L. J. R. HOLST.

PHOTOGRAPHIC PRINTING MACHINE.

APPLICATION FILED OCT. 23, 1914.

1,205,632.

Patented Nov. 21, 1916.

4 SHEETS—SHEET 1.

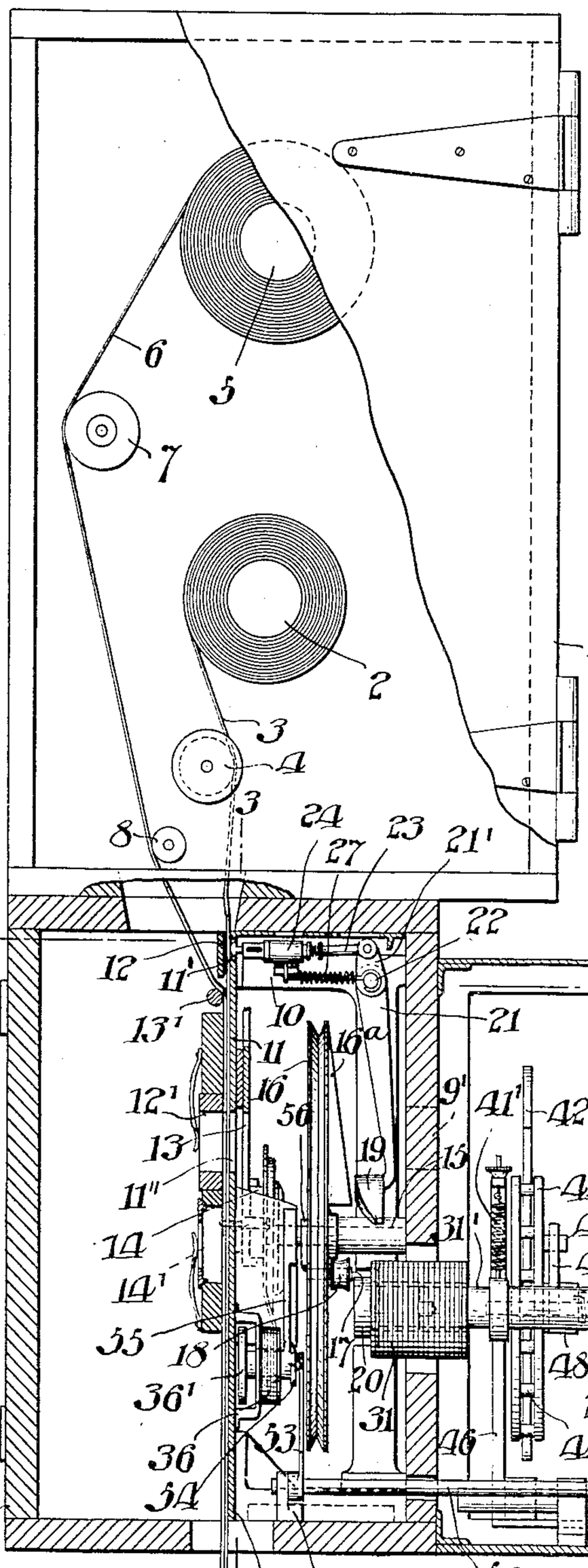

Fig. 1.

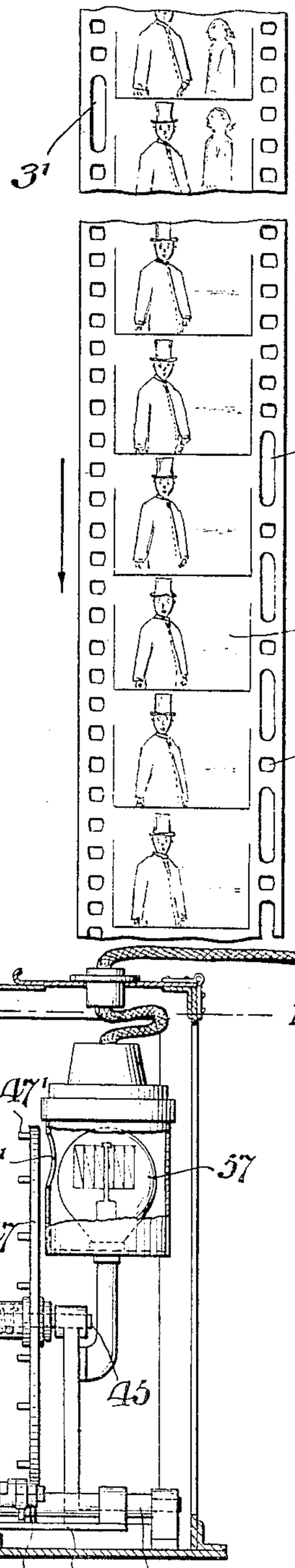

Fig. 1a.

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Marjory D. Graf

INVENTOR:

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4 SHEETS—SHEET 2.

