

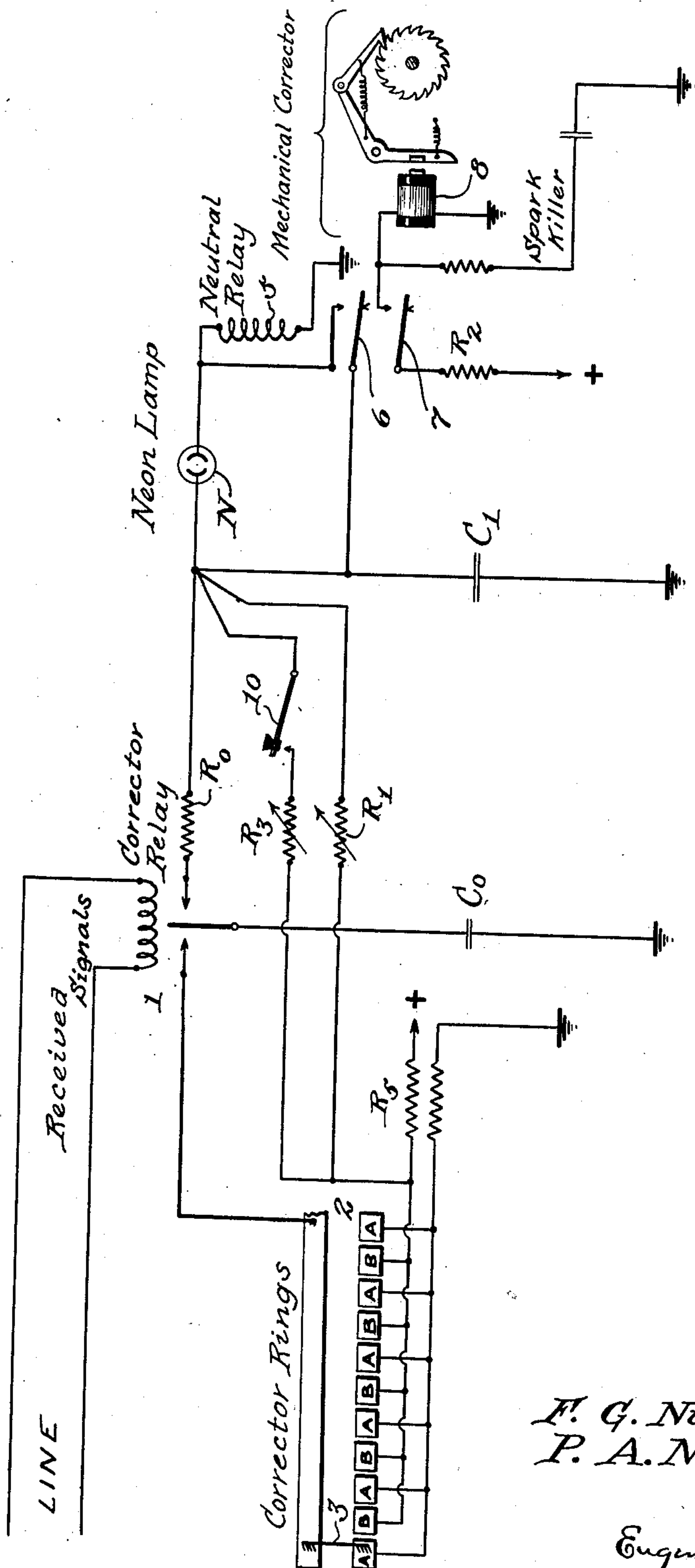
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SYNCHRONIZING SYSTEM

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SYNCHRONIZING SYSTEM

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This invention relates to synchronous communication systems and particularly to high speed printing telegraph systems.

In the synchronizing systems in common use in high speed multiplex telegraphy, the rotary distributors at the transmitting and receiving stations are operated by a constant driving force, such as fork controlled motors of the La Cour type. It has been the practice to operate the distributor at the transmitting station, at the desired signal transmitting speed and the distributor at the receiving station at a slightly greater speed. A corrector mechanism which operates in conjunction with the receiving distributor maintains the brushes of the distributors in proper phase relation by stepping the brushes of the receiving distributor backward, independently of the driving motor, whenever an angular shift between the brushes and the motor shaft was required in order to restore said proper phase relation. This method of maintaining the phase relation between the brushes of the respective distributors is disclosed in Patent No. 1,298,622 granted to Yorke and Benjamin, March 25, 1919. In this system each current reversal affecting the correcting relay affords an opportunity for making a correction; but the correction mechanism operates only when, at the time of one or more of such reversals, the brushes of one distributor are sufficiently out of phase with the brushes of the other distributor to require correction.

