

Nov. 24, 1953

H. L. RUSCH

2,660,509

RECORDING APPARATUS

Original Filed Jan. 15, 1944

3 Sheets-Sheet 1

Fig. 1.

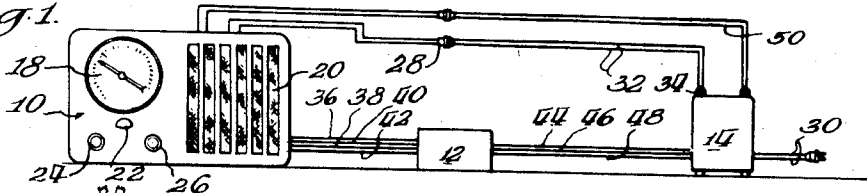


Fig. 2.

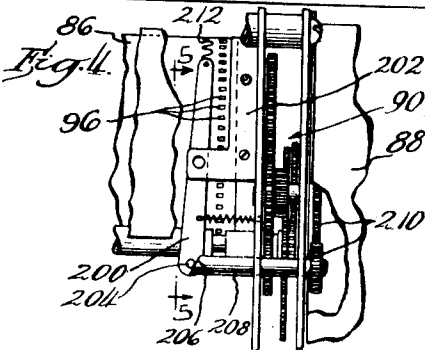
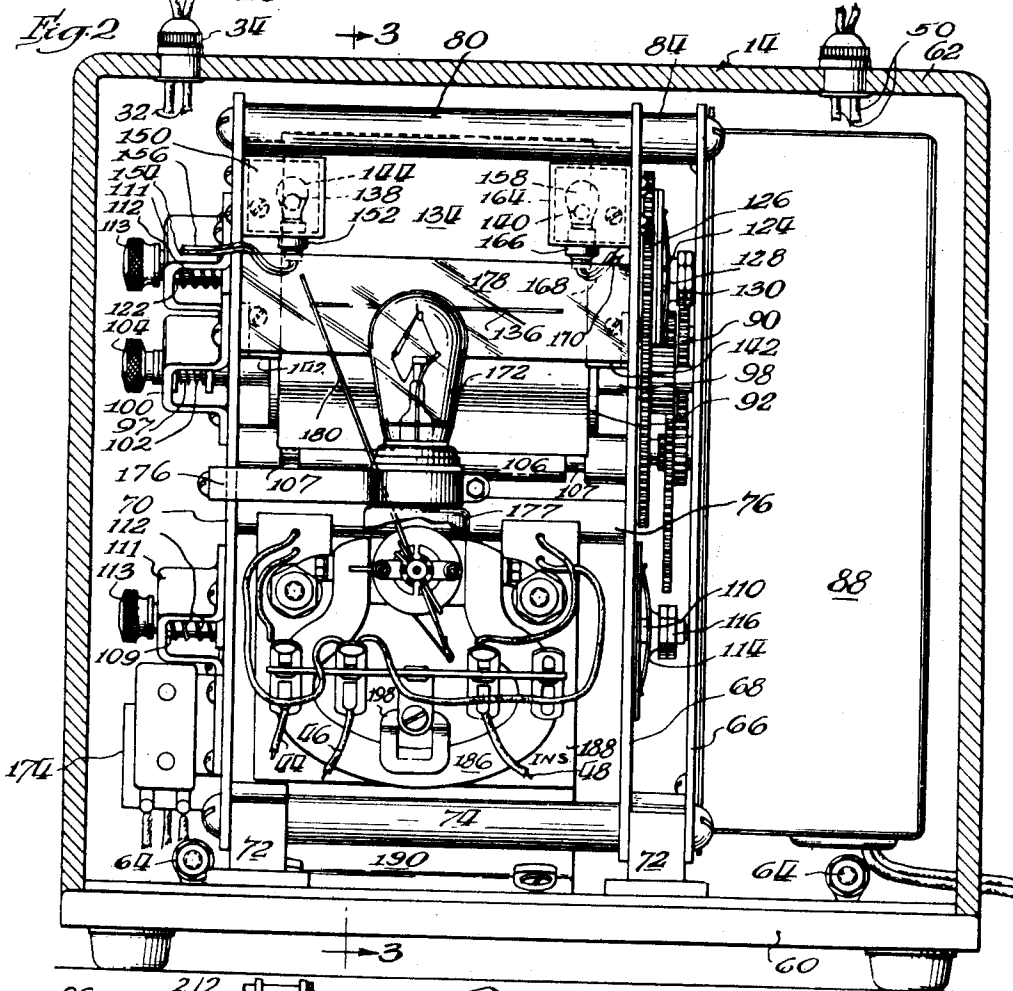
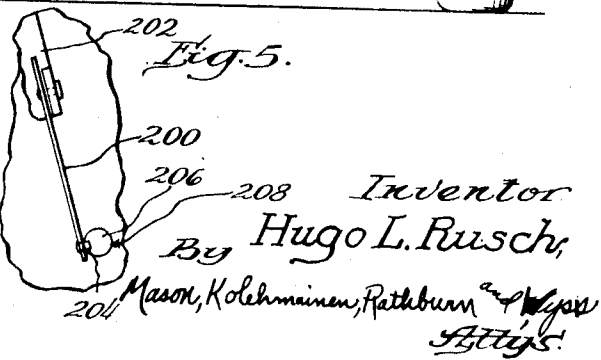


