No. 768,334.

PATENTED AUG. 23, 1904.

W. J. LLOYD & G. WRIGHT.

BREAKER FOR ELECTRIC CIRCUITS.

APPLICATION FILED JULY 8, 1902. RENEWED JAN. 23, 1904.

NO MODEL.

5 SHEETS—SHEET 1.

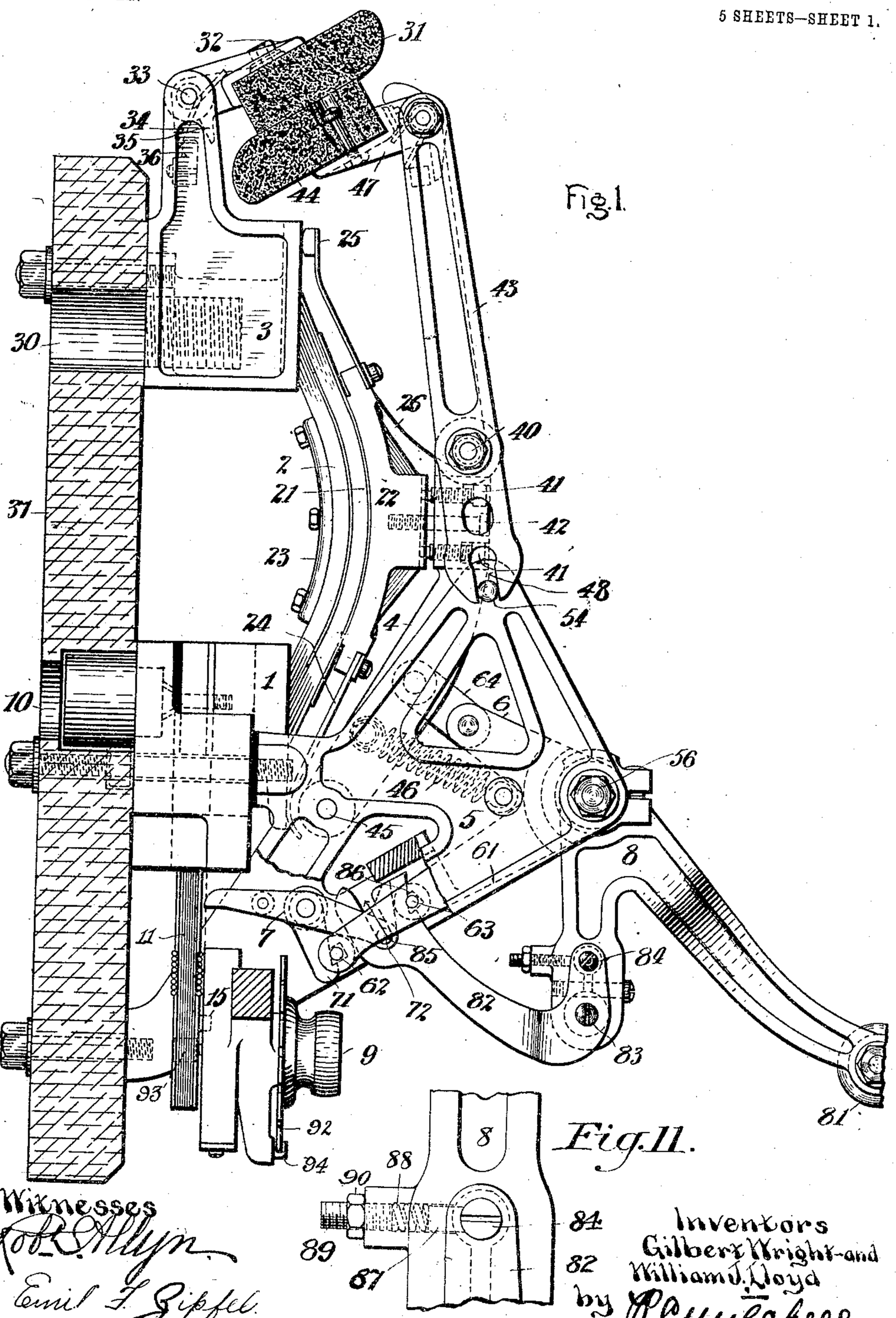

Fig. 1.

Fig. 11.