Due to irregularities and distortion in the shape of the received signal wave, which may be caused by extraneous currents, variations in line characteristics etc., the instants of reversal may vary considerably from the theoretically correct point so that the brush may be sufficiently out of phase to require a succession of correcting impulses to restore it. It is evident therefore that there is an area of uncertainty in which the point of current reversal may occur.

As the brushes of the receiving distributor are driven at a slightly greater speed than those of the transmitting distributor, they have a tendency to gain in phase with respect to the brushes at the transmitting station. This causes a slow creep of the area of uncertainty over the corrector segments in the direction of brush rotation. As the area of uncertainty tends to creep onto the next forward segment, it will only be able to reach a position such that the proportion of the area that extends over the advance segment will just contain the number of reversals necessary to effect the required retardation and

it will "hunt" back and forth as the control mechanism attempts to hold that portion of it necessary for compensation over the segment.

The phase wander inherent in the above correction methods prohibits their use in extremely high speed signaling systems when the signal impulse waves become very short. Moreover the relays which actuate the correcting device require relatively large impulses thus making it necessary for a considerable arc to pass between the brush and segment before the contact area between brush and segment becomes large enough to pass sufficient current to operate a relay.

One purpose of my invention is to provide a corrector system which follows the mean position of a series of signal current reversals and thus is controlled by the phase relation between the average received reversals and the corrector ring, thereby overcoming the tendency to "hunt" and the irregularity of the prior edge correction devices.

The synchronizing system disclosed herein is an improvement upon the system described and illustrated in said Yorke and Benjamin Patent No. 1,298,622, in which the rotary distributors at the transmitting and receiving stations are driven by fork controlled La Cour motors, the brushes of the receiving distributor (designated as the "corrected distributor") being driven at a slightly greater speed. The brushes of the "corrected distributor" are stepped backwardly independently of the driving motor in the manner illustrated in Fig. 1^c of said patent, whenever the angular shift between the brush and the motor shaft is required to restore proper phase relation between the brushes of the two distributors. The disclosure of said patent is assumed to be embodied in this case.

The accompanying drawing is a diagram illustrating the circuit arrangement of our improvement in synchronizing systems.

The control mechanism of the phase corrector embodies a segmented ring consisting of pairs of segments A and B, the corresponding segments of each pair being connected together. In the usual correcting system, in which the brush of the corrected distributor is retarded to effect a correction, if the distributor brush is rotated in synchronism with the signals, each reversal will occur while the brush is on one of the A segments. In this event no correction will be applied. However, if the distributor brush gains relative to the rate of signal transmission, so that a reversal occurs while the brush is on one of the B segments, a correcting impulse is produced which

actuates the magnet of the corrector mechanism to set the brush back, relative to the driving motor shaft so as to restore it to the proper A segment.

5 Referring to the accompanying drawing, the corrector relay 1 receives the incoming signals. Its armature is connected to a grounded condenser C_0 of small capacity, which picks up a positive charge from the corrector rings 2, while
10 the corrector relay is on its marking contact, if the corrector brush is on a B segment at that instant, the amount of this charge being determined by the phase relation between the signal reversal and the corrector brush 3 at the instant
15 the corrector relay leaves its marking contact. The pick-up condenser C_0 discharges into a larger storing condenser C_1 while the corrector relay is on its spacing contact, thereby producing an increment or decrement in the voltage of storing
20 condenser C_1 , the magnitude of which is dependent on the ratio of the two capacities. The function of the resistance R_0 is to prevent condenser C_0 from completely discharging between successive reversals when the signal frequency
25 is low, thus making the effect of a single reversal dependent upon the number of correcting opportunities afforded.

If we assume storing condenser C_1 to be discharged, it is evident that if the phase relation
30 of the signal reversals to the position of the corrector brush 3 is such that a preponderance of positive increments are received, condenser C_1 will gradually acquire a positive charge at a rate depending upon the number of positive increments
35 per unit of time and therefore upon the phase relation between the received signal and the corrector ring.