Fig. 5.



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3 Sheets-Sheet 2

Fig. 3.

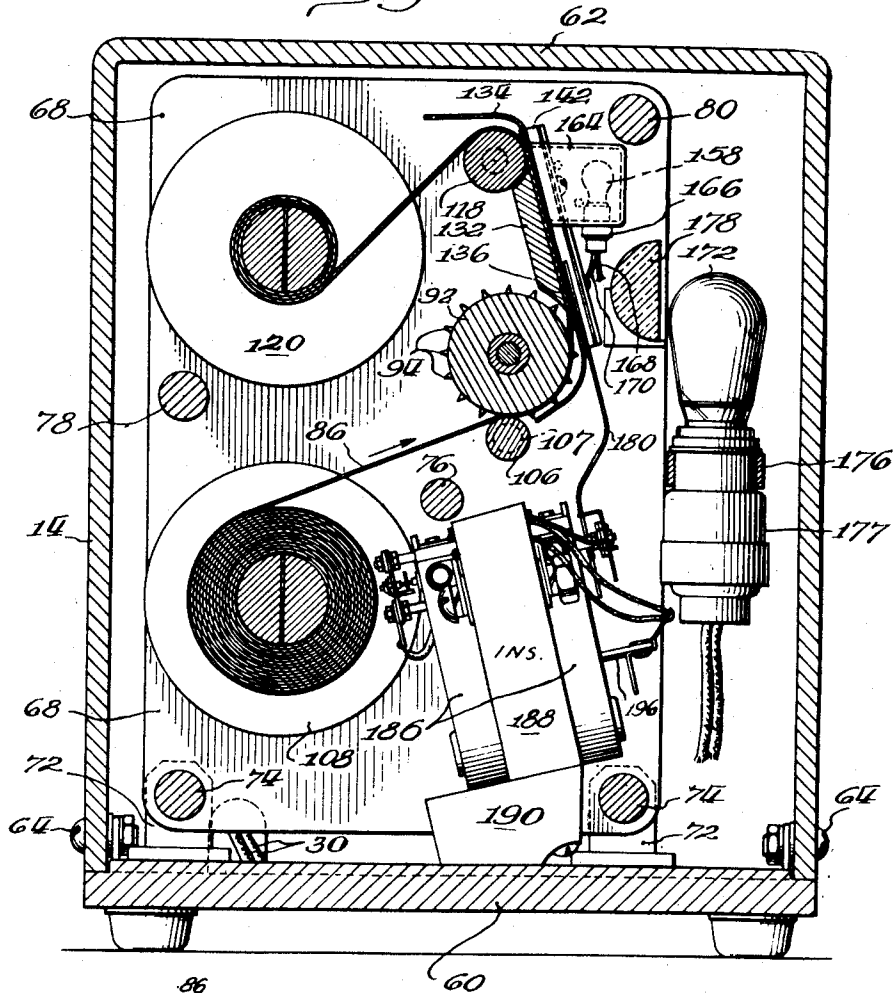
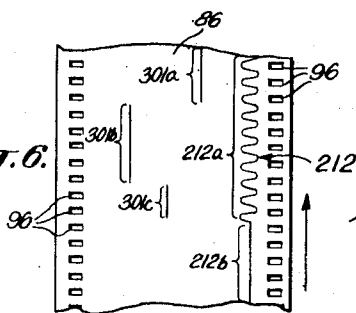


Fig. 6.