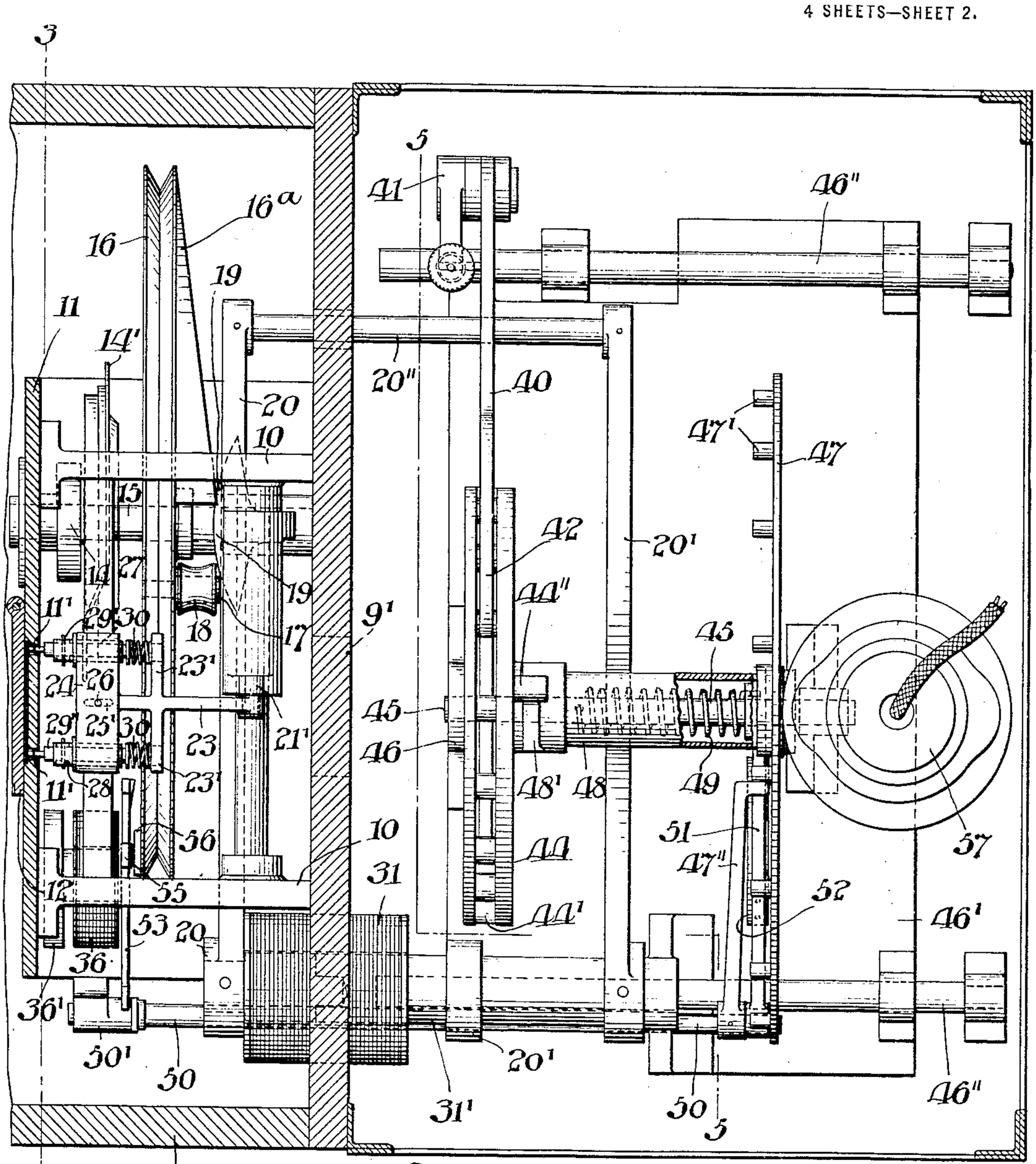

Fig. 2.

Fig. 1b

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4 SHEETS—SHEET 3.