For the purpose of interpreting this potential rise in terms of the phase correction required per unit of time, a normally deenergized neutral relay
40 5, provided with tongues 6 and 7, is connected to one electrode of a negative glow lamp or neon tube N, the other electrode being under the control of the potential across storing condenser C_1 .
45 As the potential of condenser C_1 becomes more positive, a potential is reached which causes the gaseous ionizable gap of the neon tube to break down, thus permitting a sudden rush or surge of current to flow through the neutral relay. The
50 operation of the relay causes a short circuit through tongue 6 to be placed around the neon lamp, thus permitting a direct discharge of the condenser C_1 to prolong the impulse through the neutral relay and ensuring a sufficient operating
55 pulse. Simultaneously current from positive battery through relay tongue 7 operates the magnet 8 of the mechanical corrector and causes the corrector brush 3 to step backward. When the potential across condenser C_1 has been reduced
60 to a certain value, current through the neutral relay will be insufficient to hold the relay tongues in operated position so that they will return to the unoperated position. This removes the short circuit across the neon lamp and permits the storing condenser C_1 to again acquire a positive
65 charge in the manner previously described.

The voltage across the neon lamp is now below the ionizing or breakdown point so that it is evident that the above described functions will
70 be repeated at a rate which is determined by the rate of rise of potential across condenser C_1 and therefore by the phase relation between the average received reversal and the correcting ring.

By connecting a leak resistance R_1 from condenser C_1 to positive battery, the condenser can

be charged at such a rate that the corrector mechanism will be operated periodically at the average rate when current reversals fail to arrive for a number of revolutions of the distributor or in case of a momentary failure of the line and thereby step the corrector brush to maintain synchronism with the distributor at the transmitting station.

In order to be able to step the brushes backward quickly to bring the brushes into proper
10 phase relation after an interruption a switch button 10 is provided in a normally open shunt circuit, provided with a suitable resistance R_3 , to lower the resistance between the condenser C_1 and resistance R_5 , thereby causing the corrector
15 mechanism to operate at a faster rate than the normal rate.

As noted above, in the Yorke-Benjamin synchronizing system the corrector mechanism follows the edge of the correcting area, whereas in
20 the integrating or averaging corrector system disclosed herein, the corrector follows the mean of a series of signal current reversals. This results in overcoming the tendency to "hunt" and the irregularity in the corrector movements of
25 the prior devices.

We claim:

1. A synchronizing system for telegraph apparatus, comprising a signal receiving relay, a
30 condenser proportionally arranged to store incremental charges controlled by said relay, a rotary member normally in phase with said signals, a corrector magnet operable under control of a surge of said condenser as the rotary member
35 tends to move out of phase, mechanical means including said magnet for correcting the position of said rotary member, and insulating means between the condenser and said magnet which becomes conductive at a certain potential to
40 thereby permit said condenser surge when the condenser charge attains said potential.

2. A synchronizing system for telegraph apparatus, comprising a distributor, a brush cooperating therewith, means for rotating said brush, mechanical means for changing the angular
45 displacement of said brush with respect to said distributor, a polar relay, a condenser proportionally arranged to store incremental charges upon the operation of said relay on the receipt of signals of one polarity, said mechanical means being
50 operated to step said brush by a surge of said condenser and an ionizable gaseous path between the condenser and the relay permitting the passage of said surge at a certain potential.

3. In a synchronizing system for telegraph apparatus, a distributor, a brush moving thereover, a polar signal receiving relay, a pick-up condenser of small capacity, said condenser being
55 charged through one contact and discharged through the other contact of said relay, a second storing condenser of larger capacity, said second condenser being proportionally arranged to be increasingly charged by the successive discharges of said first named condenser, means operable by a surge of said second condenser to cause angular
60 displacement of said brush with respect to the distributor, and an ionizable device arranged to break down at a certain potential to thereby control the instant at which said surge occurs.

4. In a synchronizing system as set forth in
70 claim 3, means actuated by said surge to short circuit said ionizable device and thereby facilitate and prolong discharge of the condenser.

5. In a synchronizing system as set forth in
75 claim 3, an auxiliary circuit connecting said sec-

ond condenser with a potential source to gradually charge said second condenser and cause a periodical surge therefrom during a temporary interruption in the received telegraph signals.

5 6. In a synchronizing system as set forth in claim 3, and means for manually connecting a

potential source to said second condenser to produce a desired number of condenser surges for the purpose of quickly obtaining the desired angular displacement of said brush.

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