C. AALBORG.

ELECTRIC SWITCHING DEVICE.

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963,735.

Patented July 12, 1910.

Fig. 1.

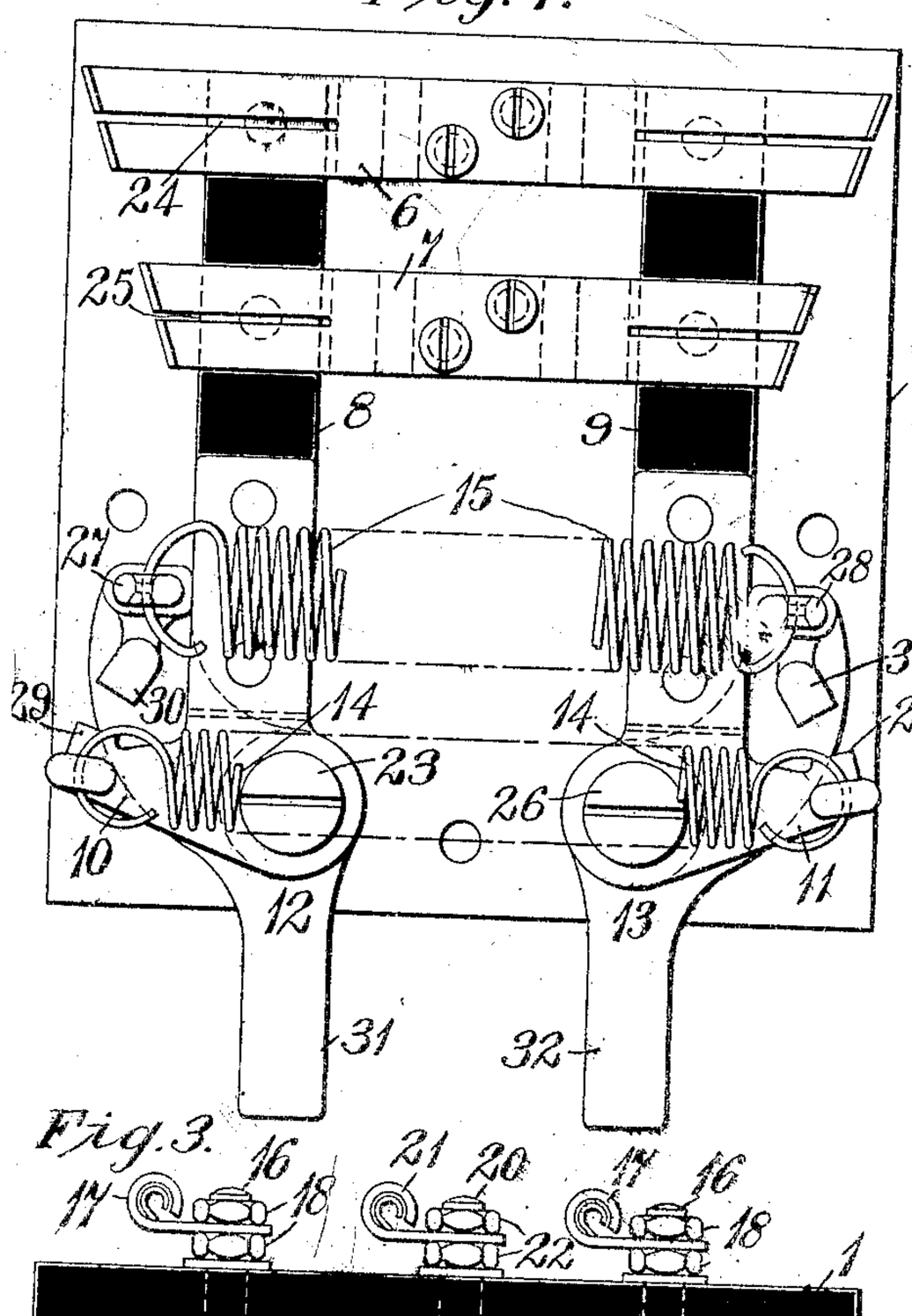


Fig. 2.

