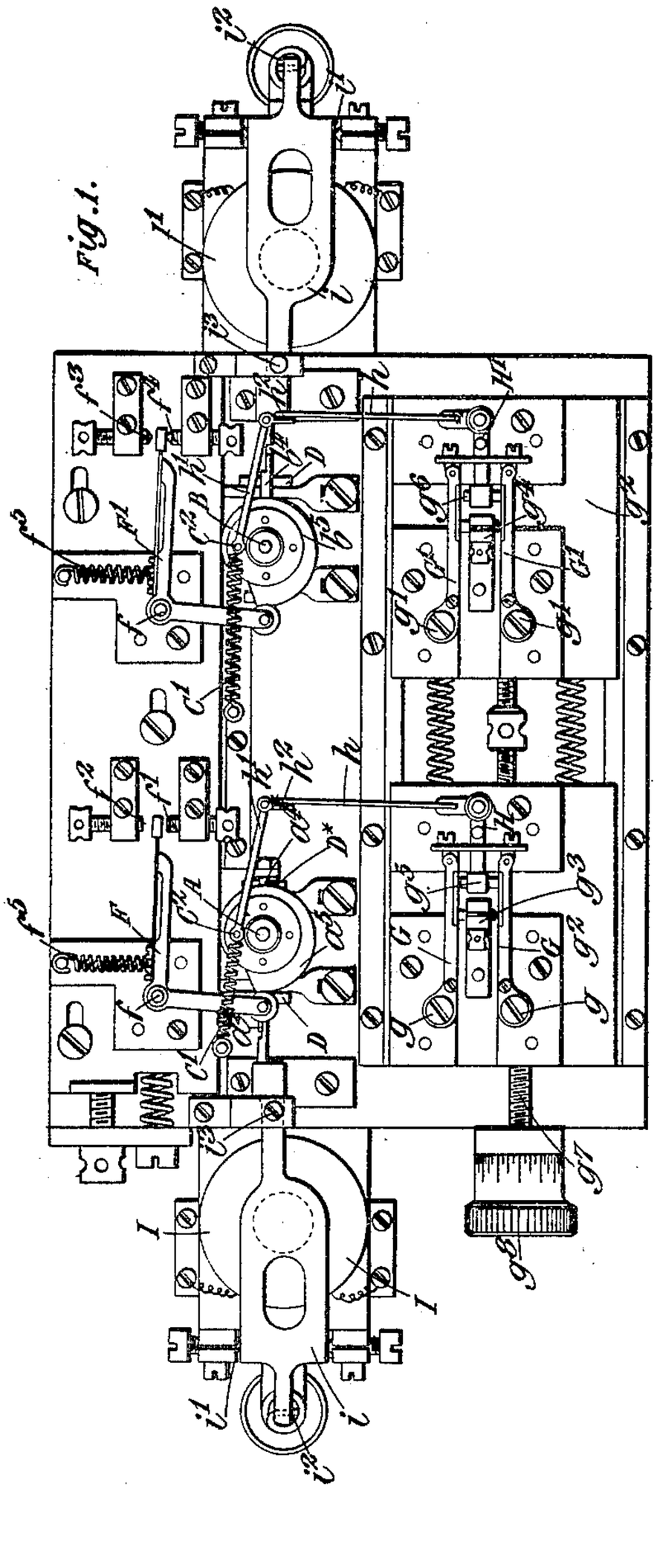

Fig. 2.

