No. 896,402. PATENTED AUG. 18, 1908.

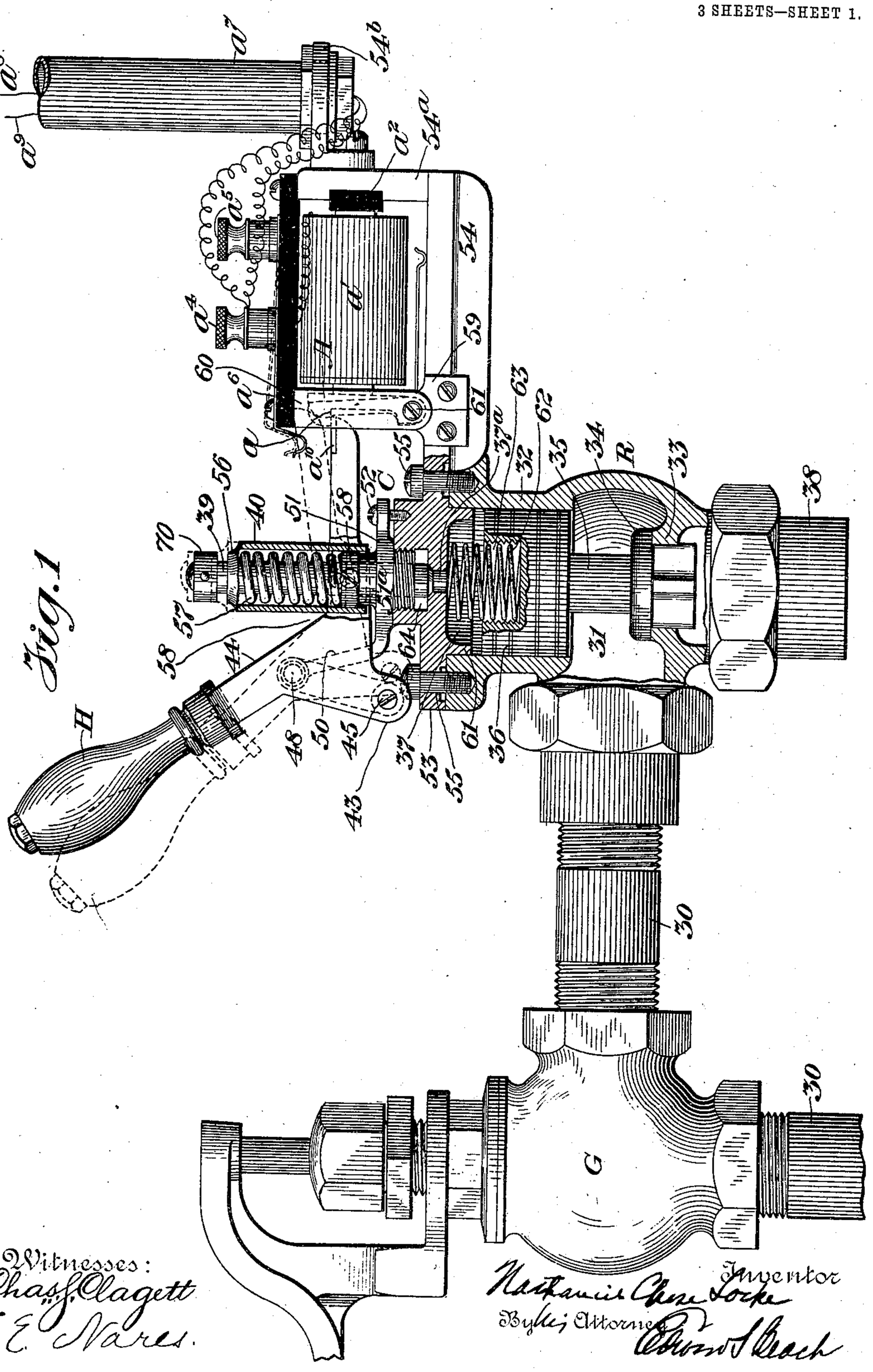
N. C. LOCKE.

AUTOMATIC ENGINE STOP.

APPLICATION FILED AUG. 6, 1907.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