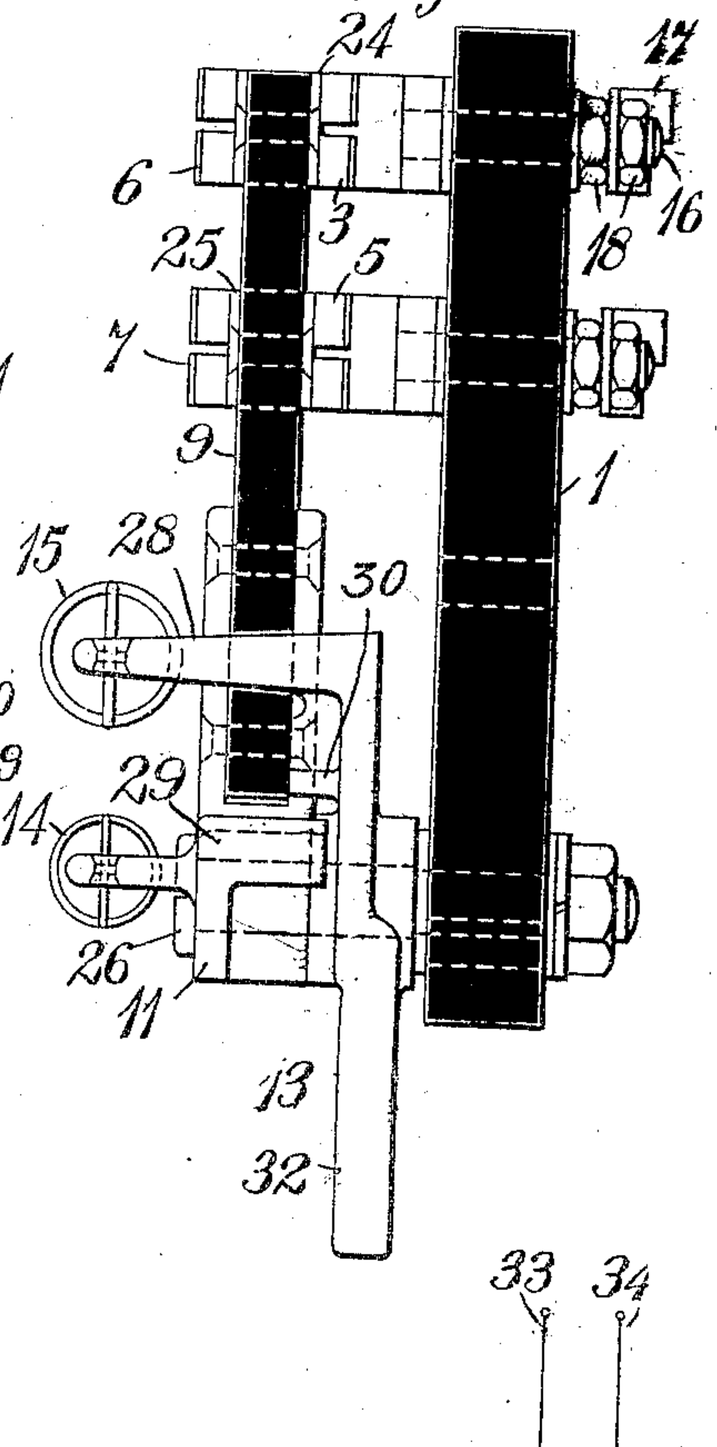


Fig. 3.