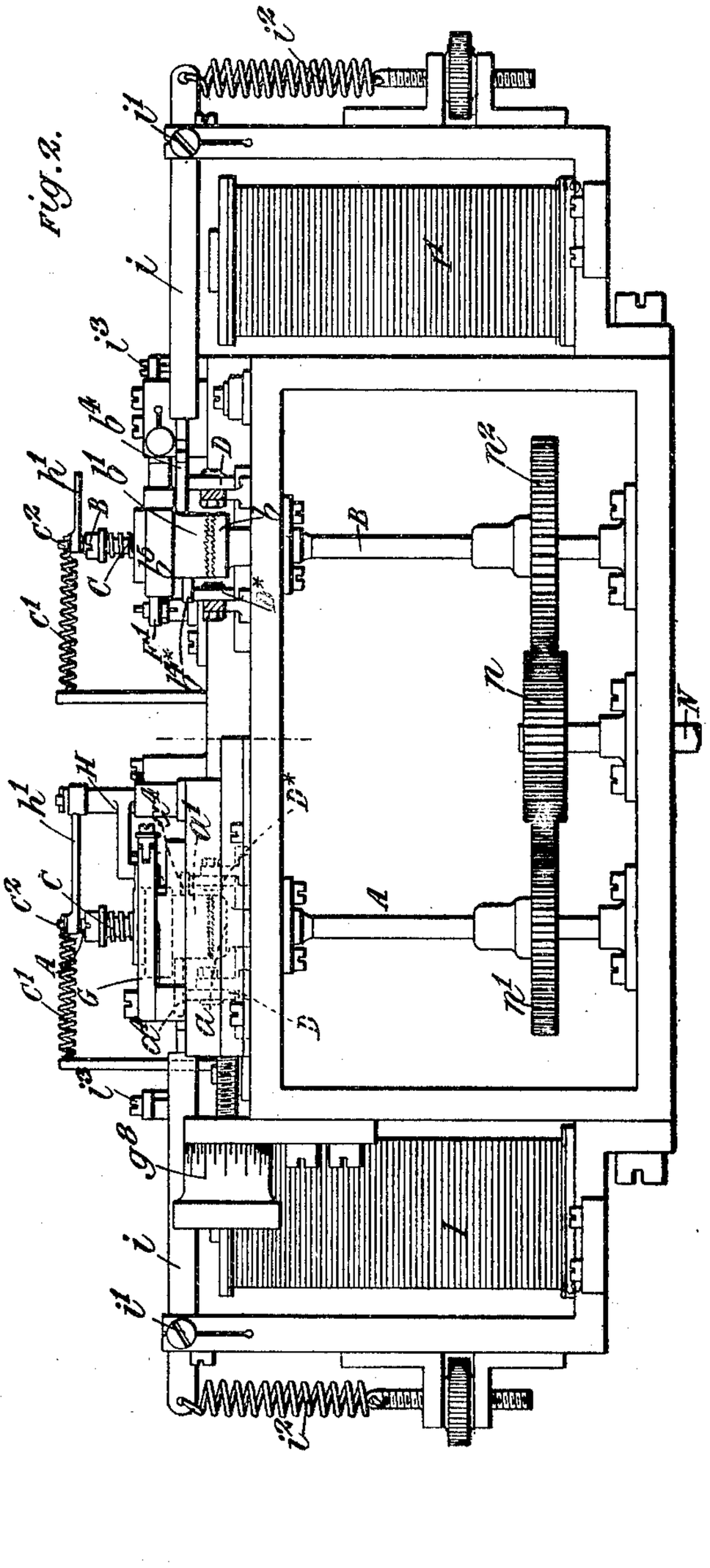

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Fig. 3.

