(No Model.) 3 Sheets—Sheet 1.

F. A. WALTERS.

AUTOMATIC COAL RECORDING SYSTEM FOR RAILWAYS.

No. 553,632. Patented Jan. 28, 1896.

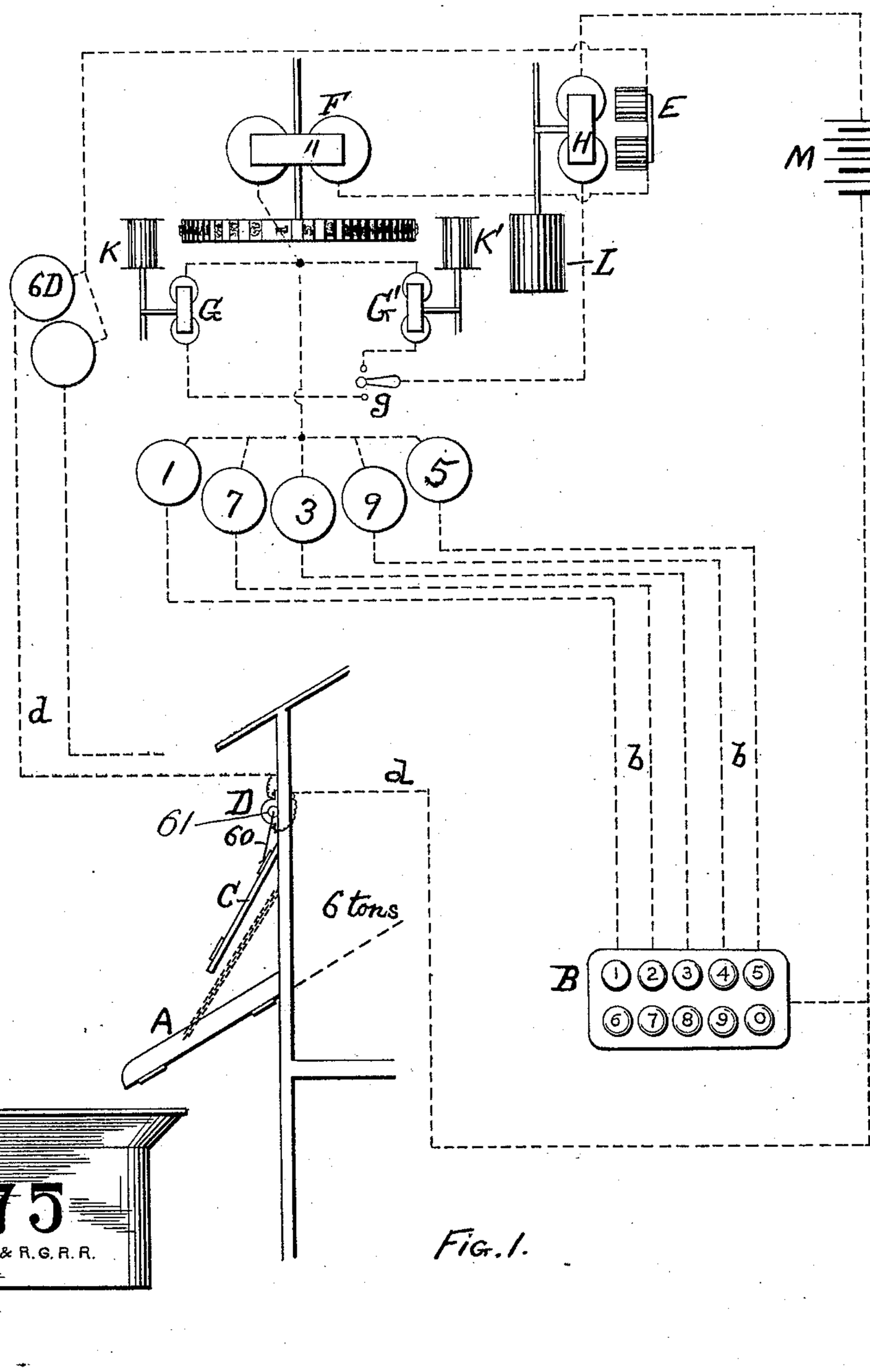

FIG. 1.

WITNESSES:

Lewis Searing.

George H. Sonneborn.

INVENTOR

Frank A. Walters

BY Harold Binney

ATTORNEY

(No Model.) 3 Sheets—Sheet 2.

F. A. WALTERS.

AUTOMATIC COAL RECORDING SYSTEM FOR RAILWAYS.

No. 553,632. Patented Jan. 28, 1896.

