P. C. RALPH & W. PINCH.

AUTOMATIC SWITCH OPERATING MECHANISM.

APPLICATION FILED MAY 1, 1909.

991,087.

Patented May 2, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

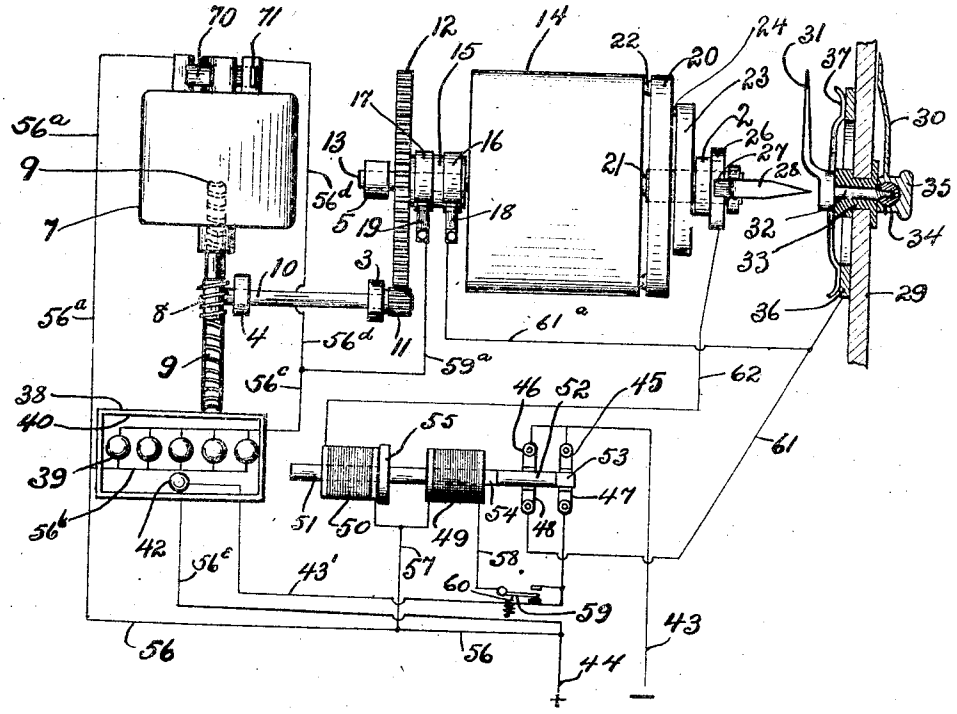
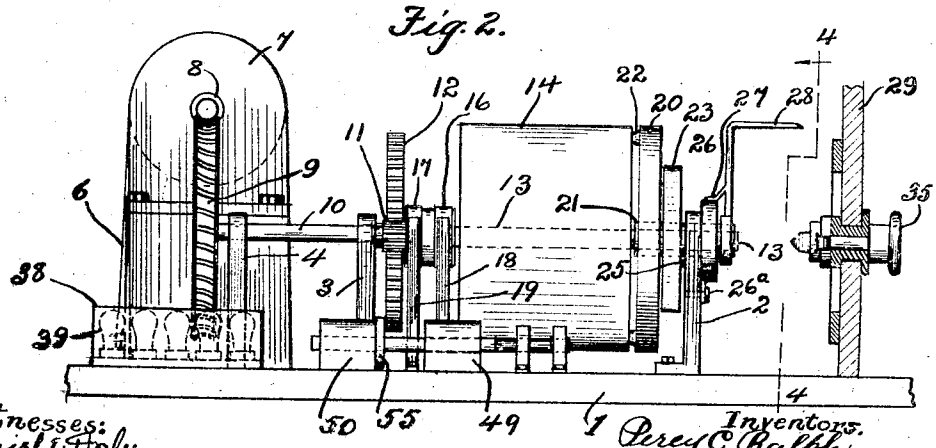


