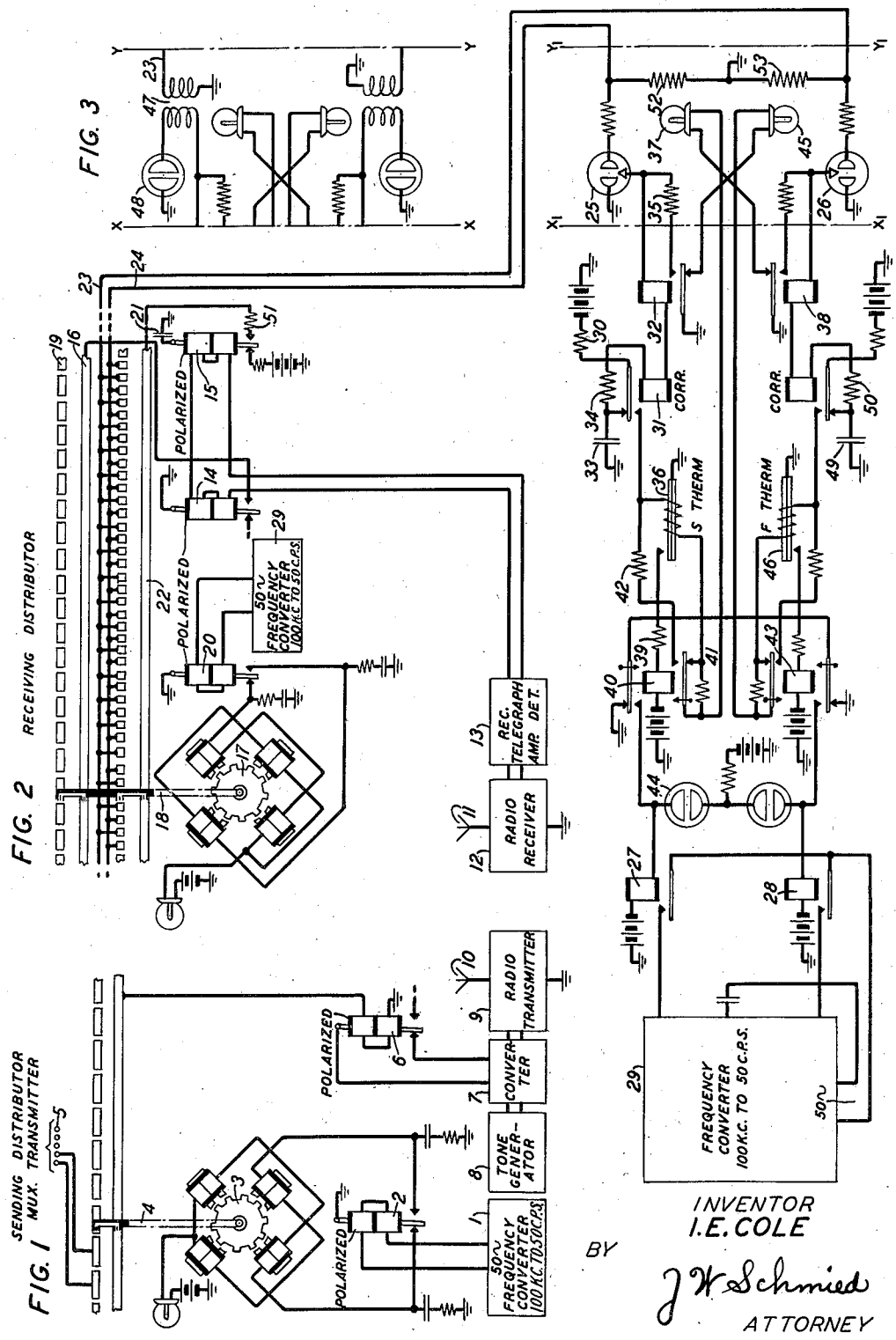
July 22, 1941. I. E. COLE 2,249,747

REGULATING SYSTEM

Filed June 21, 1940



Patented July 22, 1941 2,249,747

UNITED STATES PATENT OFFICE

2,249,747

REGULATING SYSTEM

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Application June 21, 1940, Serial No. 341,623

8 Claims. (Cl. 178—53)

This invention relates to signaling systems and particularly to systems wherein rotary distributors at the opposite ends of a transmission channel are maintained in synchronism through a correction system operated by the signals passing over the said transmission channel.

