Aug. 18, 1925.

1,549,821

G. S. VERNAM

PRINTING TELEGRAPH SYSTEM

Filed Sept. 14, 1923

2 Sheets-Sheet 1

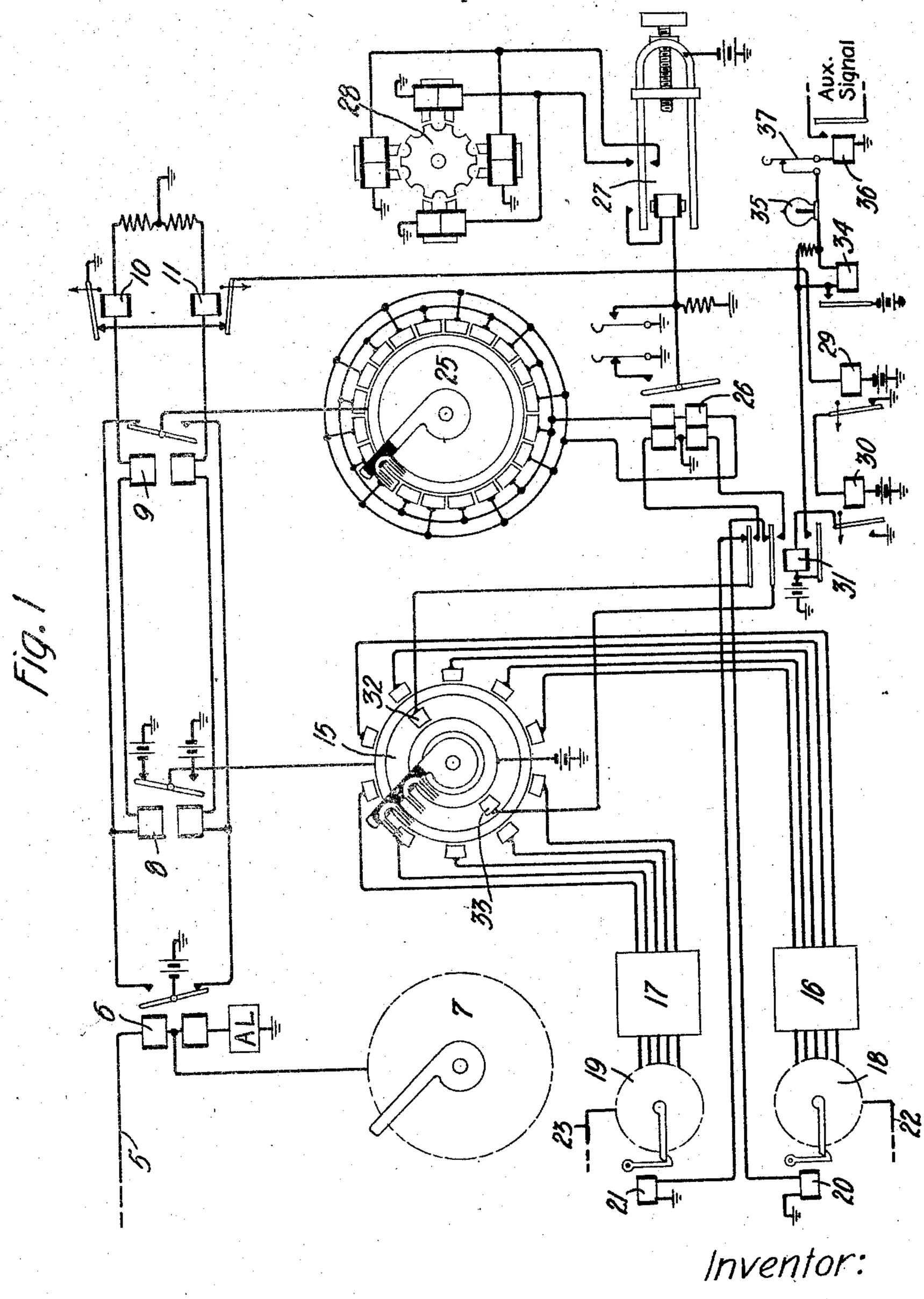

Fig. 1.

