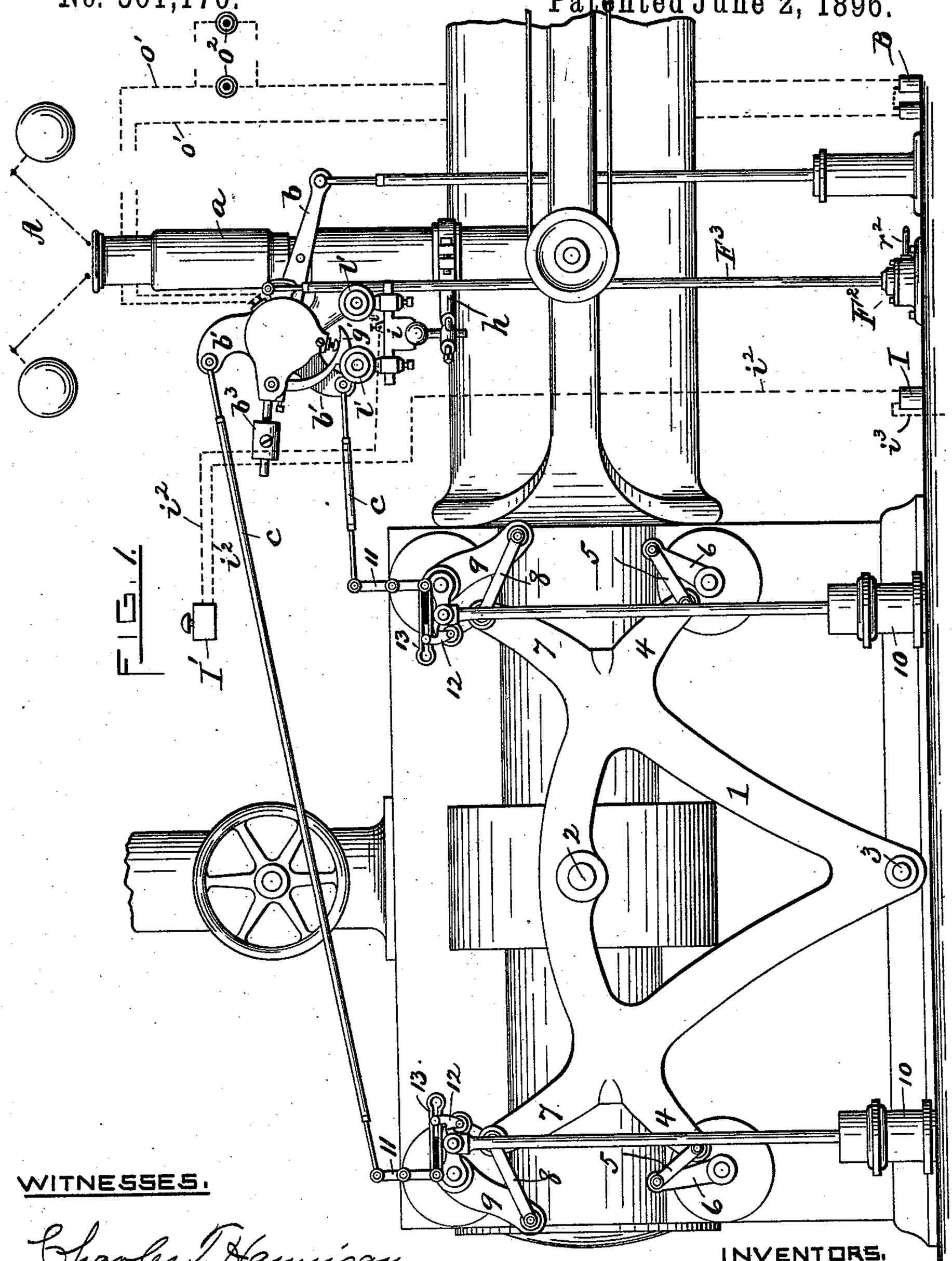
(No Model.) 4 Sheets—Sheet 1.

E. C. MYRICK & G. C. DOEG.

STOP MOTION FOR STEAM ENGINES.

No. 561,170. Patented June 2, 1896.



WITNESSES.

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(No Model.) 4 Sheets—Sheet 2.

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STOP MOTION FOR STEAM ENGINES.