The object of the invention is to provide means for more accurate correction of distributor speeds, and to minimize the tendency toward hunting. Where the transition from a spacing signal to a marking signal is used to indicate the fast or slow running of the distributor being corrected, a condenser charged from a local circuit is discharged at the instant of transition. Usually this condenser is discharged into one winding or another of a correcting relay which thereupon acts to influence the speed of the corrected distributor. However, the discharge of the condenser is completed in an extremely short time and it has been found that the responsive relay must be of an expensive type and is still difficult to adjust and maintain.

A feature of the present invention is a fast and a slow train of relays in mutually disabling circuits each put in operation by a cold cathode tube fired by the discharge of a condenser and effectively lengthening the condenser discharge time. By way of example the discharge of the condenser may be of the order of one or two milliseconds and the tubes after being fired may be maintained active for two to three hundred milliseconds.

Another feature is the use of a cold cathode tube in a self-extinguishing circuit. After the tube has been fired it operates a relay which besides relaying the signal operates to extinguish the tube.

Still another feature is a thermal integrating relay which responds to the signals relayed from the cold cathode tubes and when a sufficient number of signals has been received within a given time acts to perform a correcting function. In order to prevent overcorrection this thermal relay operates another relay in the chain which in turn changes the operating circuit of the thermal relay to render it less sensitive whereby it releases more readily.

Another feature of the invention is a gaseous discharge device ionizable by a condenser discharge and relay means responsive thereto for directing the discharge of another condenser into said device and through said relay means for maintaining said relay means operated and said device ionized for a predetermined length of time.

This invention is an improvement over an arrangement disclosed in Patent No. 2,207,748, to L. A. Meacham, issued July 16, 1940. The invention is applied to a system of the type generally shown in Patent No. 2,207,720, issued to Cole and Melhose July 16, 1940.

The drawing consists of a single sheet showing partly a schematic circuit diagram and partly a complete circuit diagram.

Fig. 1 is a schematic diagram of a transmitting distributor and the associated apparatus for transmitting permutation code impulses over a channel here illustrated as a radio link.

Fig. 2 is a circuit diagram, part of which is shown schematically and it illustrates a receiving distributor for translating the incoming permutation code impulses and feeding them to a printer. The lower part of the figure is a circuit diagram, in full, illustrating the correcting circuits for keeping the distributor motor of Fig. 2 in exact synchronism with the distributor motor of Fig. 1.

Fig. 3 is an alternative arrangement which may be inserted in the circuit of Fig. 2 at the lines *xx* and *yy*.

The system schematically illustrated in Figs. 1 and 2 is explained and considered in detail in the Cole et al. patent. In Fig. 1 the box 1 represents a source of 50-cycle frequency. This continuously operates relay 2 which vibrates its armature at the rate of 50 cycles per second, and drives motor 3 of a well-known type which need not be described in any more detail. Motor 3 drives a distributor arm over a distributor face and sequentially connects the leads from a multiplex transmitter 5 to the segments of the distributor and thence to a sending relay 6. This sending relay operates a converter 7 which divides a tone from a tone generator 8 into spacing and marking impulses which are then fed into a radio transmitter 9 and transmitted over the antenna 10 to the antenna 11 of the receiving device of Fig. 2. In Fig. 2 the antenna 11 is connected to a radio receiver 12 whose output is connected to amplifier detector 13 where, through the relays 14 and 15, they are operated in accordance with the signals sent out from the transmitter. Relay 14 has its marking contact connected to ring 16 and as the motor 17 drives the distributor arm 18 causes appropriate marking and spacing impulses to be distributed to the segments, such as 19, from which they are fed into a printing device.

The motor 17 of well-known design is driven from a source of 50-cycle current through the driving relay 20 in the same manner as the motor

3 is driven by the relay 2. In order to keep the motor 17 in exact synchronism with the motor 3, a corrector relay 15 is provided. This relay has a condenser 21 connected to the armature of the relay which becomes charged in a circuit from ground, condenser 21, the armature and spacing contact of relay 15 to battery. Whenever a marking impulse is received, relay 15 moves its armature to its marking contact and discharges the condenser 21 through a circuit including the ring 22 and some one of the segments connected either to conductor 23 or conductor 24, resulting in the operation of either tube 25 or 26.

As will appear hereinafter, if the motor 17 is being driven too slowly, tube 26 will eventually cause the operation of relay 28 which will cause an adjustment in the 50-cycle output frequency of the converter 29 and result in the speeding up of the motor 17. If the motor 17 is running too fast, tube 25 will be operated and will eventually cause the operation of relay 27 which will bring about an adjustment in the 50-cycle output frequency of the converter 29 which will result in a slowing down of the motor 17.

It should be noted that the frequency converter 29, shown as a large box in the lower left-hand corner of this drawing, is the same as the 50-cycle frequency converter 29 feeding into the relay 20. It should be further noted that the converter 1 is similar to the converter 29, the main difference being that the converter 1 is the master and thereby controls the converter 29. Converter 1 is known as the correcting converter and 29 is known as the corrected converter.