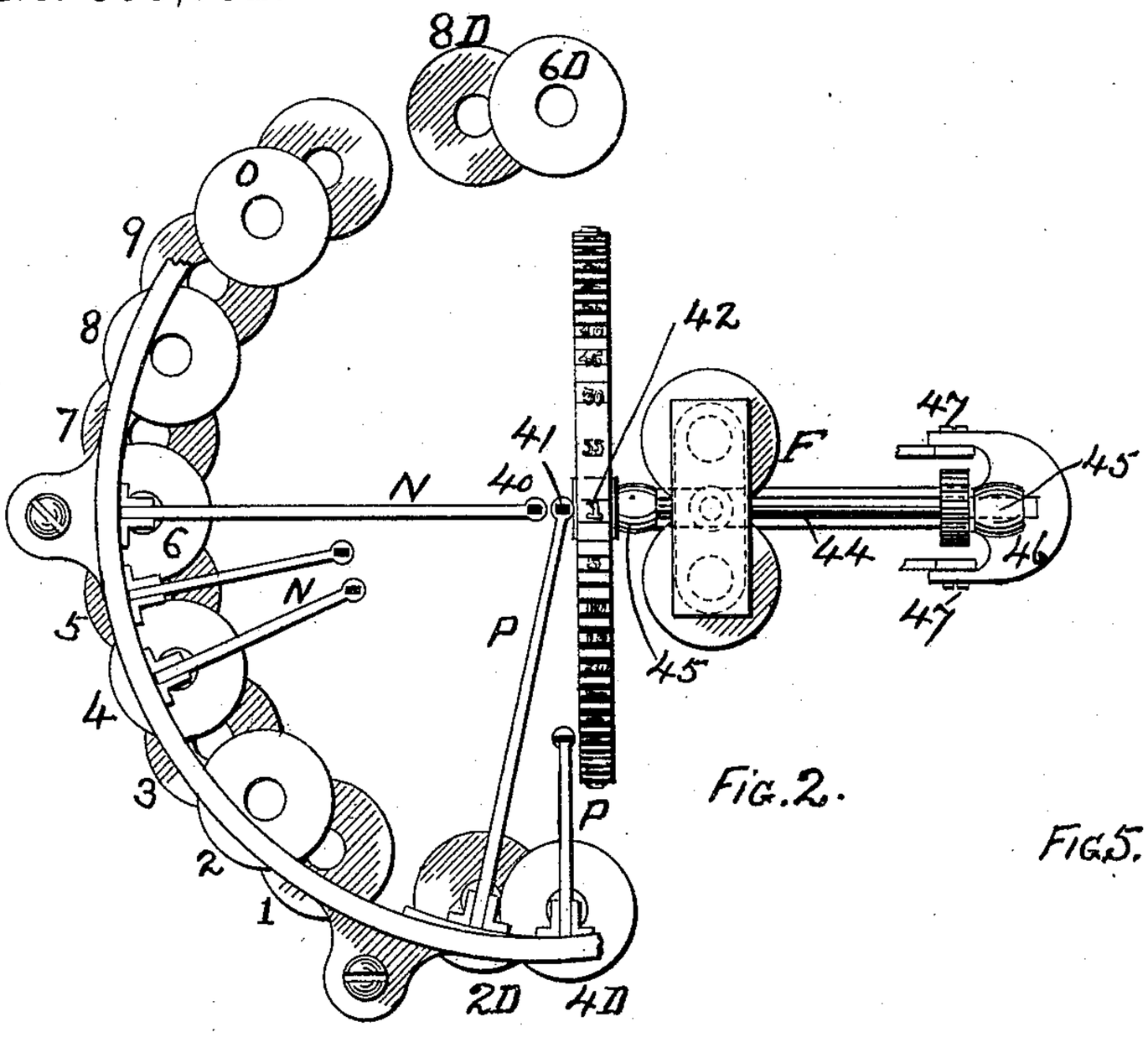

FIG. 2.

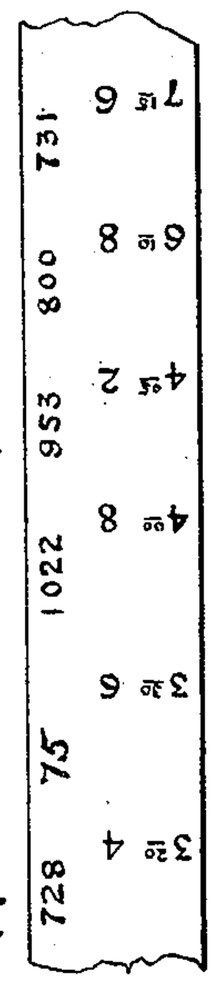

FIG. 5.

