G. F. ROYER.

RECORDING APPARATUS FOR MINE HOISTS.

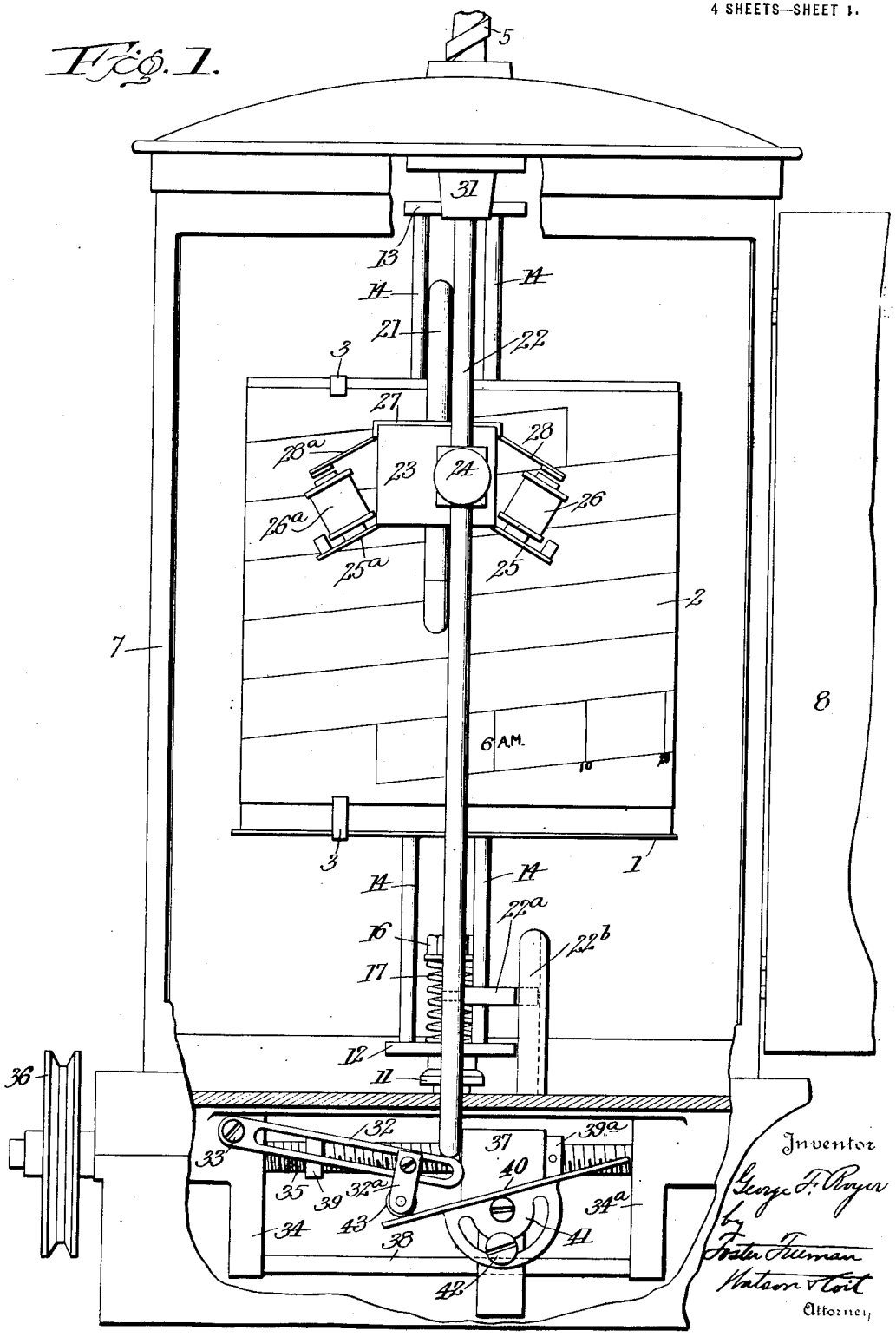
APPLICATION FILED OCT. 26, 1917.

**1,275,605.**

Patented Aug. 13, 1918.