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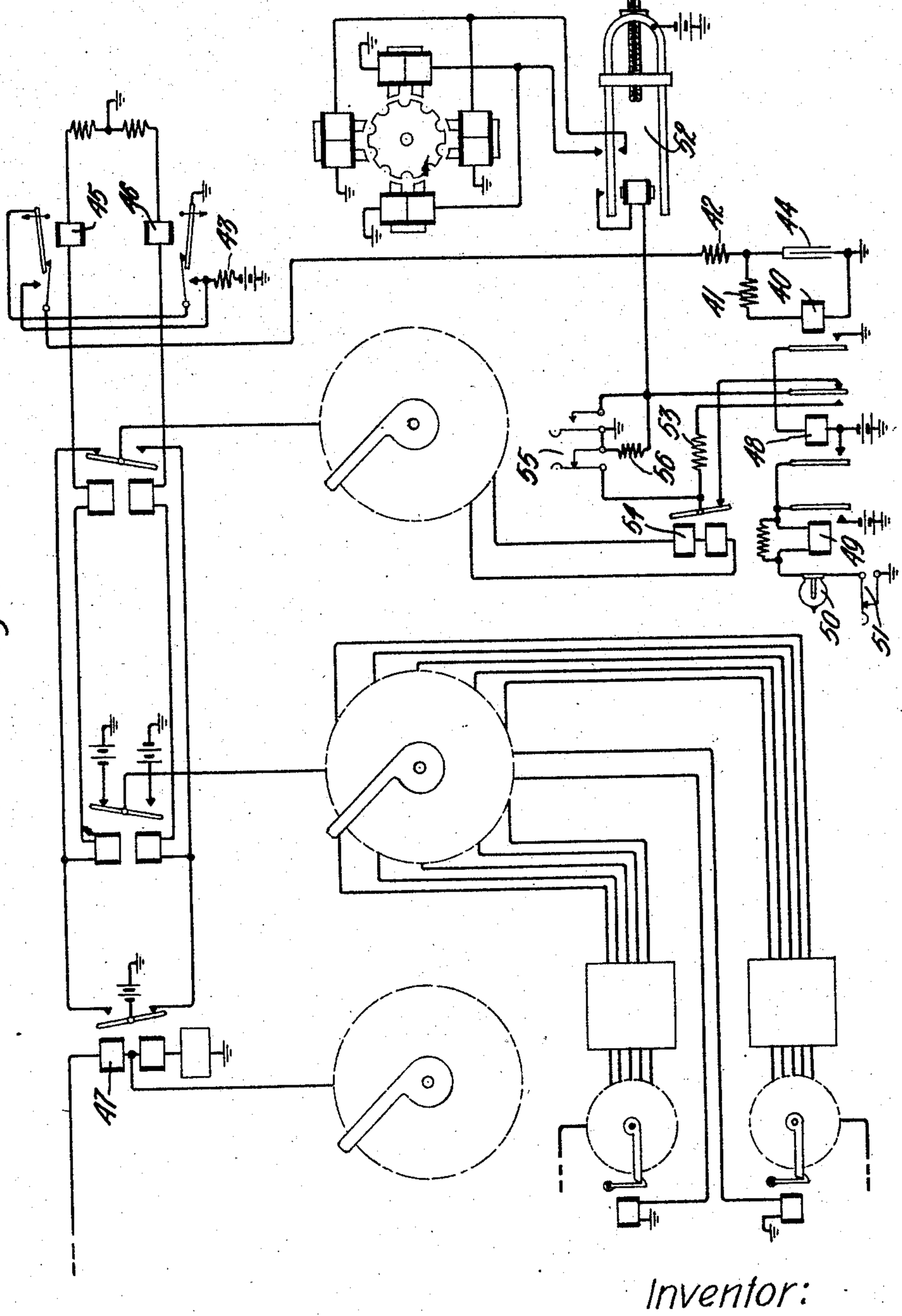

Fig. 2

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Patented Aug. 18, 1925. 1,549,821

UNITED STATES PATENT OFFICE.