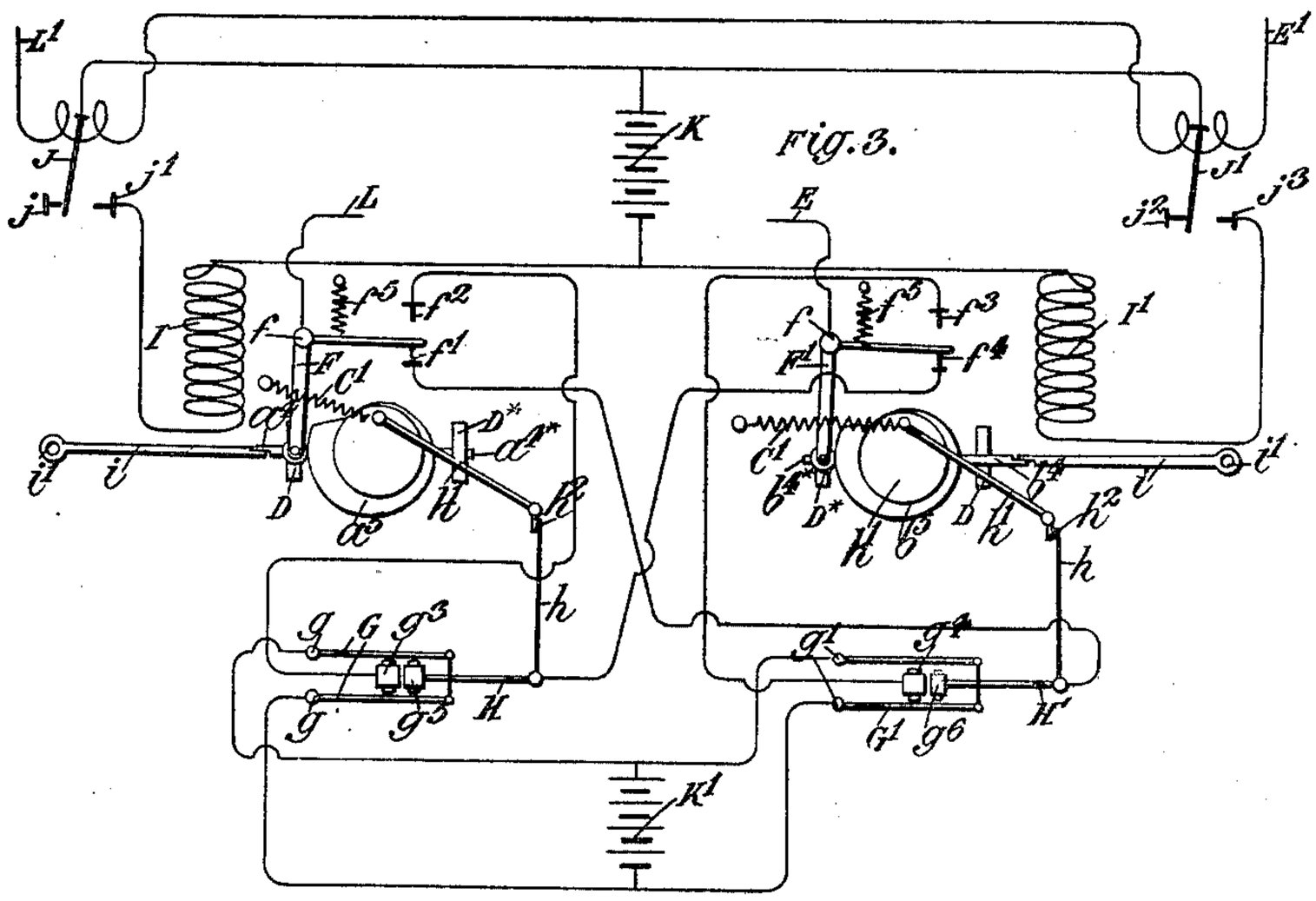
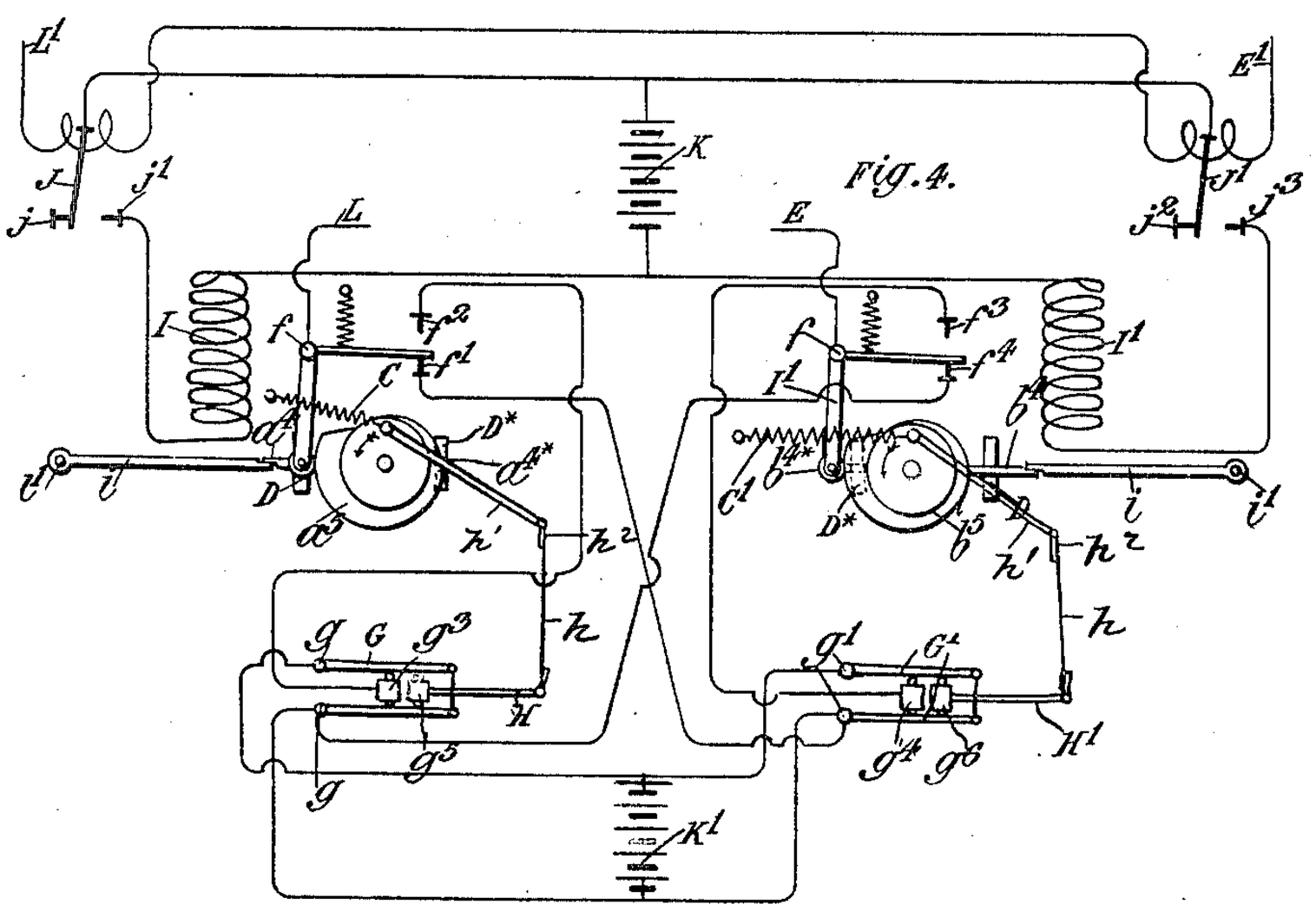