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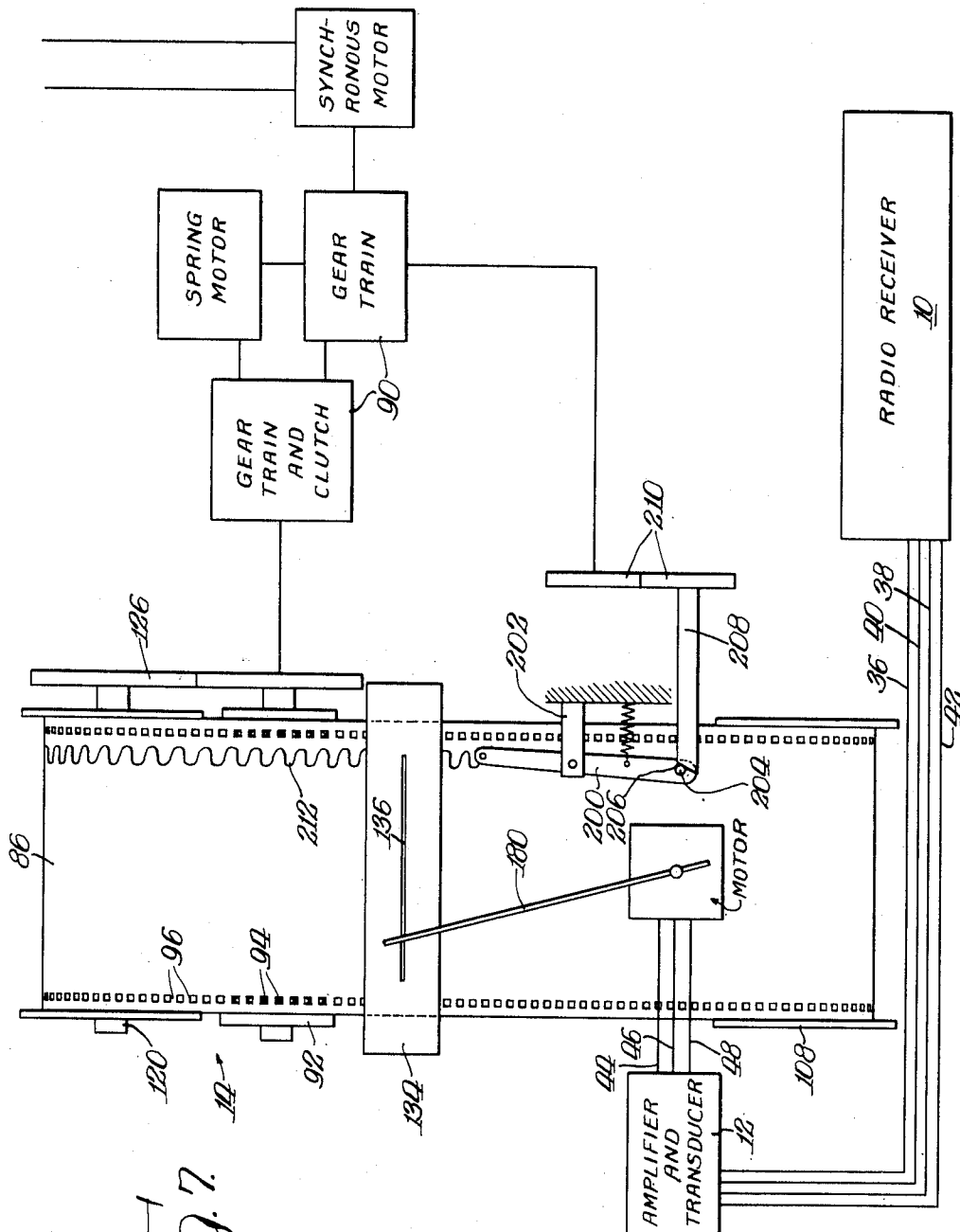
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RECORDING APPARATUS

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3 Sheets-Sheet 3



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2,660,509

RECORDING APPARATUS

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Continuation of application Serial No. 518,355,
January 15, 1944, which is a division of appli-
cation Serial No. 273,300, May 12, 1939. This
application November 4, 1948, Serial No. 58,165

5 Claims. (Cl. 346—37)

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The present invention relates to recording apparatus and particularly to apparatus for recording power outages and faulty operation of indicating means of the character utilized for recording the broadcast station to which a radio receiver is tuned. The present application is a continuation of my prior application Serial No. 518,355, filed January 15, 1944, now abandoned, which is in turn a division of my original application Serial No. 273,300, filed May 12, 1939, now Patent No. 2,354,836 granted August 1, 1944.

One of the objects of the present invention is to provide a new and improved apparatus for recording power outages, i. e., periods during which power is not supplied or available for operation of apparatus, particularly apparatus such as the radio receiver whose operation is under observation.