GILBERT S. VERNAM, OF BROOKLYN, NEW YORK, ASSIGNOR TO AMERICAN TELEPHONE AND TELEGRAPH COMPANY, A CORPORATION OF NEW YORK.

PRINTING-TELEGRAPH SYSTEM.

Application filed September 14, 1923. Serial No. 662,678.

To all whom it may concern:

Be it known that I, GILBERT S. VERNAM, residing at Brooklyn, in the county of Kings and State of New York, have invented certain Improvements in Printing-Telegraph Systems, of which the following is a specification.

This invention relates to signaling systems and particularly to printing telegraph systems.

An object of the invention is the provision of means in a synchronous multiplex printing telegraph system responsive to the interruption of the line signals for a period longer than would occur during the normal operation of the system for maintaining synchronism and indicating such interruption to an attendant.

In accordance with one of the embodiments, the invention contemplates the provision in a printing telegraph system employing continuously rotating distributors which depend for their correction upon line signals, of means responsive to a prolonged open line condition for preventing loss of synchronism and operating suitable indicating mechanism for advising an attendant that the line has failed.

Referring now to the drawings, Figure 1 illustrates one embodiment of the invention while Fig. 2 shows a modification of the arrangement shown in Fig. 1.

A better understanding of the invention may be had from the following description when considered in conjunction with the accompanying drawings.

Referring for the moment to Fig. 1 there is shown an incoming line 5 which extends from a distant central station and terminates at the station shown in this figure. It should be noted here that the system for which the present invention is especially adaptable is of the type commonly referred to as synchronous multiplex systems with extension circuits, that is,—a system wherein the message impulses are transmitted over a multiplex system and then retransmitted by means of start-stop equipment to branch offices where the messages are recorded and where start-stop equipment is also located. It is, of course, understood that one of the multiplex stations serves as the pace setting station while the other station is what is termed the corrected station. It is the latter station which has been shown in the present instance.

Connected to the line conductor 5 is a line relay 6 which has connected to its contacts, relays 8, 9, 10 and 11. To the midpoint of the connection of the windings of relay 6 is connected the sending segments of a multiplex distributor 7 which, for the sake of clearness, has been shown diagrammatically as it does not form a part of the present invention. The receiving distributor 15 has been shown in detail and has its continuous ring connected to the armature of relay 8 and receiving segments connected to storage devices 16 and 17 also shown diagrammatically. Each of the storage devices 16 and 17 has circuits controlled thereby extending to start-stop distributors 18 and 19 which have their brush arms controlled by release magnets 20 and 21 respectively and which serve to retransmit the impulses received on receiving distributor 15 to the branch lines 22 and 23. This particular part of the system is shown in detail in my copending application Serial No. 528,763, filed January 12, 1922, and since only so much of the system as is shown enters into the present invention, a more detailed showing is considered unnecessary.

The relay 9 controls through its armature, the application of current in accordance with the operation of the receiving relay 6 to the continuous ring of the correcting section 25 of the distributor for operating a control relay 26 which functions to correct the speed of a tuning fork 27 in accordance with the line signals. The tuning fork 27 through its contacts controls the energization of diametrically opposite driving magnets of a LaCour motor 28, the armature of this LaCour motor being connected to a shaft upon which the brush arms of the various sections of the distributor are mounted. As is well understood, the motor 28 serves as a driving means for the brush arms of the various distributor sections. This method of correction is fully disclosed in Patent 1,333,000, issued March 9, 1920 and further description of this part of the system is believed unnecessary.