4 SHEETS—SHEET 1.

Fig. 1.




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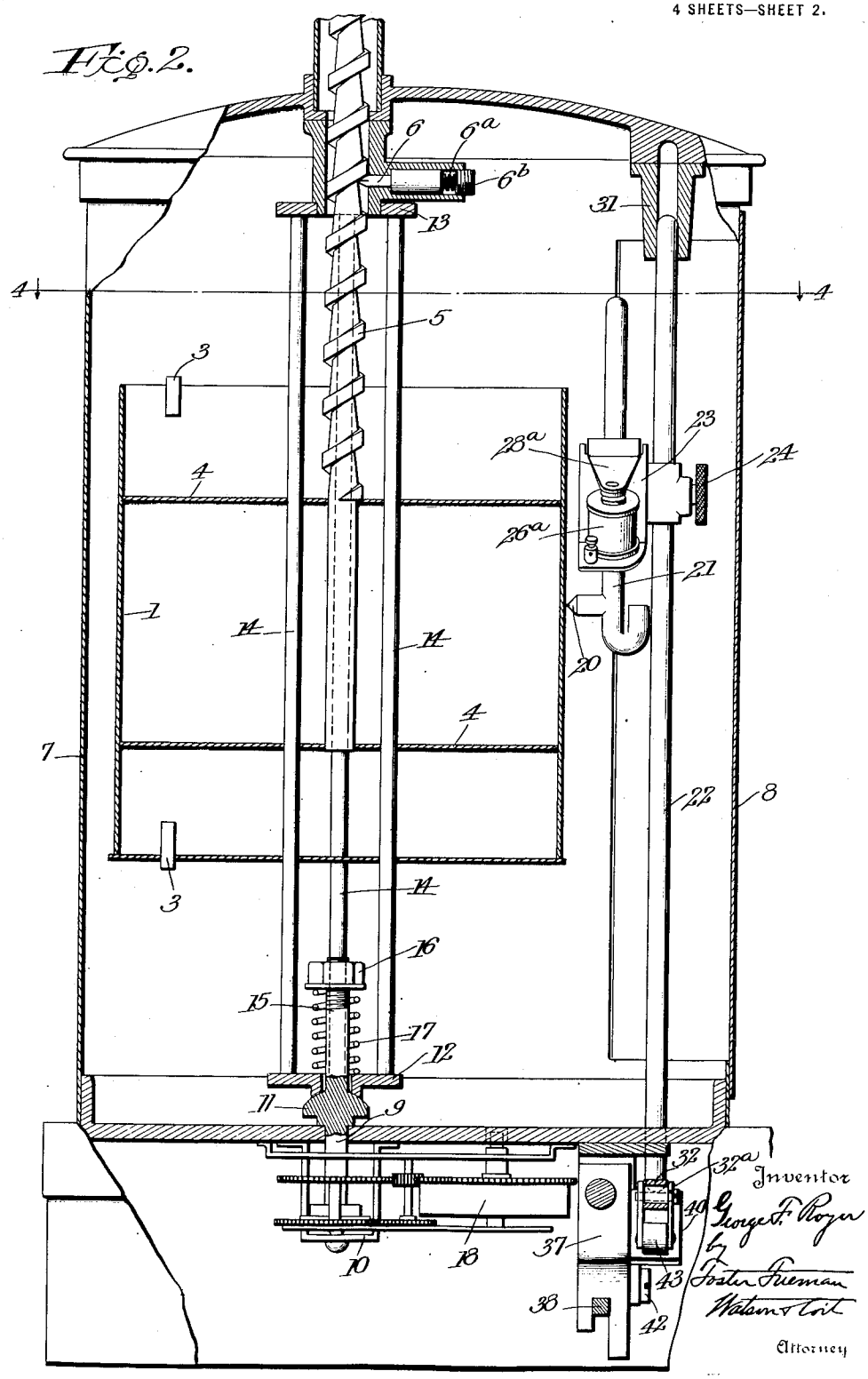
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4 SHEETS—SHEET 2.

Fig. 2.




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4 SHEETS—SHEET 3.

FIG. 3.