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

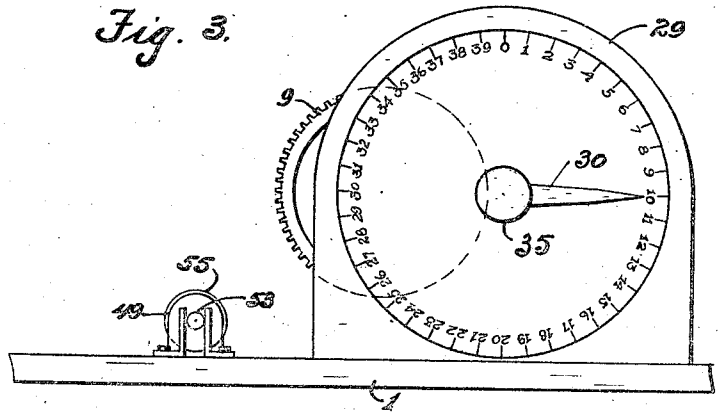


Fig. 4.

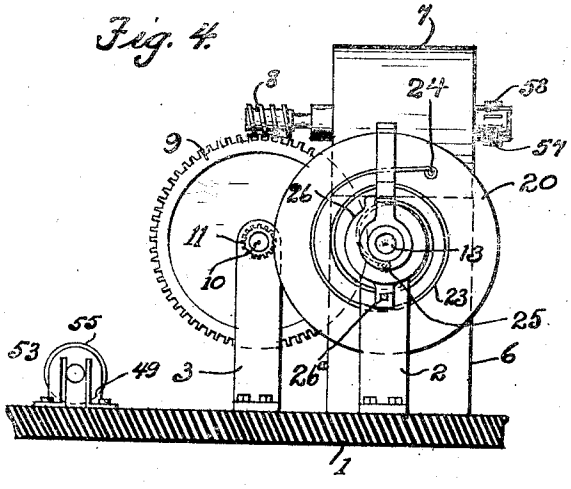
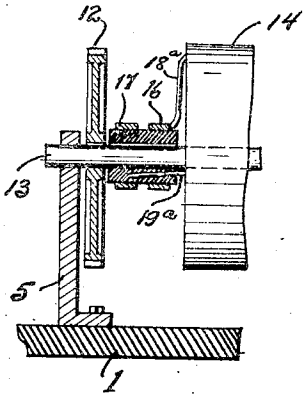


Fig. 5



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UNITED STATES PATENT OFFICE.

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AUTOMATIC SWITCH-OPERATING MECHANISM.

991,087. Specification of Letters Patent. Patented May 2, 1911.

Application filed May 1, 1909. Serial No. 493,275.

To all whom it may concern:

Be it known that we, PERCY C. RALPH and WILLIAM PINCH, citizens of the United States of America, and residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Automatic Switch-Operating Mechanism; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same.

This invention relates to improvements in automatic switch operating mechanism and particularly adapted for use with photographic printing machines for timing the length of exposures.

The object of the invention is to provide a machine of the character referred to which is simple in construction, automatic in operation, and which will give an exposure dependent upon and inversely proportional to the strength of the light.

Generally speaking the invention may be defined as consisting of the combinations of elements embodied in the claims hereto annexed and illustrated, in one embodiment, in the drawings forming part hereof.

In the accompanying drawings Figure 1 represents a somewhat diagrammatic plan view of an apparatus constructed in accordance with the invention. Fig. 2 represents a side elevation of the apparatus shown in the preceding figures, the negative support being omitted for clearness of illustration. Fig. 3 represents a front view of a part of the front of the machine. Fig. 4 is a section on line 4—4, Fig. 2. Fig. 5 is a detail view, mostly in section, of the connections between the conducting rings and the terminals of the electro-magnet 14.

In carrying out the invention, the essential parts of the machine are mounted in any convenient form of cabinet, but this is omitted from the drawings for clearness of illustration.

Describing the parts by reference characters, 1 denotes a bed plate, preferably of insulating material, on which the various parts of the apparatus are supported. This bed plate is provided with suitable standards 2, 3, 4 and 5, for a purpose to be described hereinafter, and with an upwardly projecting casing 6 upon which there is mounted an electric motor 7 of any approved construction, said motor being provided with a worm shaft 8 and meshing with a worm gear 9 on a shaft 10 supported by the standards 3 and 4. For convenience of description, that end of the apparatus on which the motor 7 is mounted will be referred to hereinafter as the "rear" end and the opposite end as the "front-end". The front end of the shaft 10 is provided with a pinion 11 meshing with a gear 12 on a shaft 13 which is supported at its rear end by the standard 5 and at its front end by the standard 2. The shaft 13 has mounted thereon an electro-magnet 14.

