No. 677,286. Patented June 25, 1901.

F. McM. STANTON.

RECORDING DEVICE FOR HOISTS.

(Application filed Feb. 18, 1901.)

(No Model.) 8 Sheets—Sheet 1.

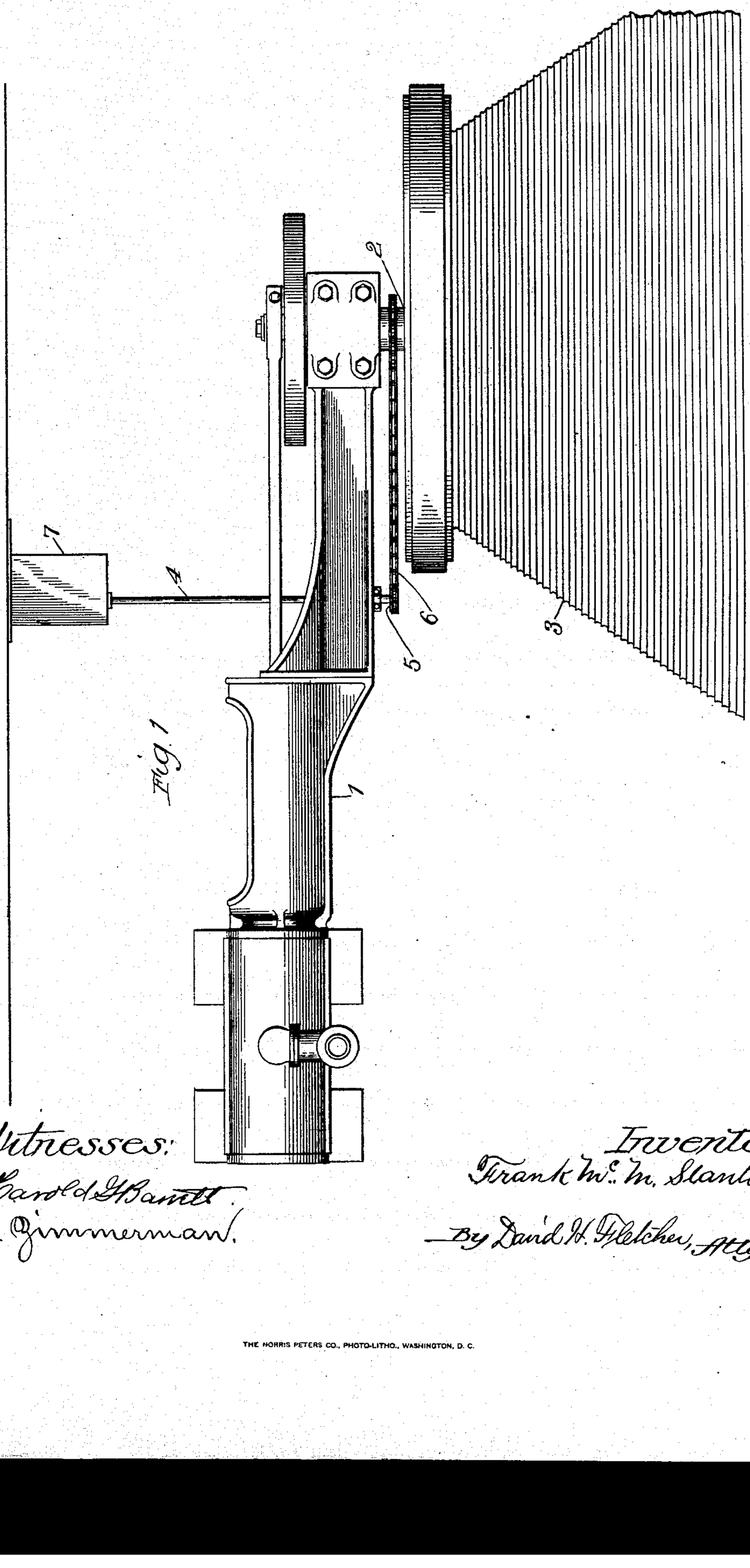

Fig. 1

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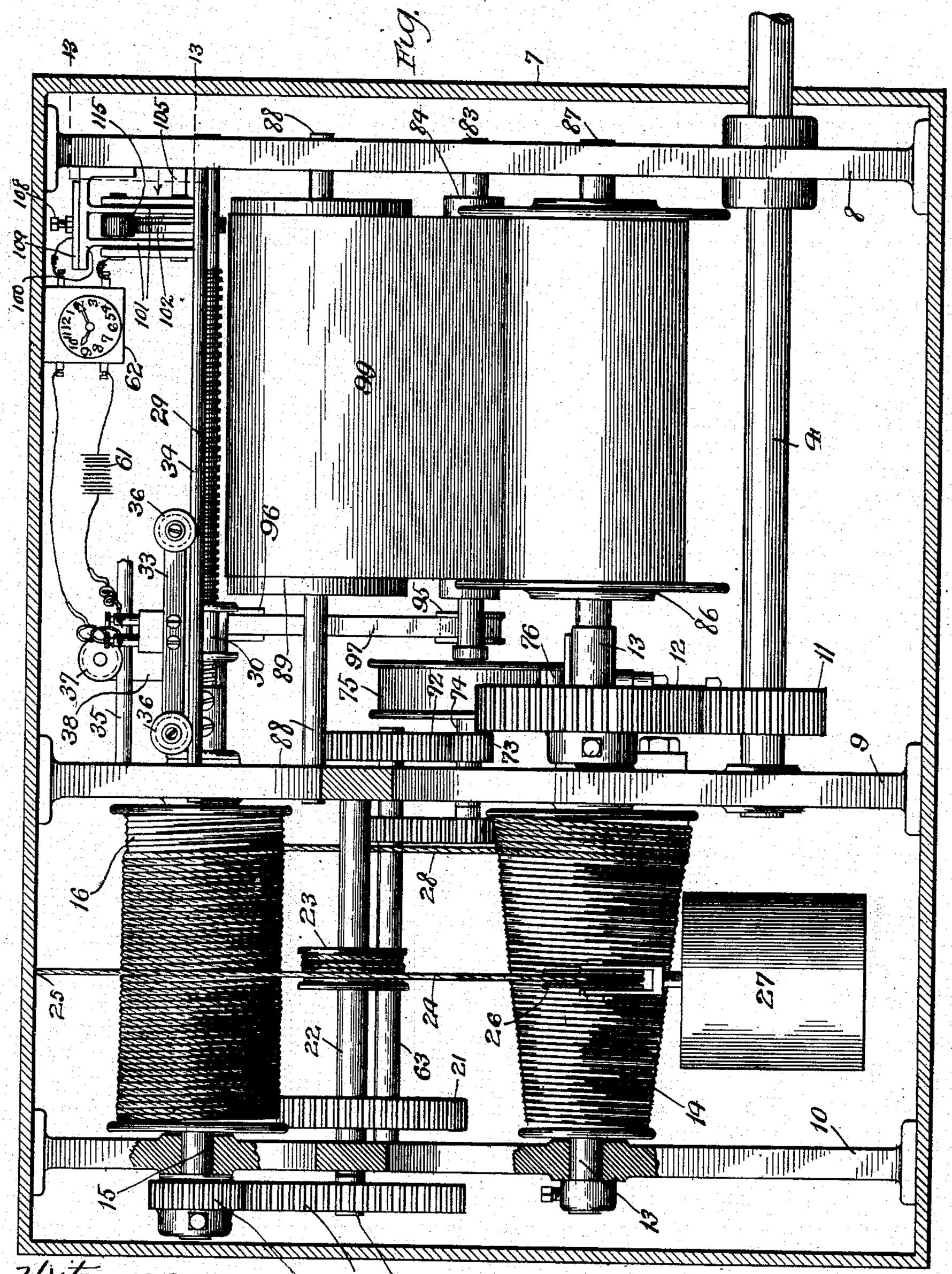
(No Model.) 8 Sheets—Sheet 2.

Fig. 2.