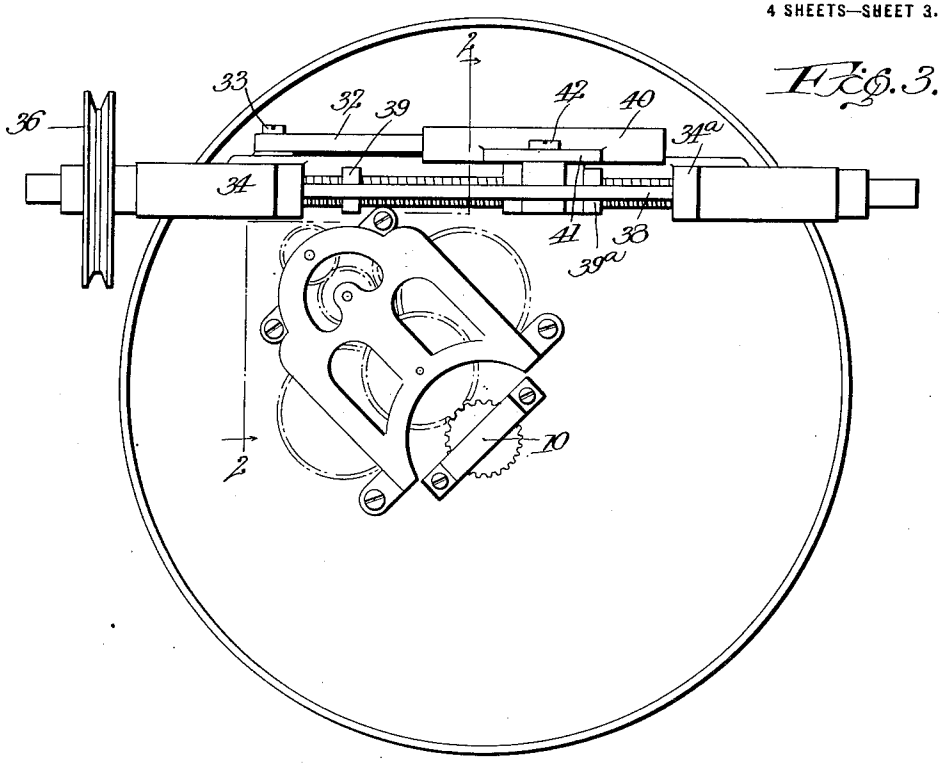
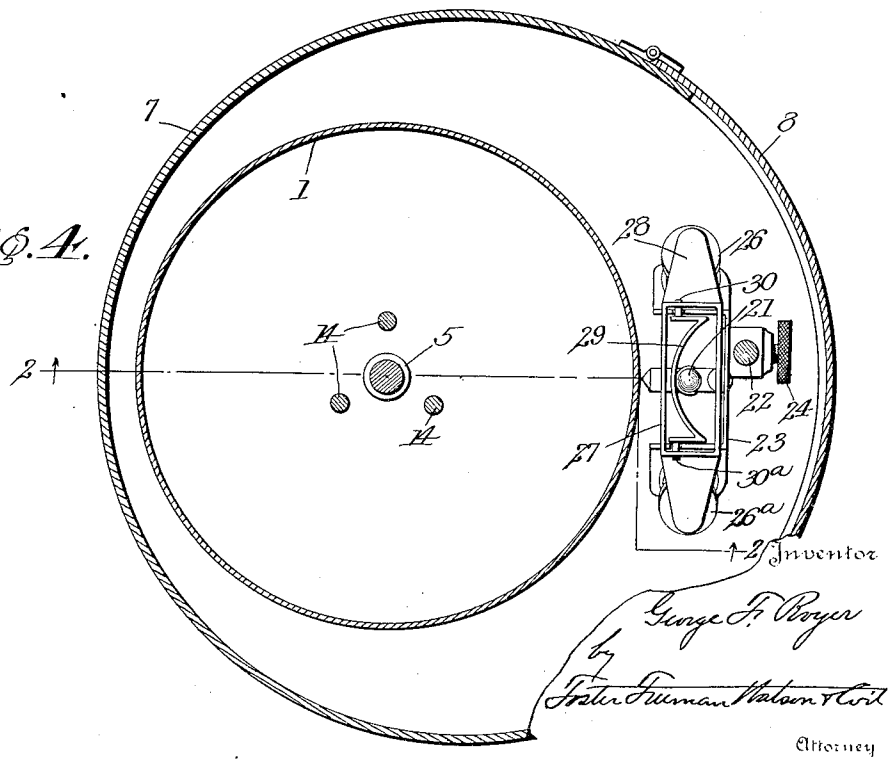



FIG. 4.