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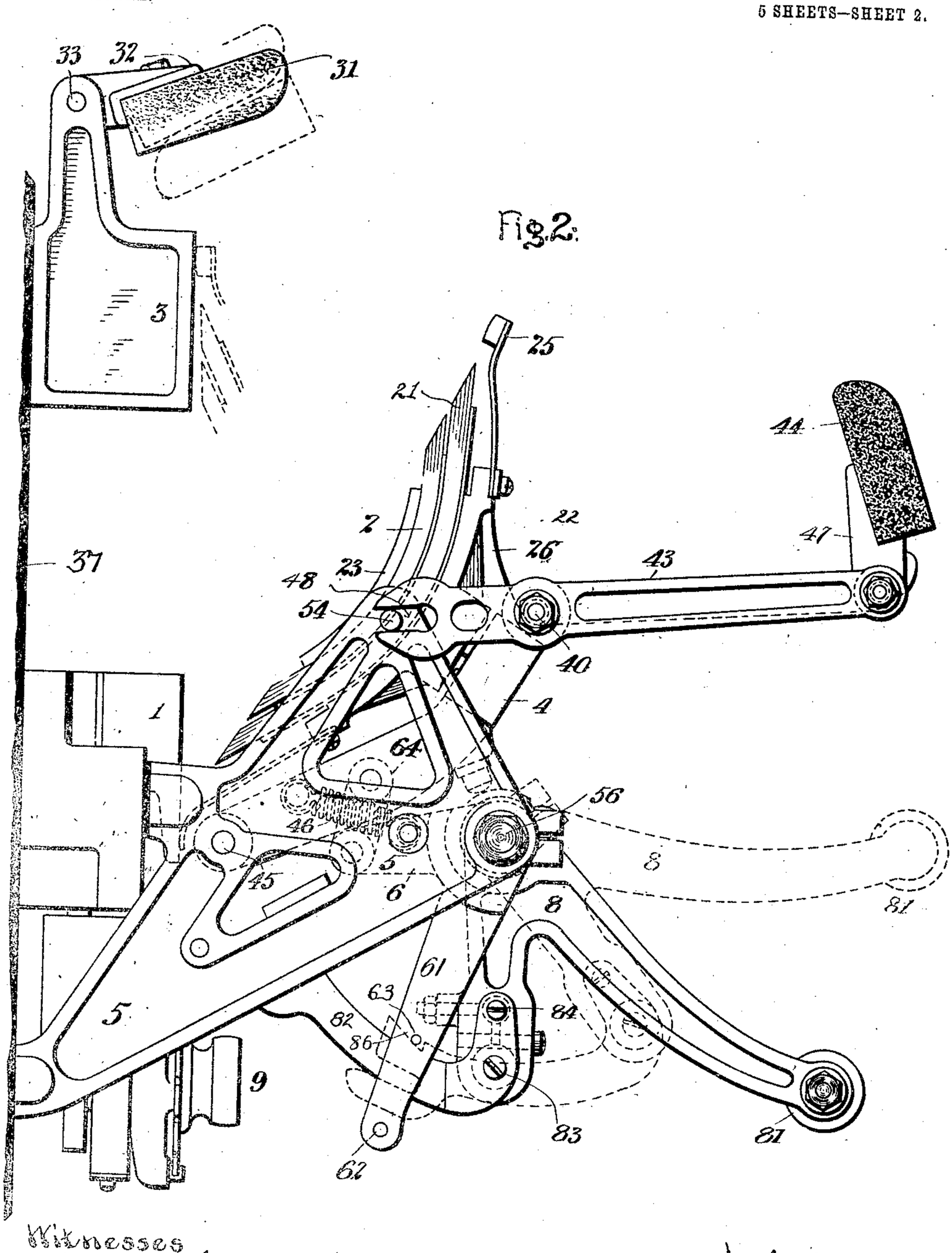
NO MODEL. 5 SHEETS—SHEET 2.

Fig. 2.



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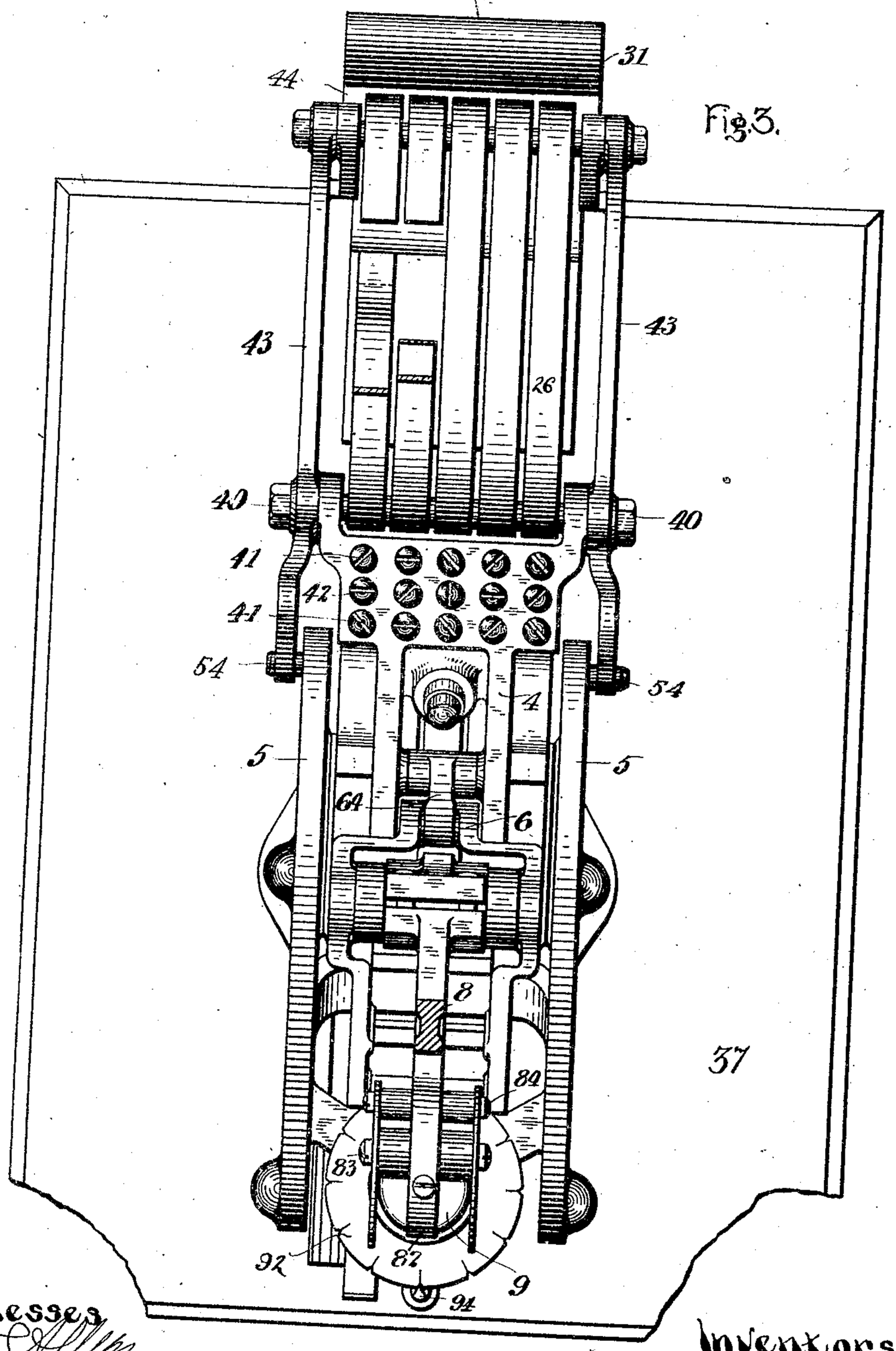
5 SHEETS—SHEET 3.