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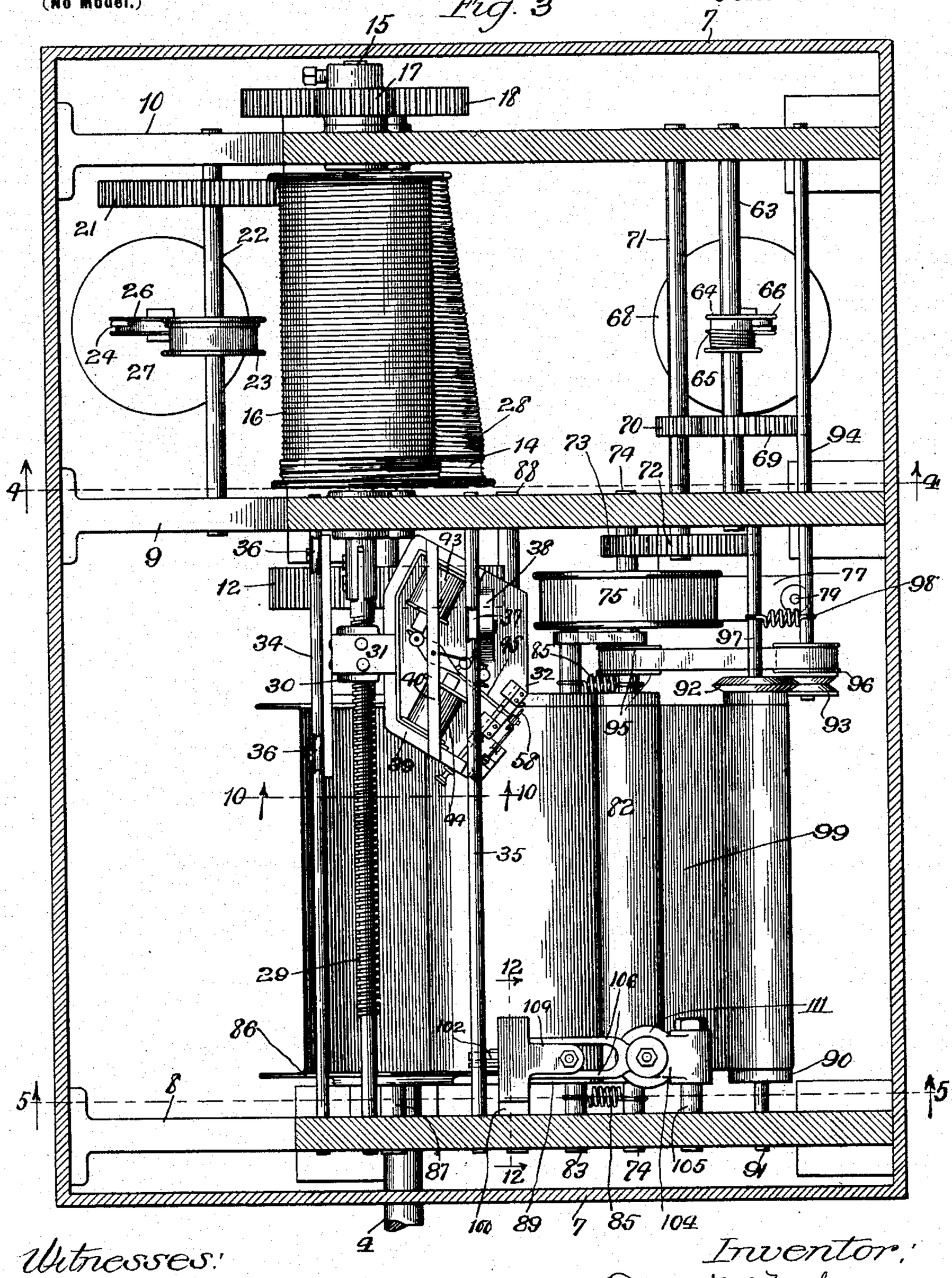
(No Model.) 8 Sheets—Sheet 3.

Fig. 3



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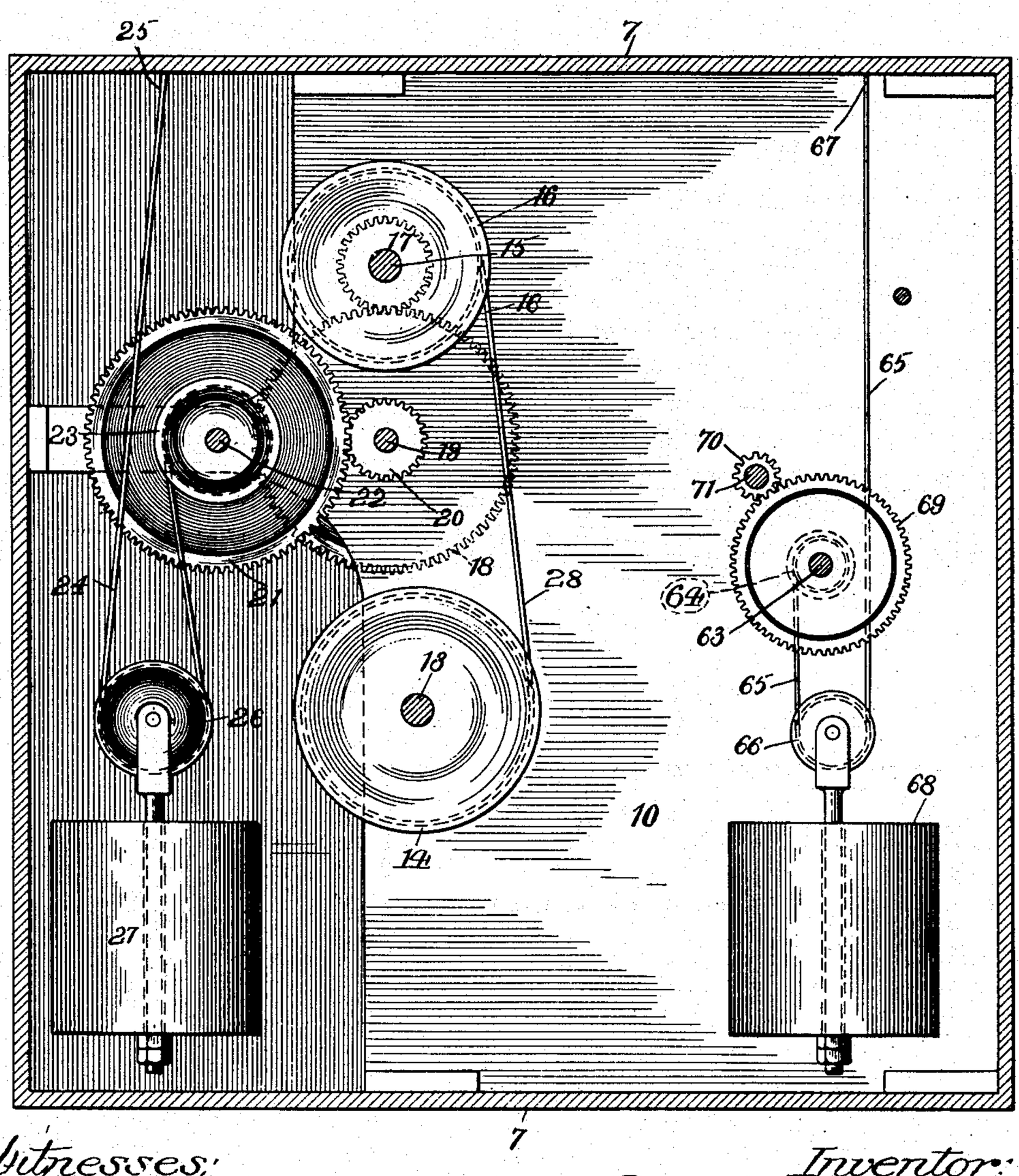
(No Model.) 8 Sheets—Sheet 4.

Fig. 4.



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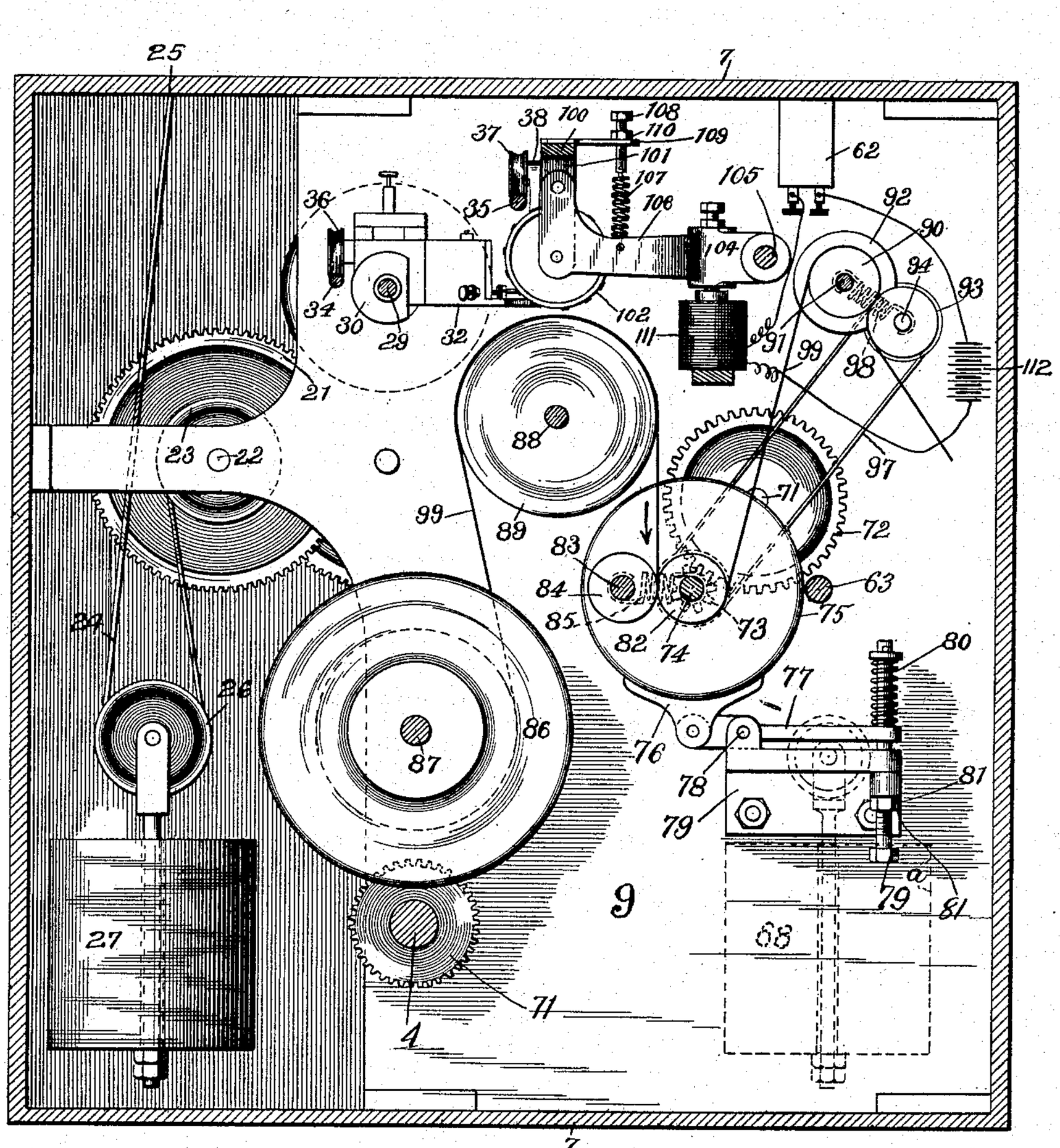
(No Model.) 8 Sheets—Sheet 5.