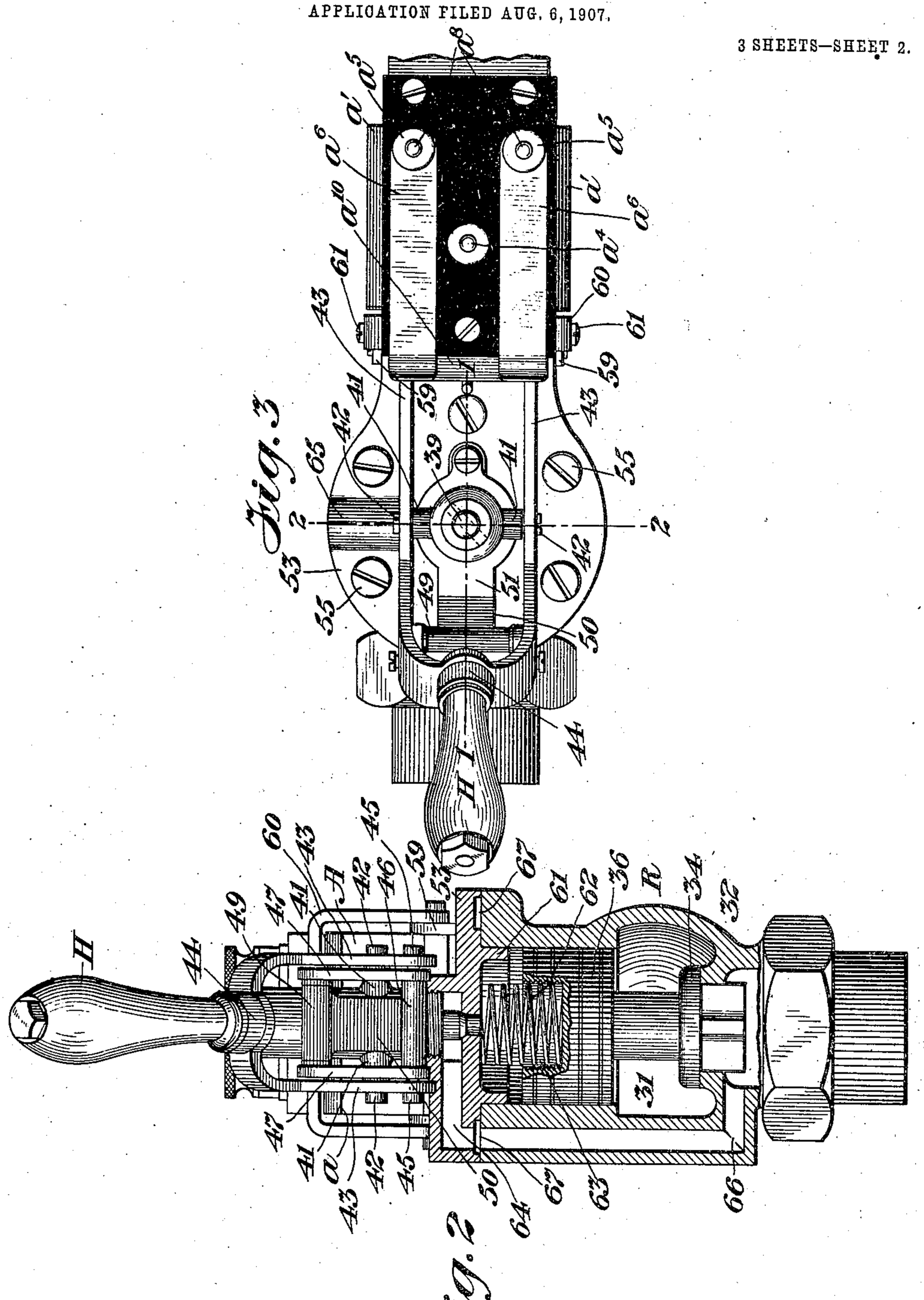

Fig. 3.

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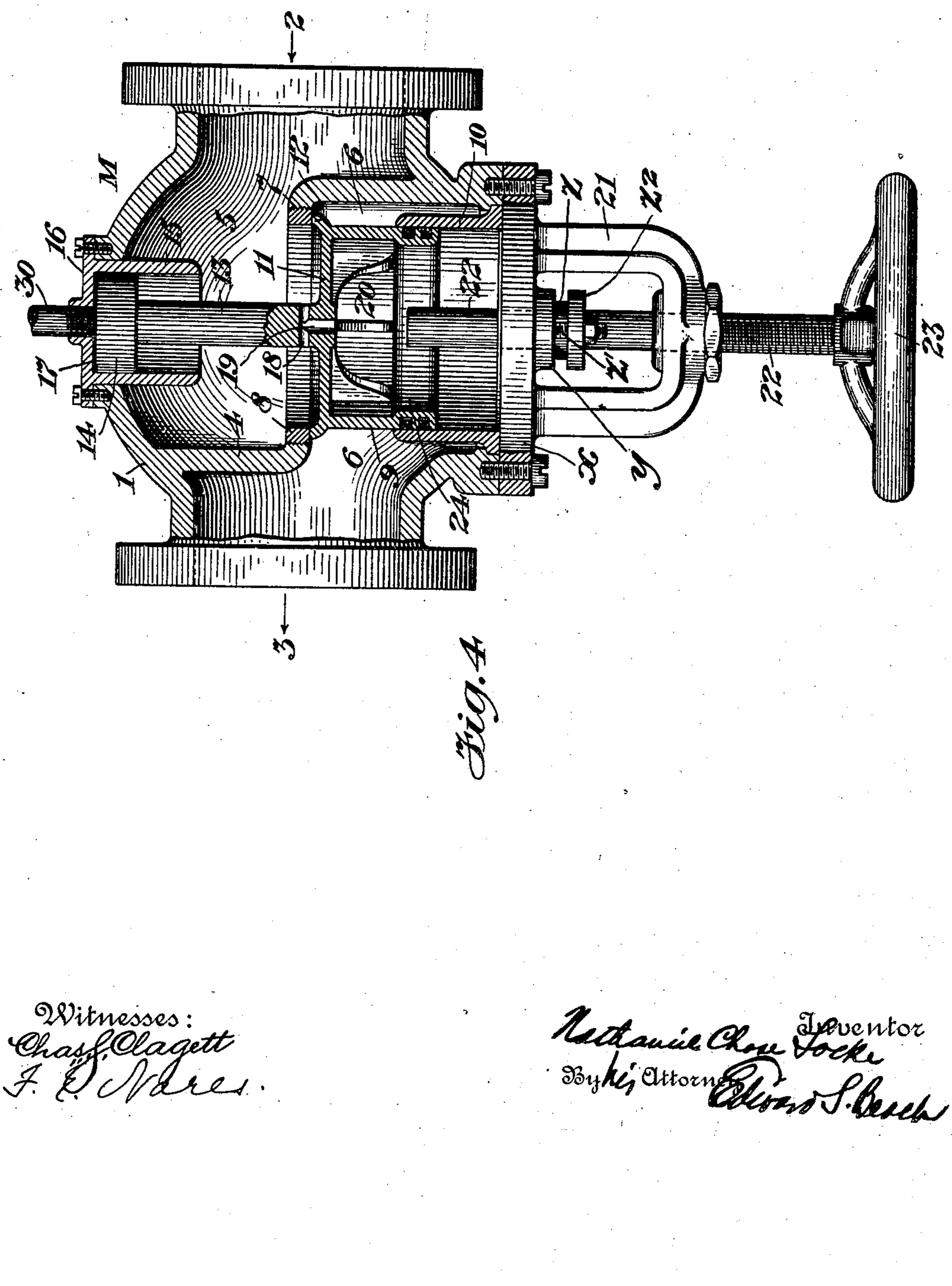

