(No Model.)

3 Sheets—Sheet 1.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,986. Patented Dec. 13, 1892.

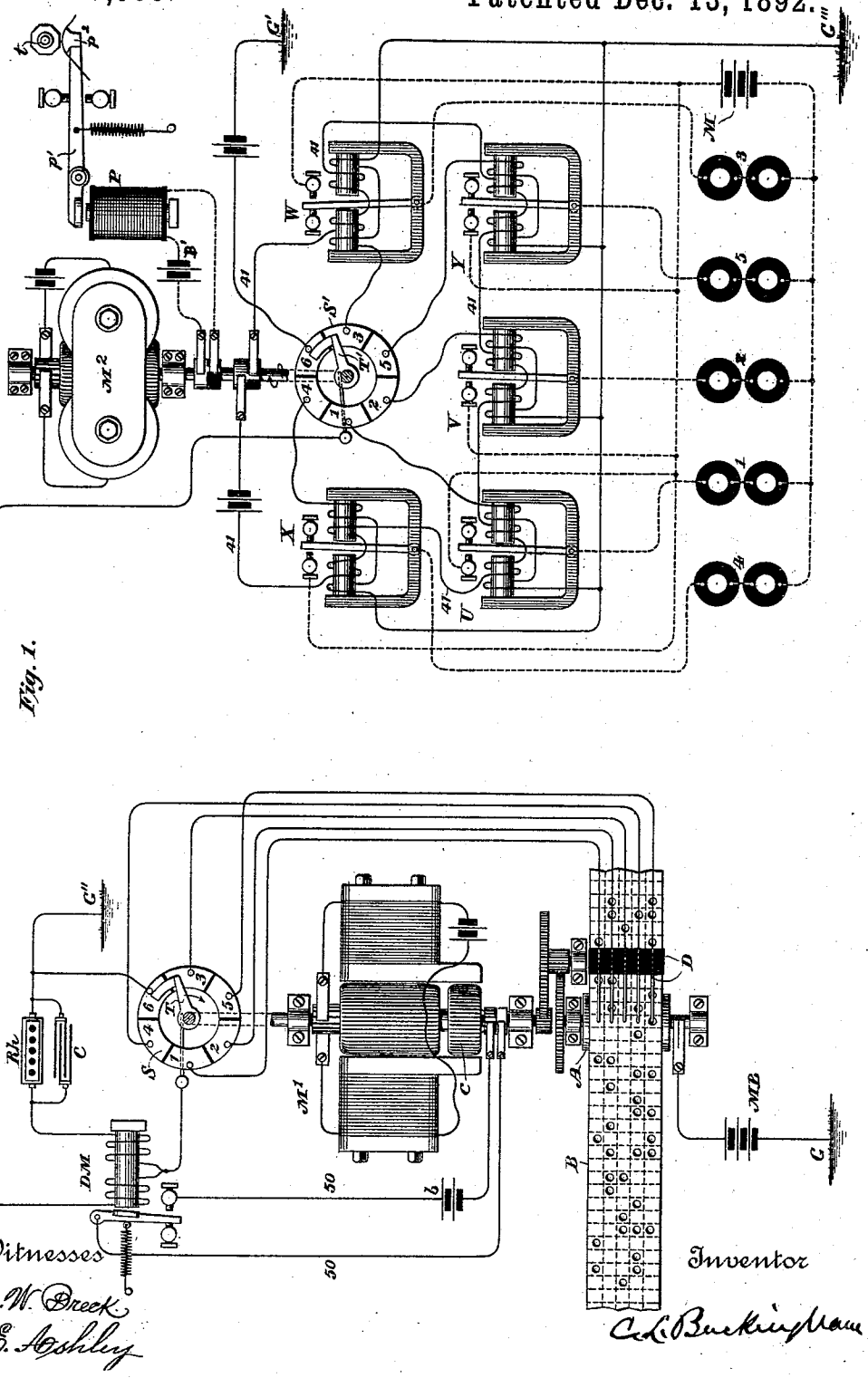

Fig. 1.