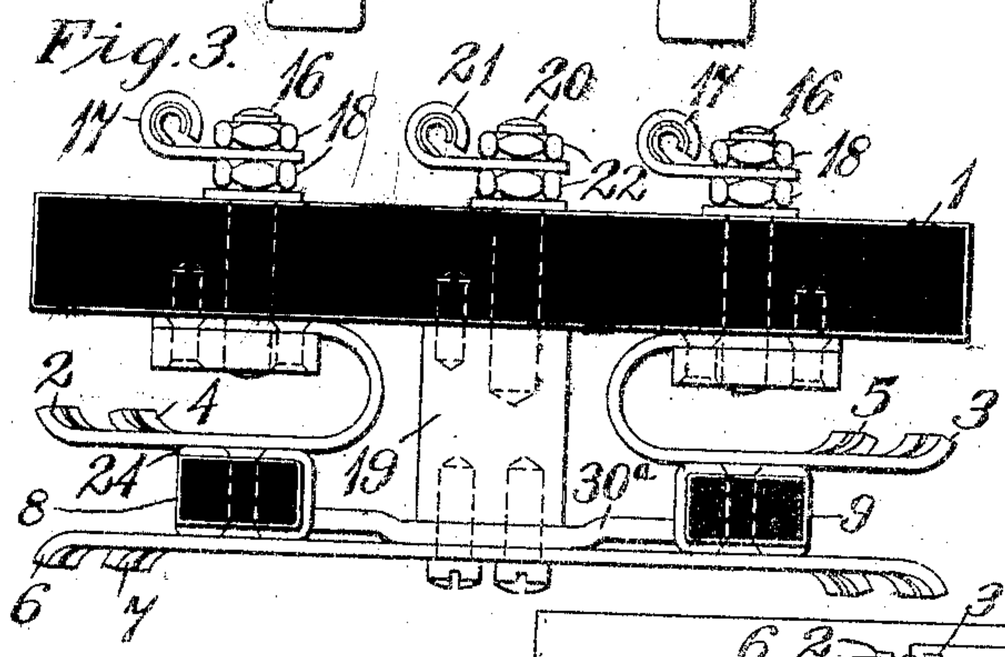
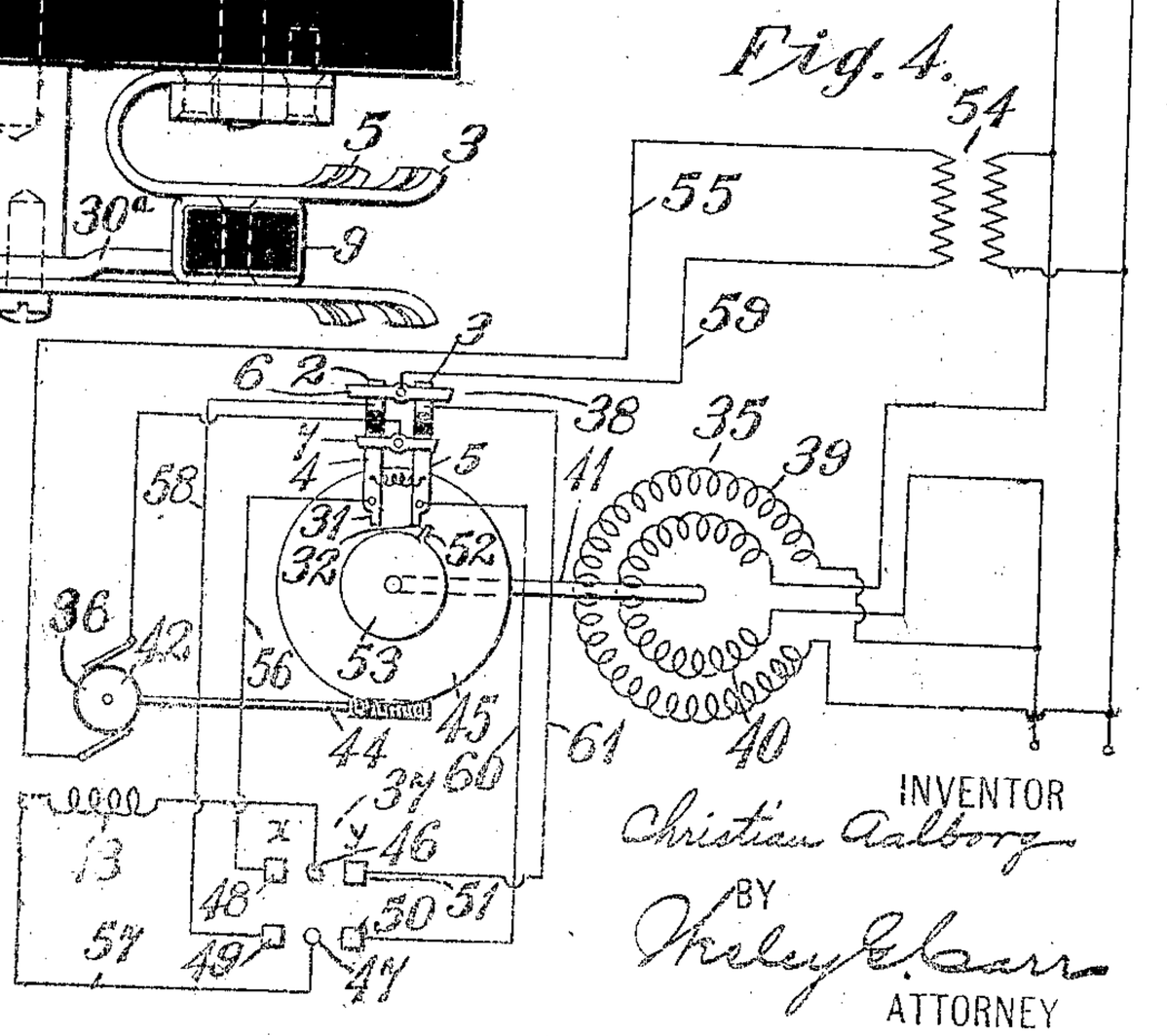


