Dec. 26, 1939. L. W. HOWLE 2,184,916

START-STOP PRINTING TELEGRAPH SYSTEM

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FIG. 1

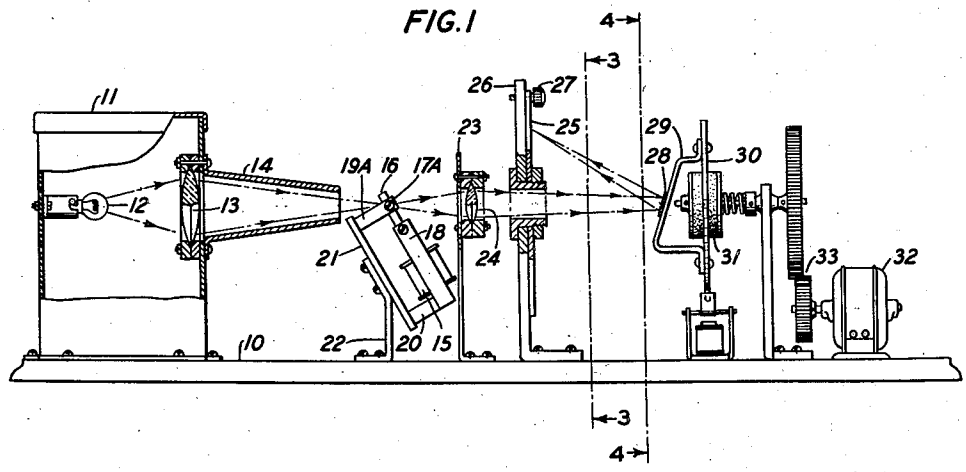


FIG. 2

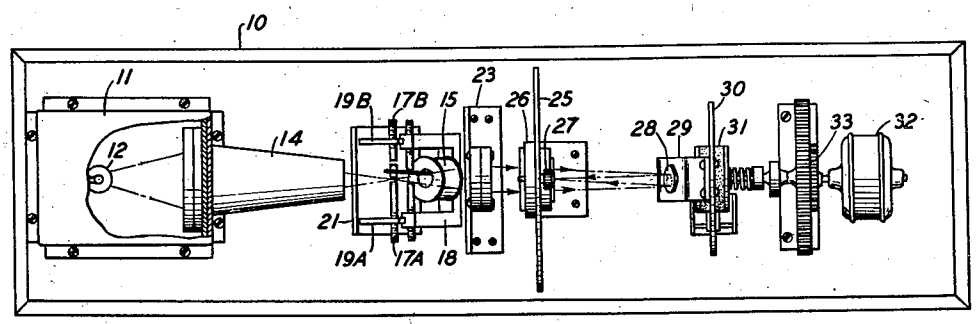


FIG. 3

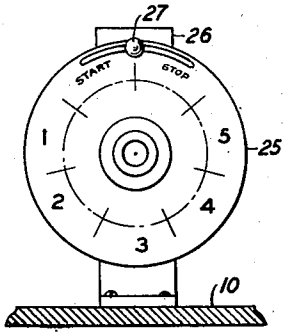
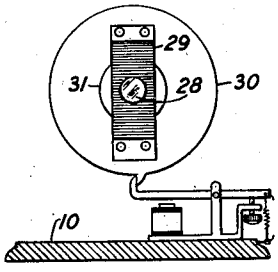