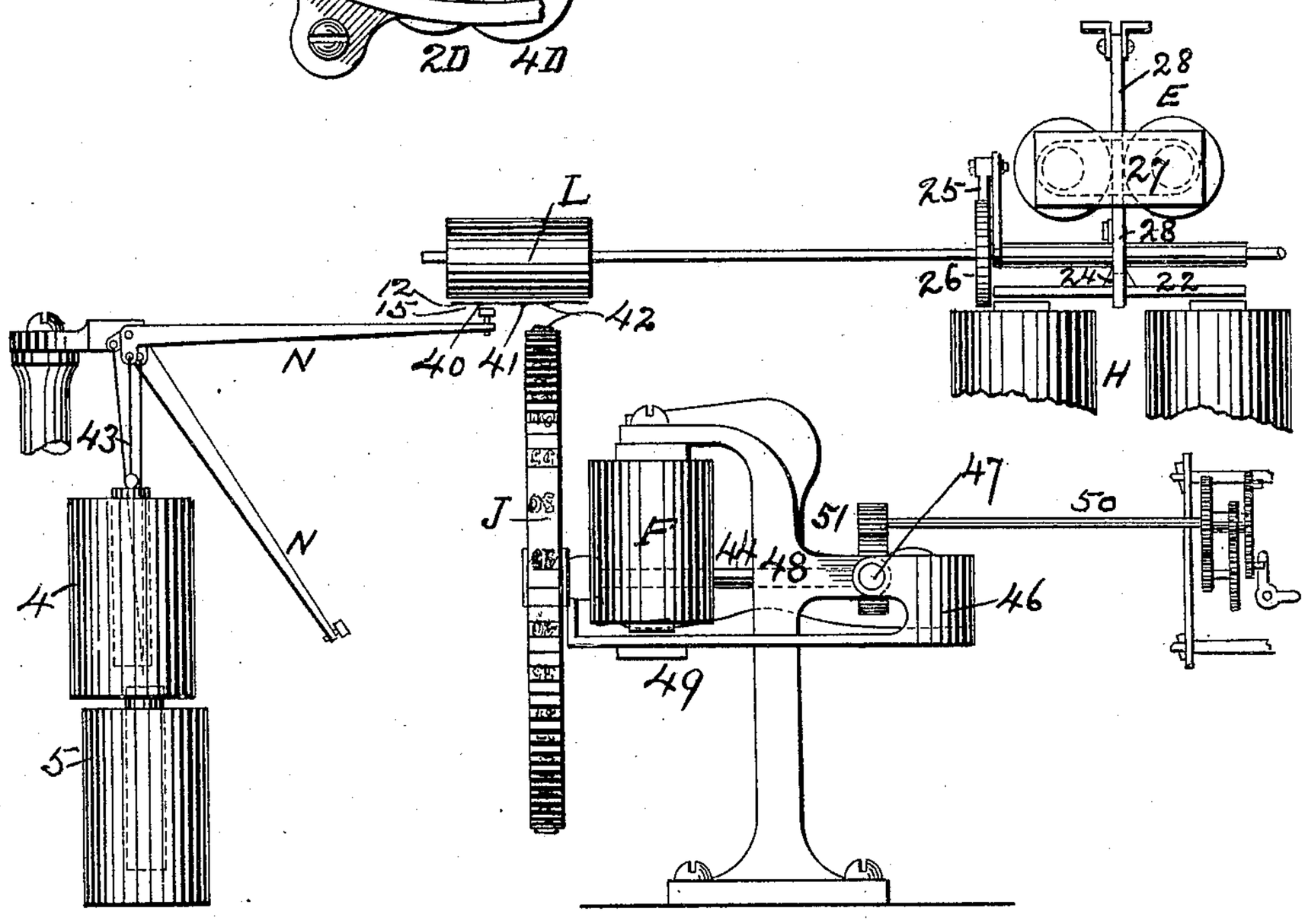

FIG. 3.

WITNESSES:

Lewis Searing.
George H. Somebody.

INVENTOR
Frank A. Walters
BY Harold B. Binney
ATTORNEY

(No Model.) 3 Sheets—Sheet 3.

F. A. WALTERS.

AUTOMATIC COAL RECORDING SYSTEM FOR RAILWAYS.

No. 553,632. Patented Jan. 28, 1896.