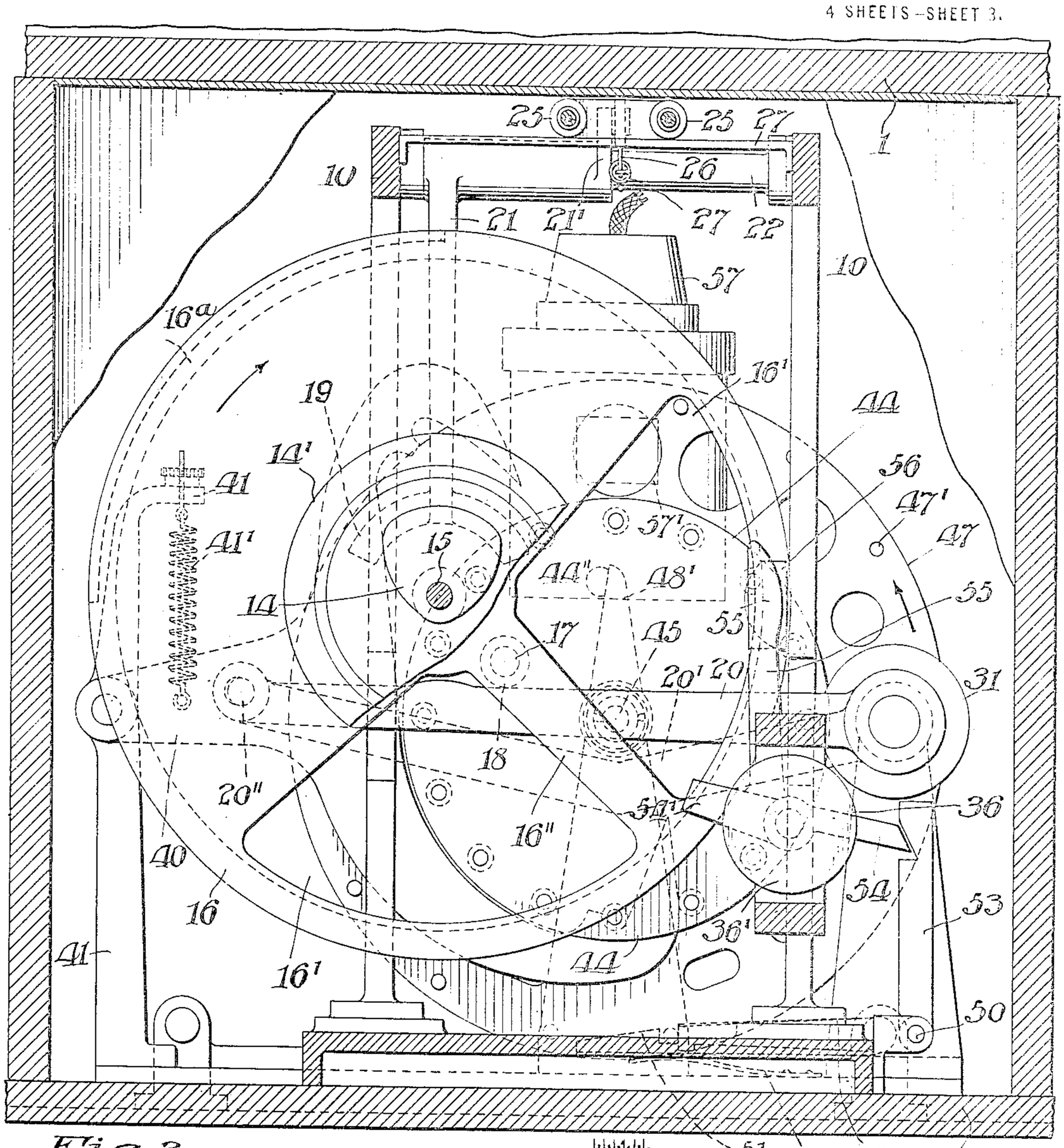

Fig. 3.

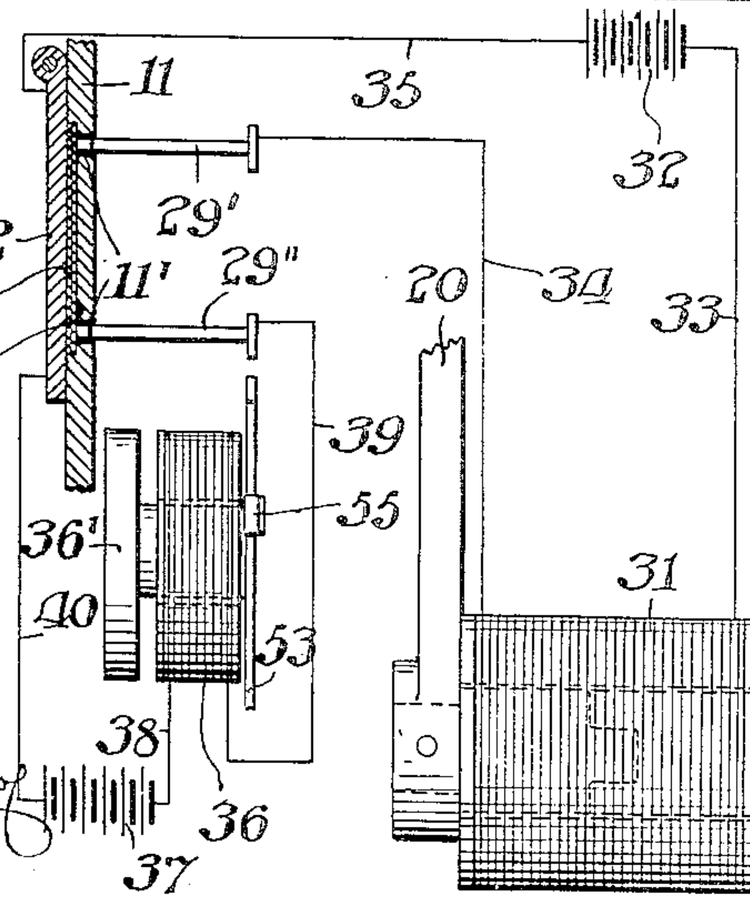

Fig. 4.

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4 SHEETS—SHEET 4.