Fig. 4.



Witnesses
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UNITED STATES PATENT OFFICE.

SIDNEY GEORGE BROWN, OF BOURNEMOUTH, ENGLAND.

TELEGRAPHIC APPARATUS.

SPECIFICATION forming part of Letters Patent No. 681,617, dated August 27, 1901.

Application filed March 29, 1900. Serial No. 10,656. (No model.)

To all whom it may concern:

Be it known that I, SIDNEY GEORGE BROWN, electrician, a subject of the Queen of Great Britain, residing at Van Buren, Poole road, Bournemouth, in the county of Hants, England, have invented certain new and useful Improvements in Telegraphic Apparatus, of which the following is a specification.

This invention relates to improvements in electric-telegraph apparatus and refers to automatic transmitting instruments more especially adapted for the purpose of translation or transmission from one line or cable section to another.

The arrival-currents from a long cable-section worked at fast siphon-recorder speed are of such a nature that the received signals have not hitherto been able to be efficiently transmitted automatically to another cable-section by a relay, the usual practice being to repeat such signals by hand, which repetition increases the liability to error and limits the speed of signaling to that of hand-sending—that is to say, when working over a long cable-section if a succession of impulses of the same polarity and of equal strength and duration be applied to one end of such section the first of such impulses will carry the tongue of the relay situated at the opposite end of such section against its "marking-stop" or contact. The variation in the strength of the received current due to the remainder of said impulses is, however, so small that the said tongue is not permitted to fall away from its marking-stop and break contact between the succeeding impulses of the same polarity and of equal strength and duration as it ought to in order to correctly reproduce the original signals. When the polarity of the current sent is reversed, the tongue of the relay responds readily, however, and is carried over to its opposite "stop" or contact, where it again remains without breaking contact between successive impulses of the same polarity and of equal strength and duration. When using a siphon-recorder, this failure of the relay-tongue to break contact between impulses of the same polarity results in the first impulse of a series of impulses of the same polarity being correctly recorded and in the remaining successive impulses of the said series being recorded merely by a straight line. Such imperfect signals may be read by a clerk from their general outline, but if they are automatically transmitted by a relay to another long cable-section without first having the missing impulses reinserted the signals received at the opposite end of such other cable-section are distorted beyond recognition.

This invention has for its object transmitting apparatus which may be adapted to automatically repeat signals at siphon-recorder speed from one cable-section to another cable-section after reinserting or "interpolating" the impulses that have been lost, as aforesaid, in such manner as to assure absolute accuracy in the reproduction of the signals and to maintain the speed of signaling.

According to my invention one or other of a pair of electromagnets is energized by the received signaling-currents accordingly as such currents are of positive or negative polarity. The electromagnet thus energized attracts one of a pair of armatures. The armature thus attracted is adapted to release one of a pair of clutch-sleeves, which released sleeve is then thrown into gear with a rotating spindle. The clutch-sleeves are frictionally attached to the rotary spindles, and when they rotate these clutch-sleeves are adapted to operate transmitting-levers or other signaling devices. When used for sending-on purposes, the sleeves are adapted when thrown into gear with the rotating spindles to oscillate transmitting-levers at the same rate that the contact-levers of the original transmitting instrument are oscillated, so that the number of impulses retransmitted by the relay apparatus will correspond to the numbers of impulses sent by the original transmitter and the speed of signaling will be maintained, notwithstanding the fact that the variation in the strength of the received current due to a series of impulses of the same polarity and of equal strength and duration may be insufficient to release the armature, and thereby arrest the clutch-sleeve during the space of time between each of such series of impulses. The clutch-sleeves are provided with teeth, which are adapted to gear with similar teeth carried by collars on the rotary spindles. The clutch-sleeves are also provided with laterally-projecting pins, which