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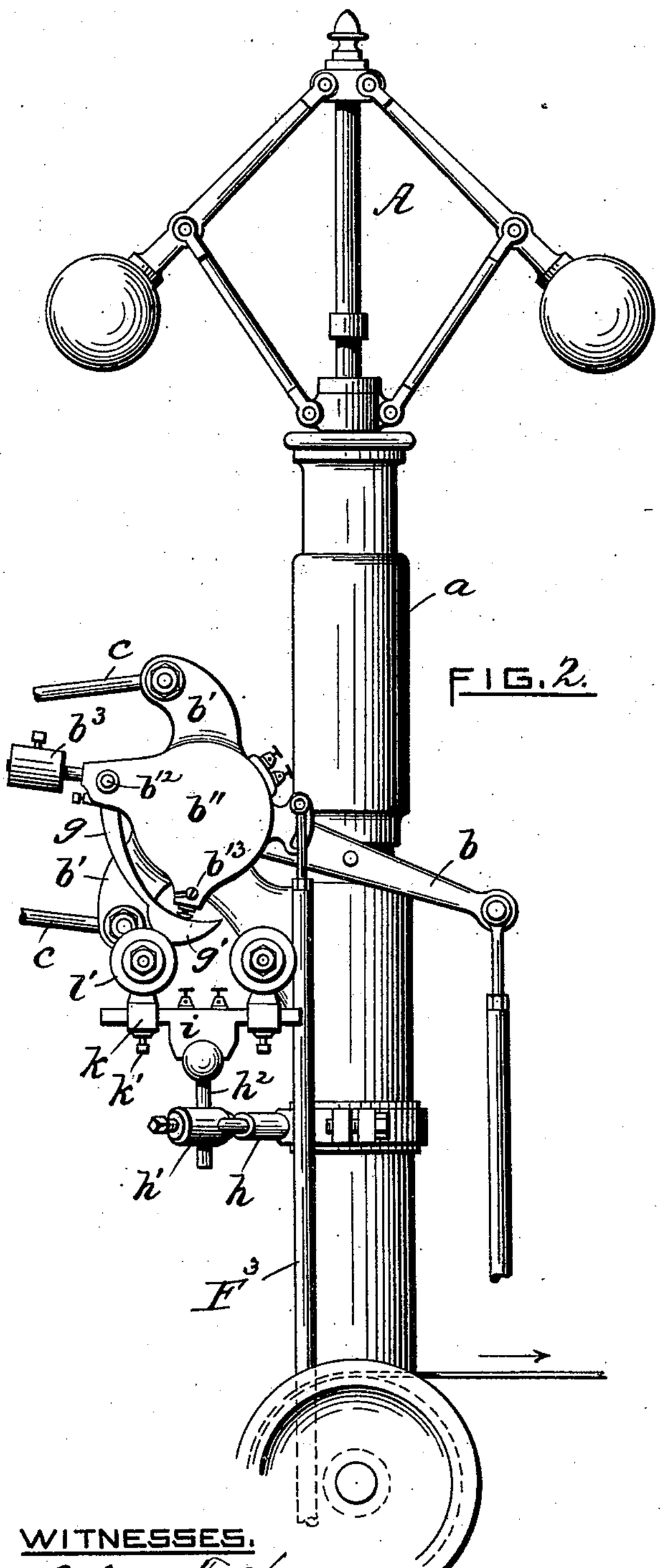

FIG. 2.

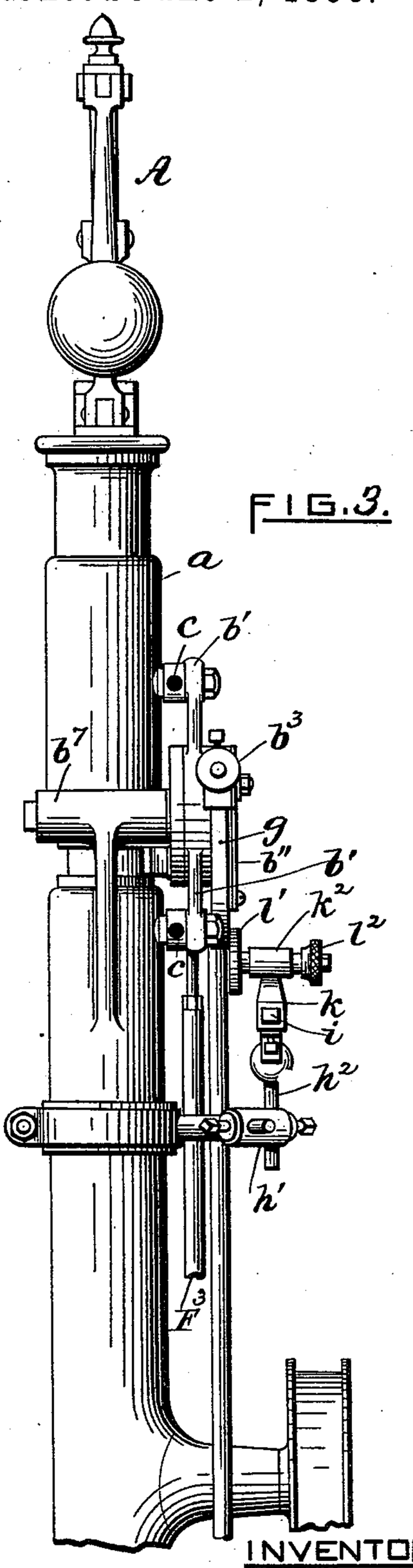

FIG. 3.