Another object of the present invention is to provide apparatus for recording power outages whereby an operator may tell at a glance when power was available.

A further object of the present invention is to provide a new and improved power outage indicator capable of providing a record enabling faulty operation of the station indicating means readily to be detected. For instance, the station indicating means may indicate that a station was received when power was not available for operation of the radio as indicated by the power outage indicator.

A further object of the present invention is to provide a power outage indicator so constructed and arranged relative to recording means provided with a normal electric drive and a mechanical standby drive that a continuous repetitive non-linear record is made when the electric drive moves the sheet and a straight line is made on the sheet when the latter is moved by the standby drive. Thus record sheet stoppages are indicated by a plurality of transverse lines; faulty action of the record sheet take-up spool is indicated by irregularities in the shape of the repetitive non-linear curve; and simultaneous drive by both the electric and standby drives is indicated by a spreading out of the curve.

A further object of the invention is to provide an improved recording apparatus with means for recording errors in speed or continuity of movement of a record sheet.

Other objects and advantages of the present invention will become apparent from the ensuing description in the course of which reference is had to the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of the

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component parts and electrical connections therebetween of a system embodying the present invention;

Fig. 2 is a side elevation of the frequency responsive and recording apparatus (with one of the side panels of its enclosing cabinet removed) partly broken away better to illustrate details thereof;

Fig. 3 is a vertical transverse sectional view taken along the line 3—3 of Fig. 2, also illustrating details of both the frequency responsive and recording apparatus;

Fig. 4 is a partial front elevation of the improved power outage, speed and continuity of record sheet movement error indicating means forming the subject matter of this application and which may be utilized in the apparatus illustrated in Figs. 2 and 3;

Fig. 5 is a partial side elevational view of the mechanism illustrated in Fig. 4 taken along the line 5—5 of Fig. 4;

Fig. 6 is an enlarged fragmentary view of a portion of the record sheet produced by the recording apparatus of Fig. 4; and

Fig. 7 is a diagrammatic representation of some of the components of the apparatus shown in Figs. 1 to 5, illustrating more clearly the correlation and arrangement thereof.

The general nature of the invention may best be understood from a brief description of the system as a whole, which is illustrated diagrammatically in Fig. 1. Upon reference to this figure, it may be noted that the system comprises three electrically interconnected major parts: first, a multi-band radio receiving set 10; second, a relatively small cabinet 12, housing amplifying means and a transducer; and, third, a frequency responsive meter and recorder housed within a relatively small sized and substantially light-proof cabinet 14, which is preferably located remote from the receiver set and from the amplifying means.

The receiving set may be of any design or manufacture because of the universal applicability of the apparatus to receiving sets of practically any design or manufacture. The set has been illustrated as a table model having a tuning dial 18 on its front panel and a loudspeaker compartment 20. A station tuning knob 22, suitably secured in operative relationship to station tuning condensers in a manner well known to those skilled in the art, is mounted on the front panel, as are the usual combined power and volume control switch 24 and a band selector switch 26. The latter, it is assumed for the purpose of describing

the invention, is operable from a normal position conditioning the set for reception of stations broadcasting within the commercial frequency band to a displaced position conditioning the set for reception of stations broadcasting within one of the short wave bands. The radio set is supplied with power through the usual plug connector 28 attached to the set, a second plug connector 30 leading from the power supply to the recorder for reasons hereinafter to be made apparent, and an intermediate conductor 32. The conductor 32 is preferably connectable to the recorder by a socket 34.

An electric voltage having a characteristic (radio frequency) indicative of the broadcast station to which the receiver is tuned, is supplied to the amplifying means through a conductor 36 and a conductor 38 common to this circuit and to the amplifier power supply circuit. The amplifier, which is preferably of the thermionic type, is preferably supplied with cathode heater current through the common conductor 38 and conductor 40, which is ordinarily connected to a cathode heater transformer (not shown). Positive plate potential is supplied to the plate of the thermionic amplifier through a fourth conductor 42. However, the amplifier could be supplied with energizing power from a separate power pack built into the cabinet 12 similar to that found in the radio receiver.

The amplified radio frequency voltage derived from the receiver is supplied to a transducer and then transmitted to a differential meter of a type to be described hereinafter through three conductors 44, 46 and 48.

While the amplifier and transducer have been illustrated in Fig. 1 as located at a point half way between the receiver and recorder, they should ordinarily be placed relatively near the former in order to avoid the deleterious effect of local electromagnetic or electrostatic disturbances upon the conductor 36, which is connected to a radio frequency circuit of the receiver, and also to minimize inter-conductor capacities.