FIG. 4



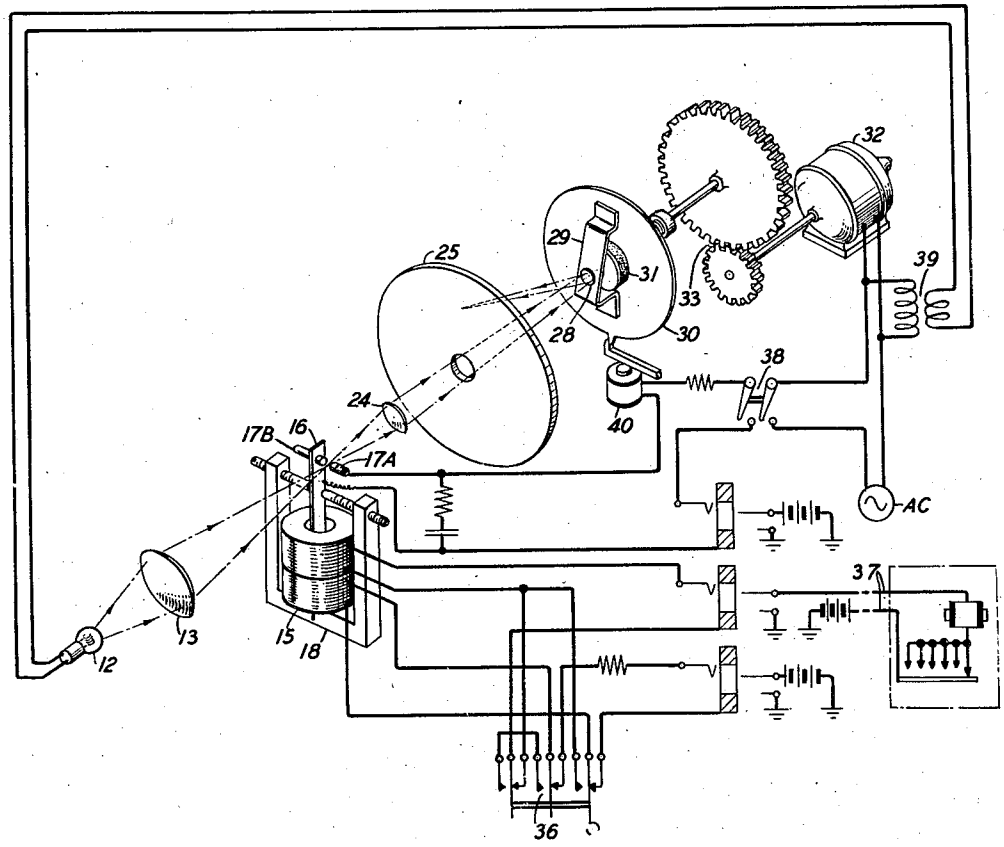
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FIG.5



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START-STOP PRINTING TELEGRAPH SYSTEM

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Application March 19, 1938, Serial No. 196,982

12 Claims. (Cl. 178—69)

The invention relates to distortion indicating devices employed in printing telegraph systems.

An object of the invention is to produce a non-recording type of oscillograph for indicating distortion in a portable set for testing start-stop telegraph signals.

A more specific object is to analyze telegraphic transmission to a somewhat finer degree than is ordinarily possible by using only a monitoring teletypewriter.

Heretofore in using certain distortion indicating and measuring devices adapted for use in teletypewriter systems flashes appeared at recurring intervals corresponding to the intervals of incoming signaling pulse transitions. If the incoming signaling pulses were undistorted the flashes appeared at predetermined points on a rotating disc, but if distortion were present these flashes appeared to be rotating clockwise or counter-clockwise depending upon whether the signaling pulses were longer or shorter than the standard unit length.

Another system heretofore employed is that in which a beam of light is permitted to fall upon a rotating mirror for the duration of the signal to be recorded. The mirror causes the reflected beam to travel across a surface, such as a photographic plate which may be continuously moved, so that the surface signals will appear on the developed plate as parallel lines forming a column. If imperfect signals are transmitted variations from the perfect unit, due to lines or apparatus effects, will be indicated by lengthened or shortened lines in the column.

The present invention comprises arrangements which are more convenient, compact and effective to give similar or better results and more particularly to produce more finely graduated and easily read indications than these and other known types of prior art devices.

According to the present invention there is provided a non-recording oscillograph for indicating distortion which shows the length and relative location of teletypewriter signal pulses by using a beam of light flashing on a frosted screen. Light emitted from a small incandescent lamp is focussed, by means of a lens, on the space between the armature and spacing contact point of a line relay. The relay windings are connected to the circuit under test on a polar or neutral basis, as desired. The relay armature, therefore, operates in unison with the incoming signals allowing the light to pass between its associated contacts when the circuit is in a marking condition and prohibiting the light from passing when the circuit is in a spacing condition. The light thus controlled by the relay is passed to a second lens which condenses the light beam. The light from the second lens falls, at an angle, on a small revolving mirror. This mirror, in revolving, causes the beam of light to be thrown in a circular path, on a flat, white screen. The mirror is operated on the familiar start-stop basis using a clutch and a synchronous motor, the mirror being fixedly mounted on the start-stop rotating disc and at an angle thereto. The contacts of the relay are used to control the operation of the start magnet in the usual way. The screen is calibrated by sending signals into the set from a distributor face transmitter, movable indicators having been provided to show where each pulse of the teletypewriter signal should begin and end. As sufficient light is available, and as the speed of the beam is such that the eye retains the image for a short time, the marking signals appear on the screen as stationary arcs of white light.