Fig. 3.



Witnesses
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NO MODEL.

5 SHEETS—SHEET 4.

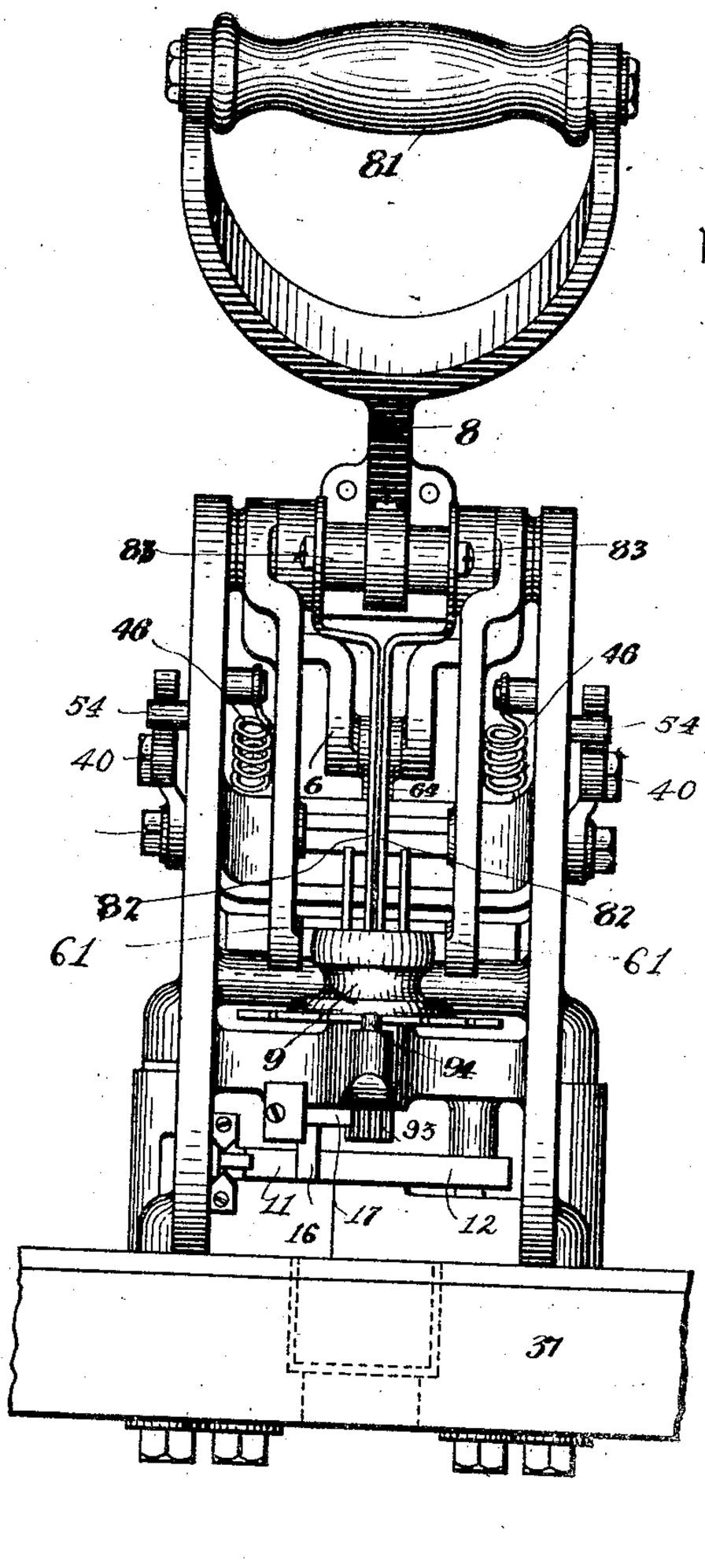

Fig. 4.

Witnesses
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NO MODEL.

5 SHEETS—SHEET 5.

Fig. 5.