(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

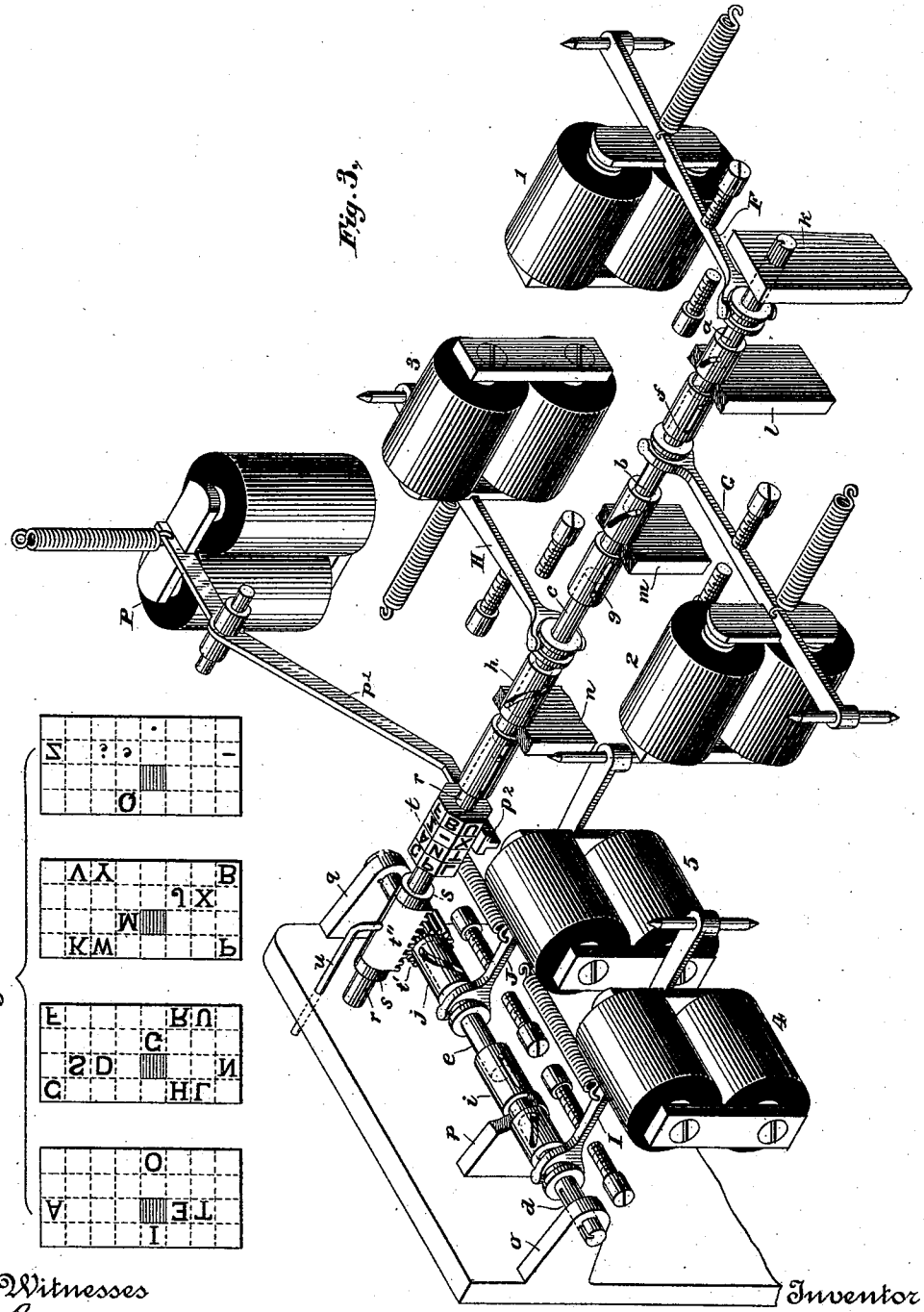

Fig. 2.

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(No Model.)

3 Sheets—Sheet 3.

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Fig. 4.