A feature of the invention is the use of a light beam reflected in unison with the incoming signal pulses of start-stop signals on a frosted screen, the marking pulses appearing on the screen as stationary arcs of white light the ends of which coincide with the beginning and ending of each pulse or group of pulses. Distorted signals cause an overlapping of the arcs while marking bias is present and unlapping when spacing bias is present. Fortuitous distortion causes the positions of the ends of the arcs to vary erratically. Incorrect transmitting speed may be detected by noticing the amount of deviation from a perfect signal which becomes gradually greater as the pulses progress from the start pulse to the stop pulse.

Another feature is its adaptability to studying and clearing transmission troubles due to characteristic distortion. Trouble in keyboard transmitters may be quickly cleared as the exact pulse or pulses causing the trouble can be readily determined.

Another feature is that the oscillograph may be mounted in a suitcase of suitable size for convenient carrying and therefore may be used in field and service work in conjunction with a portable transmitter at points to which it is customary to transport such a transmitter.

A more complete understanding of the invention will be had by referring to the accompanying drawings in which:

Figure 1 is a side elevation view of the oscillo-

graph set with certain parts broken away to show cross-sectional views;

Fig. 2 is a plan view of Fig. 1;

Fig. 3 is an elevation view taken along axis 3—3 in Fig. 1 and shows the frosted screen upon which the beams of light representing the duration of the incoming marking pulses, are impinged;

Fig. 4 is a front elevation view taken along axis 4—4 and shows the start-stop rotatable disc on which is fixedly mounted at an angle the mirror for reflecting the beam of light on the frosted screen; and

Fig. 5 is a perspective view of the oscillograph set shown with its operating circuit.

Corresponding parts shown in the five figures are designated by like reference characters.

Referring to Fig. 1, chamber 11 is a closed housing within which is mounted an incandescent lamp 12. Chamber 11 is fixed on base 10. At one end of chamber 11 is an aperture into which is securely fitted a biconvex lens 13. Light from lamp 12 is passed through lens 13 and through a conical shaped housing 14 to the contact point of a high speed relay 15, the lens 13 being so located between lamp 12 and the relay contact point that the focus of the light beam is at the contacts of the relay. Lamp 12 typifies any source of light which approximates a point source. The cone-shaped housing 14 is used to prevent any stray or distorted rays from reaching the area around the relay contact point. The group of rays emitting from the conical housing pass at the focal point between the relay contacts when the circuit under test is in a closed, or marking, condition. When the circuit is opened, or in a spacing condition, the relay armature 16 moves to contact 17A (Fig. 5) obstructing the light path and allowing no light to pass by the relay contacts. Thus, when the circuit is in the marking condition, the beam of light is allowed to pass between the contacts and when the circuit is in spacing condition, the light path is completely blocked. In other words, the relay armature 16 serves as a shutter with respect to the emitted light beam. Relay 15 is fixedly mounted on a U-shaped frame 18, the upright members of which have at their free ends, adjusting screws as shown for regulating the movement of armature 16. Adjustable contacts 17—A and 17—B extend through the free ends of the uprights 19—A and 19—B. The fixed end of the U-shaped frame 18 is fixedly attached to another U-shaped bracket 20. Uprights 19—A and 19—B and bracket 20 are fixedly mounted on plate 21 of insulating material, which is fixedly attached to base 10 of a supporting bracket 22. The relay is mounted at an angle to the base in order that the light path may be unobstructed by mounting plate 21.