Fig. 4.

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UNITED STATES PATENT OFFICE.

NATHANIEL CHASE LOCKE, OF SALEM, MASSACHUSETTS.

AUTOMATIC ENGINE-STOP.

No. 896,402. Specification of Letters Patent. Patented Aug. 18, 1908.

Application filed August 6, 1907. Serial No. 387,286.

To all whom it may concern:

Be it known that I, NATHANIEL CHASE LOCKE, citizen of the United States of America, residing at Salem, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Automatic Engine-Stops, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to automatic engine stops by use of which, in case of accident or other emergency, the steam from the boiler to the engine may be cut off without sending an order to that effect to the engineer or other attendant in the engine-room; and the object of my invention is to produce an improved, electrically actuated, automatic engine stop, connected with push-buttons, switches, speed limits or the like, in various rooms of the plant, whereby, either in case of accident to the machinery or to workmen employed about the machinery, the engine may be quickly shut down; or, in case of the racing of the fly-wheel, due to a decrease of load thereon, the engine can be quickly shut down and the danger of fly-wheel explosions minimized.

In the drawings, illustrating the principle of my invention and the best form now known to me of applying that principle, Figure 1 is an elevation, partly in section, at line 1—1, of Fig. 3, and shows my new electrically-actuated relief-valve controller on my new form of relief-valve coupled with an ordinary globe shut-off valve, and piped to my new steam throttle-valve; Fig. 2 is an elevation, partly in full lines and partly in vertical central section, at line 2—2, of Fig. 3, looking to the right. The full lines in this view, above the relief-valve shown in section, show parts of the mechanism of the relief-valve controller; Fig. 3 is a top-plan view of the relief-valve controller with its electro-mechanical attachments, and also of the upper or outer end of the relief-valve controller; Fig. 4 is a central sectional view (on a relatively smaller scale than Figs. 1, 2 and 3,) of my new throttle-valve provided with a pipe for connecting it with the relief-valve.

In the form of my invention shown in the drawings, M is my new steam throttle-valve, to be interposed between a boiler and engine; R is the relief-valve; C is the relief-valve controller, and G is a shut-off valve which is preferably, but not necessarily, interposed in the pipe that connects the throttle-valve M with the relief-valve R.

A is the armature of electro-mechanical apparatus forming a part of the relief-valve controller.

1 is the casing of the steam throttle-valve M, 2 being its inlet from the boiler and 3 its outlet to the engine. The particular form of valve M herein shown is new; and in my new broad combination other proper forms of steam throttle-valves may be substituted, if desired, for the one shown; but my new form of throttle-valve M coöperates very efficiently, and with increased certainty of action, with my new relief-valve R and with my new relief-valve controller C.

Casing 1 is provided with an interior partition 4 dividing the casing into a steam-admission chamber 5 and a steam-escape chamber 6. This partition is provided with an opening 7 (preferably threaded,) between chambers 5 and 6, and is provided with a valve-seat 8 that is preferably in the form of a threaded annulus, as shown. A cup-shaped piston-valve 9 is mounted in chamber 6, its open piston end sliding in piston-ring 10, also in chamber 6; 11 indicates the closed end of the valve-plug, said end being formed with a peripheral flange 12 forming the seat of the valve portion of piston-valve 9, and adapted, when the latter is seated, to contact with the opposed wall of valve-seat 8.

Piston-valve 9 is provided with a piston-carrier 13 which extends through chamber 5 and is provided, at its outer end, with a piston 14 slidably mounted in a piston-ring 15 which, as a matter of convenience, is integral with the end plate 16 of casing 1 and is provided with a steam-escape pipe 30 that communicates with the preferably existing chamber or space 17 between the outer end of piston 14 and the inner surface of end plate 16. Piston-carrier 13 is formed with a transverse steamway 18 which opens into a steamway 19 leading to the chamber 20 of the cup-shaped piston-valve 9. Casing 1 is also preferably provided, on its side opposite piston 14, with a bracket 21 having a threaded opening through which a threaded part of spindle 22 passes, the outer end of the spindle being provided, preferably, with a wheel 23 (for either manual or power actuation of the spindle), and the inner portion of the spindle

passing through an opening in casing 1, the chamber of piston-ring 10, and into the chamber 20 of the piston-valve 9, and engage the inner wall thereof to force the piston-valve 9 on, and to hold it against, its seat 8, when required; and also to close the passage-way 19, when required. Spindle 22 is not an operating part of the engine-stop, but is conveniently provided for use whenever it is desired to hold the valve 9 seated, in case of repairs or other emergencies.