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(No Model.) 4 Sheets—Sheet 3.

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STOP MOTION FOR STEAM ENGINES.

No. 561,170. Patented June 2, 1896.

FIG. 3.

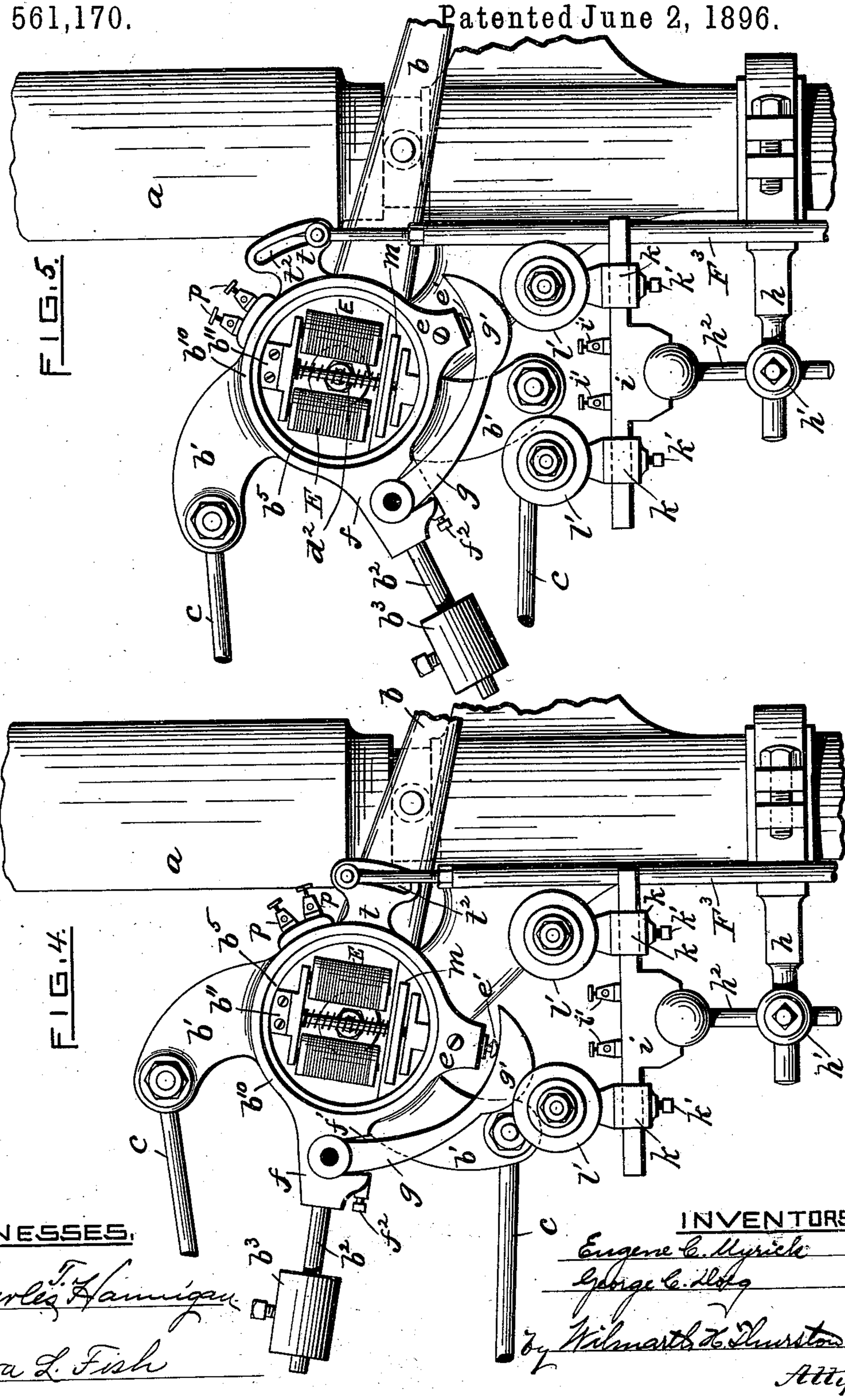

FIG. 4.

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(No Model.) 4 Sheets—Sheet 4.

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STOP MOTION FOR STEAM ENGINES.