engage with projections on the armatures or other suitable devices and rest upon fixed lifting-rollers when the said sleeves are at rest, and thereby raise them (against the pressure of springs) out of gear with the rotary spindles. When the armatures are attracted by their magnets, they release the pins, whereupon the clutch-sleeves are thrown into gear with the rotary spindles by means of the springs. The clutch-sleeves are provided with cams or their equivalent for operating the transmitting-levers or other signaling devices. The spindles are caused to continuously rotate by any convenient means, such as by an electromotor provided with a governor to keep its speed constant. When sending "curbed" signals, the contact-levers are connected through the intervention of "reversing-levers" to the battery-terminals. The reversing-levers of each pair are pivoted to a sliding plate at one extremity and have their opposite extremities connected together by an insulating connecting-piece. A fixed contact and a movable contact are situated between each of these levers, the movable contact being carried by one arm of a lever, the other arm of which is connected through a spring connection to a crank and crank-pin fixed to one of the rotatable clutch-sleeves, so as to oscillate the reversing-levers. The sliding plates can be adjusted in such manner as to regulate the position of the reversing-levers with respect to the clutch-sleeves so as to vary the relative duration of the signals and their "curbing-currents" as required.

Referring to the drawings, Figure 1 is a plan, and Fig. 2 is a side elevation, with one of the sliding plates and its reversing-levers removed, of the transmitting apparatus arranged as an automatic relay. Fig. 3 is a diagram of the electrical connections for sending signals with curbing-currents. Fig. 4 is a diagram of the electrical connections for sending signals without curbing-currents.

Referring to Figs. 1, 2, and 3, A and B are the rotary spindles, provided with fixed toothed collars $a\,b$. $a'\,b'$ are the rotary clutch-sleeves, mounted loosely on the spindles A B and provided with teeth adapted to engage with the teeth of the collars $a\,b$. C C are springs which surround the upper ends of the spindles A B and have their ends bearing, respectively, upon the upper surfaces of the clutch-sleeves and upon washers retained in position on the tops of the spindles A B by nuts. The springs C C tend to press the sleeves $a'\,b'$ into engagement with the toothed collars $a\,b$. C′ C′ are springs which have their ends respectively connected to loose collars on crank-pins C^2 C^2, carried by the sleeves $a'\,b'$, and to pins fixed to the bed plate or frame of the instrument. a^4 a^{4*} are pins projecting laterally from the sleeve a'. b^4 b^{4*} are pins projecting laterally from the sleeve b'. D D and D* D* are the fixed lifting-rollers, which project into the paths of the pins a^4 a^{4*} and b^4 b^{4*} and lift the sleeves a' b' out of gear with the collars $a\,b$ when the pins a^4 b^4 and a^{4*} b^{4*} strike them as the spindles A and B rotate. The pins a^{4*} b^{4*} are shorter and are arranged at a lower level than the pins a^4 b^4, the rollers D and D* being so arranged that during one revolution of the sleeves a' b' the pins a^4 b^4 pass over the rollers D* D* without striking them and that the pins a^{4*} b^{4*} pass clear of the rollers D D. The springs C′ C′ tend to draw the pins a^4 a^{4*} and b^4 b^{4*} off the lifting-rollers D and D* when the sleeves a' b' are at rest. a^5 and b^5 are cams carried by the sleeves a' b'. F F′ are crank transmitting-levers, which are pivoted at $f\,f$ and are connected by suitable conductors L and E to line and to earth, respectively. The arms at one side of the levers F F′ carry rollers which bear against the cams a^5 b^5, and the other arms of these levers are adapted to oscillate, respectively, between fixed contacts f' f^2 and f^3 f^4. f^5 f^5 are springs which tend to hold the levers F F′ against the stops f^2 f^3. G G and G′ G′ are the reversing-levers for sending curbing-currents. These levers are respectively pivoted at $g\,g$ and g' g' to plates adapted to slide in grooves or between guides on the frame of the instrument. The opposite ends of the levers G G and G′ G′ are respectively connected together by links of insulation material. g^3 g^4 are fixed contacts placed between the reversing-levers G G and G′ G′. g^5 and g^6 are contacts carried by crank-levers H H′. The levers H H′ are pivoted to the sliding plates g^2 g^2 and have their opposite arms connected by springs $h\,h$ and links h' h' to collars on the crank-pins C^2 C^2, carried by the sleeves a' b'. h^2 h^2 represent insulation placed between the springs $h\,h$ and the links h' h'. As the cams a^5 b^5 rotate they therefore rock the levers H H′, and thereby oscillate the reversing-levers G and G′ during the transmission of every signaling impulse, and thus reverse the battery connections during the signals, thus curbing the signals with currents of opposite sign, as is well understood. g^7 is a screw which passes through the frame of the instrument and into one of the sliding plates g^2. The screw g^7 is provided with a head g^8, which bears against the frame of the instrument. The plates g^2 g^2 are adjustably connected by a screw-coupling. By turning the screw-head g^8 the positions of the sliding plates may be regulated and the relative positions of the levers H H′ to the sleeves a' b' thereby adjusted so as to regulate the relative duration of the signaling-currents and their curbing-currents. I I′ are electromagnets provided with armatures $i\,i$. The armatures $i\,i$ are pivoted at i' i' and when no signaling-currents are received are raised out of contact with the electromagnet by springs i^2 i^2, so that they project into the paths of the pins a^4 b^4 and by coming into contact with said pins hold them stationary on the rollers D D and out of gear with the spindles A B. i^3 i^3 are stops to restrict the upward move-