When the circuit being tested is in marking condition the beam of light passing through the relay contacts to a light shield 23 located in front of lens 24. The shield blocks out any reflected or distorted rays coming from the relay contacts. Lens 24 serves to condense the beam of light so as to obtain finally a small brilliant reflection about the size of a pencil point on the white screen 25 as will be hereinafter described. From lens 24 the light passes through a bushing in the screen 25 and screen support 26. The bushing serves to hold the screen 25 against the screen support 26 and allows the screen to be oriented about it as a bearing. The screen may be locked in any position within its range of orientation by thumb screw 27. The beam of light somewhat condensed impinges upon a flat surface mirror 28 fastened to a bracket 29. Bracket 29 is fixedly mounted and arranged at an angle to a rotatable disc 30. Mirror 28 is positioned with respect to rotatable disc 30 so that it is in the center of rotation. Rotatable disc 30 is fixedly mounted on the driven end of clutch 31, the driving end of clutch 31 being driven by the synchronous motor 32 through gears 33. Mirror 28 upon receiving the light beam reflects it to the surface of screen 25. As the rotatable, or clutch, disc 30 and mirror 28 revolve, the point of light, visible on screen 25, traces a circular path on the screen surface with the center of the bushing as the center of the circular path.

As the free speed of the mirror is approximately 420 revolutions per minute and as the duration of the signal teletypewriter pulse is about 22 milli-seconds, the arc covered by the light spot on the screen during the transmission of the signal pulse is 55.5 degrees in length. Thus, 55.5 degrees represents 100 per cent of a perfect unit pulse, 1 per cent being equivalent to .555 degree. With this as a basis, the screen is calibrated to show each transition point and deviation in per cent from the perfectly positioned transition point. The oscillograph set is calibrated by orientating screen 25 around the bushing while receiving undistorted signals until the beginning of the arc representing the first pulse coincides with the first transition point. The other transition points automatically assume their correct positions. A locking thumb screw, or nut, 27 is provided for clamping the screen after calibration is completed. The clutch disc to which is attached reflecting mirror 28 is controlled indirectly by the line current, using the same principle involved in the start-stop operation of a rotary distributor brush arm used in regenerative repeaters for telegraph systems.

In Fig. 5 is shown the circuit arrangement for operating the oscillograph set. Line switching key 36 is provided in order that the two windings of line relay 15 may be conveniently connected for measuring either polar or neutral, that is, open-closed, signals. Circuit 37 represents in diagrammatic form the line circuit under test. Snap switch 38 controls the power supply from alternating current source AC to synchronous motor 32, and incandescent lamp 12 through the windings of transformer 39. Switch 38 serves also to open the direct current operating circuit for start magnet 40 when it is in the "off" position in order to prevent current from flowing through the winding of the start magnet when the circuit is opened and the oscillograph set is not in use.

In start-stop teletypewriter signaling systems of conventional commercial type the first pulse of a signal combination is always spacing and the armature 16 of line relay 15 accordingly, in response to a spacing pulse, moves to engage contact 17—A to prohibit the light beam from passing to lens 24 and close the operating circuit for start magnet 40. Magnet 40 operates and rotatable, or clutch, disc 30 begins to rotate. As the selecting pulses flow through the winding of line relay 15, armature 16 operates away from contact 17—A in response to the marking pulses and engages contact 17—A in response to the spacing pulses. During the reception of the marking pulses the light beam is reflected by mirror 29 to screen 25 and the mirror rotates through one revolution whereby the reflected

light spot describes an arc of light on the screen for the duration of each incoming marking pulse. Any variation of the arc of light from the corresponding length of segments shown on the screen in Fig. 3 will be the measure of distortion in the incoming signal pulses.

What is claimed is:

1. A testing device for observing as an arc of illumination on a screen the time occupied by the relay of an armature in a given position comprising an electromagnetic relay having an armature, a source of a beam of radiation intercepted by said relay in a certain position thereof, a mirror always occupying some plane oblique to said beam of radiation, a screen having its face in a plane transverse to said beam of radiation, and means for causing relative rotary movement at a definite angular velocity about said beam of radiation as an axis between said screen and said mirror.

2. A start-stop signal distortion measuring set comprising a source from which are transmitted groups of electric impulses, a relay responsive to the impulses of said source, an armature for said relay, a source of light arranged to pass a narrow beam through the space occupied by the armature of said relay in one of its two positions of energization and deenergization, a mirror for reflecting the light passing said armature, the plane of said mirror being such as to reflect the light at an angle, start-stop driving means for rotating the mirror through one revolution for each group of impulses received from said source and a stationary screen for indicating in the form of a segmented circle the light beam reflected by said mirror in rotating through each revolution.