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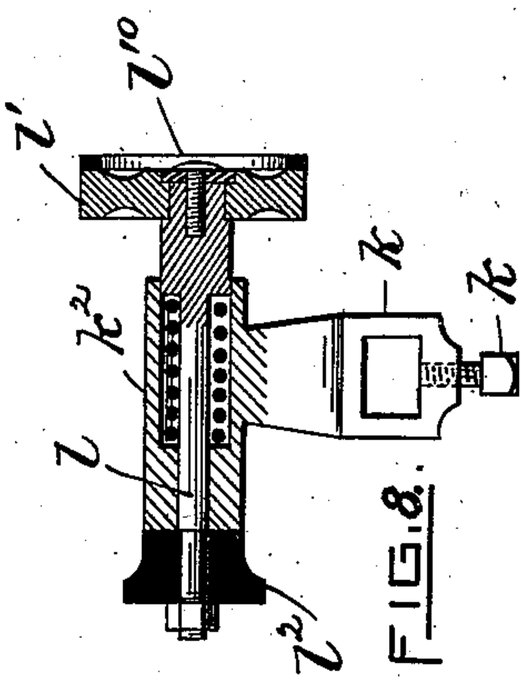

FIG. 8.

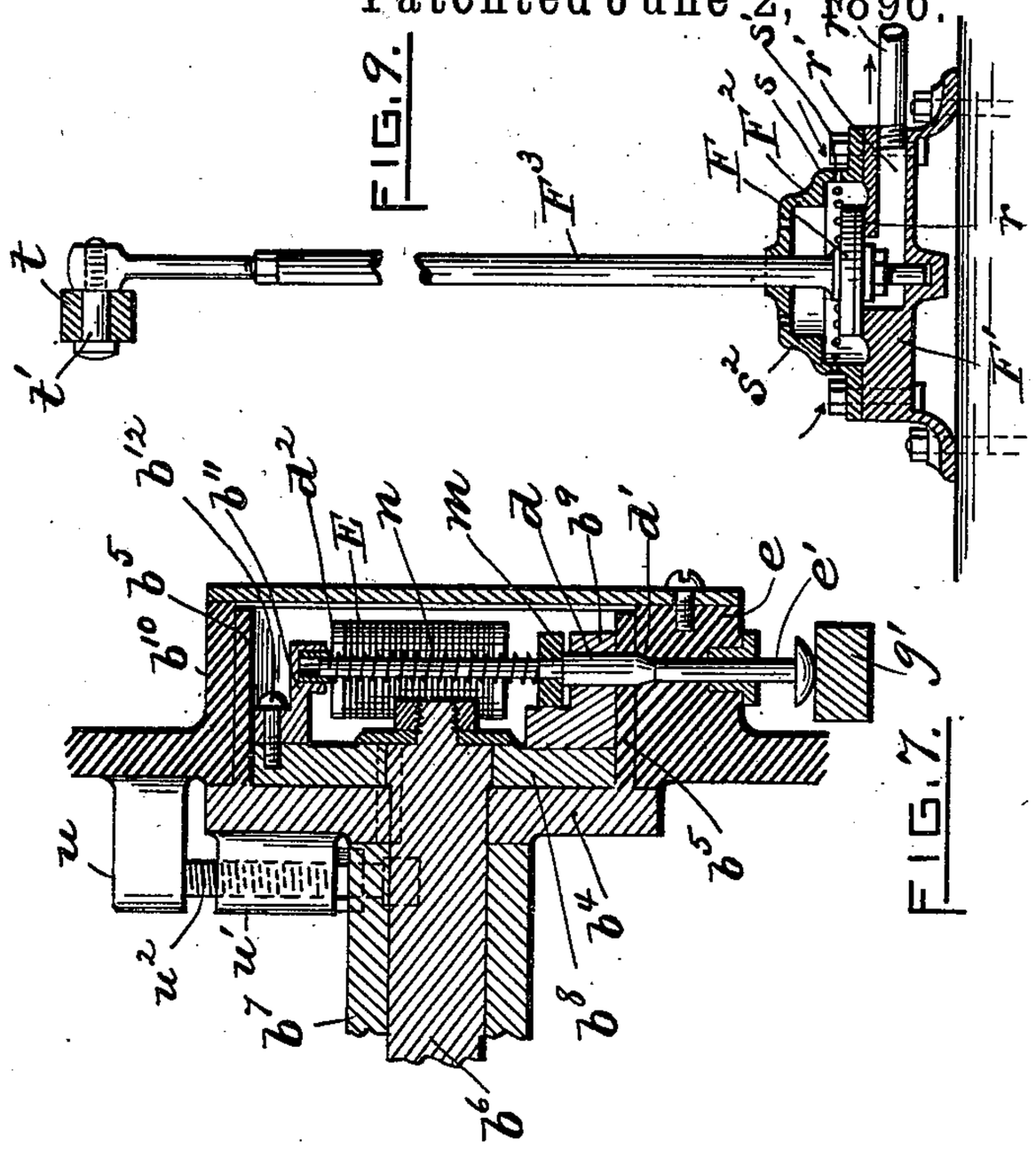

FIG. 9.