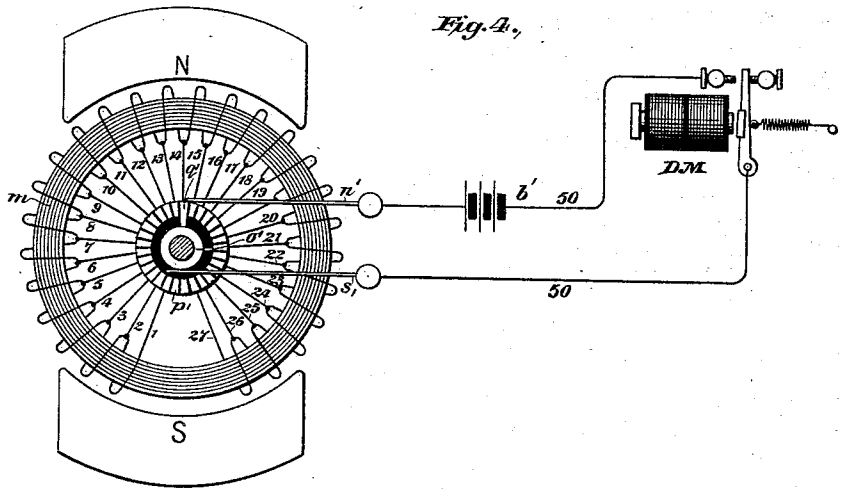
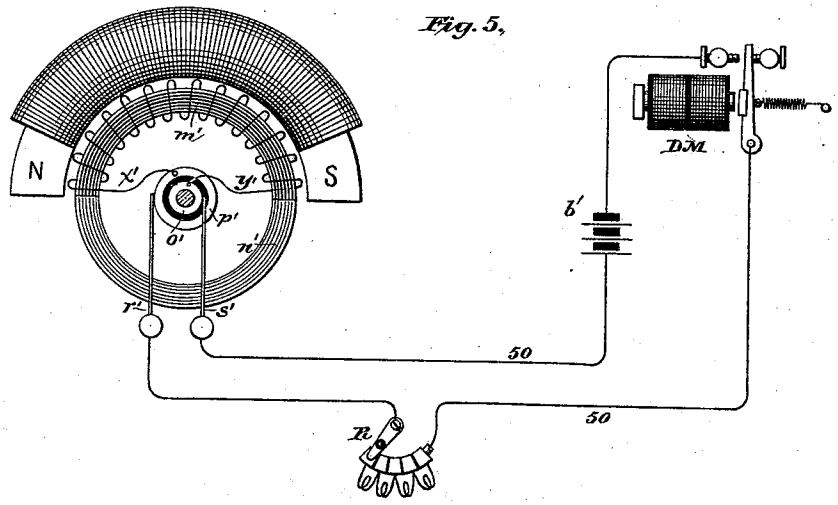


Fig. 5.



Witnesses
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UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,986, dated December 13, 1892.

Application filed April 25, 1890. Renewed June 24, 1892. Serial No. 437,844. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, a citizen of the United States of America, residing in the city, county, and State of New York, have made a new and useful Improvement in Long-Line-Printing Telegraphs, of which the following is a specification.

In other applications I have described and claimed, in combination with various telegraph systems, a printing-instrument in which a type-carrying device is controlled by a series of adjusters having limits of action collectively commensurate with the maximum movement of the type-carrier.

My present invention relates to the application of such printing mechanism to the synchronous multiple telegraph, the adjuster-magnets at the receiving-station being controlled by bringing the corresponding branches at each station successively into connection with the main line.

I will now describe my invention by reference to the accompanying drawings.

Figure 1 is a diagram showing the transmitter, the unison mechanism, and the relay and magnet arrangement of my present system. Fig. 2 is a development of the surface of the type-wheel or type-carrier, showing those letters that are brought to position to be printed by calling the adjusting-magnets into action one at a time, two at a time, three at a time, and four at a time, respectively. Fig. 3 shows the form of printing-instrument which I prefer to use in this system. Fig. 4 is a unison device by which the trailing arm at the receiving-station is kept in synchronism with that of the transmitter. Fig. 5 shows a second form of synchronizing motor.