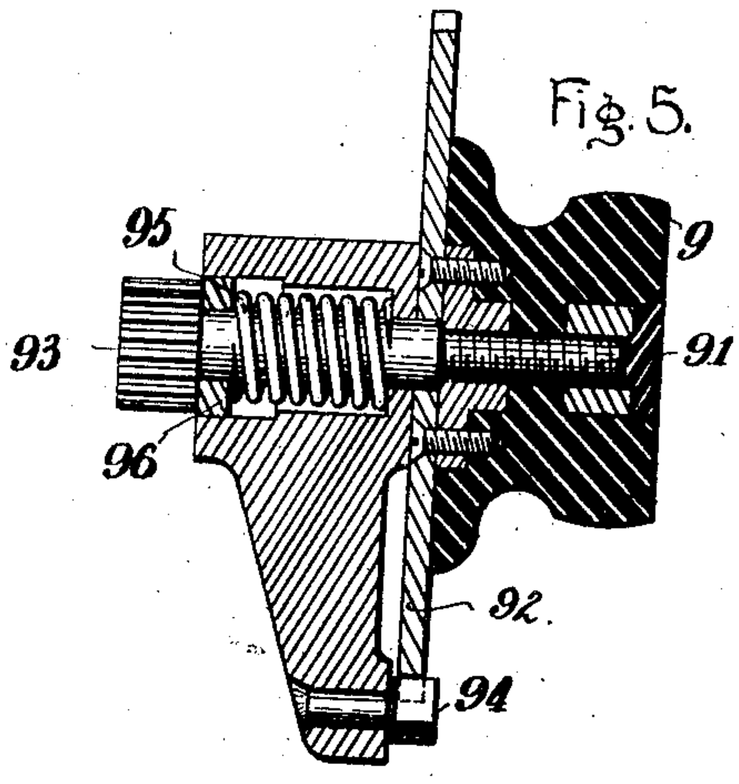
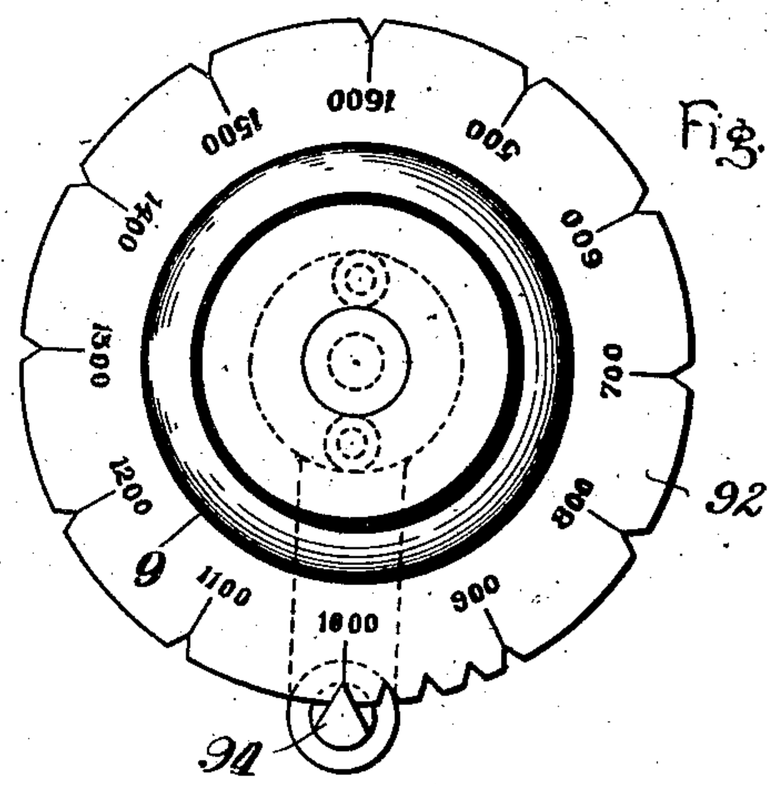


Fig. 6.



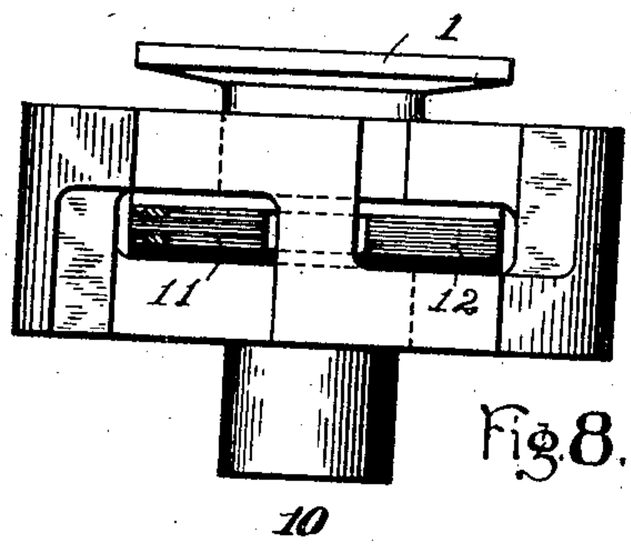


Fig. 8.