FIG. 7.

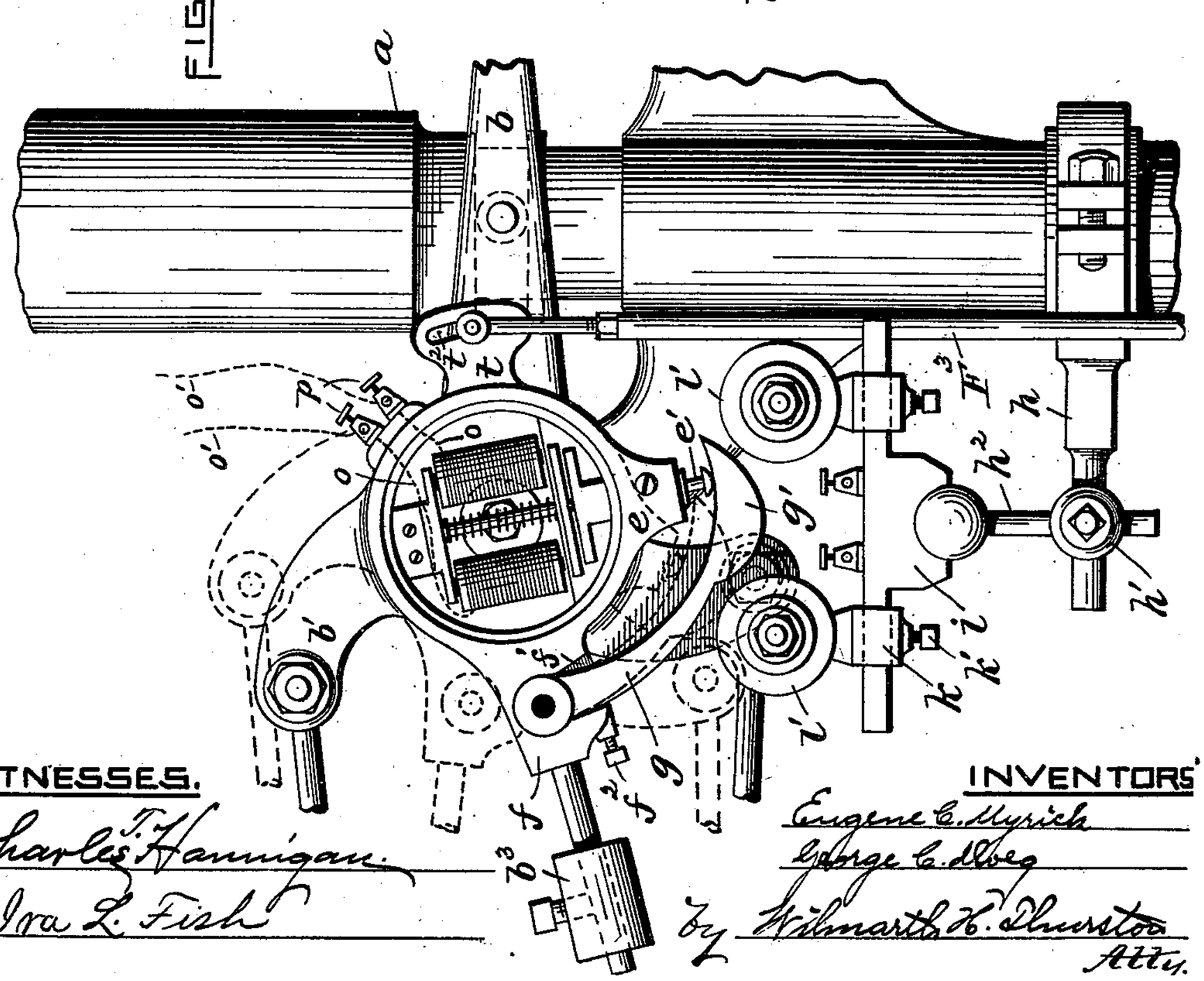

FIG. 6.

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UNITED STATES PATENT OFFICE.

EUGENE C. MYRICK AND GEORGE C. DOEG, OF PROVIDENCE, RHODE ISLAND.

STOP-MOTION FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 561,170, dated June 2, 1896.

Application filed December 30, 1895. Serial No. 573,726. (No model.)

To all whom it may concern:

Be it known that we, EUGENE C. MYRICK and GEORGE C. DOEG, of the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Stop-Motions for Steam-Engines; and we do hereby declare the following specification, taken in connection with the accompanying drawings, forming a part of the same, to be a full, clear, and exact description thereof.