Relays 10 and 11 which are also controlled by the line relay 6 are of the slow-to-release type as indicated by the arrows being so designed that they will not release their armatures except upon the happening of a cessation of line signals for a period longer than the normal operation of the system, as might be caused by a line failure. When this occurs one or the other of these relays releases its armature for causing the deenergization of a slow-to-release relay 29. This slow-to-release relay 29 in releasing its armature, opens the energizing circuits of another slow-to-release relay 30 for completing a circuit through the armature and contact of the latter relay for energizing relay 31. Relay 31 disconnects at its armatures the circuits extending from the start segments 32 and 33 of the multiplex distributor 15 to the release magnets 20 and 21 of the start-stop distributors 18 and 19 respectively. Thus, though the distributor 15 continues to be rotated, the start-stop distributors 18 and 19 will not be released as the circuits for their release magnets are severed at the armatures of relay 31. There is, however, completed at the upper armatures of these relays, circuits extending from the segments 32 and 33 of the distributor 15 to the left-hand windings of control relay 26 whereby the control relay 26 will be energized upon the passage of the brush of the distributor 15 over the segments 32 and 33 independent of the operation of the correcting section 25 of the distributors. Relay 31 also completes at its lower armature and contact an energizing circuit for relay 34 which, upon being energized, causes the operation of a signal lamp 35 and a relay 36 which controls the operation of an auxiliary signaling device such as a bell or other audible signaling device. The operation of the lamp 35 or the auxiliary signaling device indicates to the attendant at the multiplex or central station that there has been a cessation of signals or that the line has failed. The attendant may then attempt to locate the trouble and again set the system into its normal operation without waiting to be advised by the operators at the branch offices of the failure.

Lamp 35 and relay 36 may be restored to normal by opening key 37 momentarily and in the normal operation of the system when relay 31 is deenergized, correcting relay 26 is controlled by impulses through its right-hand winding generated by reversals in the polarity of the line signals as impressed on the relay 9 by line relay 6. As the armature of relay 26 moves from side to side in response to these impulses, the distributor is caused to vary between two speeds, one slightly faster and the other slightly slower than that of the distant distributor which originated the line signal. Should these line signals stop because of line trouble, the armature of the correcting relay will remain in one or the other of its positions and the distributors will run steadily fast or slow as the case may be and drift out of phase. It is, however, apparent that with the proposed arrangement this condition will not exist for when the line fails causing the signals to be interrupted for a period longer than in the normal operation of the system, one or the other of the relays 10 or 11 will be released for causing the energization of relay 31 which, as previously described, connects through its upper armatures the left-hand windings of relay 26 to the segments 32 and 33 of the distributor 15. Impulses from segments 32 and 33 will now control correcting relay 26 and will cause the armature of this relay to vibrate slowly, remaining in its two positions, each for a half revolution. This will vary the speed periodically from fast to slow so as to maintain an average speed approximating that of the distributor at the pace setting station.

Fig. 2 illustrates a slightly different arrangement for obtaining substantially the same results. In general, the operating features are the same as that described in Fig. 1 but a different relay arrangement has been substituted for that shown in Fig. 1 as well as a slightly different method of controlling the distributor speed. Relay 40 of Fig. 2 is designed to operate on a small but definite current and is connected in series with three resistances 41, 42 and 43 and shunted by a condenser 44. Resistances 41 and 43 are comparatively high while resistance 42 may be a small resistance. The value of these resistances is such that relay 40 can operate through them only when the condenser 44 is fully charged or nearly so.

If either relay 45 or relay 46, which are of the slow-to-release type, and which release their armatures only upon the engagement of the armature of relay 47 with either its upper or lower contact for a period longer than the normal operation of the system is deenergized, battery will be connected to the circuit of relay 40. At first the condenser 44 acts as a low impedance path across relay 40 and resistance 41. The condenser charges slowly through the resistances 42 and 43 and as it charges the potential across relay 40 and resistance 41 is gradually increased. At the same time the operating current through relay 40 increases with the result that relay 40 operates when the condenser is charged nearly to its maximum potential.

The time required for operating relay 40 depends upon the time required for charging the condenser 44 and this depends upon the constants of the circuit particularly the condenser capacity and the value of the resistances and applied voltage.

If relays 45 and 46 are both restored to

their normal energized condition before relay 40 operates, the condenser will be discharged to ground through the comparatively low resistance 42. This resistance serves to limit the discharge current and prevents sparking on the contacts of relays 45 and 46.