Fig. 5



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(No Model.) 8 Sheets—Sheet 6.

Fig. 6

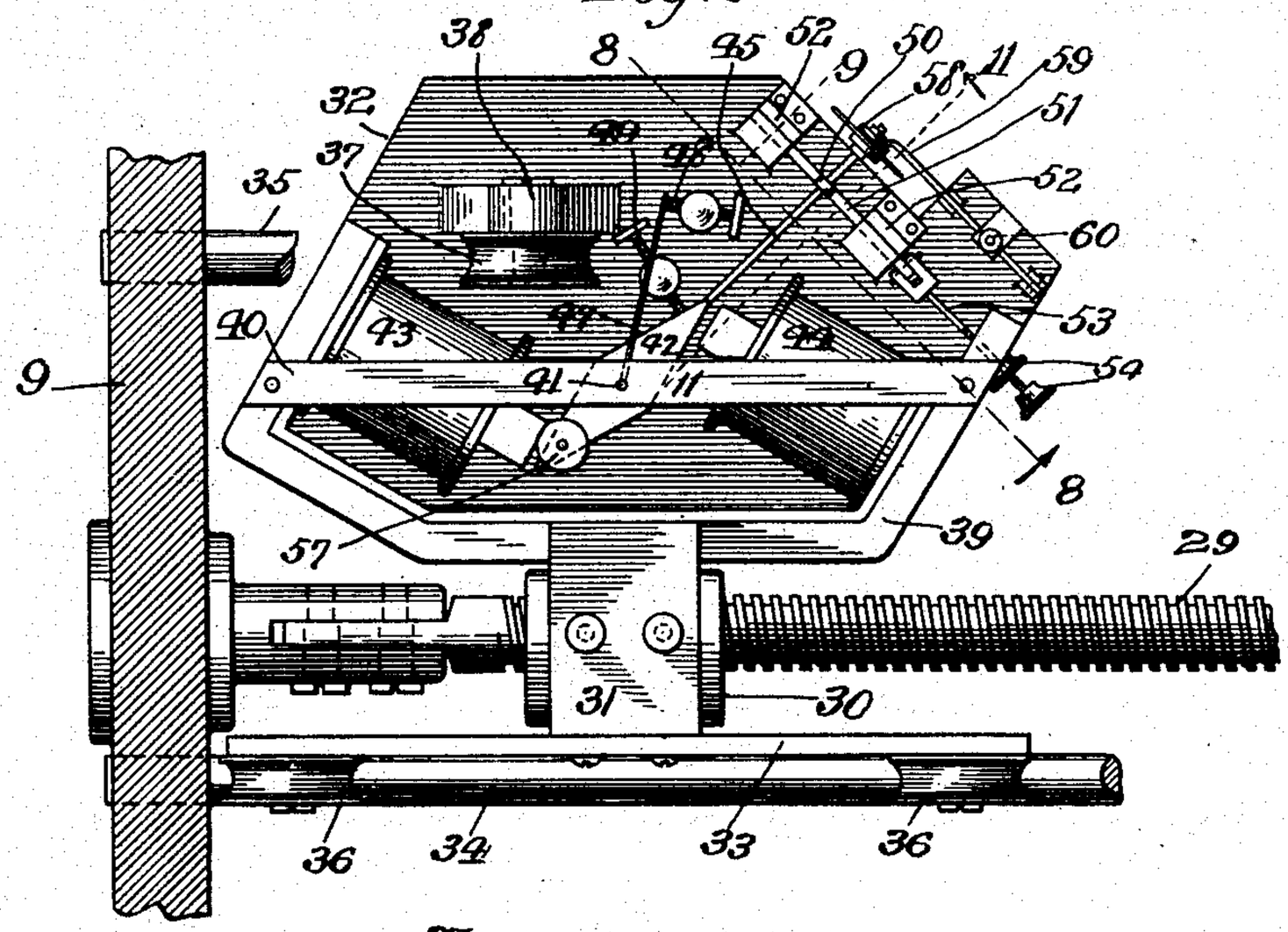


Fig. 7

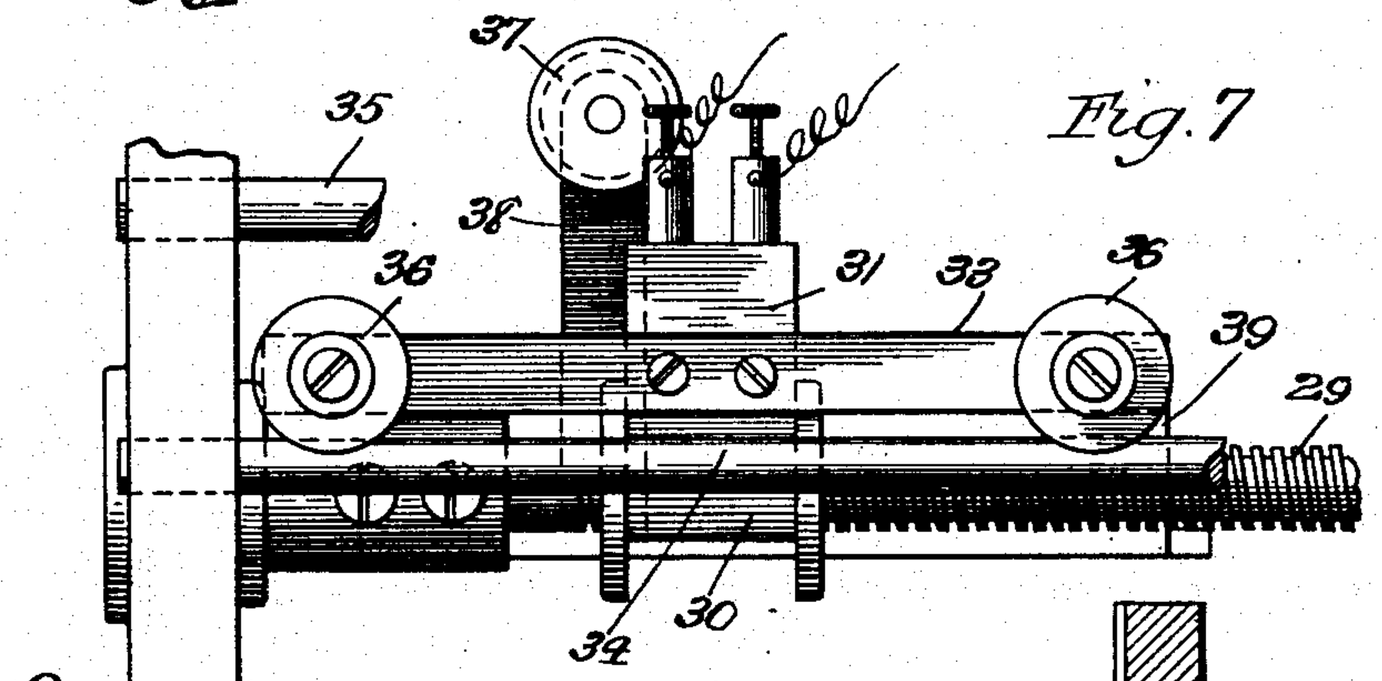


Fig. 8

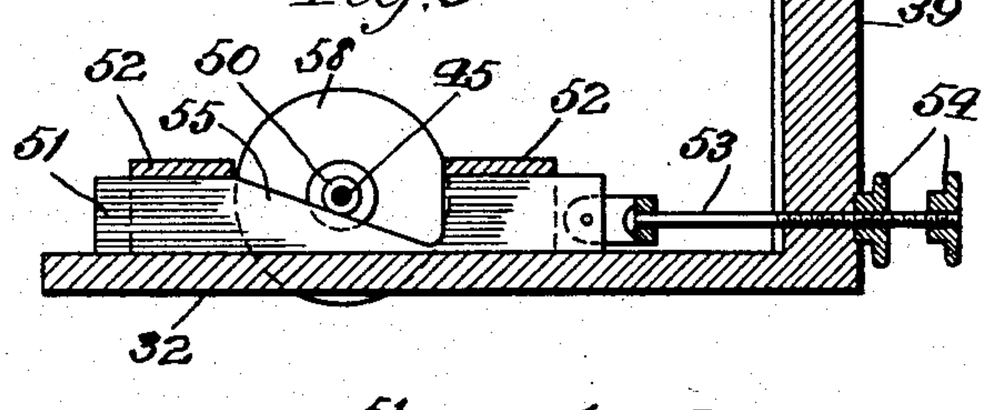
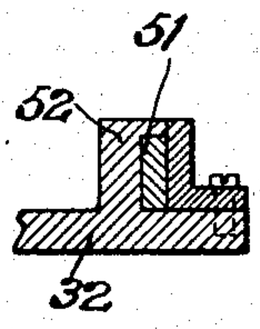


Fig. 9



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RECORDING DEVICE FOR HOISTS.