Fig. 4.



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ELECTRIC SWITCHING DEVICE.

963,735

Specification of Letters Patent. Patented July 12, 1910.

Application filed April 10, 1908. Serial No. 426,313.

To all whom it may concern:

Be it known that I, CHRISTIAN AALBORG, a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Electric Switching Devices, of which the following is a specification.

My invention relates to electric switching devices, and it has for its object to provide a device of this character that shall be simple and durable in construction and adapted for limiting the operation of electric motor-driven apparatus by interrupting the motor circuit at predetermined points in the motor travel.

Induction regulators of large size and certain other devices are driven by electric motors which operate in either direction, within predetermined limits which are dependent upon the regulator or other driven device, under such conditions as to be brought to rest without interfering with the automatic return of the device to an intermediate position.

According to my present invention, I provide a switching device which acts suddenly, when called upon to open the motor circuits, and which comprises a minimum number of operating parts.

Figure 1 of the accompanying drawings is a front elevation of my improved switching device, Figs. 2 and 3 are, respectively, a side elevation and a plan view of the device shown in Fig. 1, and Fig. 4 is a diagrammatic view of a system of electric regulation embodying the limit switch of the other figures.

Referring to Figs. 1, 2, and 3 of the drawings, the device here illustrated comprises an insulating slab or base 1, resilient contact members 2, 3, 4, 5, 6, and 7, movable contact-bearing switch arms 8 and 9 having lateral projections 10 and 11, tripping levers 12 and 13 and springs 14 and 15. The contact members 2, 3, 4, and 5 are of substantially U-shape and one side of each member is secured to the insulating plate 1 by means of a bolt 16 which extends through the plate and is provided with a terminal piece 17 and lock nuts 18. The contact members 6 and 7 are in the form of flat strips and are respectively supported in front of the contact members 2 and 3 and 4 and 5, by means of blocks 19 that are mounted on the plate 1 between the U-shaped members and are held in position by studs 20, bearing connectors 21 and set nuts 22 on the back of the plate. The contact-bearing switch arm 8 is pivotally mounted upon a stud 23 and is provided with contact members 24 and 25 which are respectively adapted to make electrical connection between the contact members 2 and 6, and 4 and 7. The switch arm 9 is pivotally mounted upon a stud 26 and is similar to the arm 8, except that the one is a right-hand and the other is a left-hand member. The contact members carried by the switch arm 9 are adapted to electrically connect the stationary contact members 3 and 6, and 5 and 7 when the limit switch occupies its closed circuit position. The projections 10 and 11 project laterally from the switch arms near their supporting studs and the spring 14 connects the outer ends of the projections together and serves to assist in holding the switch closed. The levers 12 and 13 are pivotally mounted upon the respective studs 23 and 26 between the switch arms 8 and 9 and the insulating plate 1 and are respectively provided with lateral projections 27 and 28 which normally rest against the outer edges of the switch arms and are connected together by the spring 15. The projections 10 and 11 are provided with auxiliary projections 29 which, under predetermined conditions, may engage auxiliary projections 30 which extend laterally from the projections 27 and 28 of the levers 12 and 13. When the switching device is closed, however, the auxiliary projections are materially separated from each other and the switch arms rest against stops 30^a that are secured to the blocks 19. The outwardly projecting arms 31 and 32 of the levers 12 and 13 may be engaged by a dog or pawl which is actuated by the motor or by the driven member at a predetermined limit in its operation. When rotative movement of either of the levers 12 and 13 is thus effected, in opposition to the spring 15 the corresponding projection 30 is moved into engagement with the adjacent projection 29 to effect rotative movement of the switch arms to which it pertains. Since the arrangement of parts is such that the center line of the spring 14 will be moved across the line joining the axes of rotation of the switch arms by a small de-