Referring to Fig. 3, it is seen that the type-wheel is controlled by five adjusting-magnets 1 2 3 4 5 and that the wheel may be thrown into any required position by the adjusters when brought into action singly or together in any one of many possible combinations. The adjusting-magnets control armature-levers F G H I J, the latter at their free ends being provided with forks the prongs of which work within circumferential grooves of the rods *a b c d e*. Rods *a* and *d* are incapable of rotation, owing to feathered bearings in supports *k* and *o;* but they may be freely moved along their axes. Rods *b*, *c*, and *e*, however, are capable both of rotary and longitudinal movement, and each of the latter is provided at either end with a pin, one of which plays in a straight slot in a sleeve at one side, while the other works in a spiral groove in a second sleeve on the other side. The purpose of the straight slots and spiral grooves in sleeves *f g h i j* is apparent, it being understood that the sleeves are capable only of rotation, they being collared or journaled in supports *l m n p q*, as shown. Shaft *r*, upon which type-wheel *t* is fixed, is provided at one end with a radial pin, which slides within the straight slot in the outer end of sleeve *h*, while at the opposite side of the wheel rod *r* is provided with two collars *s s*, which inclose the ends of a rack-bar *t''*. It will now be seen that as the pinion *t'* rotates it will move *t''* and that the latter by pressing against collars *s s* carries the type-wheel backward and forward along its axis without in any manner disturbing its circumferential position. Shaft *r* passes axially through rack-bar *t''*; but it is held against rotation by a guide-rod *u*, the latter being rigidly fixed to the bar, while it slides freely in an opening in the frame. Press-magnet P, bar *p'*, and platen p^2 are actuated by a local battery B', the circuit of which is normally open. This circuit is automatically closed after the type-wheel has been set to a position for printing once during each rotation of the trailer by a circuit-closer placed on the shaft of the driving-motor, as shown in Fig. 1. By actuating adjusting-levers F G H singly the type-wheel will be rotated one, two, and four spaces, respectively. By actuating bar I the left ring of the type-wheel will be brought over the platen. Likewise by operating J the right ring will be moved to the same position, while the second type-ring from the right end of the wheel is brought over the press by the conjoint action of I and J. The wheel is provided with a blank space in the type-ring second from the left end, which normally rests over the platen. To avoid extreme movements of the type-wheel, it is never rotated more than half-way in either direction. This is made possible by arranging armature-lever H to act in a direction opposite to that of F and G, though

the armatures might all be attracted in the same direction if the spiral groove in *h* were oppositely cut, as is the groove in *j* with reference to the groove in *i*.

For a more general description of printing-instruments of this class reference may be had to my applications, Serial No. 290,449, filed November 10, 1888, and Serial No. 333,308, filed December 11, 1889. My invention herein claimed, however, is not limited to use with the particular form of printing-instruments shown in Fig. 3. In fact, this improvement is adapted to any form of printer in which a series of adjusters are employed whose limits of action collectively are commensurate with the maximum movement of the type-carrier.

The invention is also in part applicable to an entirely-different class of printers.

Having referred to one form of printing mechanism, I will now describe the means by which I am enabled to actuate or control the several adjusting devices one independently of the others, whereby any one or more of them may by currents passing over a single line be operated to the exclusion of the others.