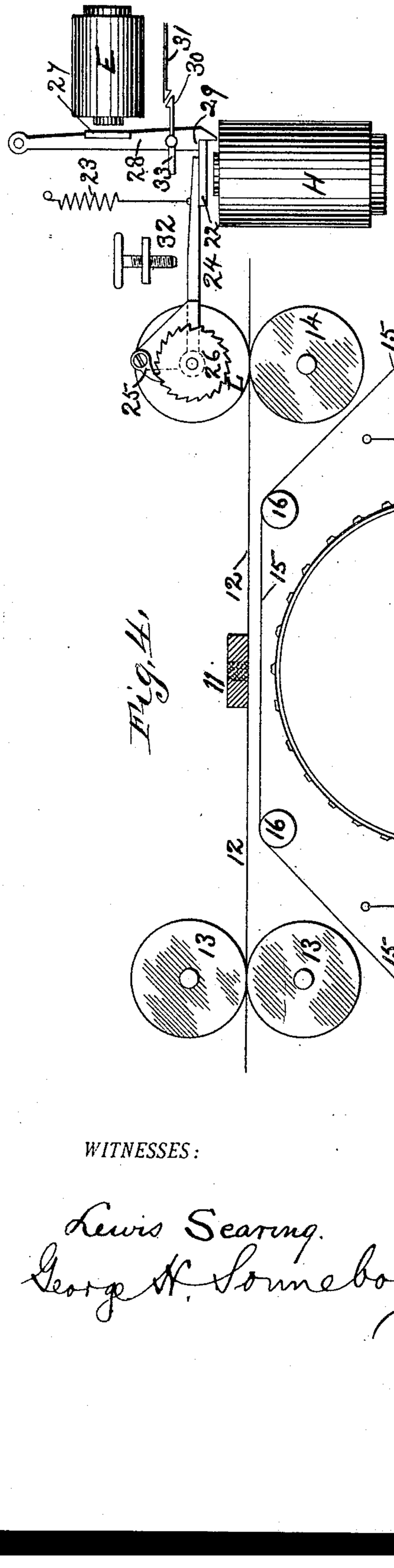

Fig. 4.

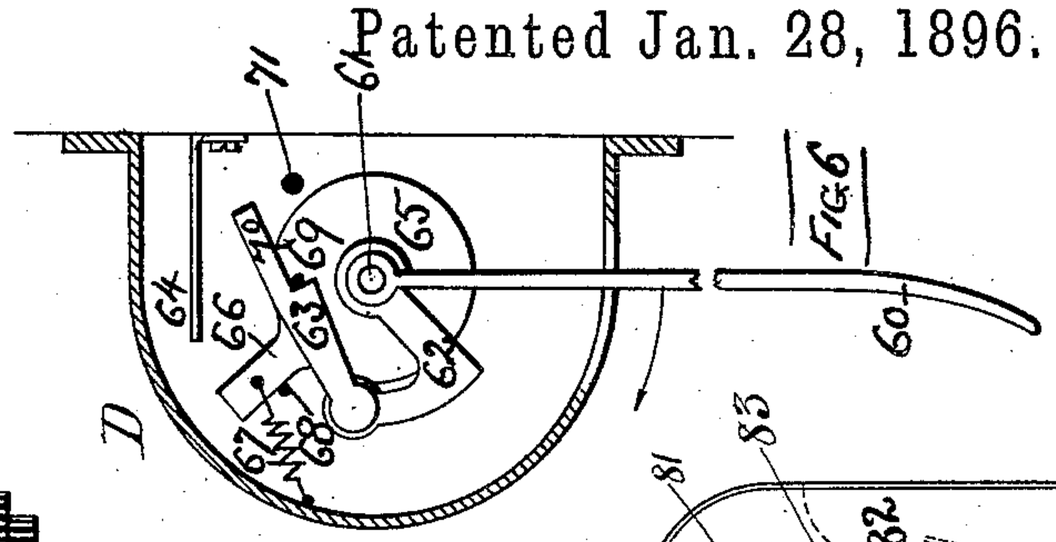

Fig. 6.

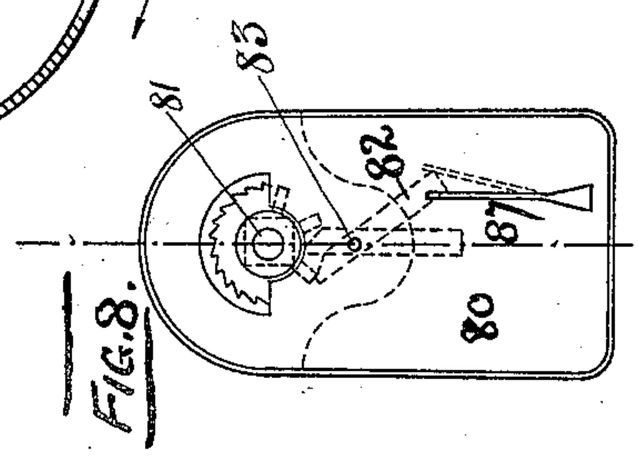

Fig. 8.

Fig. 7.

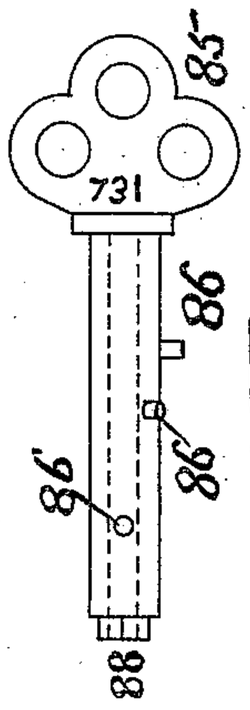

Fig. 9.

WITNESSES:

Lewis Searing.
George H. Sommeborn.

INVENTOR
Frank A. Walters
BY Harold Bimey
ATTORNEY

UNITED STATES PATENT OFFICE.

FRANK A. WALTERS, OF DENVER, COLORADO.

AUTOMATIC COAL-RECORDING SYSTEM FOR RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 553,632, dated January 23, 1896.

Application filed May 23, 1895. Serial No. 550,352. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. WALTERS, of Denver, Colorado, have invented a certain new and useful Automatic Coal-Recording System for Railways, of which the following is a description, referring to the accompanying drawings, which form a part of this specification.