When relay 40 operates it energizes relay 48 which performs similar functions to the corresponding relay 31 of Fig. 1. That is,—it causes the energization and locking up of relay 49 which causes the lighting of lamp 50 for communicating the trouble to the attendant. The release of relay 49 is controlled by a key 51.

The speed of the driving fork 52 in the case illustrated, is controlled as in the previous case by the insertion and disconnection of a resistance 56 by the operation of either the control relay 54 or the correcting key 55. When this resistance 56 is in series with the driving magnet of the fork 52, the operating current is reduced and the speed of the driving fork and the motor is slightly increased while when the resistance is short-circuited, the current of the magnet circuit is increased and the fork and motor speed decreased. When relay 48 operates, it connects a second resistance 53 in parallel with resistance 56 and thereby regulates the current in the driving magnet circuit to a value between that for the fast and slow speeds. Under these conditions, the fork and motor will operate at a speed approximately the same as that of the pace setting distributor.

It may also be desired to disconnect the start circuits of the start-stop distributors as was done in the case of Fig. 1. If this is desired it only becomes necessary to provide additional contacts and armature on relay 48 for accomplishing this result in a manner similar to that previously described in connection with Fig. 1.

Although the invention has been shown as applied to a particular type of system, it is, of course, obvious that it is equally adaptable to other types of systems without departing from the spirit and scope of the present invention.

What is claimed is:

1. A telegraph system comprising a line, synchronous multiplex distributors associated with said line, correcting means responsive to line signals for maintaining synchronism, and means operated when said line signals fail for a period longer than would occur in the normal operation of a printing telegraph system to maintain substantial synchronism independently of any signals transmitted over said line.

2. A telegraph system comprising a line, synchronous multiplex distributing apparatus associated with said line, correcting means responsive to line signals for maintaining synchronism, and relay means operated when said signals fail for a period longer than would occur in the normal operation of a printing telegraph system to maintain substantial synchronism independently of any signals transmitted over said line.

3. A telegraph system comprising a line, synchronous multiplex distributors associated with said line, correcting means responsive to line signals for maintaining synchronism, means operated when said line signals fail for a period longer than would occur in the normal operation of a printing telegraph system to maintain substantial synchronism independent of the line signals, a signaling device, and means controlled by said second recited means for operating said signaling device to communicate to an attendant the failure of the line signals.

4. A telegraph system comprising a line, a relay connected in said line, synchronous multiplex distributors associated with said relay, correcting means responsive to the operation of said relay by line signals for maintaining synchronism, and slow acting relay means operated only when said relay is caused to engage its contacts for a period longer than would occur in the normal operation of a printing telegraph system for controlling operation of said correcting means to maintain substantial synchronism.

5. A telegraph system comprising a line, a relay connected in said line, synchronous multiplex distributors associated with said relay, correcting means responsive to the operation of said relay by line signals for maintaining synchronism, slow-to-release means operated when said relay is caused to engage its contacts for a period longer than would occur in the normal operation of a printing telegraph system, and means controlled by said slow-to-release relay means for supplying the correcting impulses to said correcting means independently of the line signals for maintaining substantial synchronism.

6. A telegraph system comprising a line, synchronous multiplex apparatus associated with said line, correcting means responsive to line signals for maintaining synchronism, extension circuits, start-stop distributing apparatus intermediate said multiplex apparatus and said extension circuits, and means operated when said line signals fail for a period longer than would occur in the normal operation of a printing telegraph system to control said correcting means to maintain substantial synchronism and prevent the release of said start-stop distributing apparatus.

7. A telegraph system comprising a line, receiving equipment associated with said line, means operated when signals on said line fail for a period longer than the normal operation of the system, and means respon-

sive to the operation of said means for indicating the failure of the signals.

8. A telegraph system comprising a line, receiving equipment associated with said line, an indicating device, and slow-acting relay means responsive when there is a cessation of signals on said line for a period longer than would occur in the normal operation of a printing telegraph system to effect the operation of said indicating means.

In testimony whereof, I have signed my name to this specification this 12th day of September 1923.

GILBERT S. VERNAM.