The stop-motion which forms the subject of the present invention is more particularly adapted for use upon steam-engines which are provided with a detachable valve-gear and mechanism connected with and controlled by the governor for regulating the detachment of the valves.

The invention relates to means for stopping the engine automatically whenever the speed of the engine rises above or falls below predetermined limits, and which will also enable the engine to be stopped whenever desired from a point distant from the engine-room.

In Letters Patent No. 541,287, heretofore granted to us, is shown and described a stop-motion constructed to be operated electrically, both for stopping the engine automatically and for stopping it by hand from a distant point. In the arrangement of said patent the mechanism connected with and controlled by the governor for connecting said governor with the mechanism for regulating the detachment of the valves is constructed in two parts detachably connected together, one of said parts being provided with an independently-movable engaging device for engaging the other part, and carrying an electromagnet and armature for operating said engaging device to disconnect the detachably-connected parts and thereby permit the valve-detaching mechanism to be moved independent of the governor, so as to effectually prevent the admission of steam to the cylinder, the disengagement of the engaging device being effected in all cases electrically by energizing the electromagnet referred to.

One feature of the present invention consists in a combination and arrangement of parts whereby the independently-movable engaging device may be disengaged mechanically instead of electrically to effect the automatic stopping of the engine when the speed thereof exceeds or falls below predetermined limits.

A further feature of invention consists in a combination and arrangement of parts whereby the independently-movable engaging device may be disengaged mechanically to effect the automatic stopping of the engine, and may also be operated electrically from a distant point to effect such disengagement. In the operation of a stop-motion of the character referred to the stopping of the engine is effected by preventing the admission of steam to the cylinder. In the case of a condensing-engine the cutting off of the steam is not sufficient to bring the engine promptly to rest. To do this, it is necessary that the vacuum in the condenser and in the engine-cylinder should also be destroyed.

A further feature of invention therefore consists in the combination, with mechanism for regulating the detachment of the valves, of means for moving said regulating mechanism to prevent admission of steam to the cylinder and means for destroying the vacuum in the condenser when the steam is thus cut off.

A further feature of invention consists in providing an indicator so connected with the governor that the indicator will be operated whenever the speed of the engine becomes abnormal.

The invention also consists in certain combinations and arrangements of parts hereinafter described.

Referring to the drawings, Figure 1 is an elevation of so much of a steam-engine as is necessary for an understanding of the present invention. Fig. 2 is a side view of the governor of a steam-engine and its attachments embodying our invention. Fig. 3 is an end view of the same. Figs. 4, 5, and 6 are side views, on an enlarged scale, of parts composing the stop-motion and representing said parts in their different positions. Fig. 7 is a vertical section, on a still larger scale, of a portion of Fig. 6, the same being taken on line $x\ x$ of said figure. Fig. 8 is a detail, and Fig. 9 is a central vertical section of the vacuum-valve and its operating-rod.

The engine shown in the drawings is of the Corliss type, embodying rotary cut-off valves and one of the most recent forms of Corliss

valve-operating mechanism. It is to be understood, however, that the features of invention hereinafter described are not limited to any particular form or type of engine, but may be applied to any engine provided with detachable valve-gear, whether horizontal or vertical, stationary or marine, and can easily be applied to such class of engines now in use without any change in or addition to the mechanism for regulating the detachment of the valves.

1 represents an oscillating or swinging frame pivoted at 2 and operated in the usual manner by an eccentric upon the main shaft of the engine connected to said swinging frame at 3 for giving the proper movements to the steam and exhaust valves of the cylinder. The arms 4 4 of the swinging frame 1 are connected by means of the links 5 to the crank-arms 6, which operate the exhaust-valves. The arms 7 7 of the swinging frame are connected by means of links 8 8 to the crank-arms 9 9, which operate the steam-valves. As will be understood, the crank-arms are not permanently connected with the steam-valves, but are detachably connected therewith through a suitable latch connection and so that the valves may be unlatched and disconnected from the arms 9 before the completion of their throw and quickly closed by weights working in the dash-pots 10. The time of unlatching and thus disconnecting the steam-valves from the arms which operate them is automatically controlled by the position of the governor acting through proper connecting mechanism to vary the position of the latch connection or in some other suitable way.

Heretofore the mechanism commonly used for connecting the governor with the mechanism for regulating the detachment of the valves in an engine of the type shown in the drawings has consisted of a T-lever suitably pivoted upon the framework, the long arm of which was connected with and operated by the governor-sleeve a, and from the short arms of which extended connecting-rods c c, connecting said short arms of said T-lever with the pivoted levers 11 11, the opposite ends of which were connected to the parts 13 13, which in this case serve to regulate the detachment of the valves, the combination being such that as the governor-sleeve rose and fell under the action of the governor-balls the T-lever would be oscillated and thereby through the connecting-rods c the position of the parts 13 would be automatically controlled and determined.