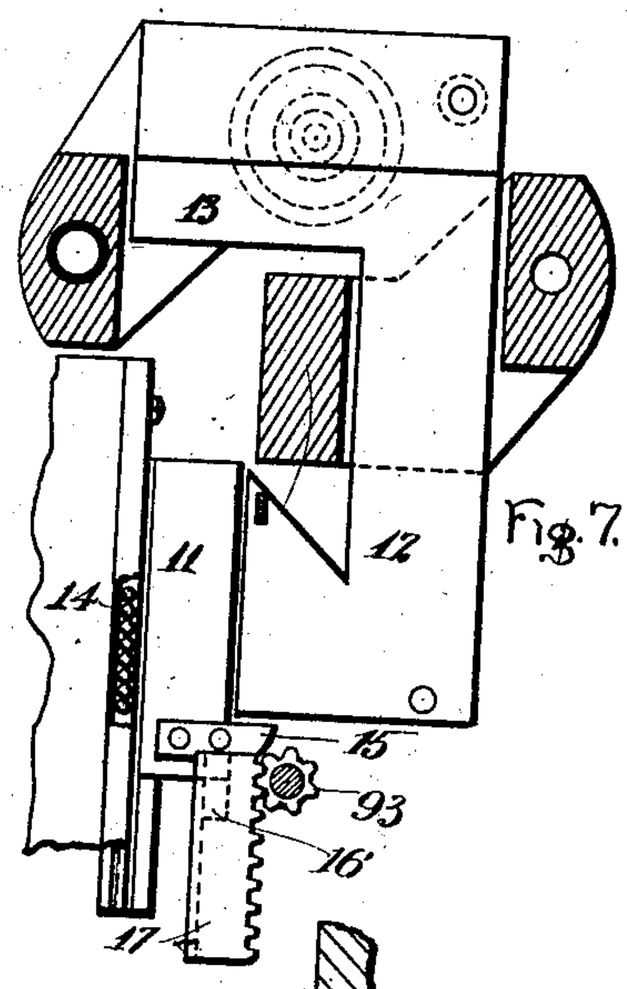


Fig. 7.

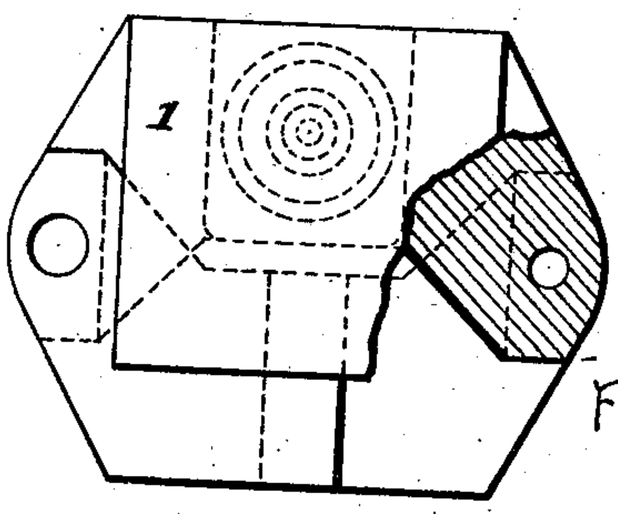


Fig. 10.

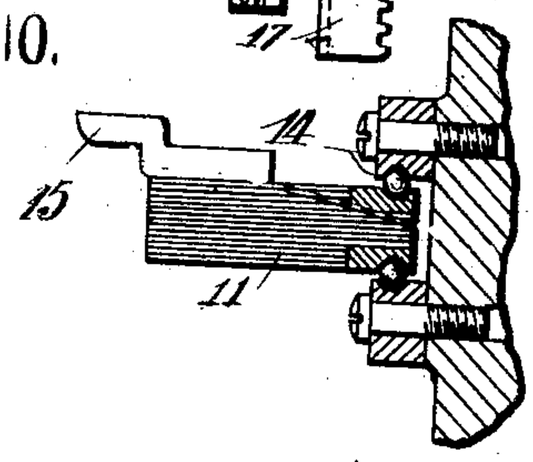


Fig. 9.

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No. 768,334. Patented August 23, 1904.

UNITED STATES PATENT OFFICE.

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BREAKER FOR ELECTRIC CIRCUITS.

SPECIFICATION forming part of Letters Patent No. 768,334, dated August 23, 1904.

Application filed July 8, 1902. Renewed January 23, 1904. Serial No. 190,363. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM J. LLOYD and GILBERT WRIGHT, citizens of the United States, residing at Pittsfield, in the county of Berkshire, State of Massachusetts, have invented certain new and useful Improvements in Breakers for Electric Circuits, of which the following is a full, clear, and exact description.

Our invention relates to improvements in electrical apparatus, and particularly to a breaker for electric circuits.

The object of this invention is to provide a circuit-breaker of substantial construction which will be simple and effective in its operation and of reliable action. It will be found to be automatic and adapted to be adjusted to currents of different strengths. The breaker may also be operated by hand independently and is provided with means to prevent setting on an overload.

It consists in the improvements hereinafter to be described and as embodied in the construction shown in the accompanying drawings.

Figure 1 is a side elevation, parts being broken away, of a device embodying our invention and in its closed-circuit position. Fig. 2 is a side elevation of a breaker in its open-circuit position. Fig. 3 is a vertical projection of the device in its closed position, parts being broken away. Fig. 4 is a projection looking upward from the bottom of the device when closed. Fig. 5 is a detailed section of a setting-dial. Fig. 6 is a front elevation of the same. Fig. 7 is a detailed view, partly in section, of a magnet coil and cores. Fig. 8 is a projection of the same looking upward from the bottom. Fig. 9 is a detail of the guides for the movable core. Fig. 10 is a vertical projection of the series-magnet coil, part of the same being broken away. Fig. 11 shows a detail in the construction of the switch-levers.