15 denotes an insulating sleeve with conducting rings 16 and 17 mounted thereon with which the brushes 18 and 19 respectively are in engagement. By reference to Fig. 5, it will be seen that the terminals of the electro-magnet 14 are led to the rings 16 and 17 in such a manner as to permit the rotation of said rings and of the electro-magnet without any interference between said terminals and the brushes. In front of the electro-magnet is an armature 20, which is rigidly mounted upon a non-conducting sleeve 21 loose upon the shaft 13. The armature is provided with a plurality of rearwardly projecting buttons or spacers 22 of non-conducting material, which prevent the armature from "freezing" to the magnet. A coil spring 23 is connected at one end to the armature 20 as by means of a stud 24, and has its other end connected to some fixed part of the apparatus, for instance the standard 2, as shown at 25. In front of the standard 2, the sleeve 21 has mounted thereon a conducting ring 26 against the surface of which a spring finger 27 bears, said finger being carried by the forwardly projecting contact member 28. This conducting ring is loosely mounted on the sleeve 21 being secured against rotation thereon to standard 2, shown at 26^a.

In front of the contact finger 28 is a dial 29, carried by the front of the base plate 1. This dial, as will appear from Fig. 3, is provided with a series of equally spaced numerals and with an indicating finger 30 which is rotatably mounted on said dial and which co-acts with the numerals in a manner to be explained hereinafter.

31 denotes a contact finger which is mounted on the rear side of the dial. Indicating member 30 and contact finger 31 are connected so as to move in unison. For the purpose of securing such connection and

to insulate these members from each other, member 31 may be provided with a shaft 32 extending through an insulating bushing 33 in the dial 29. At its front end the shaft 32 is shown as threaded into a suitable piece of insulating material 34 in the hub 35 on which the indicating finger 30 is mounted.

36 denotes a ring of conducting material mounted on the dial 29 and adapted to be engaged by oppositely extending springs 37 carried by the hub of the contact finger 31.

38 denotes a casing which may be applied to the lamps 39, these lamps being the actinic lamps that are provided for printing purposes and being referred to hereinafter as the "printing" lamps. Any suitable number of these lamps will be employed. The case 38 will be provided with an opening 40 on which the negative is placed when printed.

42 denotes a lamp having an orange or red shade. This lamp may be made use of for the purpose of centering the sensitized paper or other material employed in printing and will be referred to hereinafter as the "inspection" lamp.

With the apparatus thus far described, I employ electric circuits for automatically energizing the printing lamps 39, for placing in operation the motor and the shaft 13 with its appurtenances, and for automatically suspending the operation of said lamps, motor and shaft after subjecting the negative and sensitized material to a predetermined light exposure. These circuits are illustrated in Fig. 1, wherein 43 and 44 represent positive and negative conductors leading to any source of electrical energy (not shown). Conductor 43 is connected to the contacts 45 and 46. These contacts are spaced from oppositely arranged contacts 47 and 48 and the arrangement of parts is such that when the circuit is closed between contacts 45 and 47 it will be broken between contacts 46 and 48, and vice versa. For effecting this result and for the purpose of accomplishing other results to be pointed out hereinafter, I employ a pair of solenoids 49 and 50 having a common core 51. This core is provided with an extension which fits between contacts 45 and 47, and 46 and 48. This extension consists of an insulating rod 52 carried by the core 51 and having at one end thereof a circuit-closing segment 53 and at its opposite end a circuit-closing segment 54. The core 51 is also provided with a stop disk 55 which, when the coil 50 is energized, will limit the movement of the core toward said coil and which will in a similar manner limit the movement of the core toward the coil 49 when the latter coil is energized. The coils and the disk 55 are so arranged that when the core is at one limit of its movement, the circuit closing segment 53 closes the circuit between the contact members 45 and 47 and when the core 51 is at the opposite limit of its movement the circuit closing segment 54 is interposed between contacts 46 and 48 and closes the circuit therebetween.