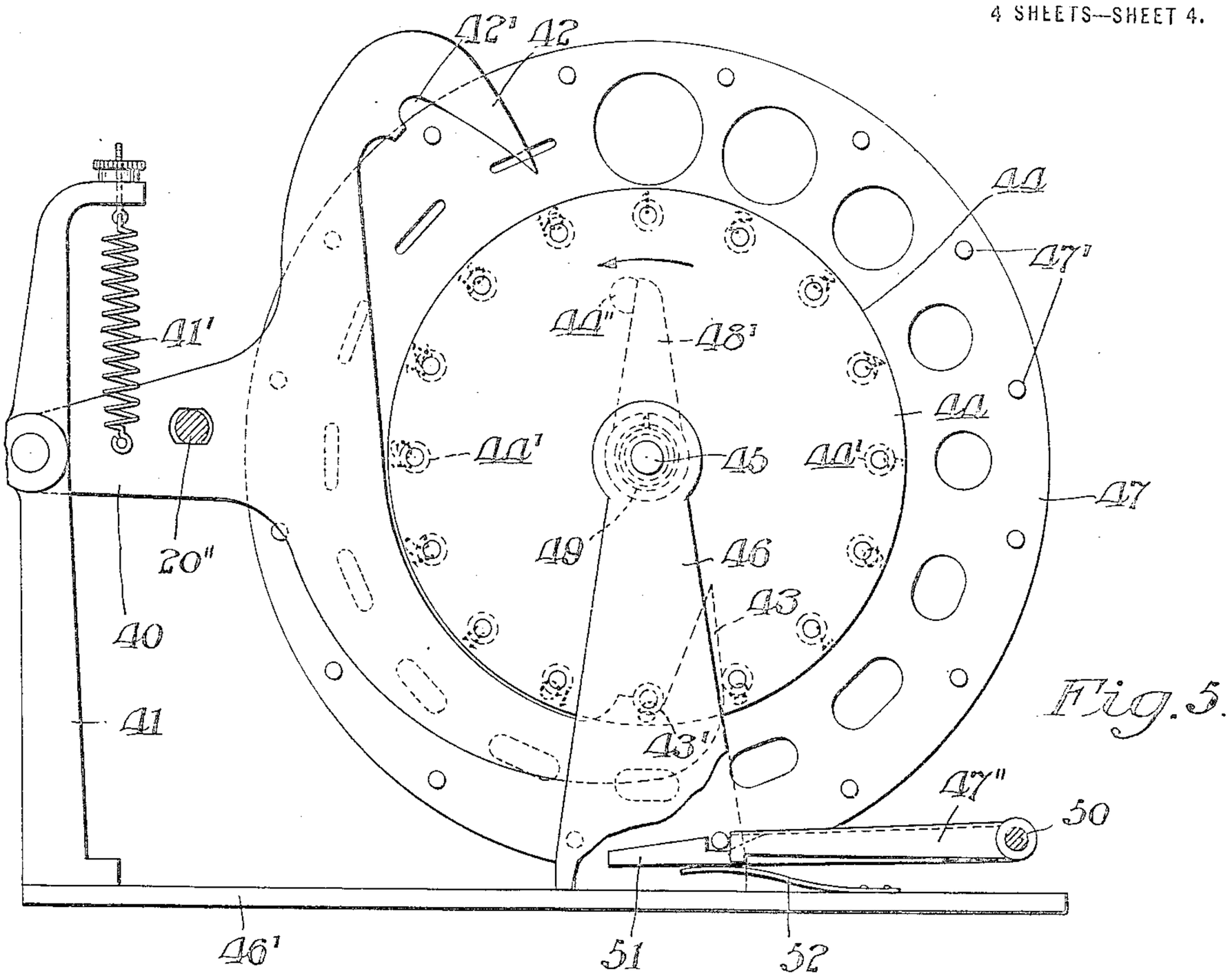

Fig. 5.

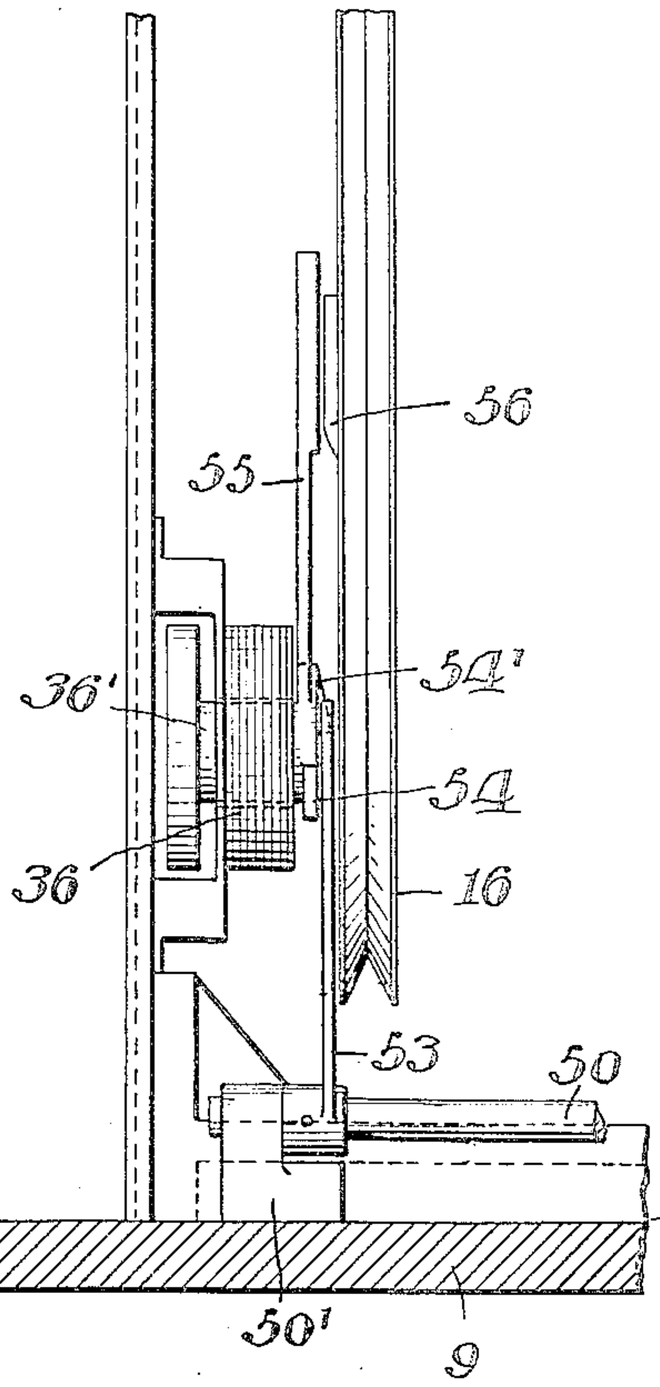

Fig. 6.