In the application of the present invention to the engine of the type shown there is no change in or addition to the mechanism for regulating the detachment of the valves, the latches 12, the parts 13, and the connecting-rods c being all constructed as heretofore. Instead, however, of connecting the rods c to the governor-sleeve a through a T-lever constructed of a single part or piece said T-lever, as in the patent above referred to, is constructed in two parts adapted to be detachably connected together.

A represents an engine-governor, to the sleeve a of which is connected the long arm b of the T-lever, to the short arms b' b' of which lever are connected the rods c c of the valve-detaching mechanism. As in the case of our said prior patent, the T-lever is constructed in two parts adapted to be detachably connected together, one of said parts embodying the long arm b and the other part embodying the short arms b' b'. To the part which embodies the arms b' b' is secured an arm b^2, upon which is adjustably mounted a weight b^3, which may be held in any adjusted position by means of a set-screw. The two parts of the T-lever are normally connected together, and when so connected the valve mechanism is thereby connected with the governor, so that the time of cut off will be regulated and controlled by the governor. Whenever the two parts of the T-lever, however, are disconnected, the weight b^3 will act to turn the part embodying the arms b' b', so as to move the connecting-rods c c independent of the governor and sufficiently to prevent the admission of steam to the cylinder.

The two parts of the T-lever are detachably connected together by means of a sliding bolt d, constituting an independently-movable engaging device. This bolt d is mounted in one of the parts of the T-lever and is arranged to slide, so as to enter a corresponding hole or recess formed in the bottom part of said T-lever. In the arrangement shown in the drawings the bolt d is mounted in that part of the T-lever which embodies the arm b. The arm b is provided with a hub b^4, carrying an annular flange b^5, which flange may be either cast integral with the hub b^4 or rigidly secured thereto. The hub b^4 is mounted upon a stud b^6, to which it is keyed, as indicated in Fig. 7. The stud b^6 is mounted in a sleeve or support b^7, secured to the frame of the engine, and is free to oscillate in said sleeve. Keyed to the end of the stud b^6 is a disk b^8, carrying a bracket b^9, in which bracket the bolt d is arranged to slide freely, the end of said bolt projecting through the flange b^5, as shown in Fig. 7. Formed integral with the arms b' b' is a hub b^{10}, arranged to fit over the annular flange b^5, so as to turn thereon when allowed to do so. In the hub b^{10} is formed a hole or recess d' to receive the end of the bolt d, which said bolt, when projected to enter the recess d', thus serves to connect the two parts of the T-lever together. All that is necessary therefore in order to disconnect the two parts of the T-lever and thereby bring about the stopping of the engine is to withdraw the bolt d from the recess d'. By the present arrangement this may be done automatically by mechanical means when the governor-balls move beyond a predetermined limit in either direction or electrically from a distant point.

Referring first to the mechanical means for effecting the disengagement of the bolt *d* automatically, the hub b^{10} is provided with a projecting lug 2, in which is mounted a sliding pin *e'*, the inner end of which underlies the end of the bolt *d*. Said hub is also provided with another projecting lug *f*, arranged at a suitable distance from the lug *e*. Pivoted to the lug *f* is a curved lever *g*, the free end of which is arranged to underlie and support the sliding pin *e'*. This lever *g* is provided at its free end with a curved or cam projection *g'*. Preferably the lug *f* is provided with a recess *f'* in one face thereof to receive the pivoted end of the lever *g*, said recess being somewhat wider than the middle of the lever, and so that the vertical position of said lever and of the cam portion *g'* may be adjusted by means of the adjusting-screw f^2, said lever being held in proper position by the edge of said lever abutting against either the wall of the recess *f'* or the end of the screw f^2.