(Application filed Feb. 18, 1901.)

(No Model.) 8 Sheets—Sheet 7.

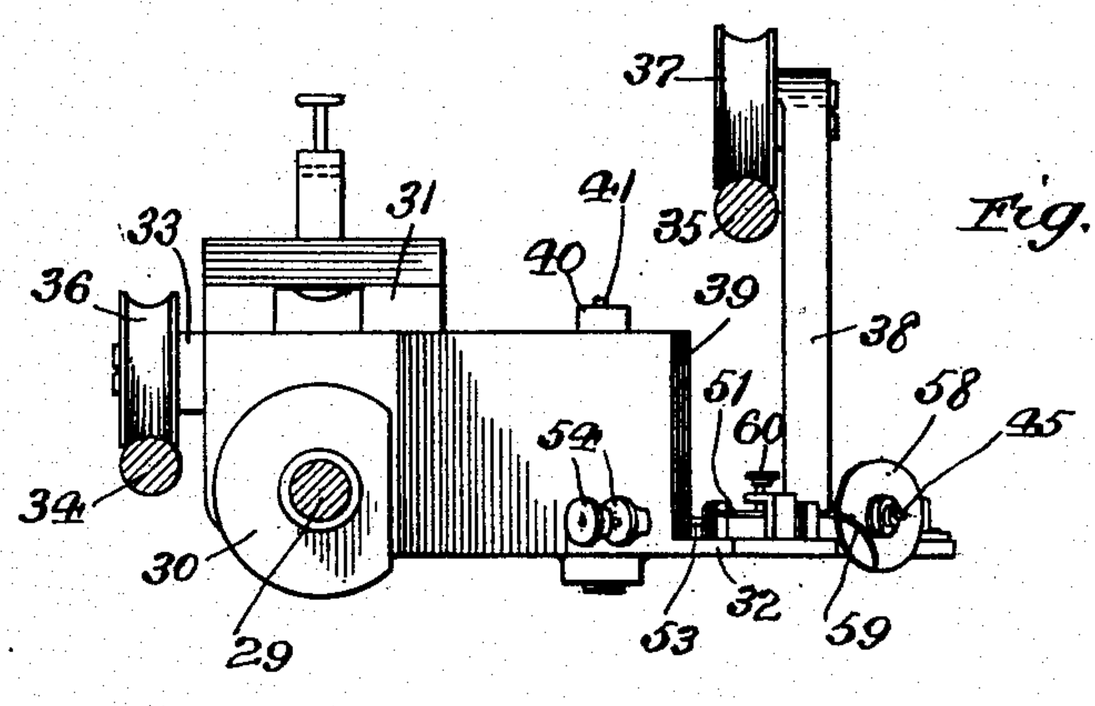

Fig. 10

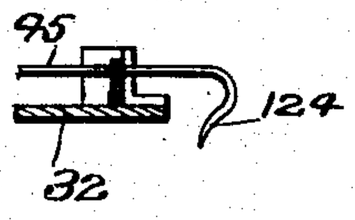

Fig. 11a

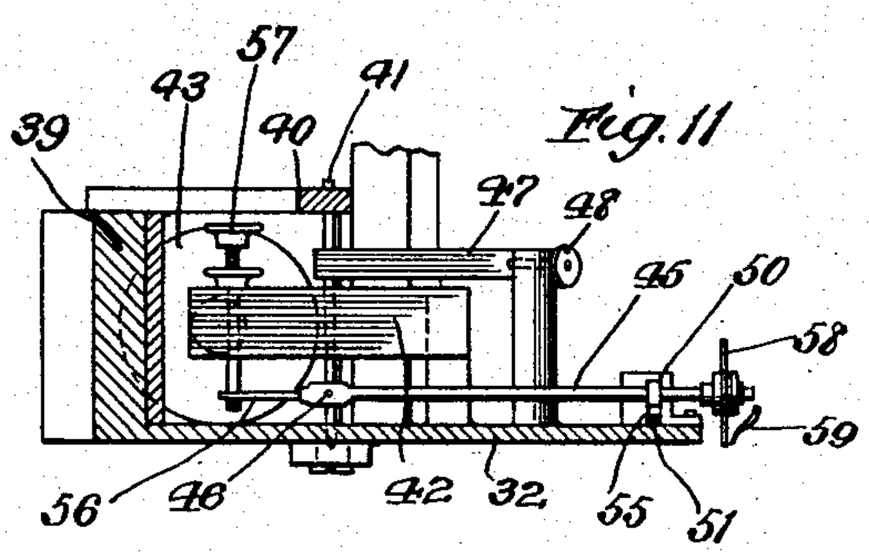

Fig. 11

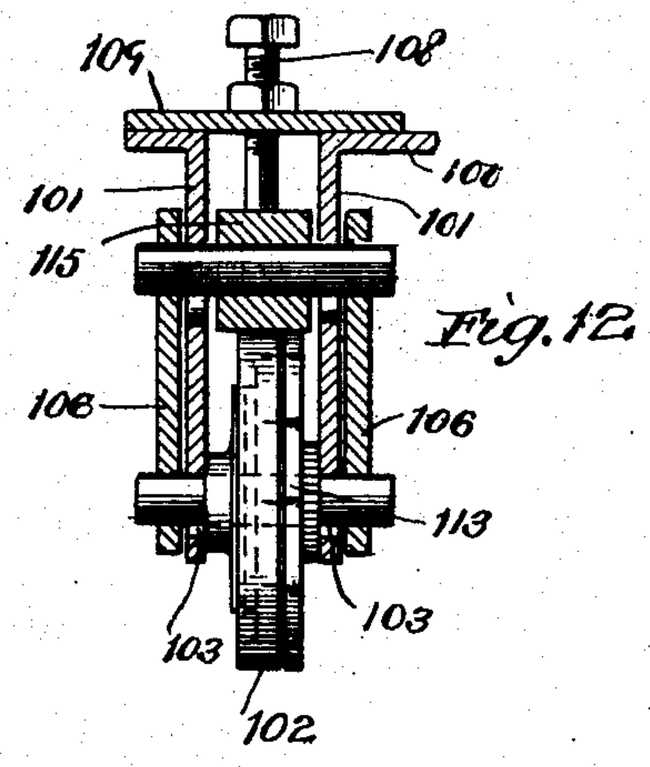

Fig. 12.