WITNESSES:

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ATTORNEY.

UNITED STATES PATENT OFFICE.

LODEWYK J. R. HOLST, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO LUBIN FILM COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

PHOTOGRAPHIC-PRINTING MACHINE.

1,205,632. Specification of Letters Patent. Patented Nov. 21, 1916.

Application filed October 23, 1914. Serial No. 868,185.

To all whom it may concern:

Be it known that I, LODEWYK J. R. HOLST, a citizen of the United States, residing in the city of Philadelphia, county of Philadelphia, and State of Pennsylvania, have invented certain Improvements in Photographic-Printing Machines, of which the following is a specification.

My invention is designed primarily for use in printing motion pictures, and its leading purpose is to obviate the necessity for printing separately and then joining together the several scenes which together form a picture story, but it will be evident that the invention is adapted for more general use.

Where several negatives are made separately under varying conditions of light and exposure, as is requisite in most instances in producing motion pictures, it has been necessary, in order to obtain satisfactory positive prints from such negatives, to make such prints separately so that the intensity of the light can be regulated in accordance with the density of the several negatives, the requisite printing light intensity being determined usually by test exposures as a guide in making the several positive prints separately.

The improvements of my invention contemplate, in the preferred form, joining the several negatives or negative sections together in proper relation, in accordance with test exposures, and providing such sections with special perforations, by means of which, in the operation of printing, an electric circuit or circuits are closed and mechanism operated thereby to automatically regulate the intensity of the light to that desired or in accordance with the density of the negative section to be printed.

The invention, as illustrated in the accompanying drawings, is adapted to a particular type of machine, but it will be understood that the design of the machine may be changed within the scope of the invention.

In the drawings, Figure 1 is a sectional elevation of the machine embodying my improvements; Fig. 1ª is a section of a motion picture film perforated or slotted for use therein; Fig. 1ᵇ is an enlarged sectional view of details of construction shown in Fig. 1; Fig. 2 is an enlarged sectional view taken on the line 2—2 of Fig. 1; Fig. 3 is an enlarged sectional view taken on the line 3—3 of Figs. 1 and 2 with the partition between the lamp and printing housings broken away; Fig. 4 is a sectional elevation of diagrammatical character illustrative of electrical mechanism comprised in the improvements; Fig. 5 is a broken sectional view taken on the line 5—5 of Fig. 2; and Fig. 6 is a broken sectional elevation of detached details of construction.

The machine, as illustrated in the drawings, comprises the case 1 containing the reel 2 from which the sectional negative film 3 is drawn over the roller 4, and the reel 5 from which the film 6 is drawn over the rollers 7 and 8.

The case 9, on which the case 1 is supported, contains the frame 10, which supports the plate 11 provided with the apertures 11′ and 11″ together with the doors 12 and 12′ adapted to close thereover. The doors 12 and 12′ coöperate with the plate 11 in guiding the negative film 3 across the apertures 11′ and 11″ as the film is drawn through the machine by the usual feeding device 13 operated by the cams 14 and 14′ fixed on the journaled shaft 15. The film 6 upon which the positive images are to be exposed through the negative film 3 is guided over the rollers 7, 8, and 13′ and makes contact with the negative film after having passed this latter roller. The positive film 6 is fed through the machine simultaneously with the negative 3 and by the same propelling mechanism.

A belt driven shutter wheel 16, which is fixed on and drives the shaft 15, contains the equal apertures 16′ separated by the spoke 16″. This wheel, a half or more of which is closed, is coördinated with the cam 14 so that when the end of the downward movement of the film by the cam has been effected the shutter wheel moves from a position covering the aperture 11″ to one uncovering

the same. The wheel 16 is provided with a pin 17 carrying a roller 18 and with a cam 16a. The pin is adapted to engage for about 90 degrees of its movement and during the period of exposure a cam 19, and the roller 18 is adapted to engage a bar 20 which is movable into the path thereof by mechanism hereinafter described and removable from said path by the cam 16a.

The cam 19 is fixed on the arm 21 which is connected with an arm 21', these arms being fulcrumed on the shaft 22. A bar 23, having the transversely projecting arms 23', connects the arm 21' with a block 24 which is movable on the supporting plate 25 attached to the frame 10, the block being provided with a pin 26 movable in the slot 25' in the plate 25 and connected by a spring 27 with the shaft 22. Insulating bearings 28 are carried in the ends of the block 25 and bolts 29' and 29'', having their forward ends in the apertures 11', are adapted to reciprocate in the block, the bearings being provided with the slots 28' and the bolts with the pins 29' movable therein. Springs 30 are disposed between the arms 23' and the heads of the bolts 29' and 29'' to move the latter forward and permit them to move backward within the bearings 28, and the spring 27 acts to hold the cam 19 in the path of the pin 17. The cam 14, causes the film strips to move downwardly in an intermittent manner, and is so placed with respect to the opening in the shutter wheel 16 that when the opening uncovers the printing aperture 11'' the film strips are at rest. During this period, the forward ends of the pins 29' and 29'' will rest against the negative film 3 if it presents its normal perforations, whereas either of these pins will pass through the film and rest against the metal door 12 in case the negative presents one of its special elongated perforations 3' or 3'' before them. The action of the spring 27 withdraws both these pins from contact with the film or with the door 12 before the film feeding mechanism operates to bring the succeeding picture before the printing aperture.