When the motor 17 is running fast, then the discharge from the condenser 21 feeds into conductor 24 and causes tube 25 to flash, thereupon tube 25 is maintained operated through a circuit from battery, resistance 30, the armature and back contact of relay 31, the winding of relay 32 to tube 25 and thence to ground. Relays 31 and 32 both become operated but a substitute circuit for maintaining tube 25 operated for a short interval is provided by the condenser 33 which has been charged while relay 31 was non-operated. Now that the charging circuit of condenser 33 is broken, it will discharge through the resistance 34, the winding of relays 31 and 32 and tube 25. Relay 32 closes a circuit from ground, its armature and front contact through resistance 35 to quench the tube 25, but relays 31 and 32 remain operated until the condenser 33 has discharged to a critical value.

The relay 32 is slightly less sensitive than relay 31 whereby it will always release first on diminishing current and thus avoid establishing a circuit from ground armature and front contact of relay 32, resistance 35, windings of relays 31 and 32, resistance 34, back contact and armature of relay 31, resistance 30 to battery which might cause relay 31 to "buzz" and disable the corrector circuit.

During the operation of relay 31, a circuit is established from battery, resistance 30, the armature and front contact of relay 31, the winding of thermal relay 36, signal lamp 37, the armature and back contact of relay 38 to ground.

The operation of the tube 25 and the relays 31 and 32 is rapid, and this results in the feeding of a large number of impulses of short duration to the thermal relay 36. The relay 36 operates on an integrating principle and therefore, if a proper number of impulses are received within a given period, relay 36 will close a circuit from ground through the elements of the relay, thence through resistance 39 and the winding of relay 40 to battery. Relay 40, by moving its armature, introduces a resistance 41 into the circuit of the winding of relay 36 and connects a resistance 42 about the winding of relay 36, whereby this relay is allowed to release quickly. Relay 40 also establishes a connection from ground, the lower armature and back contact of relay 43, the upper armature and front contact of relay 40, and thence in parallel through the winding of relay 27 to battery and through the glow lamp 44 to battery. The glow lamp 44 is an indicator and performs no other function. Relay 27 connects one side of the 50-cycle output to the correcting means within the converter 29. This is shown in full in the Meacham patent.

It should also be noted that lamp 37 while providing a circuit for the thermal relay 36 also acts as an indicator to show that the motor 17 is running fast.

Should the motor 17 run slow, then the tube 26 will become operated, the lamp 45 will indicate this slow operation and a similar chain of relays will finally result in the operation of relay 28 which causes a correction in the converter 29.

Note that these chains are mutually disabled. Thus when the relay 32 is operated, the circuit for the thermal relay 46 is opened. Also when relay 40 is operated, the circuit for relay 28 is opened. This is a provision against erratic or false operation through an occasional energization of tube 26, for instance, when tube 25 is being fairly continuously operated.

The tubes 25 and 26 are of the three-element type. In Fig. 3 a two-element tube is shown. In this case, a condenser discharge over the conductor 23 causes a pulse through the transformer 47 to energize the two-element tube 48. This tube will then remain operated in the circuit through the windings of relays 32 and 31 initially, through the resistance 30 to battery, and for a short time after the operation of relay 31, through the condenser discharge from condenser 33.

It should be noted that relays 40 and 43 are slow to release, this provision being made to give more positive action of relay 27 than might otherwise be the case since the contact made by the thermal relay 36, when it is heated just to the point of making such contact, is liable to be unreliable.

It should further be noted that condenser 33 and resistance 34 and the companion condenser 49 and resistance 50 form hang-over circuits for the automatic quenching circuit for tubes 25 and 26, respectively.

Attention is further drawn to the fact that resistances 51, 52 and 53 are so proportioned that when the brush on distributor arm 18 is in contact with both the fast and slow segments connected to conductors 23 and 24 at the instant of transition, that neither tube 25 nor 26 will be operated because the voltage drop across resistances 52 and 53 in parallel, in series with resistance 51 is too low to fire either tube. This results in less frequent operation of the tubes and relay chains when the motors are running in substantial synchronism.

The smallest correction margin obtainable is limited by the length of time the brush is in contact with both segments. This margin may be increased, if desired, by increasing either the size of condenser 21 or the size of resistors 51, 52 and 53 or both, thus increasing the length

of time that the voltage remains above the firing voltage of the gas tubes. The starting time of the gas tube is of the order of 200 microseconds, and is thus substantially instantaneous for this purpose.