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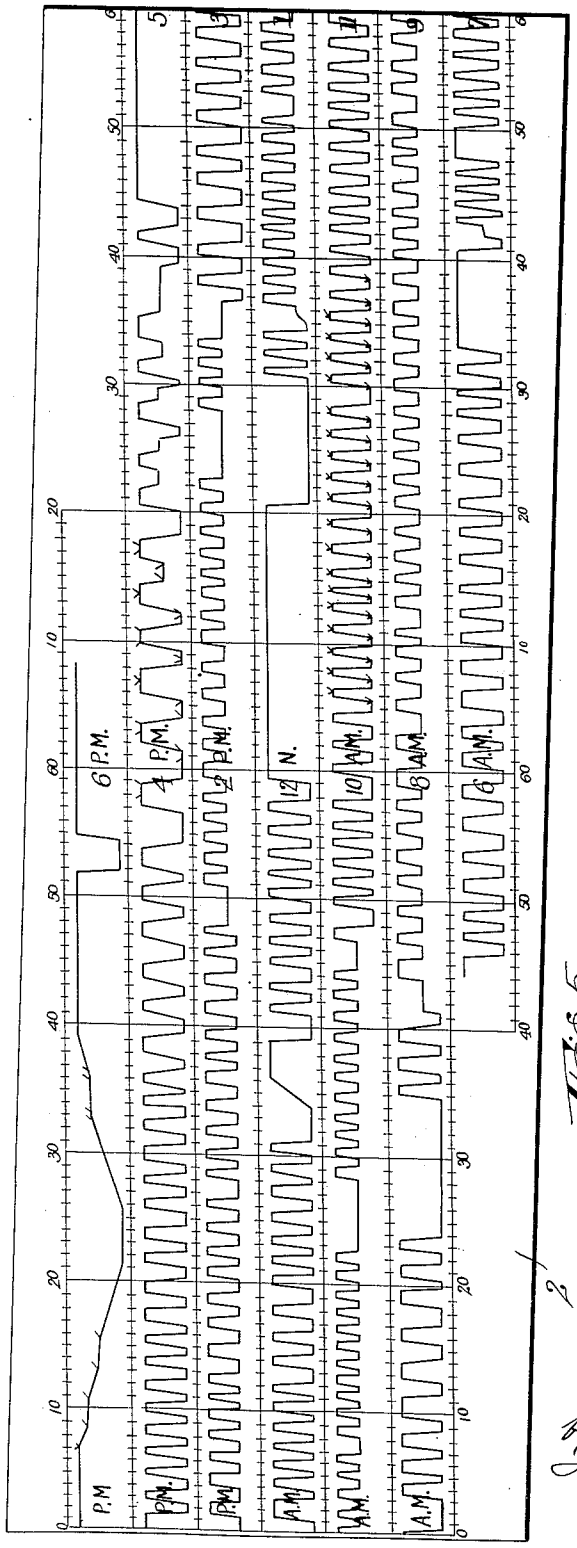



FIG. 5.

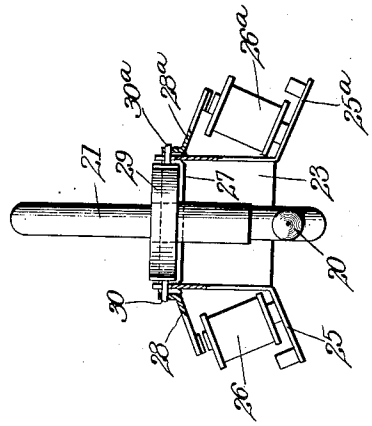



FIG. 6.