When spindle 22 is suitably withdrawn from engagement with piston-valve 9, steamway 19 is uncovered, and piston-valve 9 is free to move away from seat 8. Steam coming from the boiler, under pressure, into chamber 5 will then force piston-valve 9 off its seat, and the greater portion of the steam will pass through the annular valve-seat 8 into chamber 6 and thence to the engine. At the same time, some of the steam in chamber 5 will pass through steamways 18 and 19 into chamber 20 of valve 9 and balance it, so that it will readily respond to the exhaustion of the relief-valve for automatically seating piston-valve 9 and cutting off the steam from the boiler to the engine.

The effective steam pressure surface of the valve 9, exposed to the steam in chamber 5, is the area within the peripheral flange 12 of the piston-valve 9, the open end portion of which is best thickened at 24 to form a piston slidable in piston-ring 10. The effective steam-pressure area of the open end of piston-valve 9 is the area of the inner surface of wall 11 plus the area of the end wall of piston-portion 24 of piston-valve 9. These two latter areas are substantially equal to the area inclosed by the flange 12, so that a very perfect balance of the piston-valve 9 is secured when spindle 22 is out of contact with it, the steam-pressure in chambers 5 and 20 being equalized. Some of the steam, when the apparatus is in use and piston-valve 9 is balanced, will pass from chamber 5, by leakage past piston 14, into the space 17 and thence through the steam-escape pipe 30 which connects the main steam throttle-valve M with the exhaust relief-valve R.

As illustrated in the drawings, a shut-off valve G (shown as a globe-valve) is interposed between throttle-valve M and relief-valve R, being connected on each side with pipe 30. This shut-off valve is a convenient, but not essential, accessory of the apparatus in its entirety. Pipe 30 communicates with chamber 31 of exhaust relief-valve R, the casing 32 of which is interiorly provided with a valve-seat 33 for valve 34, having a piston-carrier 35 provided at its outer end with a cup-shaped piston 36, at the outer open end of which is a steam-chamber 37. Chamber 31 communicates, by means of the opening of the valve-seat 33, with the exhaust steam-outlet 38 of relief-valve R, this outlet 38 leading directly into the room of installation, if desired, or usually being piped to the exterior of the building or to a sewer or the like. End plate 53 of valve R, opposite the outer end of piston 36 is provided with an exhaust steam-port 37^a which is controlled by the valvular end of an endwise slidable valve-rod 39, constituting the controller-valve of the controller C of relief-valve R.

Valve-rod 39 is mounted in a cylinder 40, the lower or inner end portion of which is provided with oppositely projecting lugs 41, the outer ends of these lugs being secured by screws 42 between the forked arms 43 of the angular hand-lever 44, preferably provided with a handle H. This lever is for setting the electro-mechanically actuated controller C with its controller-valve 39 seated and on the relief-valve R in position for automatic exhaustion whenever the lever is disengaged from the armature of the electro-mechanical devices. The forks 43 of this angular lever are provided with rearward and downwardly-extending extensions (or heel-portions) 43^a, between which, by means of the screw-pintles 45, the cross-bar 46 of an approximately U-shaped link is given a fulcrumed connection with the angular lever 44. The side arms 47 of this U-shaped link extend upwardly, and by means of pintles 48 are upwardly connected with the upwardly-projecting end 49 of a bracket 50, the foot 51 of which is apertured for passage therethrough of the valve-rod 39 and forms the cover of a steam-exhaust chamber 64 with which the cap-plate 53 of the relief-valve R is formed.

Foot 51 is preferably formed with a threaded boss which screws into a threaded opening in the outer side of plate 53, as shown, the foot 51 of the bracket being clamped in fixed position on the outer side of plate 53 by means of a screw 52, for example, so that the bracket 50, with its attached parts, cannot move with relation to the relief-valve R and to the electro-mechanical apparatus when the parts are once assembled. Cover-plate 53 of relief-valve R is formed with an extension-plate 54, and is secured in place on the casing 32 of the relief-valve, conveniently by screws 55. The outer end 56 of cylinder 40 is provided with an aperture for the passage of valve-rod 39, and within cylinder 40 there is mounted, around valve-rod 39, a coiled spring 57 between the inner wall of end 56, and a collar 58 fast on valve-rod 39 within cylinder 40. The inner end portion of cylinder 40, below said collar, incloses and slides on an upwardly-extending annular boss 51^a, on the outer end of which the collar 58 rests, boss 51^a forming an abutment for collar 58 and holding the inner end of cylinder 40 away from the opposed outer wall of foot 51, so that