The general arrangement of wiring is as follows,—The conductor 44 is connected to one terminal of the solenoid 49 and to one terminal of the solenoid 50 by a wire 56 and a wire 57 which has a branch to each solenoid and the conductor 44 is also connected to one terminal of the printing lamps 39 by the wire 56 and a wire 56^b and to one terminal 70 of the motor by wires 56 and 56^a and one terminal of the inspection lamp by wire 56^c. To the other terminals of the printing lamps 39 is connected a wire 56^c which branches, a part 56^d going to the terminal 71 of the motor and a part 59^a going to the contact 19. A wire 61 is connected to the ring 36 and to the contact point 48. A wire 61^a extends from the contact 18 to the wire 61. A wire 62 extends from the ring 26 to the other terminal of the solenoid 50. A wire 58 extends from the other terminal of the solenoid 49 to the contact 47 and in this part of the circuit is arranged a switch 59 which is normally held open by means of a spring 60. A wire 43′ connects the other terminal of the inspection lamp with the contact 47.

With the parts arranged as described, the operation will be as follows,—the parts being shown in the drawings in the position which they occupy previous to the starting of the printing operation. The negative having been applied to its frame or casing with the sensitized material applied thereto, the operator closes the switch 59. Some of the current flowing through the conductor 43 and the contacts 45 and 47 is shunted through the solenoid 49. This energizes the solenoid and throws the core 51 to the right, until stop 55 engages the solenoid 49. This movement of the core immediately breaks the circuit through the lamp 42 and closes the circuit between the contacts 46 and 48 through the segment 54. Current then flows through the conductor 43, contacts 46 and 48, conductors 61 and 61^a to brush 18 then through the winding of the electro-magnet 14, brush 19 and conductor 59^a, where it is divided, part of the current going to the motor 7 through branch 56^d, brush 71 and brush 70 and conductors 56^a and 56 and part of the current flowing through branch 56^c to the lamps 39, thence through the conductor 56^b to conductor 56 to 44. The lamps 39 are illuminated and the motor 7 is driven. By means of the reduction in speed effected by worm 8, worm gear 9, pinion 11 and gear 12, the shaft 13 is rotated slowly. This energizing of the electro-magnet 14 causes the armature 20 to turn with said electro-mag-

net on the shaft 13, and through the sleeve 21 with which the armature is rigidly connected, and to rotate the contact finger 28. It will be understood that the indicating member 30 has been previously set to such position with reference to the numbers on the dial as will correspond with the light-exposure to be given other sensitized material. As soon as the contact finger 28 engages the contact finger 31, the circuit of the circuit-changer is closed through 43, 46, 48, 61, ring 36, springs 37, finger 31, finger 28, ring 26, conductor 62, solenoid 50, conductors 57 and 56, back to 44. This at once energizes the solenoid 50 and shifts the core to the position shown in Fig. 1, thereby breaking the circuit of the printing lamps 39 at contacts 46 and 48, immediately stopping the operation of the motor and the parts driven thereby and immediately illuminating the inspection lamp. The rotation of the armature 20 has however wound up the spring 23. As soon as the magnet 14 is deënergized by the breaking of the circuit in the manner just described, the sleeve 21 is free to rotate and the spring 23 restores the armature 20 and contact finger 28 to initial or starting position.

From the above description it will be apparent that, when the circuit, including the printing lamps 39, is established, the circuit including the inspection lamp 42 is broken, and vice versa. Furthermore, as the speed of the motor 7 (and consequently the length of exposure) is dependent upon the amount of current supplied to the motor, it will be apparent that my apparatus automatically provides for a longer or shorter exposure of the negative to the action of the printing lamp according as the current is weak or strong and hence according as the said lamps are illuminated fully or incompletely.

It will be apparent that the solenoids 49, 50, contacts 45, 48, and core 51 with segments 53, 54, constitute an electric circuit making and breaking device whereby the printing circuit is broken simultaneously with the closing of the inspection-lamp circuit and whereby the printing, motor and magnet circuits are automatically broken as soon as the circuit through solenoid 50 is closed by the engagement of contact fingers 28 and 31. Furthermore, the motor 7, shaft 13 with its self-adjustable finger 28 and the adjustable contact finger 31 and the circuit including said contact fingers and the circuit-closing device constitute a timing device whereby the length of the exposure of the paper or other sensitized material to the action of the printing lamps may be determined.