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# UNITED STATES PATENT OFFICE.

GEORGE F. ROYER, OF WILKES-BARRE, PENNSYLVANIA, ASSIGNOR OF TWO-THIRDS TO JENNIE H. WEBB, OF PITTSBURGH, PENNSYLVANIA.

## RECORDING APPARATUS FOR MINE-HOISTS.

1,275,605. Specification of Letters Patent. Patented Aug. 13, 1918.

Application filed October 26, 1917. Serial No. 198,675.

*To all whom it may concern:*

Be it known that I, GEORGE F. ROYER, a citizen of the United States, residing at Wilkes-Barre, in the county of Luzerne and State of Pennsylvania, have invented certain new and useful Improvements in Recording Apparatus for Mine-Hoists, of which the following is a specification.

The present invention relates to improvements in apparatus for recording the movements of mine hoists or similar apparatus, and has for its object to provide a simple and compact mechanism by which to indicate on a suitable chart the level to and from which the car or cage of the hoist is operated, the length of time consumed by each trip, the duration of the periods of rest intermediate of vertical movements of the car or cage, and the sequence of the starting signals which control each hoisting or lowering movement.

It is customary in the operation of mine hoists for an employee at the foot of the shaft, or at the level from which the hoisting is to be effected, to notify the engineer or signal man at the top of the shaft that the car or cage is ready for hoisting which signal is repeated by the engineer or signal man. By the present invention means are provided whereby the chart will show the time interval, if any, occurring between such signals and therefore enable the management to determine to whom delays, if any are chargeable.

In the accompanying drawings:

Figure 1 is a side elevation of an apparatus constructed in accordance with the present invention a portion of the outer housing or casing being broken away;

Fig. 2 is a vertical sectional view of the apparatus, substantially on the lines 2—2 of Figs. 3 and 4;

Fig. 3 is a bottom plan view;

Fig. 4 is a horizontal sectional view on the line 4—4 of Fig. 2;

Fig. 5 is an elevation of the chart produced by the apparatus;

Fig. 6 is a detail view of the recorder supporting devices.

Referring to the drawings, 1 designates the body of a chart holding drum, which is supported to rotate about a vertical axis and to which a suitable chart 2, is adapted to be secured by means of clips or other fastening means 3.

As shown in Figs. 1 and 5 the chart is preferably provided with longitudinal lines that divide it into a series of spirally arranged zones each of which is subdivided by transverse lines into time periods of ten minutes each, the ten minute spaces referred to being further subdivided into ten equal parts by marks provided along a longitudinal edge thereof. The chart illustrated is of such dimensions as to represent a twelve hour period, the hours and period of day (a. m. and p. m.) being suitably indicated thereon.

The chart holding drum or casing 1 is provided with internal transverse braces or partitions 4, and has secured thereto a threaded stem 5, which is arranged axially of the drum and projects above the upper end thereof. With the thread on said stem 5 engages a relatively stationary stud 6, mounted in a suitable bearing in the casing or housing 7, within which the apparatus is arranged and which housing is provided at one side with a swinging door 8, so that access may readily be had to the chart holding drum, the recorder, etc.

The thread on the stem 5 is relatively steep and as the weight of the drum is suspended from the stud 6 it automatically tends to rotate and move downward. The speed of rotation is controlled by a suitable clock mechanism 18, that engages a pinion on a vertical shaft 9, which extends through a bearing in the floor or bottom wall of the housing 7, and has its lower end stepped in a bearing 10. The shaft 9 is provided with a head 11 having a convex upper surface which fits close against a concave surface formed on a plate 12 which is connected with a similar plate 13 by vertical rods or bars 14. These bars or rods extend through openings in the partitions 4 of the chart drum so that they act as guides for said drum during its vertical movement. The shaft 9 extends some distance above the plate 12 and has the upper portion thereof threaded as at 15. A nut 16 on said threaded section of the shaft 9, acts to compress a coil spring 17, arranged between itself and the plate 12, so that the latter is held in close frictional engagement with the head 11, whereby the rotation of the drum will be controlled as said shaft is turned by the clock mechanism 18.