All railway systems at present in use, so far as I am aware, require the engineer to deliver either to a man in charge at the station or into a box at the station a ticket indicating the number of tons taken for each engine at each loading. Various methods are used in connection with this system for checking, so that mistakes may be avoided and thefts of coal, either by the firemen or by other parties, prevented. Moreover, by keeping a record of the amount delivered to the firemen not only is the negligent waste of coal prevented, but a desire is created among the engineers and firemen to compete with each other in the economical use of coal in order that as good a showing may be made on the record as possible. As a matter of fact, the coal delivered to engines never equals the coal delivered to the coaling-stations. To some extent this is due to natural and unavoidable waste in handling. A far larger amount of waste may be traced to willful neglect or intentional falsification of records, for the engineers, knowing that the system is faulty, may give a ticket of less amount than that actually taken in order to make the record show up in their favor. Others, knowing it to be impossible to keep a just and correct record by this system, do not attempt to economize, believing that the record means nothing if they are faithful in other respects. Still others throw coal from the tender during the run to contribute it to the poor along the road. In some instances firemen have been known to throw away large lumps rather than take the trouble to break them up to the proper size for firing.

The object of the present invention is to effect, automatically, a complete recording of the amount of coal taken.

Under my invention the precise amount of coal, the number of the engine, and the time of day within two minutes and a half are recorded by a recording mechanism which is entirely out of reach of the engineers and firemen, and therefore not subject to their manipulation. The coal at the coaling-station is loaded into compartments or chutes of varying sizes to suit the requirements of the different sizes and types of engines, and the tonnage of each chute is accurately known. When the engineer has run his engine into position before a chute which holds the amount he wishes to take, he opens the mouth of the delivery-chute, causing the coal to be delivered directly into the tender of the engine. While this is being done, he records the number of his engine by means of buttons or other signaling device, or, preferably, by means of a key, of different design for each engine, which is inserted into a suitable keyhole and turned once around. By so doing the number of the engine is printed by the recording mechanism. When the apron of the chute is opened it automatically records the number of tons which that chute holds, and the time of day, so that at each coaling there is recorded the number of the engine, the time of day, and the amount of coal taken, and the record is out of reach of the engineer and fireman and cannot be tampered with.

The engineer must raise the apron to receive the coal, and in so doing the record of the time and the amount of coal taken is automatically made. He is required to give the number of his engine. If he fails to make this record or if he has lost the key he can report himself, and if not, the time of day shown by the record will indicate on comparison with the schedule what engine it was.

By this invention the engineer and fireman can have no object in falsifying the number recorded, and therefore a simple recording device worked by contacts similar to a typewriter and communicating electrically with the record-making mechanism amply suffices. I prefer, however, to employ in my system and under my method a key of simple form which automatically makes record of the number of the corresponding engine.

Of course under the invention various forms of apparatus may be invented to effect each part of the necessary steps of operation, and I desire to protect myself broadly for the method of automatically and simultaneously

recording the amount of coal taken, the time of day, and the number of the engine.

The accompanying drawings illustrate one embodiment of the invention.

In the drawings, Figure 1 is a diagrammatic illustration of the whole system, showing the various mechanisms and the connections for carrying out the method electrically. Fig. 2 is a plan view of the recording mechanism. Fig. 3 is a side elevation of the recording mechanism, showing, also, in part the mechanism for advancing the blanks or paper tape on which the record is made. Fig. 4 is a front elevation showing in part the apparatus for advancing or drawing the paper or other blank through the recording-instrument and the apparatus for operating the type-writer ribbon where a printed record of that form is employed. Fig. 5 shows one form of record as printed upon paper tape. Fig. 6 shows the automatic contact which is operated by the apron of the chute. Figs. 7, 8, and 9 are detail views of an automatically-operated contact device for recording the engine-number and the key for operating it.

Throughout the drawings like letters and numerals of reference indicate like parts.

In Fig. 1 the whole system is briefly illustrated. The tender of engine No. 75 is indicated in position for receiving the coal. From the delivery-chute A, which connects with a coal bin or chute filled with a definite weight of coal—for the sake of illustration, six tons, the amount which engine No. 75 requires. At B are shown the keys by which the engineer or fireman records the number of the engine. These keys are connected in common with a suitable battery, and the several keys, which correspond with the figures 1 2 3 4 5 6 7 8 9 0 are severally connected with ten solenoids (bearing reference-numerals 1 to 9, respectively, only 1 7 3 9 5, however, appearing in Fig. 1) operating ten type-bars which correspond. The engineer or fireman depresses in succession the keys 7 and 5, causing the number 75 to be recorded upon the tape. Thereupon he opens the apron C of the chute and the coal is delivered to the engine. By raising the apron or otherwise opening the chute there has been made a record of the time and the number of tons—six—which that chute holds. On the section of tape shown in Fig. 5 the complete record may be seen, as follows: "Engine No. 75, 3:30 o'clock, six tons." This is effected in the following manner: The raising of the apron C closes a switch at D, sending the current through the circuit *d* through solenoid 6^{b}, which prints the number "6" corresponding to the tons of the chute; thence through solenoid or magnet E, solenoid or magnet F, solenoid or magnet G or G′, (one or the other, according to the position of the switch *g*,) and finally through magnet or solenoid H back to the battery. The magnets G G′ serve only to advance the type-writing ribbon. The position of the switch *g* determines in which direction the ribbon shall move. The magnet F operates the printing-wheel J, which carries type corresponding to each five minutes of the twenty-four hours. The magnets E and H, when both are energized, as just described, cause the record-blank to be advanced three spaces to separate the record made for one engine from that made for the next engine. When, however, the magnet H is alone energized the record advances but one space, and it will be seen from the circuits that such is the case when one of the number-recording keys B is depressed. Take, for instance, the key 7. When this is struck current passes through the solenoid 7 and thence through one of the magnets G G′, switch *g*, and magnet H back to the battery.