when the forks 43 of the hand-lever are moved downwardly, cylinder 40 may be moved downwardly to compress spring 57 on collar 58, and thereby seat the inner valvular end of the thereto-attached valve-rod 39 firmly on its seat to close the exhaust steam-port 37^a against the tension of spring 57, whereby, when the free ends of the forked arms 43 are subsequently permitted to move upwardly, the tension of spring 57 will instantly unseat the valvular end of the valve-rod 39 and open said exhaust-port 37^a for outflow of steam through said port. The opposite sides of extension-plate 54 are, in the form of my apparatus shown, provided with oppositely-disposed, upwardly-extending ears 59 of an inverted, approximately U-shaped frame-piece 60, between which and said ears the armature A of the electro-mechanical apparatus is pivoted by the screw-pintles 61 through the ears 59. The fore edge of this oscillating armature A is provided with a transverse shoulder *a* which engages with the outer ends of forked arms 43 to hold the armature and said arms interlocked and the valvular end of valve-rod 39 seated at such times as steam is passing normally from the boiler to the engine, the relief-valve controller and electro-mechanical apparatus being then out of operation, and steam under boiler pressure then filling the throttle-valve chamber 17 (if that chamber is provided,) and also filling pipe 30; chamber 31 of the relief-valve, and also filling, by leakage past piston 36, the chamber 37 of the relief-valve from which exhaust-port 37^a leads. Piston 36 is formed to permit steam to leak past it.

The inner surface of casing-plate 53 is formed with an annular boss 61 which fits within the piston-chamber of casing 32 and serves as an abutment against which the opposed wall of the piston may contact when valve 34 is open. A coiled spring 62 s mounted partially in chamber 37 and partially in chamber 63 of piston 36, to aid the steam (of boiler pressure) in maintaining valve 34 on its seat. Plate 53 is provided with an exterior chambered boss 65 in which an exhaust steam chamber 64 is partially formed, this chamber communicating with the exhaust steam passage 66 formed in the shell of the relief-valve and communicating with the steam-exhaust port 38 thereof (see Fig. 2).

An annular chamber 67 is formed between the end wall of casing 32 and the thereto opposed inner wall of casing-plate 53, so that if any moisture of condensation passes the joint between the annular boss 61 of plate 53 and the thereto opposed wall of the piston-cylinder portion of casing 32, such moisture will condense in chamber 67 and escape thence into the exhaust steam passage 66 with which the chamber 67 communicates, as shown in Fig. 2. This is of practical importance, as it keeps said joint absolutely tight and prevents outward escape of steam into the room.

The plate extension 54 is provided with an upwardly extending rear end 54^a parallel with the frame 60; armature coils a' are supported on end 54^a, a suitable insulating-block a^2 being interposed. An insulating-plate a^3 is supported by frame 60 and rear end 54^a. Insulating-plate a^3 supports a binding post a^4 for the positive lead and a pair of binding posts for the negative leads. A pair of contact-springs a^6 extend over plate a^3 from the negative binding posts a^5 into position to come in contact with the forked ends 43 of the angular lever when the armature A is pulled towards the armature-coils to release the forked ends 43. These spring contact-plates a^6, when the forked ends 43 come in contact with them, not only serve to arrest the upward movement of the forked ends, but also, when in engagement therewith, serve for electrical connections whereby any electric current that may perchance pass into the angular lever are led back through the spring to the negative binding posts a^5 and through the negative leads a^8. Positive lead is indicated by a^9, and the two leads a^8 and a^9 are preferably brought to the binding posts through the conduit a^7 supported on a bracket 54^b attached to the end 54^a. As a matter of convenience, the forked ends 43 are connected by a transverse contact-plate a^{10}, and the oscillating armature is provided with a spring a^{11} which forces its upper edge forwards when the inner ends of the forked lever are forced past the upper, outer beveled wall of the armature above the shoulder *a*. The front ends of forked arms 43 are rounded or beveled so as to make a sliding contact with the upper forward transverse edge of the armature and to push it back against the tension of its spring a^{11} when the hand-lever H is moved forwards to carry the forked ends 43 downwardly under shoulder *a* to set the apparatus.

Whenever an electrical impulse is sent through the armature coils, the armature will be pulled towards the armature coils, carrying shoulder *a* out of engagement with the angular lever, whereupon spring 57 will expand and force end wall 56 of the cylinder 40 against collar 70, which is fixed, conveniently by pin 71, on valve-rod 39; consequently, the valve-rod will be slid endwise, instantly unseat its valvular end and allow the steam in chambers 37 and 63 to exhaust through exhaust steam-port 37^a, chamber 64, and passage 66, into the exhaust 38 of the relief-valve. When valve-rod 39 is to be seated, movement of the lever to bring its ends 43 into working engagement with shoulder *a* of the armature, pulls end-wall 56 against spring 57 and compresses it against collar 42, thereby forcing the valvular end on

its seat and holding it there under spring pressure. The inner surface of the valvular end of valve-rod 39 is directly exposed to steam-pressure in chamber 37, and this pressure aids the spring in unseating the valve-rod, which slides in an opening through the bosses, on opposite sides of the foot 51. Consequently, the boiler steam-pressure in chamber 31, on the under side of piston 36, will compress spring 62 and move the piston so as to carry relief-valve 34 off its seat, at which time all the boiler pressure on the exhaust side of the piston 14 of the throttle-valve M will be instantly reduced so as to unbalance piston-valve 9 and cause it to be instantly seated by the boiler steam-pressure in chamber 20 of the throttle-valve.

In practice, piston 36 is made about .007 smaller than the cylinder in which it moves, and piston 36 has a sufficiently larger steam-pressure surface than valve 34 to enable the boiler steam-pressure on the inner end of the piston to overcome the tension of the interposed spring.