It will be seen that the clock work thus

controls rotation of the drum and that the latter will be automatically fed downward by reason of the engagement between the screw 5 and stationary stud 6. When it is desired to reset the drum, or restore it to its initial, uppermost position, the stud 6 is withdrawn from engagement with the screw 5 and the drum and screw bodily lifted. As shown the stud 6 is fitted within a tubular bearing and normally projected into the path of the screw 5 by a spring $6^a$, arranged between the end of the stud and a removable screw plug $6^b$.

Coöperating with the chart on the drum is a recorder which may be of any suitable character but as shown is a pen 20 projecting from an ink supply tube 21. The recorder is supported from a vertical rod 22, by a frame 23 which has a portion extending about the rod 22 and securely locked thereto at any desired elevation by a thumb screw 24. The supporting body 23 is provided with laterally extending arms 25, $25^a$, on which are mounted electro-magnets 26, $26^a$, which are respectively connected with the signal devices at the different levels in the shaft and with the signal device at the top of the shaft. A frame 27 having rocking engagement with the side plates of the recorder supporting body 23 is provided at opposite sides with armature members 28, $28^a$, that extend over the magnets 26, $26^a$. The tube 21 is engaged by a spring clasp 29, the arms of which are provided with projecting pins 30, $30^a$, that extend through openings in the frame 27 so that as the magnets 26, $26^a$, are energized a lateral movement will be imparted to the pen 20.

The recorder supporting rod, 22, is guided at its upper end in a bearing, 31, in the casing or housing 7 and the lower end thereof extends through a guide opening in the bottom wall or floor of said casing and rests upon a lever 32, which is fulcrumed at 33 on one of the bearings 34 of a horizontally arranged threaded shaft 35. Rotary movement of the rod 22 is prevented by an arm $22^a$ thereon engaging a stationary guide $22^b$.

The shaft 35 is mounted in suitable bearings 34, $34^a$, and at one end, outside of the housing or casing, is provided with a pulley 36, which is adapted to be connected, by a belt or chain, with a member of the hoist so that the shaft 35 will be rotated simultaneously and in synchronism with the main winding drum of the hoist.

A nut 37 engages the shaft 35 and has a depending slotted portion engaging a stationary bar or rod 38, whereby it is prevented from rotating with the shaft but is caused to move longitudinally thereof as the shaft turns. Such movement of the nut 37 is limited by stops 39, $39^a$. The nut is provided with an incline or cam surface 40, which as shown is formed on a plate 41, that is pivotally connected with the depending portion of the nut so that the angle or extent of inclination of said surface to the shaft 35, may be varied. A set screw 42 extending through an arc shaped slot in the plate 41 is provided for holding the cam plate 40 in the desired adjusted position. Said plate 40 extends beneath a roller 43 at the lower end of an arm $32^a$, adjustably connected with the lever 32. As the nut 37 is reciprocated beneath the arm $32^a$, the recorder supporting rod 22 will be moved vertically so that the pen will produce on the chart 2, a line corresponding to the vertical movement of the car or cage of the hoist. The length of such line will of course depend on the amount of travel of the car or cage, or the depth of the level from which it is raised or to which it is dropped, and as the drum is rotated the inclination of such lines will indicate the length of time required for the hoisting operation.

By varying the inclination of the cam plate 40 and adjusting the arm $32^a$ to or from the fulcrum of the lever 32, it will be seen that the number of turns of the screw 35, required for effecting a complete vertical movement of the recorder carrier rod 22 can be varied so that the apparatus is adapted for use with hoists in shafts of different depths, the length of the line produced by the pen in each case being less than the width of the spirally arranged zone on the chart.

The operation and advantages of the apparatus will, it is thought, be clear from the foregoing description and the drawing.

It will be seen that each operation of the hoist will be represented on the chart by a line extending transversely of the spiral zone thereon and that the intermediate periods of rest will be indicated by lines extending circumferentially of the drum. The inclination of the substantially vertical lines shows in connection with the time indications on the chart the length of time occupied by each hoisting movement.