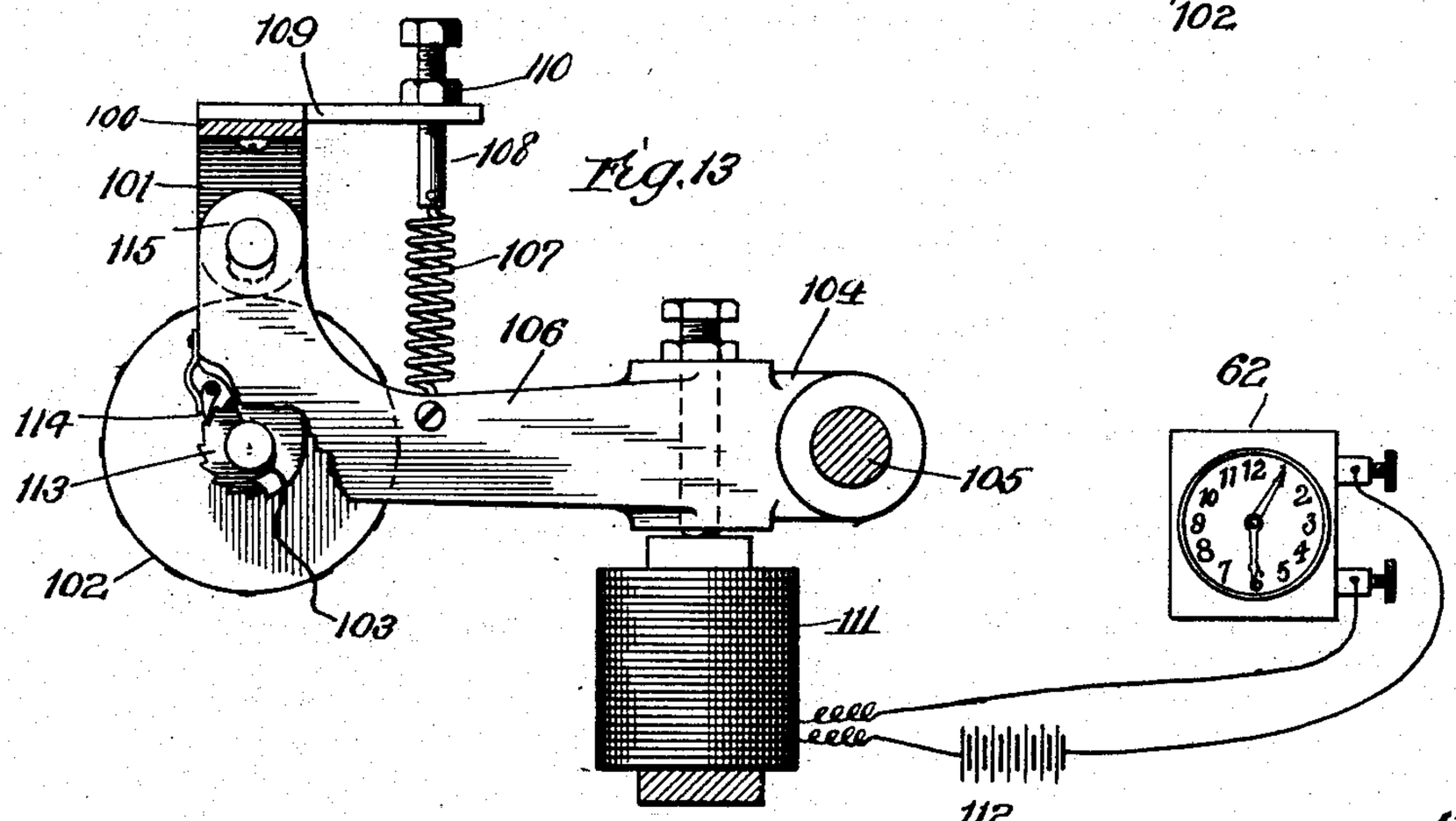

Fig. 13

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No. 677,286. Patented June 25, 1901.

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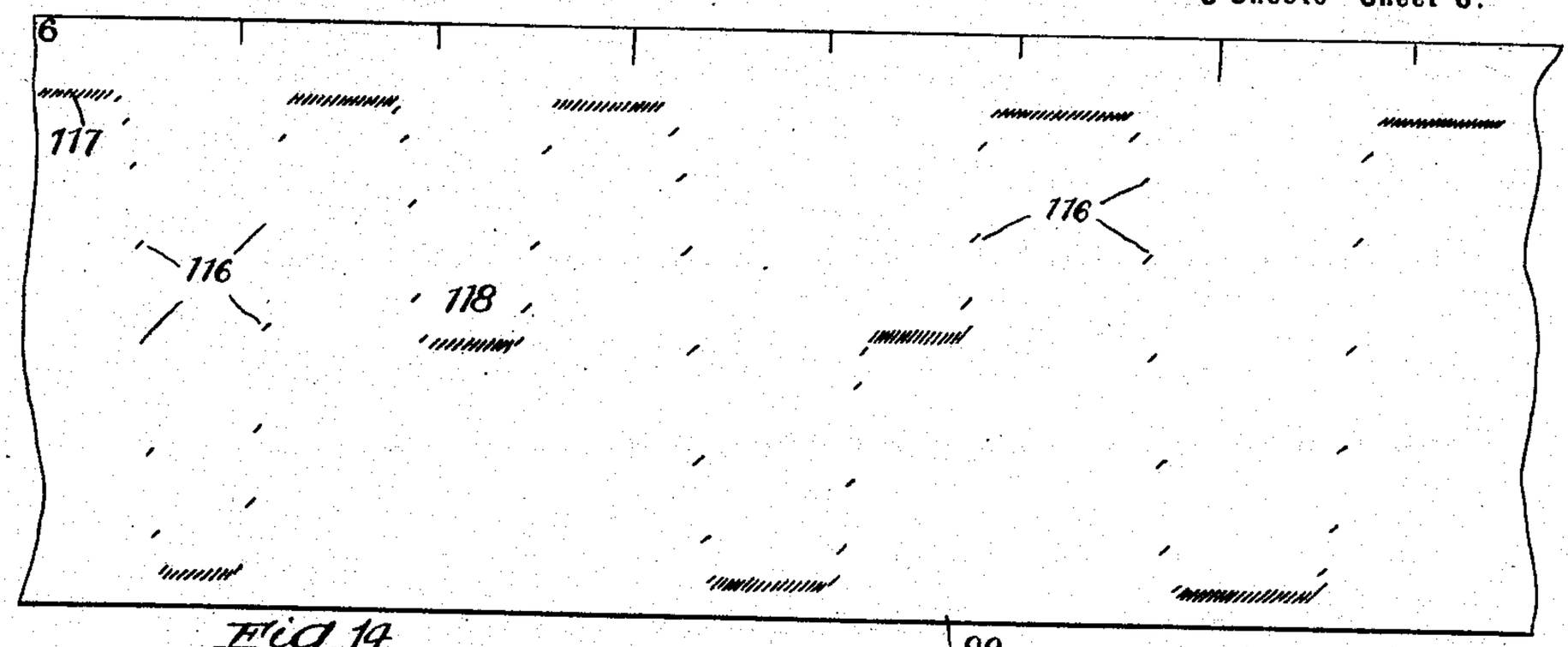

Fig. 14.

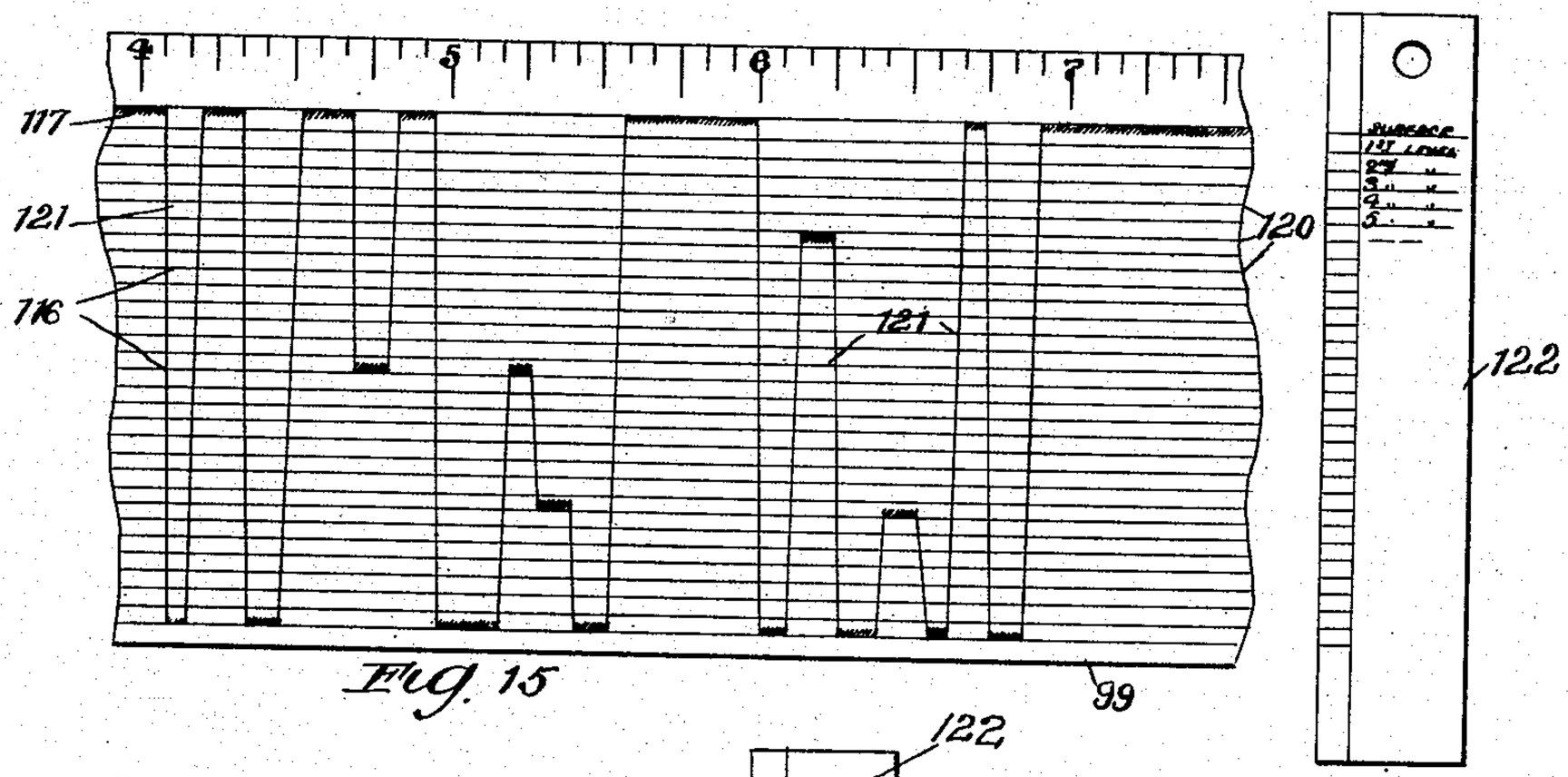

Fig. 15.