A solenoid 31 and any source of electric energy 32 are connected by the conductor 33, the solenoid being connected with the bolt 29' by a conductor 34 and the battery 32 being connected with the door 12 by a conductor 35. This circuit is automatically closed when slots 3'' of the negative film register with the bolt 29' so that the latter can make contact with the door 12.

A solenoid 36 and any source of electric energy 37 are connected by a conductor 38, the solenoid being connected with the bolt 29'' by the conductor 39 and the source of electric energy being connected with the door 12 by the conductor 40. This circuit is automatically closed when registering slots 3' of the films, during printing periods or periods of rest, register with the bolt 29'' and the latter engages the door 12.

The bar 20 and the downwardly bent lever 20', fixed together by the rod 20'', are fixed to the anchor 31' of the solenoid 31 which, when excited, moves these parts toward the wheel 16 and carries the bar 20 into the plane of the roller 18, the roller acting to depress the rod.

An escapement lever 40 is fulcrumed on the standard 41 and engaged by the rod 20'' which moves therethrough, and connected with a spring 41' which is anchored to the standard so as to tend to hold the lever elevated and elevate it when depressed by the rod. The lever is provided with the pallets 42 and 43 having the respective notches 42' and 43' at their bases, in the form of a usual escapement. A lantern wheel 44, provided with the trundles 44' adapted to be engaged by the pallets 42 and 43 and by the notches 42' and 43', is fixed on an arbor 45 journaled in the bearings or standards 46 on a carriage 46', the latter being movable on the ways 46'' and the wheel being intermittently advanced and locked by the reciprocation of the escapement lever 40.

A light disk 47, provided with graduated apertures numbered from 1 to 16 inclusive and corresponding in number with the trundles of the lantern wheel and with the pins 47' respectively disposed between adjacent apertures, has fixed thereto a sleeve 48 mounted concentrically in the arbor 45. The sleeve 48 is provided with an arm 48' adapted to engage a pin 44'' on the wheel 44. A spring 49 has one end fixed to the arbor 45 and the other to the sleeve 48, permitting a limited movement of the wheel 44 relative to the disk 47. When the arm 40 is depressed so that the tooth 42 engages and moves a roller 44' into the notch 42', tension is applied to the spring 49, which in turn applies force to the disk 47 tending to turn it in the direction of the arrow. The disk is normally held against the action of this spring by the engagement of a pin 47' thereon with a dog 47'' fixed on a shaft 50, which is journaled in the bearings 50'. A catch 51 is loosely mounted on the shaft 50 and supported by a spring 52 to cause it to engage any one of the pins 47', which makes contact with the dog and prevents backward movement of the light disk 47. When the locking dog 47'' is elevated to disengage the wheel 47, the latter, when subject to force communicated through the spring 49 under tension due to advancing the wheel 44, will be thrown forward until the arm 48' engages the pin 44''.

The shaft 50 has fixed on the opposite end

thereof an arm 53 (Figs. 3 and 6) adapted to be engaged and rocked by an arm 54 on the anchor or armature 36′ of the solenoid 36, the anchor also having fixed thereon an arm 55 which lies in the path of the cam or knocker 56 on the wheel 16 when the solenoid is excited. The knocker is arranged to engage the arm 55, at the end of an exposure, for the purpose of causing the arm 54 to act through the arm 53 and shaft 50 to elevate the door 47″, whereupon the spring 49 causes the disk 47 to be thrown forward to bring a succeeding light aperture (of area corresponding to the density of the next film section) into position during the period that the shutter obturates the exposure aperture 11″, the disk 47 being stopped by the engagement of the arm 48′ with the pin 44″ and locked in this position by the dog 51. When this has been effected, the circuit containing the electro-magnet 36 is broken and the armature 36′ is moved back by the engagement of the cam 56 with the arm 54′, thereby permitting the dog 47″ to again lock a pin 48″ of the wheel 47.

The lamp 57 is preferably of the glowing filament type and the light therefrom is projected through the aperture 57′ thereof, the aperture of the light disk 47 registering therewith, the aperture 9′ between the printing and lamp cases, an aperture 16′, of the disk 16, and the aperture 11″ of the plate 11 upon the films.

The apertures 1 to 16 of the light disk vary in area preferably so that from the smallest to the largest the succeeding apertures are 1.2 times as high as the preceding ones; those that are more than $\frac{5}{8}$″ in height are preferably made circular and those of less height are preferably made $\frac{5}{8}$″ in width. These apertures of varying area are designed to pass the amount of light required for the different densities of the various negative film sections.

In order to compensate for variations in the power of the light, which can be found by test, the carriage 46′, with the mechanism thereon, is moved along the ways 46″ so that the distance of the lamp from the film may be varied as required to produce the established standard intensity of the light.