The drums or spools K K′ carry the type-writer impression-ribbon and are operated by the magnets G G′, as will be described more in detail in connection with Fig. 4. The roller L operates the recording-tape and is actuated by the magnets H E, as will be described in detail in connection with Figs. 3 and 4.

Having described the arrangement of circuits by which the system is electrically operated, I will now describe, by reference to the remaining figures, the details of the various recording apparatus and devices.

Fig. 4 shows the arrangement of type-writer ribbon and record-tape. At J is shown the time-wheel, upon the periphery of which are placed rubber or other types corresponding with each five minutes of the twenty-four hours. Directly above this, and centrally arranged relatively to it, is the striking-pad 11. Across the face of this is drawn the recording tape or blank 12, which runs between and from the rollers 13 13 toward the roller L, which draws it along. The paper tape is pressed between the roller L and the roller 14, so that the motion of the roller L may by friction draw the paper across the striking-pad 11. The rollers 13 are adjustable, so that more or less tension may be applied and the paper 12 drawn more or less tightly across the pad 11. The type-writer ribbon 15 runs across the rollers 16 from the roller or spool K to the roller or spool K′, or in the reverse direction, according to the position of the switch *g*. (Shown in Fig. 1.)

If the ribbon is running from roller K to roller K′ the pawl 17 is raised so that the spool K may rotate in a right-handed direction as the ribbon is drawn off. Friction or other device is relied upon to give the proper tension to the ribbon. Each time the current passes through the magnet G′ it draws down the armature 19 against the action of the spring 20, drawing the pawl 18 to the left one tooth, and when the current is broken the spring 20, drawing up the arm 19, causes the pawl 18 to turn the ratchet 21, which is mounted upon the spool K′, and therefore advances the ribbon at each operation.

The record-tape 12 is operated by the magnets H and E as follows: When the magnet

E is not energized, the magnet H advances the record-tape a minimum amount, corresponding to one tooth of a ratchet feed. When the magnet H is energized it draws down its armature 22 against the action of the spring 23. The armature 22 is mounted upon the lever 24. This lever carries the pawl 25, as shown, and the pawl engages a ratchet 26 mounted upon and turning with the roller or reel L, which draws the recording-tape along. When the armature 22 is drawn down, the pawl 25 is withdrawn one tooth, and when the current is again broken the spring 23, drawing up the arm 24, turns the ratchet-wheel 26, advancing the tape a fixed minimum amount. When, however, both the magnets H and E are energized, a longer stroke is given to the pawl 25 and the recording-tape advances a greater distance, preferably three teeth of the pawl, corresponding to three spaces on the record. This is accomplished as follows: When the two magnets are energized, the magnet E, drawing upon its armature 27, moves the depending lever-arm 28 to the right until its shoulder 29 is clear of the armature of the magnet H. In this drawn-back or right-hand position a hook 30 upon the lever 28 engages the fixed hook 31, and holds the lever drawn back. In this position when the current is broken the armature and lever 22 24 of the magnet H are free to act through a greater distance for the shoulder 29 being drawn to the right the spring 23 is free to act upon the lever 24 and draw it up against the stop 32, allowing the ratchet 25 to make the longer stroke, as required. When, however, the arm 24 springs up under the action of spring 23, it strikes the rear end 33 of the hook 30, disconnecting it from the hook 31 and allowing the lever 28 to fall back against the armature 22, so that when the magnet H is again energized (whether with or without the magnet E) the shoulder 29 will resume its normal position before the armature 22 and restrict the motion of the arm 24 to minimum, which corresponds to the advance of the pawl 25 and the ratchet 26 one tooth only.