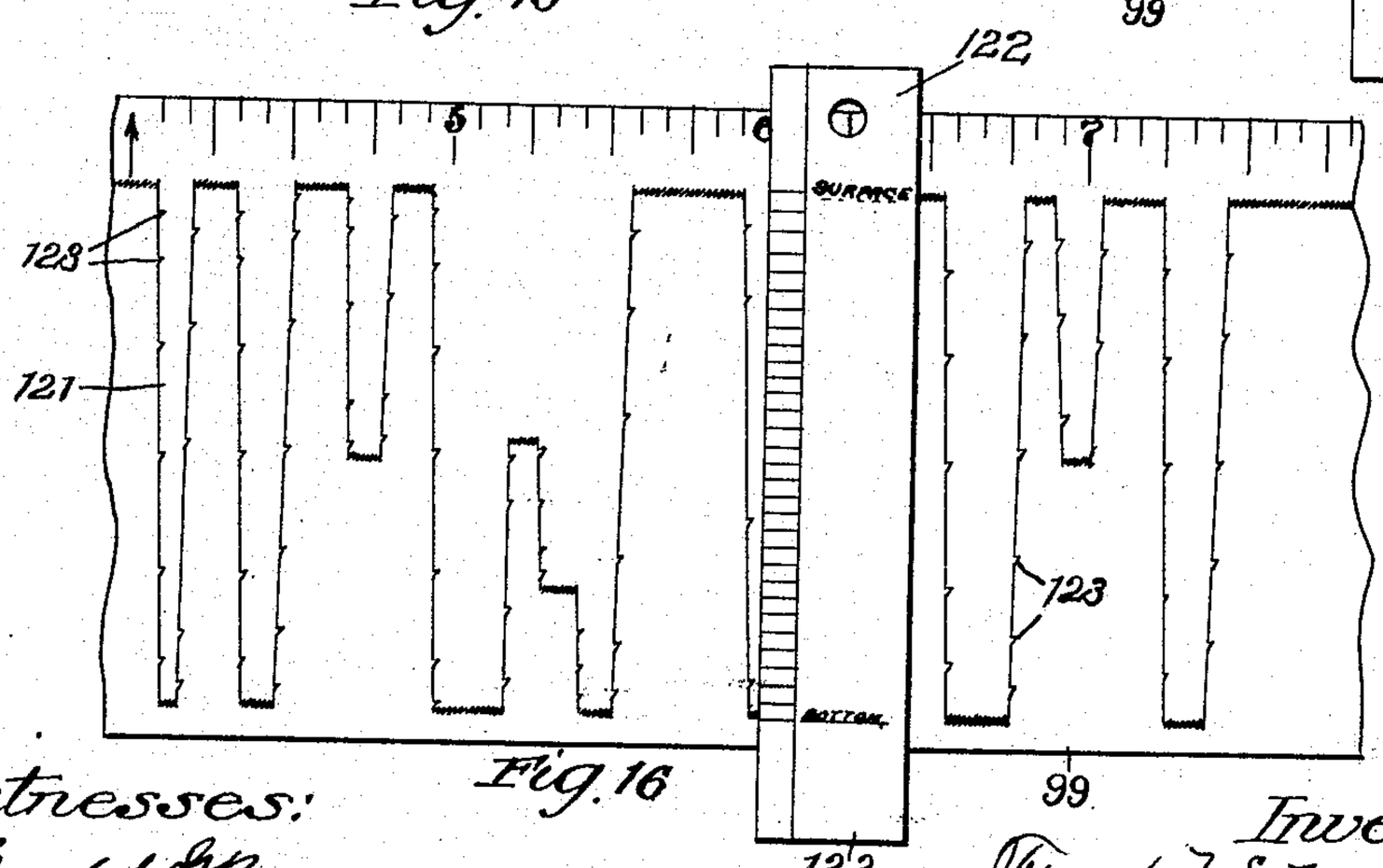

Fig. 16.

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UNITED STATES PATENT OFFICE.

FRANK McM. STANTON, OF HOUGHTON, MICHIGAN.

RECORDING DEVICE FOR HOISTS.

SPECIFICATION forming part of Letters Patent No. 677,286, dated June 25, 1901.

Application filed February 18, 1901. Serial No. 47,792. (No model.)

To all whom it may concern:

Be it known that I, FRANK McM. STANTON, of Houghton, in the county of Houghton and State of Michigan, have invented a new, useful, and Improved Recording Device for Hoists, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in which corresponding reference-numerals in the different figures indicate like parts.

My invention relates to recording devices for hoists and lifts of various kinds, but is more especially designed for those used in mines, in which hoisting is done from one or more levels. It is especially valuable in such cases to know the number of trips made by the car, cage, skip, or bucket, together with the respective levels from which hoisting has been done, as well as the speed of the car, the number and duration of stops, and when and where the same have occurred. The indication of the number of trips made by the hoist has heretofore been accomplished by means of some crude and primitive device—such, for example, as placing pegs in holes formed in a board under the control of the engineer or in other equally uncertain and objectionable ways.

The object of my invention is to overcome the objections incident to such methods by providing a simple and accurate recording mechanism so constructed that it will not only record the number of trips made by the car, cage, skip, or bucket and that automatically, but also the time consumed in making said trips, respectively, the levels from which the same were made, the speed of the moving element to be timed, and the time of rest at the beginning or end of the respective trips, as well as at any intermediate level or levels, so that a complete and accurate history of each day's work may be preserved for reference by those interested.

To this end my invention consists in the combination of elements hereinafter more particularly described, and definitely pointed out in the claims.

In the drawings, Figure 1 is a plan view of an engine and a portion of a hoisting-drum, showing the manner in which my improved recording device is connected therewith. Fig. 2 is a side sectional elevation of said recording device. Fig. 3 is a plan view thereof, the case being sectioned. Fig. 4 is a vertical sectional view taken upon the line 4 4, Fig. 3. Fig. 5 is a like sectional view taken upon the line 5 5, Fig. 3. Fig. 6 is an enlarged plan view in detail of the movable recording mechanism. Fig. 7 is a side view thereof. Fig. 8 is a sectional view in detail, taken upon the line 8 8, Fig. 6. Fig. 9 is a sectional view in detail, taken upon the line 9, Fig. 6. Fig. 10 is a sectional view in detail of the recording-carriage or stylus-carrier, said view being taken upon the line 10 10, Fig. 3. Fig. 11 is a sectional view in detail, taken upon the line 11 11, Fig. 6. Fig. 11[a] is a like view showing a modified construction. Fig. 12 is an enlarged sectional view in detail of the scale-printing mechanism, said view being taken upon the line 12 12, Fig. 3, viewed in the direction of the arrow there shown. Fig. 13 is a like view taken upon the line 13 13, Fig. 2, viewed in the direction of the arrow there shown; and Figs. 14, 15, and 16 are diagrammatic views showing different records made by said recording mechanism.

Referring to the drawings, 1, Fig. 1, represents a hoisting-engine of any approved pattern, on the shaft 2 of which is mounted a cone-shaped drum 3, over which is trained the usual hoisting-rope. Arranged parallel to the engine-shaft 2 is a small shaft 4, (also shown in Figs. 2, 3, and 5,) which shaft is mounted in suitable bearings and is provided with a sprocket-wheel 5, connected, by means of a sprocket-chain 6, with a similar sprocket-wheel upon the shaft 2. The shaft 4 constitutes the prime motor element of my improved recording device, and while it is shown in the drawings as being connected directly with the shaft of the winding-drum it is obvious that it may be connected with whatever primary element of which it is desired to record the speed, the application being varied to conform to the varying construction of different kinds of hoists or lifts. The shaft 4 is projected through a suitable casing 7, within which is placed suitable uprights 8 9 10, Figs. 2 and 3, constituting the frame. Said shaft is supported in suitable bearings in the uprights 8 and 9 and is provided with a pinion 11, Figs. 2 and 5, which meshes into a gear

12, keyed or otherwise attached to a shaft 13, which is supported in bearings in the uprights 9 10. Keyed to the shaft 13 is a miniature cone-drum 14, the taper of which is proportionate to that of the main winding-drum 3. The drum 14 is provided with grooves, as shown, to conform to those upon the main drum of the hoist. Located above the drum 14 and mounted in bearings in the uprights 9 10 is a shaft 15, having thereon a secondary cylindrical drum 16, provided with grooves corresponding to those upon the drum 14. A pinion 17 upon the end of the shaft 15 meshes into a gear 18 upon a shaft 19, having a pinion 20, adapted to engage a gear 21 upon a shaft 22. Upon the latter shaft is mounted a spool 23, adapted to receive one end of a cord 24, the other end of which is attached to the top of the casing at 25. The cord is trained beneath a pulley 26, to which is suspended a weight 27. The drums 14 and 16, respectively, are connected by means of a cord 28, which is so adjusted as to be wound or unwound from one drum to another, according to the direction of movement of the hoist. The object of the cord 24 and weight 27 is to actuate the drum 16 and cause said drum to wind thereon the cord 28 and hold the same taut under uniform tension as it is unwound from the drum 14, so as to accurately transmit to the drum 16 the proportionate speed of the moving element to be timed, whether moved up or down.