In the event it is desired to record short wave reception, two additional conductors 50 are utilized. These conductors extend to the recorder from the receiver and particularly from a switch (not shown) operable simultaneously with the band selector switch 26 mounted on the receiver to close the circuit when the switch is operated.

Before proceeding with a detailed discussion of the present invention, which is particularly illustrated in Figs. 4 and 5, it is deemed best to describe briefly so much of the recorder illustrated in Figs. 2 and 3 as will be necessary for a better understanding of the present invention. The recorder is mounted within the cabinet 14 comprising a horizontal base 60 and a side wall and top forming structure 62 removably secured to the base by a plurality of fastening means indicated by reference character 64. Several of the parts of the recorder are adapted to be supported on three spaced apart, vertically disposed frame plates 66, 68 and 70 of substantially rectangular shape. The frame plates are attached at their lower extremities to four relatively short supports 72 secured to the base. Plates 68 and 70 are spaced apart at their lower ends by a pair of circular spacer bars 74, intermediate their ends by a pair of spacer bars 76 and 78, and at their upper ends by a single spacer bar 80. These bars are so located as to provide a rigid structure without interfering with the operating parts of the recorder, to be described hereinafter.

Plates 66 and 68 are separated at their lower ends by two of the supporting flanges 72 and at their intermediate and upper portions by relatively short spacer bars 84 (only one of which is illustrated). The plates and bars are held together by suitable fastening means, which have been illustrated but not numbered for the purpose of simplifying the description.

The record sheet in the embodiment of the invention illustrated is a light-sensitive record tape 86, and it is upon this tape that the various data are recorded. It is driven at a predetermined constant speed under normal conditions, i. e., when electric power is available, by a constant speed, self-starting, synchronous motor (shown diagrammatically in Fig. 7) housed within a suitable casing 88. Under abnormal conditions, i. e., during power interruptions, the tape is driven at the same speed by power derived from a spring (shown diagrammatically in Fig. 7) mounted within the casing 88. The motor and spring construction may be of any well known form, the only prerequisites being that the spring be tensioned when the motor is operating and that it be of a size to furnish sufficient power to drive the tape for a period exceeding all but the most exceptional cases of power failure. In Fig. 7 the interconnections of the synchronous motor and the spring motor with suitable gearing to carry out the above indicated and the hereinafter described operations are indicated diagrammatically by connecting lines.

The tape 86 is driven at a constant slow speed through suitable gearing, indicated as a whole by reference character 90, mounted between plates 66 and 68 and adapted to drive a feed roller 92, disengageably and rotatably mounted between plates 68 and 70. The feed roller is provided with peripheral sprockets 94 near its opposite ends adapted to engage marginal spaced apart perforations 96 (see Fig. 4) provided near the edges of the tape, so that rotation of the feed roller imparts longitudinal movement to the tape.

The disengagement of the feed roller is provided by the slidable shaft 97, which is keyed to the driving shaft 98 within the hollow shaft of the feed roller. A key on shaft 97 engages a slot in the end of the hub of the roller when in its normal position. Shaft 97 is slidably and rotatably mounted in plate 70 and a substantially U-shaped bracket 100 attached to the plate. It is biased toward the roller by a compression spring 102 and may be moved in the opposite direction by a knob 104 mounted on the other end of the shaft.

The tape (which is preferably a form of positive photo-print paper and which is dry developed, but which may be of some other suitable type, such as ordinary photographic film) is held in engagement with the feed roller by a guide roller 106 located directly therebeneath and mounted for rotation between the plates 68 and 70. The guide roller is provided with a pair of annular grooves 107 (see Fig. 2) providing the necessary clearance for sprockets 94.

A tape supply spool 108 of usual construction and rotated as a result of pull on the tape by feed roller 92 is removably supported in a pair of stub shafts 109 and 110, adapted to engage opposite ends of the spool in the manner customarily followed in cameras and the like. The shaft 109 is, like shaft 97, slidably and rotatably mounted in plate 70 and in a substantially U-shaped bracket 111 secured to the plate. It is biased into en-

gagement with the spool by a compression spring 112 and may be moved out of engagement with the spool by means of a knob 113 mounted on the outer end of the shaft. The supply spool is frictionally held against undue rotation by a spring disc 114 bearing against nuts 116 adjustably mounted on the threaded outer end of the shaft 110.