gree of movement of either of said arms, the action of the spring tends to throw the switch open instead of to hold it closed, but the force exerted by the spring 15 is greater than that exerted by the spring 14, and, consequently, whenever the arm 31 or the arm 32 is released, after having been actuated to open the corresponding switch, the spring 15 will immediately move the parts to the circuit closing positions indicated in Fig. 1 of the drawing.

Referring to Fig. 4, the system here illustrated comprises a supply circuit 33—34, an induction regulator 35, a driving motor 36 therefor, a normally-operated reversing switch 37 and the limit switch 38, which is illustrated in the other figures. The regulator 35 is intended to be illustrative of any driven mechanism having a limited range of movement, and it comprises a stationary coil 39, a movable coil 40 and a driving shaft 41, the stationary coil being connected across the circuit 33—34 and the movable coil having a series connection with the circuit 33—34. The motor 36 comprises an armature 42, a field magnet winding 43 and a shaft 44 that is connected to the shaft 41 of the regulator by reducing gears 45. The reversing switch 37 is adapted to occupy two motor-operating positions *x* and *y*, and comprises stationary contact fingers 46 and 47 and movable contact members 48, 49, 50, and 51. The limit switch 38 is actuated by a pawl projection 52 upon a disk 53 that is driven by the shaft 41.

The circuit connections for the system are as follows: As pointed out in the preceding paragraphs, the limit switch 38 is normally closed and the operation of the regulator 35 is entirely governed by the position of the reversing switch 37. The reversing switch 37 may be manually operated, as shown, or automatically dependent for its operation upon the electromotive force of the circuit 33—34 or upon some other element for which correction is made by the regulator. The travel of the movable member of the regulator is, of course, limited to a predetermined extent in either direction from its mid-position, in which its effect is *nil*, on account of the design of the regulator itself, and the limit switch 38 is intended to bring the motor 36 to rest whenever either one of these limits is reached. This is accomplished, in the system illustrated, without interfering in any way with the subsequent operation of the motor in the reverse direction, and the limit switch itself, by reason of the spring 15, will automatically return to its normal closed-circuit position, as the pawl projection 52 moves away from either the one or the other of the lever arms 31 and 32. If the reversing switch 37 is moved to position *x*, circuit connections will be established from a transformer 54 through a conductor 55, armature 42 of the motor 36, contact member 7 of the limit switch, contact member 4, conductor 56, contact members 48 and 46, field magnet winding 43, conductor 57, contact members 47 and 49, conductor 58, contact members 2 and 6, and conductor 59 to the opposite terminal of the transformer. Thus, the motor circuit will be established and the regulator will be operated in one direction which I assume, for convenience, to be clockwise. If the reversing switch is now moved to occupy position *y*, a circuit will be established from the transformer 54 through conductor 55, armature 42, contact members 7 and 5, conductor 60, contact members 50 and 47, conductor 57, field magnet winding 43, contact members 46 and 51, conductor 61, contact members 3 and 6, and conductor 59 to the opposite terminal of the transformer. The motor is now reversed, since the circuit is established through its field magnet winding in the reverse direction and the regulator will be operated in a counter-clockwise direction. Should the reversing switch continue to occupy the position *x* until the pawl projection 52 engages the lever arm 31, contact members 2 and 4 will be moved out of engagement with contact members 6 and 7. The motor will then be brought to rest on account of the interruption of its armature but it may again be operated in its reverse direction when the reversing switch is thrown to position *y*. This is obviously the case, in view of the circuit connections which are traced for counter-clockwise operation of the regulator. The limit switch will similarly operate if the reversing switch continues to occupy position *y* until the pawl projection engages the lever arm 32.