Coupled to the shaft 15, in the manner more clearly indicated in Figs. 3, 6, and 7, is a screw 29, the opposite end of which is provided with a bearing in the upright 8. Said screw is in operative engagement with a threaded sleeve 30, which is rigidly attached to a block 31, which forms a connection between a supporting frame-plate 32 and a bar 33, the whole constituting a carriage-frame which is supported by means of grooved rollers mounted upon parallel rods 34 35, attached to the uprights 8 and 9. The rod 35 is upon a higher level than that of the rod 34, and upon the latter is mounted two grooved or flanged rollers 36 36, while upon the former is mounted a like roller 37, which is secured to an upwardly-projecting stud 38, formed upon the frame-plate. The carriage is therefore free to move upon said rollers, being actuated by means of the screw 29 in the manner and for the purpose hereinafter stated.

Upon the frame-plate 32 is formed an upwardly-projecting flange 39, Figs. 3, 6, 7, 8, 10, and 11, upon which is supported a cross-bar 40. (Better shown in Figs. 3, 6, and 11.) Pivoted in bearings in said cross-bar and frame-plate, respectively, is a vertical pivot-pin 41, upon which is mounted an armature 42 in operative proximity to the pole extensions of electromagnets 43 44. A lever-arm 45 is attached to the shaft or pivot-pin 41 by means of a pin 46, Fig. 11, which forms a pivot or fulcrum for said arm; by which the ends of the latter are free to move up and down, while the outer end of said arm is caused to move in the arc of a circle with the partial rotation of the pivot-pin 41, which is adapted to be moved by the armature 42, said armature being rigidly attached to said pivot-pin. Said armature is held in a normal position by means of a spring 47, Fig. 6, the tension of which is controlled by means of an adjusting-screw 48, tapped into a stud upon the frame-plate. A similar screw 49 serves to limit the movement of said armature as well as to control and adjust its normal position against the action of the spring 47. The arm 45 is provided with a small roller 50, Figs. 6, 8, and 11, beneath which is placed a bar 51, loosely supported in guides 52 52, Figs. 6, 8, and 9. Said bar is free to be adjusted longitudinally and is connected with a rod 53, which is passed through a bore in the flange 39 and provided with set-screws 54 for adjustment. The bar 51 is cut away so as to form an inclined or wedge-shaped bearing-support 55, as clearly shown in Fig. 8; upon which the roller 50 is caused to rest. The short end 56 of the arm 45 constitutes a spring in the outer end of which is swiveled the lower end of an adjusting-screw 57, (better shown in Fig. 11,) which is passed through a bore in the armature 42. Said screw enables the tension of the spring to be adjusted to any desired degree, thereby causing the opposite end of the arm 45 to bear downwardly for the purpose hereinafter stated. Upon the outer end of the arm 45 is mounted a revoluble disk or stylus 58. A second stylus 59, Figs. 6, 10, and 11, is adjusted in juxtaposition to said disk stylus, the relativity of said position being capable of adjustment by means of a set-screw 60, Figs. 6 and 10.

The terminals of the electromagnets 43 and 44 are connected in series with each other and with a battery or other source of electricity 61 and a clock mechanism 62, Fig. 2, the latter being constructed in any well-known way and adapted to make and break the circuit with said electromagnets at short intervals of, preferably, ten seconds each. With each closing of the electric circuit the armature 42 is actuated, thereby oscillating the shaft 41 and in turn moving the outer end of the arm 45, and with it the disk 58, laterally for the purpose hereinafter set forth. It should be noted that the arm 45 stands at an angle, preferably, of about forty-five degrees from the path of movement of the carriage, and hence a mark made thereby on a recording-surface would represent a corresponding angle.

Having described the leading features of the mechanism for making the record upon the recording-surface, I will now describe the paper-moving mechanism to be employed therewith and the manner in which the record is made.

Journaled in the uprights 9 and 10 is a horizontal shaft 63, Figs. 2, 3, 4, and 5, upon which is keyed a spool 64, having one end of a cord

65 attached thereto, said cord being trained beneath a pulley 66 and having its opposite end attached at 67, Fig. 4, to the case 7. From the pulley 66 is suspended, by means of a suitable hanger, a weight 68. A gear 69 upon the shaft 63 meshes into a pinion 70 upon a shaft 71, Figs. 3 and 4, which is supported in bearings in the uprights 9 and 10. The shaft 71 is extended through the upright 9 and has keyed upon the projecting end thereof a gear 72, which meshes into a pinion 73 upon a shaft 74.

Keyed to the shaft 74 is a friction-drum 75, which is in engagement with a shoe 76, jointedly attached to the short end of a lever-arm 77, pivoted at 78 to a bracket 79, which is rigidly attached to the upright 9. A screw-threaded bolt 79ª is passed through a vertical bore in said bracket and is provided with a spring 80, interposed between the long arm of said lever and a washer upon said bolt, to cause the shoe to press against said friction-drum. The tension of said spring may be adjusted by means of a suitable nut 81. The purpose of the friction-drum and tension-brake described is to enable the speed of the shaft 74 to be controlled against the action of the weight 68, by which said shaft is actuated, it being desirable to render the speed of said shaft constant in order to properly feed the paper web, as hereinafter specified. Secured to the shaft 74, so as to revolve therewith, is a feed-roll 82, Figs. 3 and 5. Parallel to the axis of the shaft 74 is a similar shaft 83, having a friction-roll 84 mounted thereon, said shaft being provided with suitable bearings, in which allowance is made for slight lateral play. Springs 85 85 (shown in Fig. 3 and indicated in dotted lines in Fig. 5) serve to draw one shaft toward the other and to cause the feed-rolls 82 84 to press against each other with a spring-pressure.

A paper-roll 86 is secured to a shaft 87, one end of which has a bearing in the upright 8, while the other end has its bearing in a sleeve on the end of the shaft 13 upon which the drum 14 is supported, as shown in Fig. 2.

In a vertical plane between the shafts 74 and 87 and above said shafts is located a shaft 88, having a roller 89 thereon, the periphery of which is slightly below and in operative proximity to the stylus 58, said roller forming a platen for the paper-web upon which the registration is intended to be made.

A roll 90 is mounted upon a shaft 91, attached to which is a cone or friction gear 92, adapted to engage with a counterpart gear 93 upon a shaft 94, which is journaled in the uprights 9 and 10. Pulleys 95 96, Fig. 3, are keyed to the shafts 74 94, respectively, and connected by means of a belt 97, whereby the shaft 94 may be driven from the shaft 74, while the shaft 91 may in turn be driven through the action of the friction-gears 92 93. A coiled spring 98 serves to maintain said gears in frictional contact.

The paper-web 99 is unwound from the roll 86, trained over the platen-roller 89, thence downwardly between the feeding-rolls 84 82, beneath the latter, and thence upwardly over the roller 90, as shown.

Although not absolutely essential, it is highly important to provide a suitable scale upon the margin of the paper-web in order that comparisons may be readily made, not only as an aid in the reading of the record, but to enable said record to be made more compact. This may be accomplished as follows: A bracket or hanger 100, Figs. 2, 3, 5, 12, and 13, is rigidly attached to the upright 8 and is provided with depending arms 101 101, in the lower ends of which is journaled the shaft or axle of a printing wheel or disk 102, having figures upon its periphery for marking the hours, between which figures are divisions preferably representing five-minute spaces. The arms 101 are provided with vertical slots 103, Figs. 12 and 13, for the reception of the axle of said wheel, which provides for a limited vertical movement of the latter. A lever 104, pivoted to a stud 105, attached to the frame, is provided with bifurcated arms 106 106, between which said printing-wheel is interposed, and are provided with bores to receive the axle of said wheel. A coiled spring 107 connects the free arms of said lever with a threaded bolt 108, extending through a bore in an arm 109, rigidly attached to said hanger. An adjusting-nut 110 enables the tension of the spring to be regulated. An electromagnet 111 is located beneath the lever, as shown, and is electrically connected with a battery 112 and a suitable circuit maker and breaker controlled by the clock 62, which circuit-maker is adapted to make and break the circuit at intervals of five minutes. A ratchet-wheel 113 is attached to the shaft of the printing-wheel and is adapted to be engaged by a pawl 114 when the circuit is broken with the magnet 111, and the wheel is lifted by the lever-arms 106 through the recoil of the spring 107, this action serving to shift the numbers consecutively. An ink-roll 115 is provided for distributing ink upon the printing-wheel.

I have suggested the closing of the battery-circuit for the control of the printing-wheel at intervals of five minutes; but it is obvious that it should be done whenever an impression is desired, which is a matter of predetermination.

Having thus described in detail the construction of my improved device, I will now explain its operation.