The printing device by which the impression is made upon the record-tape is shown in Figs. 2 and 3. The solenoids 1 2 3 4 5 6 7 8 9 0 actuate an equal number of corresponding type-bars N, which print the numbers corresponding to the engines as the finger-keys B are successively depressed. These magnets or solenoids are arranged in a circular line and all the type-bars center at the point 40, which is in the same plane and in line with the point 41, at which the tonnage is recorded, and the point 42 in the central plane of the type-wheel J, which records the time. It must be understood that the recording-tape and type-writer ribbon extend directly above these three central points, as indicated in Fig. 3, so that when the type-bars are struck, or the type-wheel raised against the ribbon, impression is made by the bars or wheel through the ribbon upon the paper against printing-pad 11, Fig. 4. The type-bars N may be of the form shown in Fig. 3, connected by the wire links 43 with the cores of the solenoids or magnets 1 2 3 4 5 6 7 8 9 0. The magnets may be arranged in two rows, alternating in order to save space, as seen in Fig. 3. Similar type-bars P are operated by the magnets or solenoids 2^D, 4^D, 6^D and 8^D. There should ordinarily be one of these type-bars P and solenoids 2^D, &c., for each number, capacity, arbitrary symbol, or other distinguishing feature by which the chutes or receptacles are rated or distinguished. These type-bars record the numbers, respectively, 2, 4, 6, and 8, giving the number of tons of corresponding chutes, and each of these solenoids or magnets is connected electrically with a circuit-closer or switch similar to that indicated at D, Fig. 1, which will be described more at length in connection with Fig. 6.

The type-wheel J is turned by clockwork and is raised to make its impression and print the time by means of the electromagnets F. The shaft or axis 44 of the type-wheel is mounted in bearings 45 in the horizontally-pivoted frame 46. The pivots of the frame 46 are shown at 47 and the standard or upright to which it is pivoted is shown at 48. This upright 48 forms a support or bracket for the solenoids or magnet F, which is so placed that it acts upon the armature 49 secured to the pivoted frame 46. When at rest, the type-wheel and its frame 46 are held by gravity in the lower position shown in the figure, but when the magnet F is energized it draws up the armature 49, causing the type-wheel J to strike upon the type-ribbon and recording-tape against the pad 11, printing the time upon the tape. The type-wheel J has two hundred and eighty-eight or one hundred and forty-four separate types, corresponding to each five minutes of twelve or of twenty-four hours, preferably the latter. The letters A and P may be used to indicate "A. M." or "P. M.," or heavy-faced type may be used for night and lighter-faced type used for day. This is of course a matter which is important, but it is in no way a part of the invention. The wheel J is turned by clockwork intermittently, so that in a period of five minutes it is advanced one type, and the type is therefore changed to correspond to the time. The motion is transmitted from the clockwork to the wheel J by means of a shaft 50 and the gear 51, which meshes with a gear on the shaft 44, though of course a ratchet or other feed may be employed.

In Fig. 6 is shown one form of automatic snap-switch D for making and breaking the circuit *d* which controls the time and tonnage printing devices. Mounted in a suitable casing is the metallic shaft 61 carrying the arm 60, which rests against the door of the chute, as shown in Fig. 1. Upon the same shaft is fixed the arm 62, to which is pivoted the piece or dog 63 provided with the projection

or tongue 70. Upon the same shaft 61, but freely turning upon it, is the disk or piece 65 provided with the contact 66. Normally this is held by the spring 67 against the stop 68. A fixed contact-spring 64 suitably insulated is connected so that when the contact 66 makes contact with it the circuit *d*, Fig. 1, will be closed. In the disk 65 is a pin 69, which is engaged by the dog 63, so that the arm 62 and shaft 61 cannot be turned to the right without turning the disk 65 and bringing the contact 66 against 64. When, now, the apron is raised, the arm 60 is turned to the left, as shown by the arrow, rotating the shaft 61, arm 62, and dog 63 right-handedly, turning the disk 65 and contact 66 with it, closing the circuit at 64. The instant the contacts 66 and 64 close, the tonnage of the chute and the time of day are recorded, as already explained. As the chute is farther opened, and the arm 60 pushed farther to the left, the tongue 70 comes against the stationary pin 71, and as the rotation continues the pin 71 raises the arm 63 out of contact with the pin 69, releasing the pin and the disk 65. The pin 69 and disk 65 being now free the spring 67 acts, snapping the contact 66 sharply to the left and breaking the circuit. When the apron of the chute is closed and the lever 60 returned to its normal vertical position, the dog 63 drops back into the position shown in Fig. 6, ready to be again actuated when the chute is next opened.

Figs. 7 and 8 show in central vertical section and in face view a device for automatically transmitting to the printing mechanism the number of each engine. In Fig. 9 the key is shown for engine 731. When this key is inserted and turned one revolution, the figures 731 are impressed on the recording-tape. The key is so arranged that when inserted it cannot be withdrawn or turned back until the complete revolution has been made, and the number correctly recorded. Within the housing or casing 80 is secured the central pin 81, which fits into an axial bore in the key, and upon which the key turns. Ten contact-pieces 82, corresponding to the ten units, are mounted upon the pin 83 between the insulating-plates 84. The shape of these contact-pieces 82 is indicated in Fig. 8. Each key 85, Fig. 9, is provided with studs or pins 86, so placed that when the key is properly inserted they come opposite the spaces between the insulating-plates 84, and are of such length that upon turning the key they successively strike the upper tips or tongues of the contact-pieces 82 and turn them, as shown in Fig. 8, bringing them successively into contact with spring-plates 87 and closing the circuit of the solenoid which prints, as described above, the corresponding number upon the recording-tape. The key 85 has a square or other angular head 88, which, when the key is inserted, fits into a registering recess in the ratchet-wheel 89, causing the ratchet-wheel to turn with the key. A pawl 90, engaging with the ratchet 89, prevents the key from being turned backward, while the pins 86, entering between the insulating-plates 84, prevent all possibility of withdrawing the key until the complete revolution has been made. By this means all possibility of an error in recording the number of the engine is done away with and the correctness of the record assured.