The mechanism having been adjusted and the test prints of the negative sections having been obtained, these sections are joined together, with a leader attached to the first section. This leader and the successive film sections are then provided with the slots or elongated perforations 3′ and 3″ required to operate the light disk 47. If, for instance, the first section should require that the light be passed through aperture No. 6, five elongated holes are formed on the left side of the leader and one hole is formed on the right side of the first film section at a distance above the first image thereof equal to the length of the images between the apertures 11′ and 11″ less one. These slots or perforations, in the leader, by causing the circuit to be closed through the solenoid 31, cause the bar 20 to be drawn under the roller 18 and thereby to depress the arm 40, which is followed by the breaking of the circuit before the next forward movement of the films and the shifting of the bar 20 by the cam 16ª for each of the five perforations through which the circuit of the electro-magnet 31 is closed. Thus the wheel 44 is moved five steps forward. The slot on the right in the first negative section effects the release of the light disk during the period that the first picture of the first section moves into position registering with the opening 11″ in the plate 11 by closing the circuit through the solenoid 38. If thus the light disk has previously been placed at opening 1, it has been shifted by the described operations to opening 6 when the first picture of the first scene was exposed.

Assuming that the second section has a density requiring opening number 13 to be used, the wheel 42 will be turned by means of slots in the left side of any part of scene one whereas the single hole 3′ in the correct position on the right of section two releases the disk 47 in time to print the first image of scene two through opening 13.

It is to be understood that the number of holes required on the left side of each section, in order to bring the proper light aperture of the disk into position for the next section, is found by subtracting the number of the aperture in operative position from the number of the next one to be placed in position. If the latter number be lower than the first one, the number 16 is first to be added to the same and the subtraction made from the sum so obtained. That is to say, if the active aperture be number 6 and the next one to be used is number 4, add 16 to 4 and subtract 6, which indicates that fourteen holes must be turned in order to bring aperture 4 into operative position after aperture 6 has occupied such position. Furthermore, it will be understood that it is quite immaterial in which part of a preceding section the left hand holes for the advance of the wheel 44 are located, inasmuch as the light disk 47 will only follow the advance of the wheel 44 when liberated at the proper moment by the elongated hole in the right hand side of the succeeding section.

Having described my invention, I claim:

1. In a photographic printing machine, means for feeding a film, adjustable mechanism for regulating the light passing

therethrough to said film, and automatic means for variably adjusting said mechanism proportionately to the density of the film.

2. In a photographic printing machine, means for feeding a film, a movable device for regulating the light passing to said film, and means for automatically moving said device variable predetermined distances proportionately to irregular differences of density between successive sections of said film.

3. In a photographic printing machine, the combination of revoluble shutter mechanism, a source of light, a device having apertures adapted for regulating the amount of light passed from said source of light through said shutter mechanism, and means comprising an electric circuit whereby said device is operated to change the aperture disposed between said source of light and shutter when the latter cuts off the light from said film.

4. In a photographic printing machine, revoluble shutter mechanism, a lamp, an apertured device revoluble between said lamp and shutter mechanism, means whereby said shutter mechanism turns said apertured device and changes the aperture through which light is passed, and electro-magnetic mechanism whereby said means last named are brought into operative relation.

5. In a photographic printing machine, a shutter wheel, a lamp, a revoluble apertured device for passing light from said lamp through said shutter wheel, and means for operating said device by said shutter wheel, said means comprising a film, means for feeding said film across the path of light from said lamp through said apertured device and through said shutter wheel, and an electric circuit controlled by said film.

6. In a photographic printing machine, revoluble shutter mechanism, a lamp, a revoluble device having graduated light apertures adapted to be selectively disposed between said lamp and shutter mechanism, and means for operating said device, said means comprising a circuit and a photographic film for controlling said circuit whereby said apertured device is adjusted to pass a predetermined amount of light.

7. In a photographic printing machine, the combination with a film, of means for feeding said film, a device having a plurality of light passages for regulating the light passing to said film, and automatic means controlled by said film for selectively positioning non-consecutive passages aforesaid to pass light to said film.

8. In a photographic printing machine, the combination with a film comprising sections having different densities and perforations of varying character corresponding to said different densities, of film guiding means, mechanism for feeding said film, a lamp for projecting light on said film, a revoluble device containing apertures of different areas movable between said lamp and film, and means comprising an electric circuit normally held open by said film and adapted to be closed through said perforations, whereby said device is automatically operated by the corresponding character of said perforations to set apertures thereof adapted for passing the amount of light required for printing said film sections.

9. In a photographic printing machine, means for feeding a film, means for guiding said film, a lamp, a shutter wheel adapted for periodically interrupting light projected from said lamp upon a film carried by said guiding means, a revoluble device containing apertures of different areas movable across said lamp so as to regulate the amount of light projected thereby on said film, means for turning said device, a device carried by said shutter wheel for operating said means last named, and electro-magnetic mechanism adapted to be controlled by said film for controlling the relation between said last named means and the device of said shutter wheel for operating the same.

10. In a photographic printing machine, the combination with a film having sections of different densities and perforations corresponding to said densities, of film guiding means, means for feeding said film through said guiding means, an electric circuit adapted to be automatically closed through perforations aforesaid, a lamp, a revoluble device containing apertures adapted for regulating the amount of light passing from said lamp to said film, means for giving a step by step motion to said device for the purpose of changing the apertures thereof to pass the light required for printing, a revoluble device normally out of engagement with said means, and mechanism controlled by said circuit whereby said means last named is moved into position to be operated upon by said device last named.