As noted one of the magnets, 26, $26^a$, is in circuit with the signal devices from the different levels of the mine shaft and when such circuit is closed the pen 20, is moved laterally to produce a short line extending to the left from the starting point, a similar line extending to the right being produced when the other magnet, which is in the circuit including the signal device at the top of the shaft, is energized.

Referring to Fig. 5 it will be seen that the chart indicates the following movements of the hoist:

It will be seen that the first movement represented on the chart was initiated or begun at 5.45 a. m. and that hoisting was

effected at regular intervals until 6.33 when there was a delay of eight minutes. As shown on the chart the hoist was stopped for one minute with the car or cage midway in the shaft at 6.42. At 7.31 hoisting was commenced from another, higher, level which was served until 9.47. At 11.31 a. m. a delay of three minutes is recorded the cage being hoisted slowly consuming two minutes on the next trip. From 12 noon to 12.30 p. m. only one hoist is recorded. From 3.33 p. m. to 4.43 p. m. the chart shows that more time was consumed in making a trip, this being indicated by the greater angle of the hoist representing lines and in the latter portion of this period stops were made at different landings or levels. Beginning at 5.07 p. m. the hoist was lowered very slowly, two stops being made before reaching the bottom. Thirteen minutes were consumed in making this trip and twelve minutes on the return. Lines of this character are produced on the chart when inspection trips or those during which the shaft is being examined are made.

To prevent confusion the signal lines referred to are only shown on the chart from 10.05 to 10.38 a. m. and from 3.57 to 4.18 p. m. Referring to the section of the chart covering the latter period of time the first signal to the left indicates that the hoist tender at the bottom of the shaft was ready and gave the signal first. A period of one minute elapsed before the repeat signal was given from the top of the shaft, showing that the delay in starting was due to some cause at the mouth of the shaft. At 4.06 p. m. a different condition is represented, the top signal having been given first and the delay is therefore chargeable to the bottom. At 6.13 p. m. both signals were given promptly but for some reason the engineer failed to start the hoist for one and one-half minutes and is therefore chargeable with the delay.

Having thus described the invention, what is claimed is:

1. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum, a recorder adapted to coöperate with a chart on the drum, clock controlled means for rotating the chart drum and moving it bodily longitudinally of its axis, means controlled by movement of the hoist for moving the recorder longitudinally of the drum, and means controlled by the hoist signal devices for imparting an independent lateral movement to the recorder, for the purpose described.

2. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum, a recorder adapted to coöperate with a chart on the drum, clock controlled means for rotating the chart drum and moving it bodily longitudinally of its axis, means controlled by movement of the hoist for moving the recorder longitudinally of the drum, and magnets controlled by the hoist signal devices for imparting independent movement to the recorder, for the purpose described.

3. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum supported to turn about a vertical axis, clock controlled means for rotating the drum, means for automatically moving the drum bodily vertically as it is rotated, a recorder adapted to coöperate with a chart on the drum, means controlled by movement of the hoist for moving the recorder vertically, and means controlled by the hoist signal devices for effecting a lateral movement of the recorder, for the purpose described.

4. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum, a screw shaft connected to and extending axially above the drum, a relatively stationary stud engaging and supporting said shaft, clock actuated means for controlling rotation of the shaft and drum, a recorder adapted to coöperate with a chart on the drum, a screw shaft adapted to be rotated by the hoist, a nut fitted on said shaft and held from rotation therewith, and means adjustable by the nut for moving the recorder vertically.

5. In an apparatus for recording the movements of mine hoists, the combination of a rotatable chart holding drum, clock actuated means controlling rotation of the drum, means for automatically moving the drum axially as it is rotated, a recorder mounted on a rod extending parallel to the axis of the drum, a screw shaft adapted to be rotated by the hoist, a nut on said shaft but held against rotation therewith, and a cam surface on the nut adapted to effect longitudinal movement of the recorder supporting rod as the screw shaft rotates.