In Fig. 1 I have shown at the transmitting-station a perforated strip of paper passing over a rotating conducting-drum A, which is joined to a line-battery M B through a friction-conductor. The paper is provided with perforations miscellaneously placed in five rows along its length, and the letters are represented by perforations in a transverse line across the tape. Above the tape is a series of conducting-styluses mounted upon an insulated bar D, each stylus being electrically connected with a segment of the circular series of contacts S, over which a trailing arm T sweeps. The segments 3 5 2 1 4 are thus used, while for synchronizing purposes No. 6 is joined with a branch line leading to earth G''. At the receiving-station a similar series of circularly-arranged contacts S' and a trailing arm T' are employed; but in this case segments 3 5 2 1 4 are respectively connected with a series of selecting-relays W Y V U X and thence to earth G''', while segment No. 6 is here also connected to earth by a separate branch; but in this case it is provided with a battery, which sends a synchronizing pulse over the main line every time the trailer T' makes a revolution. It is now seen that as many pulses will be sent to line as there are perforations brought under the styluses for a letter transmitted and that as the trailer sweeps over segments connected to styluses below which there are no perforations currents will not be sent. By this means some one or more branches at each station are simultaneously joined to the main line and one or more selecting-relays are brought into action to operate corresponding ones of the adjusting-magnets 3 5 2 1 4. The latter are joined by multiple branches with battery M. The armatures of the polarized selecting-relays all have a bias toward their back contacts, but under the influence of a momentary current they are moved to front contact, where they remain until returned by other and independent means. During each rotation of the trailer or during the transmission of each letter the armatures of one or more selecting-relays are brought to front contact, and it is therefore necessary to employ an automatic resetting arrangement which is brought into action and during this period, but always after the type-wheel has been set and printing effected. To this end I employ a local circuit 41, including a resetting-coil for each selecting-relay acting in magnetic opposition to the coils connected with the trailer-segments. This circuit is brought into action by a circuit-closer placed on the motor-shaft driving the trailer just after printing has occurred. Both circuit-closers are placed on the same shaft; but the one for resetting the selecting relays is adjusted slightly behind the one for printing. As the trailer T' makes a complete rotation the armature of one selecting-relay after another will be thrown to front contact, providing all of the styluses at the transmitter are during that period brought in contact with drum A. Owing to the fact, however, that only one or more apertures, as a rule, occur in a transverse row, most of the armatures of the selecting-relays remain unaffected. While T' is passing over segment 6 at the receiver the perforated transmitting-strips should be moved from the point where the styluses leave the apertures of one letter and fall into apertures of the next. With this arrangement battery M B is in each case simultaneously joined with as many styluses as there are perforations in the letter to be sent; but these styluses are only connected to the line one at a time as the trailer rotates. It is obvious that the transmitting-styluses might be set diagonally across the transmitting-paper, one in advance of another, so as to come in contact successively with drum A, or the perforations for a letter might be cut in diagonal instead of right lines across the strip, leaving the stylus-points as shown in Fig. 1. Trailer T must be so timed as to complete its movement over segments 3 5 2 1 4 while the paper is drawn over drum A the space of one perforation, and during this period all of the selecting-relays required for any particular letter must be actuated. It is thus seen that some of the selecting-relays are actuated in the early part of the trailer's movement long before printing takes place, and that from this fact the adjusting-magnets having the most work to do in setting the type-wheel may be given ample opportunity to complete their work.

Instead of using only a single pulse to set the armature of a selecting-relay and one rotation of the trailer to transmit a letter, the trailer might make many revolutions for each letter, thus sending through each of its coils a succession of pulses.

In effecting synchronism, as already stated,

I employ branches attached to the No. 6 segments, the one at the receiving-station containing a battery, by means of which a pulse is sent over the main line once during each rotation of the trailer. These pulses at the transmitting end pass through a differential relay D M and attract an armature, thereby closing a local circuit 50 through the armature-coils of an electro-magnetic motor. If the instruments at the two stations are in exact unison, owing to the construction of the synchronizing-motor, no effect is produced. When, however, the motor is running either too fast or too slow, these local circuits will set up a retarding or an accelerating influence, as occasion requires. At each station the trailing arm is driven by a uniformly-moving motor, preferably a magnetic motor, and the two are adjusted to run together as nearly as possible.