ment of the armatures *i i*. J J′ are polarized relays adapted to be respectively operated by positive and negative signaling-currents. L′ is the line conductor, and E′ is the earth conductor for conducting the signaling-currents from one line-section through the relays J J′. The tongue of the relay J is adapted to move between the stops *j j′*, and the tongue of the relay J′ is adapted to move between the stops j^2 j^3. K and K′ are relay-batteries.

In Fig. 3 the apparatus is shown at rest. Should a positive signal be received from the line L′, the tongue of the relay J is thrown over to its stop *j′*. This closes the circuit of the battery K and electromagnet I. The electromagnet I then attracts its armature *i*, moving said armature out of the path of the pin a^4. The tension of the spring C′ and the frictional connection between the spindle A and the sleeve *a′* due to the spring C then move the pins a^4 and a^{4*} off the rollers D and D* and permit the spring C to force the sleeve *a′* into gear with the collar *a*. The sleeve *a′* and cam a^5 will then continue to rotate with the spindle A so long as the armature *i* of the magnet I is held out of the path of the pin a^4 by a signal or impulse or by a series of signals or impulses of the same sign, the pins a^4 and a^{4*} being carried over the rollers D and D* by the frictional connection between the sleeve *a′* and spindle A and by the spring C′. At each revolution of the cam a^5 the transmitting-lever F is thrown against the contact f^2, thus closing the circuit of the relay-battery K′ and transmitting a signal to the relay-line L, the current passing as follows: from one pole of the battery K′ to the reversing-levers G, thence through the contact g^3 to the contact f^2, lever F, and line L, returning by line E, lever F′, and contact f^4 to the lever H, contact g^5, and reversing-levers G, and thence to the opposite pole of the battery K′. At each revolution of the sleeve *a′* and cam a^5 the reversing-levers G are also oscillated through the intervention of a link *h′*, spring *h*, and lever H, so as to reverse the connections between the battery-terminals and the contacts g^3 g^5, and thereby cause every signal or impulse sent to the line L to be curbed by a current or impulse of opposite sign. If a negative signal is received from the line E′, the tongue of the relay J′ is thrown against its stop j^3, and the circuit of the battery K and electromagnet I′ is closed. The electromagnet I′ is thus energized and its armature *i* thereby moved out of the path of the pin b^4. The cam b^5 then rotates with the spindle B in the same manner as has been already described with reference to the cam a^5. The lever F′ is moved against the stop f^3 at each revolution of the cam a^5, thus closing the circuit of the battery K′ and transmitting a signal to the conductor E, the electric current passing as follows: from one pole of the battery K′ through the reversing-levers G′ and contact g^4 to the contact f^3 and lever F′ and thence to the conductor E, returning by the line L, lever F, contact *f′*, lever H′, contact g^6, and reversing-levers G′ to the opposite pole of the battery. The reversing-levers G′ are operated by the cam b^5 so as to curb the signals in the same manner as above described with reference to the levers G and the cam a^5. Upon the cessation of signals the tongues of the relays J and J′ are arranged to fall back on their stops *j* and j^2. The cams a^5 and b^5 are rotated, so as to oscillate the levers F and F′ at the same speed as the transmitting-levers of the automatic or other transmitter employed for sending signals through the first line or cable section. It is therefore obvious that although the variation in the strength of the received current due to a series of impulses of the same polarity and of equal strength and duration may be insufficient to release the armatures *i i* after each impulse of the series, yet the correct number of impulses will be retransmitted by the levers F F′.