From the feed roller the tape is led over a guide roller 118, rotatably mounted in the plates 68 and 70, to a takeup spool 120 similar in all respects to the supply spool 108. The take-up spool is mounted upon a pair of stub shafts 122 and 124, the former being similar in all respects and mounted, like stub shaft 109, in the plate 70 and a bracket 111. Stub shaft 124, however, is adapted to be driven at a speed sufficient to wind the tape fed by the feed roller irrespective of the varying amounts of tape on the take-up spool. To accomplish this purpose, the stub shaft 124 is driven by a spur gear 126 and a friction clutch mechanism comprising the convex spring disc 128 and a pair of nuts 130 adjustably mounted on the threaded end of the shaft 124. The spool 120 is also usually mounted on stub shafts 122 and 124 in the manner customarily followed in supporting film spools in cameras and the like.

Interposed between the feed roller and the guide roller 118 is an angularly disposed light-imperious plate 132 on the front surface of which the tape slides properly to position it for the application of the various record data. Further to insure proper positioning of the tape and to prevent the exposure of the entire tape to the various light sources of the recorder, the outer surface of the tape is covered by a substantially U-shaped metallic screen 134 provided with a narrow transverse slit or aperture 136, having a length slightly less than the distance between the sprockets on the feed roller and a pair of relatively small circular apertures 138 and 140 at the opposite sides thereof substantially in alignment with the sprockets and a substantial distance above the slit. Each of the apertures is associated with an individual light source in a manner and for a purpose to be described shortly.

The plate 132 and shield 134 are mounted upon a pair of slotted angularly disposed supports 142 attached to the frame plates 68 and 70.

In the particular embodiment of the invention illustrated in Fig. 3, the continuity of the supply of the power is recorded upon the tape by means of a light source 144 adapted to be energized whenever power is obtainable for operation of the radio receiver. The light source 144 is placed adjacent the aperture 138 so that the light rays are directed upon the tape to provide, when the tape is properly developed, a relatively wide light line upon the otherwise dark edge of the record tape. When the power supply fails, the light is extinguished and the entire edge of the tape is dark for a length proportional to the length of the interruption.

The record of the continuity of the power supply will not interfere with the record of the stations to which the receiver is tuned, because the light source and the aperture associated therewith are so located that the record line is in line with the perforations along the edge of the tape. In order to prevent the light rays from the light source 144 affecting other parts of the tape, the light source and its associated aperture are enclosed within a small metallic casing 150 secured in suitable manner to one of the pair of angularly disposed supports 142. The light source may be

suitably mounted within the casing, and it has been shown supported upon a suitable receptacle 152 mounted upon the bottom of the casing 150. A pair of conductors 154 and 156 lead to the receptacle. These conductors are connected directly across the main power supply conductors 30.

A record of the time that the radio receiver is tuned to the short-wave stations is provided by a light source 158, which is adapted to be energized whenever the band selector switch 26 is operated to its displaced position to condition the set for short-wave reception. When this light source is energized, a light line remains on the otherwise dark right edge of the record tape when the tape is developed. The light source and aperture are enclosed by a casing 164 similar to the casing 150 previously described and is similarly mounted upon the other of the angularly disposed guides 142. The light source is removably mounted in a receptacle 166 mounted on the bottom of the casing 164, and power is selectively supplied to the light source through a pair of conductors 168 and 170 under the control of the band selector switch in a manner to be described more fully hereinafter.

The broadcast stations to which the receiver is tuned are recorded upon the central portion of the tape by means of a light source adapted to be energized a predetermined length of time after the radio power control switch 24 has been turned to its "on" position through a circuit including a thermal relay 174 (see Fig. 2) mounted on the outer side of frame plate 70.

The light source is supported substantially centrally and in front of the tape by a bracket 176 removably supporting a receptacle 177. The light rays emanating from the source are focused toward the transverse slit 136 by a lens 178. Interposed between the lens and the slit is a generally vertically disposed needle 180, the position of which is varied in response to the frequency of the local oscillator of the radio receiver and, therefore, in response to the frequency of the broadcast station to which the receiver is tuned. In other words, the needle occupies a position indicative of the station to which the receiver is tuned. The needle is made narrow so as to cast substantially a point shadow upon a predetermined portion of the record tape. When the photo-sensitive tape is developed, the result is a line or a plurality of lines of dark color. The stations broadcasting at the ordinary commercial frequency are recorded upon the major portion of the tape, and the short-wave stations are recorded along one edge, preferably the right side. It should be noted that the aggregate length of these lines equals the length of the line showing that the receiver has been tuned to short-wave broadcasting stations.