What is claimed is:

1. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, means at the said other end of said channel for producing a signal at the transition in said channel from one to another transmission condition, a slow and a fast correction circuit, means including said corrected distributor for directing said signal into one of said correction circuits, said circuits each comprising a cold cathode tube set into operation by said signal, a relay provided with a hang-over circuit for maintaining said tube in operation for the time period of said hang-over circuit, and an integrating relay responsive to a predetermined number of operations of said relay within a predetermined time for effecting a correcting operation.

2. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transmission from said one transmission condition to another transmission condition, a slow and a fast correction circuit, means including said corrected distributor for directing the discharge of said condenser into one of said correction circuits, said circuits each comprising a cold cathode tube set into operation by said condenser discharge, a relay responsive to said tube, another condenser charged by said relay in the normal position of said relay and discharged into said relay and said tube in the operated position of said relay for maintaining said tube and said relay operated for a predetermined time, and integrating means responsive to a predetermined number of operations of said relay within a predetermined period for effecting a correcting operation.

3. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another transmission condition, a slow and a fast correction circuit, means including said corrected distributor for directing the discharge of said condenser into one of said correction circuits, said circuits each comprising a cold cathode tube responsive to said condenser discharge, relay means responsive to said tube, means controlled by said relay means for maintaining said tube and said relay means operated for a predetermined time after the initial operation of said relay means, and integrating means responsive to said relay means a given number of times within a given period for effecting a correcting operation.

4. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another transmission condition, a slow and a fast correction circuit, said circuits being mutually disabling, means including said corrected distributor for directing the discharge of said condenser into either singly or both simultaneously of said correction circuits, said circuits each comprising a gaseous discharge device ionizable by said condenser discharge, relay means responsive to said device when ionized, means controlled by said relay means for maintaining said device ionized and said relay means operated for a predetermined time after the initial ionization of said device, and means responsive to said relay means for effecting a correcting operation.

5. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another transmission condition, a slow and a fast correction circuit, said circuits being mutually disabling, means including said corrected distributor for directing the discharge of said condenser into either singly or both simultaneously of said correction circuits, said circuits each comprising a gaseous discharge device ionizable by said condenser discharge, relay means responsive to said device when ionized, means controlled by said relay means for maintaining said device ionized and said relay means operated for a predetermined time after the initial ionization of said device, integrating means responsive to frequently repeated operation of said relay means, and a slow releasing relay responsive to said integrating means for effecting a correcting operation.

6. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another transmission condition, a slow and a fast correction circuit, said circuits being mutually disabling, means including said corrected distributor for directing the discharge of said condenser into either singly or both simultaneously of said correction circuits, said circuits each comprising a gaseous discharge device ionizable by said condenser discharge, relay means responsive to said device when ionized, means controlled by said relay means for maintaining said device ionized and said relay means operated for a predetermined time after the initial ionization of said device, integrating means responsive to frequently repeated operation of said relay means, a slow releasing relay responsive to said integrating means for effecting a correcting operation, and means controlled by said slow releasing relay for desensitizing said integrating means to prevent overcorrection.

7. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another

transmission condition, a slow and a fast correction circuit, said circuits being mutually disabling, means including said corrected distributor for directing the discharge of said condenser into either singly or both simultaneously of said correction circuits, said circuits each comprising a gaseous discharge device ionizable by said condenser discharge, a pair of relays initially energized by said ionized device, a condenser for maintaining said relays operated and said device ionized for a predetermined period, one of said relays having means to discharge said last condenser and said ionized device and the other of said relays having means to further affect the correction circuit of which it is a part, a thermal relay responsive to frequently repeated operations of said last relay, and a slow releasing relay responsive to said thermal relay for effecting a correcting operation.

8. In a communication system, a transmission channel, a correcting distributor at one end of said channel, a corrected distributor at the other end of said channel, a condenser at the said other end of said channel arranged to be charged during one transmission condition in said channel and discharged upon the transition from said one transmission condition to another transmission condition, a slow and a fast correction circuit, said circuits being mutually disabling, means including said corrected distributor for directing the discharge of said condenser into either singly or both simultaneously of said correction circuits, said circuits each comprising a gaseous discharge device ionizable by said condenser discharge, a pair of relays initially energized by said ionized device, a condenser for maintaining said relays operated and said device ionized for a predetermined period, one of said relays having means to discharge said last condenser and said ionized device and the other of said relays having means to further affect the correction circuit of which it is a part, a thermal relay responsive to frequently repeated operations of said last relay, a slow releasing relay responsive to said thermal relay for effecting a correcting operation, and means controlled by said slow releasing relay for desensitizing said thermal relay to prevent overcorrection.

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