The main terminals 1 and 3 of the circuit-breaker are bolted to a base 37 and are so constructed at the rear as to admit of the insertion of terminal studs of the circuit into recesses 10 and 30. These studs are made independent of attaching-bolts to admit of easily changing the studs to suit varying conditions of switchboard practice and to do so without disturbing the alinement of contact-blocks. When the breaker is closed, the brushes 2 and 21 connect the terminals 1 and 3. These brushes are carried by an arm 4, which is pivoted at 45 to the frame 5. The bell-crank lever 6 61, pivoted also to the frame 5 at 56, is connected to the arm 4 by the link 64. The other end of the lever 61 is adapted to engage with an arm 71 of the tripping-pawl 7. The handle 81, arm 8, and attached parts are used in opening and closing the breaker by hand. Adjustment of the device to currents of different strengths is effected by means of the setting device 9, as will more fully appear.

The contact 1 consists of a magnet-coil, one end of which is recessed, as at 10. The other end is broadened out to form a surface for contact with the brushes 2 and 21.

As shown in Fig. 1, the main circuit of the breaker when in its closed position passes from the terminal at the coil 1 through the brushes 2 21 to the contact-block 2 and second terminal.

The series-magnet coil is shown more clearly in Figs. 1, 7, 8, and 10 and consists of a copper casting formed with two turns providing two openings for the stationary core and for the movable core, respectively, which will be described more fully hereinafter. The main brushes 2 and 21 are carried by a brush-holder 22, to which they are clamped by means of bolts passing through the clamp 23 and into the brush-holder. Shunt-circuits are provided which permit the current to pass around the main circuit just before or after contact is made or broken by the brushes 2 21. The first shunt-circuit passes from the contact-facing of the the coil 1 through the spring-arm 24, brush-holder 22, and spring-block 25 to contact-block 3. The spring-arm 24 is so situated that it has a uniform pressure on the face of the coil while the arm 4 is revolved. The brush-holder 22 is adjustably secured by the screws 41 and 42 to the arm 4. At 40 on the arm 4 is pivoted a lever 43, which carries

the carbon block 44, hinged at its upper end This carbon 44 contacts with another block 31, similarly carried by the contact-block 3. The second shunt-circuit passes from the face 1 of the series magnet through the spring-arm 24, brush-holder 22, strips 26, carbon block 44, through the carbon block 31, arm 32 to the contact-block 3. The carrying-arm 32, which is pivoted at 33 and has a slight rotary movement thereon, is normally actuated by a spring 34. The amount of movement is limited by the stop-fingers 35 and stop 36. In a similar manner the carbon block 44 is bolted to the carrying-arm 47 and has a slight movement at the end of the arm 43. These two blocks are thus so mounted as to permit of a long sliding contact with each other. The carbon blocks on account of their relative positions have at the moment when the shunt spring-block 25 leaves the contact-block 3 a comparatively large area of contact, thus greatly reducing the resistance through the shunt-circuit and preventing the burning of the brushes 2, 21, and 25 in case of short circuit or abnormal load. It also insures that a good contact, by reason of the rubbing action, may take place upon the closing of the breaker.

The long arm 61 of the double lever pivoted at 66 carries near its outer end a pin 62, adapted to engage with a hook 71 of the tripping-pawl 7. When in the position shown in Fig. 1, this hook engages the pin 62, and it holds the parts of the breaker in the closed position. The same axis 56 which carries the two-armed lever 6 61 also carries the hand-controlled lever 8, which is provided with a handle 81. This lever 8 carries an arm 82, pivoted at 83 and so connected at 84, as hereinafter described, that the arm 82 may have a slight independent movement upon its pivot 83 for the purpose which will appear. The other end of the arm 82 is forked at 85 to provide a recess in which a pin 72, carried by an arm of the pawl 7, may enter and with which it may coact. The arm 61 carries a pin 63 in such a position that it may coact with the beveled face or heel 86 of the arm 82.

To break the circuit by hand or open the circuit at will, the handle 81 is raised from the position of Fig. 1 to the dotted position of Fig. 2 The result is that the beveled face 86 when drawn downward by the movement of the arm 8 slides over the pin 63 and is itself forced to the left about its pivot 83 and carries with it the pin 72 of the pawl 7 in the recess 85. This releases the hook 71 from the pin 62, and the arm 61 is then free, permitting the toggle-joint 6 64 to be actuated by the spring 46 and the brushes 2, 21, and 25 to be moved from the contacts 1 and 3. The circuit is therefore broken first at the terminals of the brushes 2 and 21, next at the block 25 through the first shunt-circuit, and last through the carbon blocks 31 and 44, which are in the second shunt-circuit, as described before. The helical spring 46 as soon as the arm 61 is released throws the arm 4 and its attached parts back quickly from the closed position, making a rapid and effective break of the circuit. At the same time the pin 63 passes by the heel of the bevel 86 and leaves the arm 8 free to fall into its normal position. In order that the second shunt-circuit may be broken quickly and at the right time, the arm 43, which carries the carbon block 44 at one end, is pivoted at 40 to the arm 4. Beyond the pivot 40 is provided a short arm with a slotted portion 48, which coacts with a pin 54, carried by the stationary frame 5. The result is that the carbon block 44 instead of having the slight movement which would otherwise result in being at the end of a long lever pivoted at 45 has a multiplied movement, due to the swinging of the arm 43 about the pivot 40, while the latter is itself being moved about the center 45.

To close the breaker from the open-circuit position, (shown in Fig. 2,) the handle 81 is raised and the arm 82 drawn over until the pin 63 slips into the detent at the bevel 86. The handle may then be drawn down, and the heel of the detent will carry the pin 63, and consequently the arm 61 and the other parts attached thereto, to the closed position. At the same time the inner end of the recess 85 will contact with the pin 72 and throw the tripping-lever and hook 71 into engagement with the pin 62 on the arm 61 and lock the parts in the closed position.