Referring to Fig. 4, the apparatus is constructed and operated in a similar manner as above described. The contacts *f′* f^4 instead of being connected to the levers H′ and H, respectively, are connected, respectively, to one of the contact-screws *g′* and to one of the contact-screws *g*, the electrical connection being thus made for sending signals without "curbing-currents"—that is, plain battery and earth signals. When the arrival signaling-current moves the tongue of the relay J onto the stop *j′* and the cam a^5 is released and the lever F is consequently moved onto the stop f^2, as above described, a signal or impulse is sent to the conductor L, as follows: from one pole of the battery K′ through the contact g^3, contact f^2, and lever F to the conductor L, returning by the conductor E, the lever F′, contact f^4, and one of the contact-screws *g* to the opposite pole of the battery K′. When the arrival signaling-current moves the tongue of the relay J′ onto its stop j^3 and the cam b^5 is released and the lever F′ is consequently moved onto the stop f^3, as above described, a signal or impulse is sent to the conductor E, as follows: from one pole of the battery K′ through the contact g^4, the contact f^3, and lever F′ to the conductor E, returning by the conductor L, the lever F, the contact *f′*, and one of the contact-screws *g′* to the opposite pole of the battery K′. It will thus be seen that no curbing-currents are transmitted, and as the cams a^5 b^5 can only work one at a time the battery K′ is not short-circuited during the operation of the said cams.

Referring to Fig. 2, the shaft N is caused to continuously rotate by an electromotor provided with suitable means for regulating its speed, such as a centrifugal governor arranged to break the electrical circuit of the motor through a shunt of suitable resistance or by any other convenient device.

n is a gear-wheel which is mounted on the shaft N and gears with other gear-wheels n' n^2, mounted, respectively, on the spindles A and B. As the shaft N rotates, therefore, the spindles A and B are caused to continuously rotate in the required direction.

What I claim is—

1. Interpolating apparatus for use on electric-telegraph circuits, comprising constantly-rotating spindles, collars fixed to said spindles, clutch-sleeves mounted on said spindles, cams carried by the clutch-sleeves, means operated by said cams for transmitting signals, means for normally holding the clutch-sleeves free from the fixed collars, and means operated by the signaling-currents received from a cable or line for throwing the clutch-sleeves into gear with the fixed collars, substantially as described.

2. Interpolating apparatus for use on electric-telegraph circuits, comprising signaling-levers, a receiving-relay, a relay-battery, a relay-line, means adapted to be released by the receiving-relay to operate said signaling-levers so as to send on the correct number of signaling impulses as originally transmitted and also to curb said signaling impulses, substantially as described.

3. Electric-telegraph transmitting apparatus comprising transmitting-levers, contact-stops between which said levers are adapted to oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal which oscillatory levers have their ends at one extremity pivoted to a fixed point and their opposite ends connected together by insulation, a fixed contact-stop between said reversing-levers, a movable contact-stop situated between said reversing-levers and carried by one arm of a pivoted lever, means for operating the transmitting-levers and means for rocking the pivoted lever so as to operate the reversing-levers, substantially as described for the purpose specified.

4. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-sleeves mounted on said spindles, cams carried by said clutch-sleeves, transmitting-levers adapted to be oscillated by said cams, contact-stops between which the transmitting-levers oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal, a fixed contact-stop between each pair of the reversing-levers, a movable contact-stop situated between each pair of reversing-levers and carried by one arm of a pivoted lever, spring connections between the clutch-sleeves and pivoted levers, means for normally holding the clutch-sleeves out of gear with the spindles, and means for throwing the clutch-sleeves into gear with the spindles for transmitting signals, substantially as described.

5. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-sleeves mounted on said spindles, cams carried by said clutch-sleeves, transmitting-levers adapted to be oscillated by said cams, contact-stops between which the transmitting-levers oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal, a fixed contact-stop between each pair of reversing-levers, a movable contact-stop situated between each pair of reversing-levers and carried by one arm of a pivoted lever, spring connections between the clutch-sleeves and pivoted levers, means for adjusting the position of the reversing-levers and pivoted levers relatively to the clutch-sleeves, means for normally holding the clutch-sleeves out of gear with the spindles and means for throwing the clutch-sleeves into gear with the spindles for transmitting signals, substantially as described.

6. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-sleeves mounted on said spindles, cams carried by said clutch-sleeves, transmitting-levers adapted to be oscillated by said cams, contact-stops between which the transmitting-levers oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal, a fixed contact-stop between each pair of reversing-levers, a movable contact-stop situated between each pair of reversing-levers and carried by one arm of a pivoted lever, spring connections between the clutch-sleeves and pivoted levers, sliding plates carrying the reversing-levers and the pivoted levers, means for adjusting the sliding plates relatively to the clutch-sleeves, means for normally holding the clutch-sleeves out of gear with the spindles, and means for throwing the clutch-sleeves into gear with the spindles for transmitting signals, substantially as described for the purpose specified.

7. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted on said spindles, cams carried by said clutch-sleeves, pins projecting laterally from said clutch-sleeves, means arranged in the path of said lateral pins and adapted to lift the clutches out of gear with the clutch-collars during part of the revolution of the clutch, means operated by the cams for transmitting signals, means engaging with the lateral pins for normally holding the clutch-sleeves out of gear with the spindles, and means for releasing the lateral pins when signals are to be transmitted, substantially as described.

8. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to force the clutch-sleeves into gear with the clutch-collars, pins projecting laterally

from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, means operated by the cams for transmitting signals, means for normally engaging with the lateral pins for holding the clutch-sleeves out of gear with the clutch-collars, and means for releasing the lateral pins for transmitting signals, substantially as described.

9. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to throw the clutch-sleeves into gear with the clutch-collars, pins projecting laterally from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, means operated by the cams for transmitting signals, armatures for normally engaging with the lateral pins so as to hold the clutch-sleeves out of gear with the clutch-collars, and electromagnets adapted to be energized and to attract the armatures so as to release the lateral pins for transmitting signals, substantially as described.

10. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to throw the clutch-sleeves into gear with the clutch-collars, pins projecting laterally from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, means operated by the cams for transmitting signals, means for "curbing" said signals, armatures for normally engaging with the lateral pins so as to hold the clutch-sleeves out of gear with the clutch-collars, and electromagnets adapted to be energized and to attract the armatures so as to release the lateral pins for transmitting signals, substantially as described.

11. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to force the clutch-sleeves into gear with the clutch-collars, pins projecting laterally from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, transmitting-levers adapted to be operated by the cams, contact-stops between which the transmitting-levers oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal, means for operating the reversing-levers from the clutch-sleeves, means for normally engaging the lateral pins to hold the clutch-sleeves out of gear with the clutch-collars, and means for releasing the lateral pins for transmitting signals, substantially as described.

12. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to force the clutch-sleeves into gear with the clutch-collars, pins projecting laterally from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, transmitting-levers adapted to be operated by the cams, contact-stops between which the transmitting-levers oscillate, oscillatory reversing-levers for reversing the battery connections during the transmission of every signal which reversing-levers have their ends at one extremity pivoted to fixed points, and their opposite ends connected together by an insulating-link, a fixed contact-stop between each pair of reversing-levers, a movable contact-stop situated between each pair of reversing-levers and carried by one arm of a pivoted lever, spring connections between the clutch-sleeves and pivoted levers, means for normally engaging the lateral pins to hold the clutch-sleeves out of gear with the clutch-collars, and means for releasing the lateral pins for transmitting signals, substantially as described for the purpose specified.

13. Electric-telegraph transmitting apparatus comprising constantly-rotating spindles, clutch-collars fixed on said spindles, clutch-sleeves mounted loosely on said spindles, cams carried by the clutch-sleeves, springs which tend to throw the clutch-sleeves into gear with the clutch-collars, pins projecting laterally from the clutch-sleeves, rollers arranged in the path of the lateral pins and adapted to lift the clutch-sleeves out of gear with the clutch-collars during part of the revolution of the clutch, transmitting-levers adapted to be operated by the cams, contact-stops between which the transmitting-levers oscillate, oscillatory levers for reversing the battery connections during the transmission of every signal which reversing-levers have their ends at one extremity pivoted to fixed points and their opposite ends connected together by an insulation-link, a fixed contact-stop between each pair of reversing-levers, a movable stop situated between each pair of reversing-levers and carried by one arm of a pivoted lever, spring connections between the clutch-sleeves and pivoted levers, sliding plates on which the reversing-levers and pivoted levers are mounted, means for moving said plates so as to adjust the position of the reversing-levers

with reference to the clutch-sleeves, armatures for normally engaging the lateral pins to hold the clutch-sleeves out of gear with the clutch-collars, and electromagnets adapted to be energized and to move the armatures out of engagement with the lateral pins for transmitting signals, substantially as described, for the purpose specified.

In testimony whereof I have hereunto set my hand, in presence of two subscribing witnesses, this 15th day of March, 1900.

SIDNEY GEORGE BROWN.

Witnesses:
WALTER J. SKERTEN,
W. M. HARRIS.