The meter, of which the needle 180 forms a part, has a pair of moving coils energized differentially by variable unidirectional currents derived from the transducer housed within the cabinet 12. The meter comprises a pair of horseshoe magnets 186 secured in parallel relationship to the opposite sides of an insulating block 188 fastened to a support 190 in turn secured to the base 60. The moving coils are within the fields of the permanent magnet and are so arranged that they tend to effect movement of the needle in opposite directions in response to currents flowing therethrough, and the construction is such that the deflection of the needle is determined by the ratio of the currents in the coils.

The moving coils, as already indicated, are supplied with variable uni-directional currents derived from the transducer, which in turn is supplied with radio frequency voltages from the local oscillator of the radio receiving set by the amplifier 12. Inasmuch as neither the amplifier nor the transducer form the subject matter of the claims of this application, a detailed description thereof is deemed to be unnecessary. It is believed sufficient to state that the amplifier is of the well known triode type and that the transducer includes a circuit having two portions with different impedance-frequency relationships and means for rectifying the voltages derived from each of said portions. Thus, as the local oscillator frequency changes in response to the tuning of the set, the ratio of the currents in the two coils of the meter changes, thereby continuously to deflect the needle 130 into different positions corresponding to the local oscillator frequencies and changes in the tuning of the receiver. During all this time the record tape is moved at a constant rate by the drive mechanism heretofore described, i. e., either the electric motor or the stand-by auxiliary mechanical drive, dependent upon whether or not power is available.

The apparatus of the present invention is utilized in making surveys which will be useful to radio advertisers in determining the approximate number of people who habitually listen to the advertisers' programs. In conducting a survey of this character, the apparatus of the present invention will be employed in a relatively small percentage of homes within the listening area being surveyed, but in order to obtain a representative sampling of radio listeners, it is essential that the apparatus be placed in homes of different income, occupational and social classes. For this reason it is especially essential that the apparatus be readily applicable to radio receivers of all different types and makes and that its installation be accompanied with as little inconvenience to the radio owner as possible, and that it be inconspicuous and unnoticeable so that the user will not in any way be influenced in his selection of programs by the fact that the apparatus is making a record of his program selections.

It is of paramount importance that the preferences of radio listeners for particular programs be determined with a high degree of accuracy. The tapes are installed by a serviceman and calibrated with respect to the stations within the listening area of the particular radio receiver. A notation is made upon the record of the time at which the operation of the apparatus was started. Then, after a month or similar period, the serviceman will remove the exposed record tape and replace it with an unexposed tape. The record tape will be duly marked with the serial number of the apparatus from which it was removed, the time of removal, and with other identifying data. The various record tapes from a plurality of installations will then be collected and decoded so that the records upon the tapes may be broken down into desired compilations.

As already indicated, accuracy is of paramount importance. According to the present invention, the apparatus is constructed and arranged so that power outages are recorded and in a manner enabling the salvaging and decoding of tapes which would otherwise be valueless. According to the present invention, a sinusoidal record is made upon the tape as long as electric power is available to drive the tape, and a straight line is

made upon the tape when the tape is driven by the auxiliary mechanical stand-by movement.

Referring now to Figs. 4 and 5, it may be noted that these figures illustrate a modification of the apparatus shown in Figs. 2 and 3 wherein the power outage indication is provided by a "sine wave scribe" instead of by a light. The illustrated means comprises an oscillatable stylus carrying arm 200 pivotally mounted upon a supporting bracket 202 secured to one of the previously mentioned supports 142. The lower extremity of the arm 200 is provided with a pin 204 adapted to abut against the diagonal end 206 of a shaft 208 rotated by gears 210 operatively connected with the synchronous motor drive. Thus, as long as the synchronous motor is energized, the shaft 208 is rotated to effect oscillatory movement of the arm 200. The stylus carried by the arm thereupon impresses a sinusoidal mark, indicated by reference character 212 in Fig. 4, upon the record tape 36. When the supply of power is interrupted and the tape is driven by the stand-by movement, the shaft 208 and stylus remain stationary, with the result that a straight line is scribed upon the tape. Suitable means of marking the sine wave and the straight line on the tape would be provided, such as a pencil or pen and ink stylus.

In Fig. 6 of the drawings there is illustrated a fragment of the record tape 36 with the trace 212 produced by the stylus 200. It will be noted that the portion 212a of the trace 212 indicates that the electrical power supply is functioning normally. However, the straight line portion 212b of the trace 212 indicates that the electrical power supply is interrupted and the record tape 36 is driven by the standby drive. The traces 301a, 301b, and 301c which are disposed in various positions transversely of the tape 36 indicate various stations to which the wave signal receiver being monitored is tuned. It will be noted that when the electrical power supply is interrupted, the trace 301c also ends.