The automatic breaking of the electric circuit is effected by means of the series magnet 1 and the movable core 11. (Shown particularly in Figs. 1, 4, and 7.) One coil of the magnet surrounds the stationary laminated core 12, while the other provides an opening in which the movable core 11 may operate. The current passing through the magnet-coil 1 energizes the core 12 and tends to attract the core 11. The controlling air-gap is situated between the lower part of the upper end 13 of the stationary core and the upper end of the movable core. In order that the core 11 may be so supported as to be free to move with as little variable resistance as possible, we have provided a ball-bearing guideway 14. Attached to the movable core 11 is a dog 15, which projects into the line of movement of one arm of the tripping-pawl 7. The core 11 is supported by a projection 16 from the rack 17 when at rest. When the current passing through the series coil 1 is sufficient to raise the movable core 11, the dog 15 contacts with the end of the tripping-pawl 7. The pawl is then turned about its pivot, so as to release the hook 71 from the pin 62 and allow the spring 46 to move the arm 4 and to break the circuit in the manner already described. When the pawl is operated, the pin 72 forces the arm 82 down and allows the pin 63 to pass over the heel of the

detent 86, leaving the handle and lever 8 down. If it is now attempted to close the circuit while the conditions are such that a continued current would constitute an overload, it will be found that as soon as the circuit is made the core 11 will rise, move the pawl 7, and the pin 72 of the tripping-pawl will hold the slightly-yielding arm 82 to the left, so that the pin 63 of the arm 61 may pass freely to the right under impulse of the spring 46 and pass the heel of the detent 86. Thus, although the handle 81 is held in the position indicated, the arm 61 will nevertheless automatically have caused the circuit to be broken. There is therefore no possibility of holding the breaker in its closed position by hand against an overload. The current interrupted by the breaker in such a case as this will be only that which was sufficient to raise the core in the magnet, owing to the resistance of the small area of contact of the carbons at that moment.

It is often desirable in devices of this character that the same circuit-breaker may be set so as to automatically operate on one of several different current strengths. For this purpose we have provided the setting device which is particularly shown in Figs. 5, 6, and 7. The knob 9, which is mounted upon the shaft 91, carries a dial 92, which may be graduated as desired. The inner end of the shaft 91 carries a pinion 93, which coöperates with the rack 17, which sustains the movable core 11. The air-gap between the parts 11 13 therefore may be varied and regulated by raising or lowering the rack 17 by means of the knob 9 and pinion 93. In order that the setting device may be locked at the position desired, we have provided a stationary projection 94, which may fit into a notch in the edge of the dial, as in Fig. 6. The shaft 91 is provided with a helical spring 95 and a washer 96. The spring acting against the washer tends to hold the dial and insulated knob 9 in the position shown in Fig. 5. When, therefore, it is desired to set the device, the knob may be withdrawn against the action of the spring and carrying with it the dial 92 until it is free from the projection 94, when it may be turned to raise or lower the rack 17 and core 11 to the position desired, as indicated by the graduations on the face of the dial. The air-gap can thus be regulated to any desired extent, depending on the capacity and construction of the device.

Fig. 11 shows a method of connecting arms 8 and 82 so as to permit of a slight independent movement of the two. Arm 82 is pivoted on arm 8 at 83 (shown in Fig. 1) and carries a pin 84, projecting through a hole in arm 8 of larger diameter than pin 84, as shown by the dotted lines. Pressing against pin 84 is plunger 87, which is pressed forward by spring 88, which in turn is held by set-screw 89. Set-screw 89 screws into arm 8 and is locked in position by set-nut 90. Thus arm 82 has a limited movement independent of arm 8 corresponding to the difference in diameter of pin 84 and the hole in arm 8 through which it passes. Spring 88 and set-screw 89 serve to regulate this movement.

What we claim is—

1. In a circuit-breaker, the combination of two contacts, one for each terminal, a brush for connecting the same, a carrier for said brush, an auxiliary brush carried by a long arm pivoted on said carrier and having a short arm engaging with a stationary member so as to produce a great movement upon a small movement of its pivot, and means for actuating said brush-carrier.

2. In a breaker for electric circuits having terminal contacts, means for connecting and disconnecting the same, one of said contacts comprising a magnet-coil formed of two turns of metal and providing an opening for a stationary core and also an opening for a movable core, said coil passing once around each core.

3. In a breaker for an electric circuit having terminal contacts, means for connecting and disconnecting said contacts, one of said contacts comprising a series-magnet coil, a stationary core therefor, and a movable core, the said stationary core being constructed so that there is a single operating air-gap between the same and said movable core.

4. In a breaker for an electric circuit having terminal contacts, means for connecting and disconnecting said contacts, one of said contacts comprising a series-magnet coil, a stationary core therefor, and a movable core, the said stationary core being constructed so that there is a single operating air-gap between the same and said movable core, and means for adjusting the said air-gap.

5. In a breaker for an electric circuit having terminal contacts, means for connecting and disconnecting said contacts, one of said contacts comprising a series-magnet coil, a stationary core therefor, and a movable core, the said stationary core being constructed so that there is a single operating air-gap between the same and said movable core, and means for adjusting the said air-gap comprising a setting-dial and a pinion and rack controlled thereby, substantially as described.