Assuming the paper-web to be adjusted upon the rolls in the manner described and the weights 27 and 68 raised, the starting of the engine causes the rotation of the winding-drum 3, the motion of the shaft of which is transmitted through the chain 6 and shaft 4, together with the gears 11 and 12, to the shaft 13, thereby actuating the miniature winding-drum 14, the motion of which is transmitted to the cylindrical drum 16 through the cord

28, said cord being kept taut by the action of the weight 27 and intervening mechanism. The result of this action is to cause the rotation of the screw 29 at a speed exactly proportionate to that of the main winding-drum. It follows, therefore, that the carriage containing the frame-plate 32 and stylus 58 will through the action of the screw be caused to move back and forth over and in the vertical plane of the axis of the platen-roll 89. A reversal of movement serves to wind up the cord 24, and thereby lift the weight 27. In the meantime, through the action of the weight 68, the paper-web 99 is caused to move over the platen-roll 89 at right angles to the main path of movement of the stylus, the rate of movement being uniform, which uniformity is attained through the action of the brake 76 upon the friction-drum 75. At each interval of ten seconds the electromagnets 43 44 are energized, which causes the arm 45 to be moved laterally and as a result of the spring action of the part 56 to be moved downwardly upon the incline 55 until the disk stylus 58 is brought into contact with the paper-web. The breaking of the electric circuit with said magnets serves to lift said disk from the paper and to restore it to its normal position. The result of this action is a series of marks or dashes at an angle to the line of movement of the paper as well as to that of the main path of the stylus, as shown at 116, Fig. 14. These marks of themselves may constitute a very complete record, but not in the most desirable form. For example, assuming the movement of the paper to be one foot per hour, then each inch in length would represent a period of five minutes. The opposite margins of the paper would represent the extreme limits of travel of the car, or, in other words, the top and bottom of the shaft. Referring to 117, Fig. 14, several dashes will be seen in a given line parallel with the web margin. These dashes having been made by the stylus at intervals of ten seconds would indicate that the car must have rested about two minutes at the top level before commencing its descent. The number of dashes shown at intervals on the downward travel indicate that the total time of passage of the car from top to bottom must have been about eighty seconds, the speed of the car varying in proportion to the relative distance from each other of the dashes. A glance will show that the time consumed in stops at the top and bottom, together with the time consumed in the downward passage, must have approximated five minutes. By referring to 118 of the same diagram it will be seen that the car in the second trip only descended about half-way and rested at that level about two minutes, while in the third trip, as shown at 119, it descended to the bottom and rested at the same middle level about three minutes. In this kind of register figures indicating the hours may be printed in the first instance upon a prepared paper-web with the intervening scale-marks, as shown; but I prefer to employ the printing-disk 102, as described, to print the numbers and scale upon the margin of the paper-web when passed through the machine, as shown in Figs. 15 and 16, and I also prefer to rule the paper-web longitudinally, as shown at 120, Fig. 15, to conform to the various levels of the mine. The diagram shown in the last-named figure indicates the use of the second stylus 59, which should be so adjusted as to be in continuous contact with the paper. This would cause it to make a series of marks 121, which would indicate the respective trips of the car, while the marks 116 would indicate its speed. By following the lines 120 and counting the cross-marks one would be enabled to determine the speed of the car, while two or more cross-marks at any given level would show that a stop was made there, as well as its duration.

As an aid to the reading of the record I prefer to employ a removable scale, as shown at 122, having scale-marks corresponding to the lines 120 and numbered to conform to the respective levels. Upon placing said scale upon the paper one may at once determine the level upon which a given stop may have been made.

In Fig. 16 it will be noticed that the cross-lines which indicate the path of movement of the car are broken by short zigzag lines 123, as distinguished from the cross-marks shown in the other diagrams. This may be accomplished by substituting for the disk stylus 58 on the end of the arm 45 a pointed stylus 124, Fig. 11ª, and either removing the slide-bar 51 or adjusting it by means of the rod 53 so as to permit the pointed stylus to rest continuously upon the paper. Each pull upon the armature will cause it to swerve laterally from its path, and thereby make the short zigzag marks referred to. This I regard as the simpler and the preferred construction, inasmuch as it enables the stylus 59 to be dispensed with, the work of cross-marking the web, and that of timing as well, being accomplished by means of a single stylus.

The making of the dashes or timing-marks at an angle to the main line of movement of the stylus enables the scale of the paper-web to be smaller, inasmuch as the respective marks may be distinguished when very close together; otherwise they might be blended into one, and thus defeat the end aimed at.

It is obvious that any scale may be adopted which is capable of being conveniently read. Greater accuracy may be had by increasing the width of the paper and the speed of its movement. Ordinarily a width of five inches would suffice for a shaft having a depth of three thousand feet.

It is obvious that the speed of the paper-web may be controlled directly by means of a clock-movement and that the stylus may be deflected periodically by automatic mechanical devices, and hence I do not confine myself to either of the specific methods shown

for accomplishing these results. The stylus employed may consist of a pencil or pen, and the paper may be of any well-known quality suitable therefor; but I prefer to use a metallic stylus and to employ what is known as "metallic paper," which is a paper having a prepared surface adapted to receive and retain a mark from such an instrument.

At the close of each day the paper-web marked during that day may be removed and dated and filed for future reference, thereby preserving a complete history of the number of trips made by a given car, the number, place, and duration of the several stops, and the speed of the car. The advantages of such a record are obvious to all concerned.

My improved registering device may be applied to all hoists, lifts, or elevators, whether the usual winding-drum be employed or not. For example, in the form of hoist known as the "hydraulic lift" it would only be necessary to cause the stylus-carrier to move in some predetermined ratio to the speed of the ram.

When the main winding-drum is cylindrical instead of conical, as shown in the drawings, it is obvious that the stylus-carriage may be actuated directly therefrom and that the drum 16 may be dispensed with.

Having thus described my invention, I claim—

1. A device of the class described, in which is combined a recording-web, means for moving the same at a predetermined speed, a stylus, means for moving the same across said web at a speed proportioned to that of the moving element to be timed, means for causing said stylus to be brought into contact with said web, and means for periodically deflecting said stylus from its normal or main path of movement, substantially as described.

2. In a device of the class described, the combination of a recording-web, a platen, means for imparting a uniform movement to said web in contact with said platen, a stylus, means for moving said stylus at right angles to the direction of movement of said web at a speed bearing a fixed ratio to that of the moving element to be timed, means for causing said stylus to be brought into operative contact with said web, and means for deflecting said stylus at regular intervals, substantially as specified.

3. In a device of the class described, the combination of a web adapted to receive indicating-marks upon its surface, a platen, means for passing said web over said platen at a given rate of speed, a stylus having its point in continuous contact with said web, means for moving said stylus at right angles to the direction of movement of said web at a speed proportionate to that of the moving element to be timed, and means for suddenly deflecting said stylus at regular intervals from its main normal line of movement, substantially as described.

4. In a device of the class described, the combination of a web adapted to receive indicating-marks upon its surface, a platen, means for imparting a uniform movement to said web, a stylus, means for moving said stylus at right angles to the direction of movement of said web at a speed proportionate to that of the element to be timed, means for causing said stylus to be brought into operative contact with said web at regular intervals, and means for simultaneously imprinting a scale upon the margin of said web, substantially as and for the purposes specified.

5. A recording device of the class described, in which is combined a recording-web, means for actuating said web at a constant speed, a stylus, a stylus-carrier, the movement of which is controlled by the primary element to be timed, means for moving said carrier back and forth over said web in a plane at right angles to the plane of movement of the latter, at a speed proportioned to that of said primary element, a stylus mounted upon said carrier at an angle to the plane of movement of the latter, means for causing said stylus to be brought into contact with said web, and means for suddenly deflecting said stylus from, and restoring it to its normal position at regular intervals of time, substantially as described.

6. In a recording device of the class described, the combination with a recording-web and means for moving the same into contact with a platen-surface at a constant speed, of two miniature drums, the first conforming in shape to that of the main drum of the hoist, while the other is cylindrical, means for imparting motion to said first drum from the shaft of said main drum, a cord connection between said miniature drums, means for causing said cylindrical drum to rotate to unwind the cord from said first drum and to hold said cord taut while being rotated in a reverse direction, a stylus-carriage mounted upon a track arranged at right angles to the plane of movement of said web, a screw driven by said second drum for actuating said carriage, and means for causing said stylus to mark said web at regular intervals, substantially as specified.

7. A recording device of the class described, in which is combined a shaft, means in operative connection with the main driving-shaft for imparting motion thereto, a cone-drum thereon, the proportions of which conform to those of the main drum of the hoist, a secondary cylindrical drum, a winding-cord for connecting the two, a cord and weight connected to said cylindrical drum in opposition to said winding-cord, a stylus-carriage, a screw connected with said cylindrical drum for moving the same back and forth in a given path as the movement of the hoist is reversed, a platen arranged beneath said path of movement, a recording-web, means for moving the same at a constant speed over

said platen at right angles to the path of movement of said stylus-carriage, a stylus adjusted at an angle to the line of movement of said carriage, means for pressing said stylus against said web, and means for suddenly vibrating said stylus at regular intervals, substantially as specified.

In testimony whereof I have signed this specification, in the presence of two subscribing witnesses, this 6th day of February, 1901.

FRANK McM. STANTON.

Witnesses:

ELLSWORTH M. INGRAM,

ALLEN F. REES.