It is conceivable that various structural modifications in the limit switching device may be effected within the scope of my invention as defined in the appended claims.

I claim as my invention:

1. In a switching device, the combination with a plurality of sets of stationary contact terminals disposed in pairs in adjacent planes, of two spring-connected but independently movable contact-bearing switch arms adapted to electrically connect and disconnect said pairs of stationary contact terminals, and means for effecting a quick separation of each switch arm from the corresponding stationary contact terminals.

2. In a switching device, the combination with a pair of movable contact-bearing switch arms having lateral projections, means for limiting the movements of the switch arms, and a single spring connecting the lateral projections of the two switch arms to hold them against the limiting means, of means for initially actuating either switch arm to permit the spring to move it away from its limiting means.

3. In a switching device, the combination with a pair of movable contact switch arms having lateral projections, of a spring connecting the ends of the projections to hold the arms in their closed positions, and levers respectively mounted on the same axes as the switch arms, a spring connecting corresponding arms of the levers to hold the switch closed, and means for operatively connecting the switch arms and levers.

4. In a switching device, the combination with an insulating plate or slab, stationary contact members secured thereto, and a pair of movable contact-bearing switch arms rotatably mounted to move parallel to the face of the plate or slab, of a single means for normally holding both switch arms in closed circuit position, and another means for causing said single means to move the one or the other of said switch arms to open position.

5. In a switching device, the combination with an insulating plate or slab, stationary contact members secured thereto, and a pair of movable contact-bearing switch arms rotatably mounted to move parallel to the face of the plate or slab, of a single spring for normally holding both switch arms in closed circuit positions, and means for causing said spring to move the one or the other of said switch arms to open position.

6. In a switching device, the combination with an insulating plate or slab, stationary contact members secured thereto, and a pair of movable contact-bearing switch arms rotatably mounted to move parallel to the face of the plate or slab, of a spring for normally holding both switch arms in closed circuit positions, a pair of levers pivoted upon the switch arm axes, and a spring connecting corresponding projections of said levers together and normally holding them against the switch arms, and coöperating projections on the levers and the switch arms for moving said switch arms toward their open positions when the levers are actuated through predetermined angles in opposite directions.

7. The combination with a plurality of sets of stationary contact terminals disposed in pairs in adjacent planes, of two independently movable contact-bearing switch arms adapted to electrically connect and disconnect said pairs of stationary contact terminals, means for effecting a quick separation of each switch arm from the corresponding stationary contact terminals, and means for automatically moving each switch arm to circuit-closing position when released in open-circuit position.

8. The combination with a plurality of pairs of stationary contact terminals, of two independently movable contact-bearing arms adapted to make and break connection between said pairs of contact terminals, a single spring for effecting a quick separation of said contact-bearing arms from the respective pairs of stationary contact terminals, and a single spring for moving said arms to circuit-closing position when released in open-circuit position.

9. The combination with a plurality of pairs of stationary contact terminals, of two pivoted contact-bearing arms adapted to be independently actuated to electrically connect and disconnect the respective pairs of contact terminals, an actuating lever for each switch arm, a single spring for effecting a quick-break action of both switch arms, and a single closing spring for both switch arms.

In testimony whereof, I have hereunto subscribed my name this 27th day of March, 1908.

CHRISTIAN AALBORG.

Witnesses:

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BIRNEY HINES.