In the foregoing description of the several mechanisms and connections by which the system may be electrically operated I have illustrated but a single embodiment of the system. In the broader aspect of the invention it is of course not restricted to the precise means employed, as it would not in any way change the system if a different mechanism capable of operating in the same way were substituted for any one part or mechanism.

I have purposely omitted an enumeration of many modifications which have suggested themselves as carrying out the invention without departing from the principles involved, for to set these forth at length would obscure rather than make clear the more essential features; but

I claim and desire to secure by these Letters Patent of the United States, together with all such variations as may be made by mere skill in the art, and with such limitations as are expressed or by law implied in view of the related arts, the following:

1. The improved storage and recording system comprising the receptacles, chutes, or storage devices of determinate capacity, means for discharging the same, time recording mechanism, recording mechanism for the capacity, symbol, or other distinguishing feature, of the said receptacles, chutes, or storage devices, and means for actuating both the said recording mechanisms when each of the said receptacles, chutes, or storage devices is discharged, substantially as set forth.

2. The improved storage and recording system comprising the receptacles, chutes, or storage devices of determinate capacity, means for discharging the same, time recording mechanism, recording mechanism for the capacity, symbol, or other distinguishing feature of the said receptacles, chutes, or storage devices, and means for actuating both the said recording mechanisms when each of the said receptacles, chutes, or storage devices is discharged, and recording mechanism for arbitrary symbols to indicate the party discharging the same, whereby record may be made of the time of discharge, the storage device or capacity discharged, and the party so discharging it, substantially as set forth.

3. In combination with two or more chutes or receptacles and means for severally discharging the same, the same chutes or receptacles being rated, or distinguished by capacity, arbitrary symbol or other distinguishing feature, time recording mechanism com-

mon to all the said chutes or receptacles, operating connections for the said time-recording mechanism actuated by the discharge of each said chute or receptacle, recording mechanism for each said capacity, symbol, or other distinguishing feature, individual operating connections therefor, each acting upon the discharge of the corresponding chute or receptacle, and other recording mechanism for the number, symbol, or other distinguishing feature of the engine or party opening or discharging the said chute or receptacle, substantially as set forth.

4. In combination with two or more chutes or receptacles and means for severally discharging the same, the same chutes or receptacles being rated, or distinguished by capacity, arbitrary symbol, or other distinguishing feature, time recording mechanism common to all the said chutes or receptacles, operating connections for the said time recording mechanism actuated by the discharge of each said chute or receptacle, recording mechanism for each said capacity, symbol, or other distinguishing feature, and the individual operating connections therefor, each acting upon the discharge of the corresponding chute or receptacle, substantially as set forth.

5. In combination with two or more chutes or receptacles and means for discharging the same, the said chutes or receptacles being rated or distinguished by capacity, arbitrary symbol, or other distinguishing feature, a recording mechanism for each said capacity, symbol, or distinguishing feature, individual operating connections therefor, each automatically actuated upon the discharge of the corresponding chute or receptacle, and other recording mechanism for the number or other distinguishing symbol of the engine or party discharging such chute or receptacle, substantially as set forth.

6. An electrically-operated recording mechanism, an electric circuit and source of energy therefor, and an apron or other relatively moving body, in combination with a circuit controller containing the following elements:—a movable contact actuated by the motion of the said relatively moving body and connected with the said circuit, a co-operating contact also connected with the said circuit, a spring for separating the said contacts, and a release for the said spring also actuated by the motion of the said body, whereby a single movement of the said body may both open and close the said contacts and control the said circuit and recording mechanism, substantially as set forth.

7. In combination in a recording device, actuated by a key, the key provided with record making projections 86, the electric contacts actuated by the said projections, the insulating plates 84 with spaces between for the passage of the said projections, and means for preventing the turning of the key in a reverse direction, substantially as set forth.

8. In combination in a recording device, actuated by a key, a key provided with a projection or head 88, a ratchet 89, engaging the said head of the key, a pawl for the said ratchet, and means for preventing the withdrawal of the key when partly turned, substantially as set forth.

In testimony whereof I have hereunto set my hand this 13th day of May, A. D. 1895.

FRANK A. WALTERS.

Witnesses:
CHARLES M. EINFELDT,
LEWIS SEARING.