The sine wave is of tremendous value in checking accurate movement of the tape because the number of such sine waves is a direct function of the number of revolutions of the synchronous motor drive. Therefore, the ratio of the number of sine waves 212 on the tape to the number of perforations 96 on the edge of the tape should be constant. If there is a variation in this ratio, it is an indication of inaccurate tape movement due possibly to the tape climbing the sprocket. The amount of the error and the location of the error can be determined accurately by comparing the number of sine waves with the number of perforations for a certain section of tape.

The power outage indicator shows when the power is on and when it is off, and also indicates exactly the time when the power goes off and when it comes on again. Consequently, the operator may at a glance tell when the power is on and thereupon immediately note that the indication of the station to which the receiver was tuned is dependable. The straight line starts immediately upon occurrence of the power failure, and there is no break in continuity between it and the sine wave. Thus, it is possible to determine the exact moment of the power failure by noting the length of the incomplete sine wave.

Another advantage of applicant's power outage indicator is that it may be used to determine faulty operation of the indicating means. For instance, the power outage indicator may indicate that the power was off and the apparatus may at the same time indicate reception from a

radio station. Under these circumstances radio reception would not be possible, as indicated by the power outage indicator.

Furthermore, tape stoppages are indicated by a plurality of substantially straight transverse lines. Faulty action of the tape take-up spool is indicated by irregularities in the shape of the oscillating curve. Simultaneous drive by both the motor and the spring drive are indicated by a spreading out of the curve. Long power outages are indicated by a straight line followed by the customary oscillating curve indicating the power is on, but which curve does not extend through the length of the tape.

While the present invention has been described in connection with the specific details of a preferred embodiment thereof, it should be understood these details are not to be construed as limitative of the invention except insofar as set forth in the accompanying claims.

What is desired to be secured by Letters Patent of the United States is:

1. Apparatus for recording over an extended period of time such as a day, a week or more information pertinent to the tuning condition of a wave signal receiver comprising tuning means for said receiver, a recording mechanism having a movable recording element associated therewith, means for normally moving said recording element at a constant speed over said entire extended period of time, means for producing a record on said element, means relating said record producing means to said tuning means thereby to produce a record representative of the tuning condition of said receiver with respect to time, and independent means for applying a time record on said element whereby time information affording a check on the constant speed movement of said element is provided.

2. Apparatus for recording information pertinent to the tuning condition of a wave signal receiver comprising a movable record sheet, means including an electric motor and a standby drive for moving said record sheet at a constant speed whether or not electric power is available, means including movable recording means in continuous contact with said record sheet, and means operatively connecting said recording means with said sheet moving means for operating said recording means to make a sine record on the sheet when electric power is available and a straight line record when electric power is not available.

3. Apparatus for recording information pertinent to the tuning condition of a wave signal receiver comprising a movable record sheet, means including an electric motor and a mechanical standby drive for moving said record sheet at a constant speed whether or not electric power is available, means including recording means in continuous contact with said record sheet, a projection on said last mentioned means, a shaft

having a diagonal end in contact with said projection and means connecting said shaft for rotation only when said motor is operating for making a continuously changing and continuously repetitive record on said sheet when electric power is available and a straight line record when electric power is not available.

4. Apparatus for recording information pertinent to the tuning condition of a wave signal receiver comprising a record sheet, the combination including, electrically operated timing means, a driving connection between said timing means and said record sheet, a stand-by movement operative to drive the record sheet when the supply of power to said timing means is interrupted, a recorder stylus in continuous contact with the record sheet, and means operable by the timing means for oscillating said stylus transversely of the record sheet, whereby a continuous repetitive record is made on the sheet when the timing means drives the sheet and a straight line is made on the sheet when the stand-by movement drives the sheet.

5. Apparatus for recording information pertinent to the tuning condition of a wave signal receiver comprising a record sheet, the combination including, electrically operated timing means, a driving connection between said timing means and said record sheet, a stand-by movement operative to drive the record sheet when the supply of power to said timing means is interrupted, a recorder including a movable member for making a continuous record upon the record sheet, and means operable by the timing means for oscillating said movable member transversely of the record sheet, whereby a continuous repetitive record is made on the sheet when the timing means drives the sheet and a straight line is made on the sheet when the stand-by movement drives the sheet.

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