Upon the same shaft with the main motor at the transmitting-station is placed the rotating armature of a second or correcting motor, as shown in Figs. 1, 4, and 5. For convenience of illustration the field-magnets of the auxiliary motor are extensions of the others, though the two may be made separate. In Fig. 5 a ring is shown, the upper half of which is of iron, while the remainder is of non-magnetic material. If at the moment local circuit 50 is closed the armature is in the position here shown, the current from battery b', flowing through brushes r' s', rings p' o', and winding x' m' y', will exert no effect; but if it is either in advance or behind this position the current from b' will exert a strong correcting effect. To regulate the force of this battery, I may use a rheostat R. With such a motor the corrective influence of correcting-pulses is exerted through a long range of movement and over a space of about one-half of the armature's rotation. This armature is rigidly geared to the shaft of the trailer at the transmitting-station, and it should occupy the position shown in Fig. 5, while the trailers at both stations are on the No. 6 segments. In Fig. 4 I have shown a different type of motor. The continuous winding is broken at the lower part of the ring and is joined from point to point with the segments of an ordinary Gramme commutator. One segment q' of this commutator is prolonged, as shown, making connection with a metallic ring o', upon which rests a brush s'. The brush n' bears upon the sectional commutator p'. If, now, the local circuit 50 is closed by relay D M, obviously while the armature of the motor is in the position here shown no current will flow through its coils; but if the armature be running either fast or slow currents will pass through coils in a direction either to retard or accelerate its motion, and the further from adjustment the armature may be the more coils will it pass through, and consequently the greater will be the correcting effect. In effecting adjustment by this device a strong correcting effect is produced only when the armature is far from a point of unison, and as this distance decreases the correcting force is correspondingly diminished. When, therefore, the motor has reached a position of adjustment, the correcting force is *nil*, and there is no tendency to throw it out of adjustment in the other direction, as might be the case in the form shown in Fig. 5 and in all other synchronizing devices with which I am acquainted.

It is desirable to place the synchronizing-relay D M at the transmitting-station, for if it were at the receiving end pulses transmitted in sending a message would when the instruments were not running in unison act upon the relay, and thus still further derange the action of the motor.

In placing the relay at the transmitting-station it will only be brought into operation when the trailer T′ at the receiving-station is in contact with segment 6, for at no other time will it be subject to an actuating-current; but to guard against message-currents from the transmitting-station the relay must be given a duplex character. In other words, it must be so made that it will not respond to outgoing currents from the transmitting-station. To this end the ordinary differential relay or bridge arrangement with an artificial line may be employed. A complete circuit from the receiving-station is always formed, for if the branches at the transmitting end are broken by the paper strip a path is found through the artificial line to the earth G‴. In this case an additional resistance is encountered. The current thus reduced, however, acts upon relay D M through the two coils instead of one.

What I claim, and desire to secure by Letters Patent, is—

1. In an automatic printing-telegraph, the combination of a multiple synchronous system, a strip of paper in which the characters are perforated in transverse lines, a series of styluses, respectively, connected with segments of a circular series of contacts, a receiving-instrument, a corresponding series of segments at the receiving-station, a series of selecting-relays, a printing-instrument, and a series of adjusters whose limits of action collectively are commensurate with the maximum movement of the type-carrying device, substantially as described.

2. In a multiple synchronous telegraph system for operating a printing-telegraph, the combination of a perforated strip of paper, substantially as described, a series of branches at the transmitting-station, a main line, a series of branches at the receiving-station, a series of selecting-relays provided with resetting devices, substantially as described, and a press-magnet which is automatically brought into operation after the type-wheel has been adjusted to a position for printing.

3. In a synchronous multiple-telegraph system for operating a printing-telegraph, the combination, at the receiving-station, of a rotating arm, a circular series of contact-segments electrically connected to earth, which

are successively joined with the main line, a series of selecting-relays, a motor for rotating said arm, and circuit-closers actuated by said motor, one for controlling a resetting-circuit and the other a press mechanism, substantially as described.

4. In a multiple synchronous-telegraph system for operating a printing-telegraph, the combination of a duplex relay at the transmitting-station for effecting synchronism, a local circuit, and a synchronizing-motor having a field-magnet, as shown, and an armature-body formed of a segment of an iron ring, as set forth.

5. In a synchronous mutiple-telegraph system for operating a printing-telegraph, the combination, at the transmitting-station, of an actuating-motor, a synchronizing-motor, a local circuit, a duplex relay for operating said local circuit, a main line, a motor at the receiving-station for rotating an arm over a circular series of contacts, a synchronizing-battery branch, a series of selecting-relays joined with segments of the circular series of contacts, resetting-coils, a printing-instrument, and a series of type-setting magnets.

6. In a synchronous multiple-telegraph system for actuating a printing-telegraph, the combination of a main motor at each station, a synchronizing-motor and duplex relay at the transmitting-station, a synchronizing-battery branch at the receiving-station, a series of selecting-relays, a printing-instrument, and a series of type-setting devices.

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Witnesses:
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