The advantages of my new relief-valve controller lie in its direct-acting controller valve 39, which is exposed to direct pressure of steam to aid in opening it, and that this valve is also provided with a spring which exerts considerable force in holding the valve closed tightly on the exhaust steam exit 37^a. Hence this relief-valve controller-valve 39 is not liable either to stick on its seat or to leak at its seat, all adhesion between the two, whenever it occurs, being overcome by steam pressure and the spring which, when arms 43 are released from the armature, tends to pull it off its seat. It is of the utmost importance that this controller-valve 39 should operate instantly and with certainty whenever it is desired to actuate it, for otherwise the automatic stoppage of the engine could not be quickly obtained, and wreckage of engine or plant or other serious accidents might result. The collar 70 is preferably adjustable on the valve-rod 39, so that it may be placed at any desired point on that part thereof which extends beyond end 56 of cylinder 40.

Cylinder 40 constitutes the preferred form of endwise moving frame for operatively connecting the controller-valve or valve-rod 39 with the lever 44. Collar 70 forms a kind of abutment outwardly of the frame or cylinder 40 for contact therewith when the cylinder is moved outwardly in the seating movement of the controller-valve 39.

The main shut-off valve has an end plate carrying the bracket 21 in which the threaded spindle 22 is mounted. This plate or wall x is formed with a central boss y through which, as well as wall x, there is an opening for the passage of spindle 22 into the chambers of piston-ring 10 and cupped valve 9. A stuffing-box z surrounds spindle 22 and projects into a chamber in the outer wall of boss y, being clamped in place by screw-bolts z' passed through the flange z^2 of the stuffing-box into the outer margin of the boss.

What I claim is:—

1. In an automatic engine-stop, the combination of a steam throttle-valve with a relief valve and an electro-mechanically actuated relief-valve controller having a controller-valve exposed to steam pressure for lifting it.

2. In an automatic engine-stop, the combination of a steam throttle-valve with a relief valve and an electro-mechanically actuated relief-valve controller having a controller-valve exposed to steam pressure for lifting it and provided with a spring whereby the steam pressure and spring both coöperate to unseat the controller-valve.

3. In an automatic engine-stop, the combination of a steam throttle-valve, a relief valve, and a relief-valve controller provided with a lever; an endwise slidable controller-valve connected therewith; a spring for said controller-valve, and an armature of electro-mechanical apparatus; the lever being adapted for manual engagement with the armature and for automatic disengagement therefrom, and said spring operating, when the lever and armature are engaged, to hold the controller-valve on its seat, and also operating, when the lever and armature are disengaged, to assist in unseating said controller-valve.

4. In an automatic engine-stop, the combination of electro-mechanical apparatus having an armature formed with an interlocking member of a lever operatively mounted to interlock with the armature, an endwise moving frame attached to said lever; an endwise slidable controller-valve mounted in said frame; a spring; an abutment on the controller-valve outwardly of the frame; and a relief valve having an exhaust steam port controlled by said controller-valve.

5. The combination of a manually operable lever with an endwise movable frame operatively connected thereto; an endwise slidable controller valve; a collar fixed thereon within the frame; a coiled spring between the outer end of the frame and said collar; a relief-valve formed with an exhaust port controlled by said controller-valve, and also provided with a bracket on which said lever is fulcrumed and which has an outwardly extending cylindrical boss on which said frame slides and through which said valve slides; and an abutment on the controller valve, outwardly of the frame.

6. The combination of a manually operable lever with an endwise movable frame operatively connected thereto; an endwise slidable controller valve; a collar fixed thereon within the frame; a coiled spring between the outer end of the frame and said collar; a relief-valve formed with an exhaust port con-

trolled by said controller-valve, and also provided with a bracket on which said lever is fulcrumed and which has an outwardly extending cylindrical boss on which said frame slides and through which said valve slides; and an abutment on the controller valve, outwardly of the frame, the abutment being adjustable.

7. The combination of a manually operable lever with an endwise movable frame operatively connected thereto; an endwise slidable controller valve; a collar fixed thereon within the frame; a coiled spring between the outer end of the frame and said collar; a relief-valve formed with an exhaust port controlled by said controller-valve, and also provided with a bracket on which said lever is fulcrumed and which has an outwardly extending cylindrical boss on which said frame slides and through which said valve slides; and an abutment on the controller valve, outwardly of the frame, said exhaust port being in communication with an exhaust passage which opens into the relief-valve on its exhaust outlet side.

8. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of a relief-valve having a cap-plate formed with an internally threaded cylindrical boss within which is a valve seat; an exhaust steam chamber, the plate having an exhaust steam passage communicating with said chamber; a valve seat; a bracket having a threaded boss on its inner, and a smooth-surfaced boss on its outer side, said bosses being formed with a steam passage also extending through the plate; a cylinder slidably mounted on said outer boss; an actuating lever operatively connected to said cylinder; an endwise movable controller valve mounted in said cylinder; a collar fixed on said controller valve within the cylinder; a coiled spring, within the cylinder and between its outer wall and the collar; the valve extending through the outer end of the cylinder; and a collar on the valve outside the cylinder.

9. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of a relief valve having a cap-plate formed with an internally threaded cylindrical boss within which is a valve seat; an exhaust steam chamber, the plate having an exhaust steam passage communicating with said chamber; a valve seat; a bracket having a threaded boss on its inner, and a smooth-surfaced boss on its outer side, said bosses being formed with a steam passage also extending through the plate; a cylinder slidably mounted on said outer boss; an actuating lever operatively connected to said cylinder; an endwise movable controller valve mounted in said cylinder; a collar fixed on said controller valve within the cylinder; a coiled spring, within the cylinder and between its outer wall and the collar; the valve extending through the outer end of the cylinder; a collar on the valve outside the cylinder; and a link hinged on the bracket and pivotally connected to the heel of the lever.

10. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of a relief-valve having a cap-plate formed with an internally threaded cylindrical boss within which is a valve seat; an exhaust steam chamber, the plate having an exhaust steam passage communicating with said chamber; a valve seat; a bracket having a threaded boss on its inner, and a smooth-surfaced boss on its outer side, said bosses being formed with a steam passage also extending through the plate; a cylinder slidably mounted on said outer boss; an actuating lever operatively connected to said cylinder; an endwise movable controller valve mounted in said cylinder; a collar fixed on said controller valve within the cylinder; a coiled spring, within the cylinder and between its outer wall and the collar; the valve extending through the outer end of the cylinder; and a collar on the valve outside the cylinder; said lever being forked; an armature provided with means to interlock with the free ends of the fork-members; and a link hinged on the bracket whereon the lever is fulcrumed.

11. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of the relief-valve casing with a cap-plate therefor; a controller-valve frame slidably mounted on the cap-plate; the controller-valve; a spring therefor; a valve seat in said plate for the controller-valve; an exhaust steam port in said plate controlled by the controller-valve; an exhaust steam chamber on the outer side of said valve seat; an exhaust steam-conduit from said chamber; an annular chamber between the cap-plate and the thereto opposed wall of the relief-valve casing, the exhaust steamway opening into said annular chamber; and an exhaust steam-conduit leading from said annular passage.

12. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of a relief-valve having a cap-plate formed with an internally threaded cylindrical boss within which is a valve seat; an exhaust steam chamber, the plate having an exhaust steam passage communicating with said chamber; a valve seat; a bracket having a threaded boss on its inner, and a smooth-surfaced boss on its outer side, said bosses being formed with a steam passage also extending through the plate; a cylinder slidably mounted on said outer boss; an actuating lever opera-

tively connected to said cylinder; an endwise movable controller valve mounted in said cylinder; a collar fixed on said controller valve within the cylinder; a coiled spring, within the cylinder and between its outer wall and the collar; the valve extending through the outer end of the cylinder; a collar on the valve outside the cylinder; said cap-plate having an extension frame; an armature hinged on said frame; and magnet coils covered by said frame; the inner end of the lever being adapted to interlock with the armature and to be automatically released from engagement therewith.

13. In an automatic engine-stop comprising a throttle-valve, a relief-valve and a relief-valve controller, the combination of a relief-valve having a cap-plate formed with an internally threaded cylindrical boss within which is a valve seat; an exhaust steam chamber, the plate having an exhaust steam passage communicating with said chamber; a valve seat; a bracket having a threaded boss on its inner, and a smooth-surfaced boss on its outer side, said bosses being formed with a steam passage also extending through the plate; a cylinder slidably mounted on said outer boss; an actuating lever operatively connected to said cylinder; an endwise movable controller valve mounted in said cylinder; a collar fixed on said controller valve within the cylinder; a coiled spring, within the cylinder and between its outer wall and the collar; the valve extending through the outer end of the cylinder; a collar on the valve outside the cylinder; said cap-plate having an extension frame; an armature hinged on said frame; magnet coils covered by said frame; the inner end of the lever being adapted to interlock with the armature and to be automatically released from engagement therewith; and a conduit for the leads of the magnet coils, attached to the frame.

14. In an automatic engine-stop, the combination of a throttle-valve; a relief-valve and an electrically actuated relief-valve controller having a slidable controller-valve; a spring to seat the controller-valve, the spring also serving, in connection with steam pressure, to unseat the valve; a seat for said controller-valve, and a steam-chamber to receive steam at boiler pressure, on the side of the seat opposite the valvular end of the controller valve; an exhaust steam port through said seat; an exhaust steam-conduit communicating with said exhaust steam port.

15. In an automatic engine-stop, the combination of a throttle-valve, a relief-valve and an electrically actuated relief-valve controller comprising a resetting lever operatively connected with the controller valve of the relief-valve controller; a spring for said controller valve; an exhaust steam port from said relief-valve casing into an exhaust steam chamber in the relief-valve controller, the port being controlled by the controller valve; in the relief-valve casing a piston-valve; a spring between said piston-valve and the wall of the relief-valve casing containing said exhaust steam port; a seat for the valve of the piston-valve, said valve controlling the exhaust port of the relief-valve; the relief-valve casing being provided with a piston cylinder for said piston which is of a diameter to permit leakage of steam past it.

16. In an automatic engine-stop, the combination of a throttle-valve; a relief-valve; and a relief-valve controller having a controller-valve, the relief-valve being formed with a cap-plate having an exhaust steam chamber, at the bottom of which is a seat for the controller valve of the relief-valve controller; a lateral exhaust-steam conduit communicating with said chamber; and, on its under side, with an annular rib fitting into the relief-valve casing, the opposed walls of said casing and cap-plate being formed with an annular chamber between them for reception of water of condensation, and an outlet for said chamber.

17. In an automatic engine-stop, the combination of a throttle-valve; a relief-valve and a relief-valve controller having an endwise movable controller-valve; a spring therefor; an abutment on the valve for said spring to rest on; an endwise movable frame having means for contacting with the other end of the spring; and a relief-valve casing having a boss on which said frame slides; an apertured seat for said valve in said boss; and means for moving the frame in setting the apparatus.