3. A combination according to claim 2 wherein said source of impulses comprises means for transmitting the impulses of each group at a definite frequency and the start-stop driving means comprises starting and stopping elements for maintaining said mirror at a predetermined definite angular velocity with respect to said frequency as stated before.

4. A distortion indicating device for a printing telegraph system of the start-stop type comprising a source of start-stop signals, a transmission circuit for transmitting signal pulses from said source, means including a shutter responsive to said signal pulses, a source of light, means for directing a beam of light from said light source to said shutter, other means for converging said light beam passing said shutter, a start-stop rotatable means controlled by said shutter, a mirror on said start-stop rotatable means for reflecting the converged light beam, a screen for receiving said reflected light beam as a spot of light, and means whereby the rotation of said mirror is effective in producing a circular arc on said screen by means of said reflected light beam, the length of said arc corresponding to the duration of the light beam passing said shutter.

5. A distortion indicating device for a printing telegraph system of the start-stop type according, to claim 4, wherein the source of stat-stop signals comprises means for transmitting polar signals.

6. A distortion indicating device for a printing telegraph system of the start-stop type according to claim 4, wherein the source of start-stop signals comprises means for transmitting neutral signals.

7. A distortion indicating device for a printing telegraph system of the start-stop type according to claim 4 wherein said directing means comprises a biconvex lens for directing a light beam from said source on said shutter and a conical-shaped member for preventing any stray or distorted ray from said light source from reaching said shutter.

8. A distortion indicating device for a printing telegraph system of the start-stop type, comprising a transmission circuit, a source of start-stop signaling pulses connected to said circuit, means in said circuit responsive to the signals from said source, a source of light, means for directing a beam of light from said light source to a focal point, movable contacts included in said responsive means for blocking the light beam at said focal point when the incoming signal pulses are of one type and for permitting the light beam to pass at said focal point when the incoming signal pulses are of another type, means for converging the light beams passing said focal point, a start-stop rotatable device controlled by said movable contacts at said focal point, a mirror on said start-stop rotatable device for reflecting said converged beam of light, an orientable screen for receiving said reflected light beam in a series of arcs of light corresponding in length to the duration of the light beam permitted to pass said focal point.

9. A distortion indicating device for a printing telegraph system of the start-stop type according to claim 8, wherein said responsive means is an electromagnetic relay connected in said transmission circuit and said movable contacts are the armature contacts of said relay arranged to determine whether or not said light beam shall pass to said mirror, and to start said start-stop rotatable device operating.

10. A distortion indicating device for a printing telegraph system of the start-stop type according to claim 8 wherein the start-stop rotatable device comprises a source of alternating current power, a synchronous motor driven by power from said source, said source of power arranged to furnish current for operating said light source, an arrangement of gears driven by said motor, a friction clutch including a driving and a driven member, a rotatable disc fixedly mounted on said driven member of said clutch and supporting said mirror at an angle to the plane of rotation of said disc, a source of direct current, a circuit including said movable contacts and a magnet, said contacts and said magnet cooperating to start said rotatable disc operating every time a group of signals is received with said responsive means from said source of signals.

11. A distortion measuring set comprising a source of incoming signals, a source of light, means for condensing a light beam from said source to a focus, relay means responsive to the signals from said source and arranged when in its operated position only to permit the light beam to pass said focus, a second means for receiving said light beam from said focus when said relay means is in its operated position and for condensing said received light beam a second time, a start-stop rotary member for reflecting said light beam condensed a second time, a screen for receiving said reflected light beam at a second focus whereby the reflected light beam at the second focus describes on said screen an arc the length of which corresponds to the operating time of said relay and means.

12. A distortion measuring set comprising a

source of incoming signals, a source of light, a lens for condensing a light beam of said source to a focus whereat the beam of light is inverted, a relay responsive to signals from said source, an armature of said relay arranged when it is in its normal position to be so positioned at the focus of the first lens that the beam of light is prohibited from passing further, a second lens for receiving said light beam in its inverted position when said relay armature is in its operated position only, an orientable screen provided at its center with an aperture through which the inverted light beam is protected, a start-stop rotary member operating in synchronism with the signals from said source and having mounted thereon a mirror positioned to receive and reflect the inverted light beam to a point on said screen whereby the operation of said relay in response to the incoming signals permits the reflected light to trace on said screen an arc of light having a length corresponding to the duration of the operating time of said relay.

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