6. A means for recording movements of a mine hoist, or similar apparatus, comprising in combination, a chart holder, a recorder adapted to coöperate with a chart carried by the holder, means for effecting relative movement between the chart holder and recorder to represent on the chart the vertical movements of the hoist and the duration of periods of rest between said movements, and means for effecting further relative movement between said parts to indicate on the chart the sequence of the start and repeat signals preceding each movement of the hoist.

7. A means for recording movements of a mine hoist, or similar apparatus, comprising in combination, a chart holder, a recorder adapted to coöperate with a chart carried by the holder, means for effecting relative vertical movement between the chart holder and

recorder to represent on the chart the vertical movements of the hoist, means for effecting relative horizontal movement between said holder and recorder to indicate on the chart the duration of periods of rest between said movements and the time consumed in each vertical movement, and supplemental means controlled by the hoist signal devices for moving the recorder to indicate on the chart the sequence of the start and repeat signals preceding each movement of the hoist.

8. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum adapted to rotate about a vertical axis, clock actuated means for controlling rotation of the drum, means for automatically feeding the drum axially as it is rotated, a recorder adapted to coöperate with a chart on the drum and having a supporting rod that extends downwardly therefrom, a lever on which the lower end of said rod rests, a screw shaft adapted to be rotated by the hoist, a nut mounted on but held against rotation by said shaft, and means on the nut for effecting a rocking of said lever as the screw rotates.

9. In an apparatus for recording the movements of mine hoists, the combination of a chart holding drum adapted to rotate about a vertical axis, clock actuated means controlling rotation of the drum, means for automatically feeding the drum axially as it is rotated, a screw shaft adapted to be rotated by the hoist, a nut mounted on said shaft but held from rotation therewith, and a recorder, adapted to coöperate with a chart on the drum, supported by a cam surface on said nut, whereby as the shaft is revolved the recorder will be moved vertically.

10. In an apparatus for recording the movements of mine hoists, the combination of a vertical, clock actuated, shaft, a chart drum mounted on said shaft and having an axially arranged upwardly extending screw, a stationary stud engaging said screw, a horizontal screw shaft adapted to be rotated by the hoist, a nut mounted on said shaft but held from rotation therewith, and a recorder supported by a cam surface on said nut, whereby it will be moved vertically as the screw shaft rotates.

11. In an apparatus for recording the movements of mine hoists, the combination of a housing or casing, a rotatable chart holding drum within the casing, clock actuated means for controlling rotation of the drum, means for automatically moving the drum vertically as it is rotated, a recorder adapted to coöperate with a chart on the drum, a vertical rod supporting the recorder and guided adjacent its ends by bearings on the casing, a screw shaft adapted to be rotated by the hoist, a nut on said shaft held from rotation therewith, and a lever extending beneath the recorder supporting rod and over a cam surface on said nut, for the purpose described.

12. In an apparatus for recording the movements of mine hoists, the combination of a clock controlled, rotatable chart holding drum, means for automatically moving the drum axially as it is rotated, a recorder adapted to coöperate with a chart on the drum, means controlled by the hoist for moving the recorder axially of the drum, and a pair of magnets movable with the recorder and adapted when energized to effect a lateral movement of the recorder, for the purpose described.

13. In an apparatus for recording the movements of mine hoists, the combination of a rotatable chart holding drum, clock actuated means controlling rotation of the drum, a recorder adapted to coöperate with a chart on the drum, means for moving the drum axially as it is rotated, a screw shaft adapted to be rotated by the hoist, a nut on said shaft and held from rotation therewith, a cam adjustably connected with said nut, a lever adapted to be rocked by said cam and to effect movement of the recorder axially of the drum, and means controlled by the hoist signal devices for effecting movement of the recorder transverse of the axis of the drum.

14. In an apparatus for recording the movements of mine hoists, the combination of a rotatable chart holding drum mounted to move axially as it is rotated, clock actuated means controlling rotation of the drum, a support for a recorder adapted to be moved parallel to the drum axis by movement of the hoist, a recorder mounted on said support to rock about an axis extending transverse of the drum axis, and magnets adapted to rock the recorder about said transverse axis.

In testimony whereof I affix my signature.

GEORGE F. ROYER.