11. In a photographic printing machine, a lamp, a revoluble device containing apertures of graduated sizes movable across said lamp, mechanism whereby said device is adapted to be turned to shift the apertures thereof, mechanism adapted for locking said device in various positions to be occupied thereby, means comprising a circuit containing an electro-magnet whereby said mechanism first named is shifted, a revoluble wheel having a device adapted for operating said mechanism first named in one position thereof, and mechanism comprising an electro-magnet for unlocking said device synchronously with the operation of said mechanism first named.

12. In a photographic printing machine, a film having sections of different densities, means for intermittently feeding said film, a shutter adapted for cutting off light from said film during the movements thereof, a circuit having devices separated by said film to open it and connected through said film to close it, a rocking mechanism, a device on said shutter for operating said mechanism, means comprising an electro-magnet in said circuit for moving said mechanism into and out of position to be operated by said device, a wheel operated by said mechanism, a light disk having graduated apertures, means whereby said wheel turns said disk, holding means for said disk, a second circuit having devices separated by said film to open it and connected through said film to close it, and means comprising an electro-magnet in said last circuit for releasing said holding means.

13. In a photographic printing machine, a film having sections of different densities and perforations corresponding thereto, means for feeding said film, a shutter adapted for cutting off light from said film, a circuit having devices separated by said film to open it and connected through said film to close it, a ratchet mechanism, a device on said shutter for operating said ratchet mechanism, means comprising an electro-magnet in said circuit and a cam on said shutter whereby said ratchet mechanism is brought into and moved out of operative relation with said device, means comprising a revoluble device containing graduated apertures operated by said ratchet mechanism, and a lamp for projecting light on said film through said apertures.

14. In a photographic printing machine, a film having sections of different densities and means for feeding said film, circuits controlled by said film, a lamp, a revoluble device having graduated apertures for passing predetermined amounts of light from said lamp to said film, and means comprising one of said circuits whereby said device is operated to permit the passage of light to said film corresponding to the densities of said sections and means comprising another of said circuits for controlling said operating means.

15. In a photographic printing machine, a film having sections of different densities, means for feeding said film, a circuit controlled by said film, a lamp, a device for passing predetermined amounts of light from said lamp to said film, and means comprising an adjustable stop controlled by said circuit whereby said device is adjusted for passing light to said film corresponding to the densities of its said sections.

16. In a photographic printing machine, a film having sections of different densities, means for feeding said film, circuits controlled by said film, a lamp, a device for passing predetermined amounts of light from said lamp to said film, and means controlled by said circuits whereby said device is adjusted for passing light to said film corresponding to the densities of said sections, said last named means comprising solenoids controlled by said circuits and mechanisms under control of said solenoids whereby said device is adapted to be alternately locked and operated.

17. In a photographic printing machine, a lamp, a revoluble disk containing graduated apertures for passing light from said lamp, locking means for holding said disk, a ratchet mechanism, flexible mechanism through which said ratchet mechanism is adapted to turn said disk, a film, means for feeding said film, a revoluble shutter, and means whereby said film releases said locking mechanism, said means comprising a rock arm, and means comprising a device on said shutter for rocking said arm.

18. In a photographic printing machine, a lamp, a revoluble disk containing graduated apertures for passing light from said lamp, disk operating mechanism comprising a spring adapted to be put under tension, locking mechanism for holding said disk, a film, means for feeding said film, a shutter revoluble between said disk and film, and means whereby said film and shutter operate said operating and locking mechanisms.

19. In a photographic printing machine, a lamp, a revoluble disk containing graduated apertures for passing light from said lamp, disk operating mechanism comprising a spring adapted to be put under tension, locking mechanism comprising a dog for holding said disk, a film, means for feeding said film, a shutter revoluble between said disk and film, an electric circuit controlled by said film, an electro-magnet in said circuit, means controlled by said electro-magnet for operating said locking mechanism, and a device carried by said shutter for operating said means last named.

20. In a photographic printing machine, a lamp, a revoluble disk containing graduated apertures for passing light from said lamp, disk operating mechanism, locking mechanism for said disk, a film, means for feeding said film, an electric circuit controlled by said film, an electro-magnet in said circuit, an armature for said electro-magnet and a lever thereon, said lever being movable by said armature into and out of engagement with said locking mechanism, and a revoluble device for operating said lever when in engagement with said locking mechanism.

21. In a photographic printing machine, film feeding mechanism, a device for regulating the light passing to said film, means comprising a circuit containing a contact for

actuating said device, and means for moving said contact toward and from the path of said film.

22. In a photographic printing machine, means for feeding a film, a device for regulating the light passing to said film, mechanism for operating said device, means for holding said device against the action of said mechanism, and means controlled by said film for releasing said device.

23. In a photographic printing machine, a light regulator, mechanism for operating said light regulator, driving means, means for moving said mechanism into the path of said driving means, and a device connected with said driving means for moving said mechanism from the path of said driving means.

In testimony whereof I have hereunto set my name this 17th day of October, 1914, in the presence of the subscribing witnesses.

LODEWYK J. R. HOLST.

Witnesses:
Jos. G. Denny, Jr.,
C. N. Butler.