What we claim is:—

1. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, an electric motor in the said circuit, a timing device driven by said motor, a second electric circuit, an inspection lamp therein, and electrically operated mechanism arranged to break the first circuit and close the second circuit when the timing device has been moved a predetermined distance by the motor.

2. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, an electric motor in shunt with said circuit, a shaft driven by said motor, an electro-magnet on said shaft, an armature for said magnet loosely mounted on said shaft, a spring connected with said armature, a contact member movable with said armature, an adjustable contact member with which the former contact member is adapted to engage, a circuit-breaker for the lamp circuit, and a circuit including said circuit breaker and said contact members.

3. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, an electric motor, a shaft driven by said motor, an electro-magnet on said shaft, an armature for said magnet loosely mounted on said shaft, a contact device movable with said armature, an adjustable contact member with which the former contact member is adapted to engage, a circuit-breaker for the lamp circuit, a circuit including said circuit breaker and said contact members, and means for restoring the armature to initial position.

4. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, an electric motor, a shaft driven thereby, an electro-magnet mounted on said shaft, an electric circuit including said magnet, an adjustable contact member, an armature for said magnet loosely mounted on said shaft, a second contact member movable with said armature and adapted to engage with the former contact member, a circuit breaking device, an electric circuit including said device and said contact members and arranged to break the lamp, motor and magnet circuits when said contact members are in engagement, and means for restoring said armature and the second contact member to initial position.

5. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, an electric motor, a shaft driven thereby, an electro-magnet mounted on said shaft, an electric circuit including said magnet, an adjustable contact device, an armature for said magnet loosely mounted on said shaft, a second contact member movable with said armature and adapted to engage with the former contact member, a third electric circuit, an inspection lamp therein, a circuit making and breaking device, an electric circuit including

said device and said contact members and arranged to break the printing lamp, motor and magnet circuits when said contact members are in engagement and to close the inspection lamp circuit, and means for restoring said armature and the second contact member to initial position.

6. In a photographic printing machine, the combination of an electric circuit, a printing lamp therein, a motor, a shaft driven thereby, an electro-magnet mounted on said shaft, an armature loosely mounted on said shaft, a contact member movable with said armature, an adjustable contact member with which the former member is adapted to engage, an electric circuit including the terminals of the electro-magnet, a circuit breaker, and an electric circuit including said circuit breaker and said contact members, said circuit breaker being arranged to break the three first-mentioned circuits when said members are in engagement.

7. In a photographic printing machine, the combination of an electric circuit, an inspection lamp therein, a second electric circuit, a solenoid therein, a switch actuated by said solenoid and arranged to break said first-mentioned circuits and simultaneously close a third circuit a motor and printing lamp in said last-mentioned circuit, a shaft operatively connected with said motor, an electromagnet mounted on said shaft, an armature for said magnet loosely mounted on said shaft, a contact finger rotatably movable with said armature, a second adjustable contact member with which the finger will engage when the finger is rotated by the motor, thus closing a fourth circuit having a solenoid therein which by its action restores the first circuit again and a coil spring for restoring said armature with attached contact member to initial position after same has been rotated by the motor.

8. In a photographic printing machine, the combination with an electric circuit, an inspection lamp therein and in action when the machine is inactive, a second electric circuit adapted to energize a revolving magnet arranged in said circuit, the magnetism thereof to attract a rotatable armature and cause said armature to rotate with said magnet, a motor for driving said magnet and a timing device comprising a finger secured to said armature, a second finger adjustably mounted in proximity to said first finger so that said first finger will contact therewith when revolved by the armature, a pointer secured to said second mentioned finger and adapted to move therewith, a dial arranged in proximity to said pointer and means for restoring the armature and first-mentioned finger to their initial position when the motor circuit is broken.

Signed by us at Cleveland, Ohio, this 31st day of August, 1908.

PERCY C. RALPH.
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Witnesses:
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