18. In an automatic engine-stop, the combination of an electrically actuated relief-valve controller; a relief-valve and a throttle-valve, the relief-valve comprising a piston-valve and a spring therefor between the piston and the casing wall opposed thereto.

19. In an automatic engine-stop, the combination of an electrically actuated relief-valve controller; a relief-valve and a throttle-valve having a partition dividing the relief-valve casing into chambers for communication with a boiler and another chamber for communication with the boiler; a steamway through said partition; the throttle-valve casing having two piston cylinders, one on one side and the other on the opposite side of said partition; one of said piston-cylinders communicating with said relief-valve; and a valve for said steamway through the partition, said valve being provided with a piston at each of its opposite sides, one fitting loosely in the piston cylinder that communicates

with the relief-valve, and the other being cup-shaped, and slidable in the other piston cylinder; the stem of the valve having a steam passage-way through it for admission of steam from the boiler-side of the partition into the chamber of the cupped piston.

20. In an automatic engine-stop, the combination of an electrically actuated relief-valve controller; a relief-valve; and a throttle-valve casing having a steam inlet and also a steam outlet to the boiler; a steam outlet to the relief-valve; an interior partition formed with a steam passage; two piston cylinders, one on one side and the other on the other side of said steam passage; and a throttle-valve comprising two pistons, one on one side and the other on the other side of it; one piston cylinder surrounding the steamway to the relief-valve and the other piston cylinder being at the opposite side of the steamway through the partition; the throttle-valve controlling the latter steamway; the piston in the piston cylinder which has a steam outlet being a loose fit in its cylinder; and the throttle-valve being provided with a steamway into the other piston cylinder.

21. In an automatic engine-stop, the combination of a relief-valve and a throttle-valve casing having a steam outlet; a steam outlet to the boiler; a steam outlet to the relief-valve; a partition formed with a steam passage; two piston cylinders, one on one side and the other on the other side of the steam passage; and a valve comprising two pistons, one on one side and the other on the other side of it; one piston cylinder surrounding the steamway to the relief-valve; and the other piston cylinder being at the opposite side of the steamway through the partition; the valve controlling the latter steamway; the piston in the piston cylinder having the steam outlet being a loose fit in its cylinder; and the valve-stem being provided with a steamway into the other piston cylinder; the relief-valve casing having a piston cylinder and an exhaust valve; a spring between the piston of the piston cylinder and an opposed wall of the casing; said piston being smaller than the valve in respect of steam pressure area; said casing wall having an exhaust steam port; means communicating therewith for carrying away steam therein; a relief-valve controlling said exhaust steam port; said relief-valve casing having an exhaust-steam port controlled by said exhaust-valve; means for setting said relief-valve in closed position, and automatic means for unseating the same.

22. The combination of a valve-casing having a bracket-carrying wall; a bracket formed with a threaded opening and projecting outwardly from said wall; a threaded spindle carried by said bracket; the said wall having an opening for passage of the spindle into the interior of the valve-casing; a stuffing box inclosing the spindle; means for attaching the stuffing box to said wall; and, within the valve-casing, a piston cylinder inclosing the upwardly projecting portion of the threaded spindle; a valve having a piston extension sliding in said piston cylinder; and a seat for said valve.

23. The combination of a throttle-valve casing formed with an interior partition having a steamway through it, the partition dividing the throttle-valve casing into two chambers; a piston cylinder in each of said chambers; a throttle-valve for controlling the steamway through said partition and formed with two pistons, one on one side and the other on the other side of the throttle-valve, one of said pistons being chambered; said pistons being slidably mounted in said piston cylinders, and the throttle-valve having a steamway through it from one of said chambers into its chambered piston; a relief-valve controlling an outlet from one of the piston cylinders, and that piston of the throttle-valve which slides in such cylinder being constructed with reference to its piston cylinder in such wise as to permit flow of steam past it into the chamber of its piston cylinder controlled by said relief-valve; and means for seating the throttle-valve from the exterior of the throttle-valve casing.

24. The combination of a throttle-valve casing formed with an interior partition having a steamway through it, the partition dividing the throttle-valve casing into two chambers; a piston cylinder in each of said chambers; a throttle-valve for controlling the steamway through said partition and formed with two pistons, one on one side and the other on the other side of the throttle-valve, one of said pistons being chambered; said pistons being slidably mounted in said piston cylinders, and the throttle-valve having a steamway through it from one of said chambers into its chambered piston; a relief-valve controlling an outlet from one of the piston cylinders, and that piston of the throttle-valve which slides in such cylinder being constructed with reference to its piston cylinder in such wise as to permit flow of steam past it into the chamber of the piston cylinder controlled by said relief-valve.

25. The combination with a steam throttle-valve of an endwise slidable relief-valve controlling a steamway from the throttle-valve casing; electro magnetic apparatus, and a lever operatively connected with the endwise slidable relief-valve and mounted with its free end in operative connection with the electro magnetic apparatus.

26. The combination with a steam throttle-valve of an endwise slidable relief-valve

controlling a steamway from the throttle-valve casing; electro magnetic apparatus, and a lever operatively connected with the endwise slidable relief-valve and mounted with its free end in operative connection with the electro magnetic apparatus; and a manually operated handle for said lever.

In testimony whereof I have affixed my signature in presence of two witnesses.

NATHANIEL CHASE LOCKE.

Witnesses:
ALBERT W. VITTY,
A. P. SWASEY.