6. In a breaker for an electric circuit having terminal contacts, means for connecting and disconnecting said contacts, one of said contacts comprising a series-magnet coil, a stationary core therefor, and a movable core, the said stationary core being constructed so that there is a single operating air-gap between the same and said movable core, the said movable core being guided by ball-bearings, substantially as described.

7. A breaker for electric circuits having contact-terminals, brushes adapted to make and break the circuit through said contacts, means for controlling said brushes, a series-

magnet coil in the circuit having a stationary and a movable core, means for adjusting the air-gap between the said stationary and movable cores comprising a rotatable dial, a pinion controlled thereby and sliding rack coacting with said pinion, the said rack being adapted to support the said movable core.

8. A breaker for electric circuits having contact-terminals, brushes adapted to make and break the circuit through said contacts, means for controlling said brushes, a series-magnet coil in the circuit having a stationary and a movable core, means for adjusting the air-gap between the said stationary and movable cores comprising a rotatable dial, a pinion controlled thereby, and a sliding rack coacting with said pinion, said rack being adapted to support the said movable core, and means for locking said setting-dial at different positions.

9. A breaker for electric circuits having contact-terminals, brushes adapted to make and break the circuit through said contacts, means for controlling said brushes, a series magnet in the circuit having a stationary and a movable core, means for adjusting the air-gap between the said stationary and movable cores comprising a rotatable dial, a pinion controlled thereby, and a sliding rack coacting with said pinion, the said rack being adapted to support the said movable core, the said dial and pinion being normally locked by a projection engaging said dial, substantially as described.

10. A setting device for a circuit-breaker, comprising movable and stationary members, a rack adapted to support said movable member, a pinion coacting with said rack, a dial carried by a shaft upon which said pinion is mounted, said shaft being slidable in its bearings, said dial being normally locked and held in position by a spring, and means for disengaging said dial and setting the same, substantially as described.

11. A breaker for an electric circuit comprising contact-terminals, brushes for connecting the same, a pivoted arm for carrying said brushes, a shunt-circuit around said brushes, contact-blocks in said shunt-circuit, one of said blocks being carried by a lever pivoted to said brush-carrying arm, and means for giving to said lever a movement relatively more rapid than that of its supporting-arm.

12. A breaker for an electric circuit comprising contact-terminals, brushes for connecting the same, the said brushes being carried by a pivoted arm, a shunt-circuit around said brushes, contact-blocks in said shunt-circuit, one of said blocks being carried by a lever pivoted to said brush-carrying arm, a part of said lever coacting with a stationary pin whereby said lever is given a multiplied and extended action, substantially as described.

13. A breaker for an electric circuit having contact-terminals, brushes for connecting the same, a shunt-circuit around said brushes, and means for operating said brushes and contact-terminals in said shunt-circuit whereby said circuit may be opened by hand by the same operation as is required to close the same.

14. A breaker for an electric circuit having contact-terminals, a brush for connecting the same, said brush being carried by a pivoted arm, a locking-lever controlling said brush-carrying arm, a tripping-pawl controlling said locking-arm, automatic means for operating said tripping-pawl, manually-controlled means for operating said tripping-pawl, the said manually-controlled means being inoperative when said automatic means is in operation.

15. A breaker for an electric circuit having terminal contacts, means for connecting the same, said connecting means being carried by a pivoted arm, a locking-lever controlling said arm, means for locking said lever, a manually-controlled arm for unlocking the same, the said manually-controlled arm also being adapted to throw said locking-lever into its locked position.

16. A breaker for electric circuits having contact-terminals, means for connecting and disconnecting the same, said means being carried by a pivoted arm, a locking-lever coöperating with said arm, a manually-controlled arm adapted to coact with said lever, a tripping-pawl carrying a hook for locking said lever, automatic means to operate said tripping-pawl, a pin carried by said pawl coöperating with said manually-controlled arm, all arranged so that when the parts are in the locked position and said manually-controlled arm is withdrawn, said tripping-pawl will release said locking-lever and when said parts are unlocked said manually-controlled arm may return said locking-lever to its locked position.

17. A breaker for an electric circuit having terminal contacts, means for connecting the same, said connecting means being carried by a pivoted arm, a locking-lever controlling said arm, means for locking said lever, a manually-controlled arm for unlocking the same, the said manually-controlled arm also being adapted to throw said locking-lever into its locked position, and means to automatically unlock said lever on an overload.

18. A breaker for an electric circuit having terminal contacts, means for connecting the same, said connecting means being carried by a pivoted arm, a locking-lever controlling said arm, means for locking said lever, a manually-controlled arm for unlocking the same, the said manually-controlled arm also being adapted to throw said locking-lever into its locked position, and means to automatically unlock said lever on an overload, and means to prevent the manually-controlled arm from locking said lever when the circuit is subject to an overload.

19. A breaker for an electric circuit having contact-terminals, brushes for connecting the same, a shunt-circuit around said brushes, and means for operating said brushes and the contact-terminals in the said shunt-circuit whereby said circuit may be opened by hand by the same operation as is required to close the same, and automatic means to prevent maintaining said circuit closed against an overload.

20. In a circuit-breaker, a magnet-coil having a stationary and a movable core, means for adjusting the air-gap between the said stationary and movable cores comprising a rotatable dial and pinion controlled thereby and a sliding rack coacting with said pinion, said rack being adapted to support the movable core.

Signed at Pittsfield, Massachusetts, this 3d day of July, 1902.

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