Secured to the governor-standard or frame of the engine is an arm *h*, on the outer end of which is adjustably mounted a vertical rod h^2, carrying at its upper end a cross-bar *i*. Mounted on this cross-bar *i* are two brackets *k*, one on each arm of said cross-bar, said brackets being adjustable upon the cross-bar and being adjusted to be held in any adjusted position by the set-screws *k'*. Each of the brackets *k* is provided at its upper end with a cylindrical enlargement k^2, in which is mounted a spring-pressed rod *l*, arranged to slide therein, as shown in Fig. 8. To one end of this rod *l* is secured a disk *l'*, and the other end is provided with a suitable knob or handle l^2. The disks *l'* in their normal position—that is, when thrust forward by their springs, as shown in Fig. 8—stand in the same vertical plane as the cam *g'* on the lever *g*. The disks *l'* are so adjusted upon the cross-bar *i* that when the engine is running at normal speed the cam *g'* will lie about midway between the two disks and out of contact therewith, the parts at such time being in the position shown in Fig. 6. With this construction and arrangement of parts it will be seen that the lever *g* and cam *g'* are connected with the governor-sleeve and so that any change in the position of the governor-balls will be accompanied by a corresponding change in the position of the cam *g'*. By properly adjusting the disks *l'*, therefore, the parts may be so arranged that as long as the engine runs within the predetermined limits of speed the cam *g'* will simply play back and forth between the disks *l'* in response to the varying movements of the governor. The position of the parts with the engine thus running is shown in Fig. 6. If, however, the governor-balls rise or fall beyond predetermined limits, such movement of the governor-balls will be accompanied by a correspondingly-increased movement of the cam *g'* to the one side or the other. Such increased movement of the cam *g'* will cause said cam to come in contact with one or the other of the disks *l'*, as the case may be, and the further movement of said cam will cause it to ride up the face of the disk, swinging the lever *g* upon its pivot. This movement of the cam *g'* will serve to press inward the pin *e'*, which in turn will serve to press inward the bolt *d*, and thereby effect the disconnection of the two parts of the T-lever. As will be seen, this movement of the bolt and the consequent disconnection of the parts will be effected by the abnormal movement of the cam *g'* to either one side or the other. Thus with the two parts of the T-lever connected if the governor-balls fall below a predetermined limit the cam *g'* will be carried to the left in Fig. 6, and, contacting with the left-hand disk *l'*, will be moved into the position indicated in dotted lines in said figure, thereby disconnecting the bolt *d*. As soon as the bolt *d* is disconnected the weight b^3 is free to fall, and in falling moves the arms *b' b'* and rods *c c* into such position that the steam-valves will not be operative to admit steam to the cylinder, the position of the parts after the weight has thus fallen and the engine has been brought to a stop being shown in Fig. 5, in which the governor-sleeve *a* and arm *b* are shown in their lowest position, to which they will fall when the steam has been thus shut off from the cylinder and the engine brought to a stop. Suitable means are to be provided, as hereinafter described, for regulating the distance through which the weight b^3 shall fall and for arresting the fall of the weight after it has moved the rods *c c* the required distance. On the other hand, if the governor-balls rise beyond the predetermined limit then the cam *g'* will be carried to the right in Fig. 5 and, contacting with the right-hand disk *l'*, will be moved inward to disconnect the bolt *d*, as before. As will be seen, the movement given to the arms *b b* and rods *c c* by the rise of the governor-balls as the speed of the engine increases is in the same direction that they are moved by the weight b^3 when said weight is free to fall independent of the governor. By reason of this fact the parts may, if desired, be so arranged and adjusted that by the time the cam *g'* has been moved by the rise of the governor-balls far enough to the right to disconnect the bolt *d* the arms *b b* and rods *c c* shall have already been brought to a position where the steam-valves will not be opened, and in such case there will be no need of having the weight b^3 (which, with the two parts of the T-lever connected, is lowered as the governor-balls rise) fall any farther after the bolt *d* is disconnected. With this arrangement of the parts, however, the disconnection of the two parts of the T-lever serves to prevent the subsequent fall of the governor-balls, resulting from the shutting off of the steam, from moving the rods *c c* back again to a position where they would permit the opening of the steam-valves, as would other-

wise be the case, the weight b^3 serving to hold the rods c c in the required position to prevent the opening of the steam-valves, the result being that the engine will be stopped and will remain stopped until again started by the engineer. If, however, the parts be not adjusted as above suggested—that is, if the rods c c have not been moved far enough by the rise of the governor-balls at the time the bolt d is disconnected—then after the bolt d has been disconnected and the weight b^3 thereby left free to fall independent of the governor said weight will fall and move the rods c c the remaining distance necessary to prevent the opening of the steam-valves. In other words, the means for arresting the fall of the weight b^3 being adjusted to permit the weight to fall or be moved to such position that the rods c c, connected with said weight, shall be brought to a position where the opening of the steam-valves will be prevented, if the weight has been moved to this position by the rise of the governor-balls at the time the bolt d is disconnected, then no further fall of the weight is necessary; but if the weight has not been moved to this position by the rise of the governor-balls then when the bolt d is disconnected the weight will fall the remaining distance necessary to prevent the opening of the steam-valves. The position of the parts when the engine has been stopped in either of the ways above described is shown in Fig. 5. By adjusting the brackets k toward or from each other on the cross-bar i, or by adjusting the vertical position of said brackets by raising or lowering the rod b^2, the position of the disks l' with relation to the cam g' may be adjusted as desired, and thereby the limits beyond which the rise or fall of the governor-balls will actuate the stop-motion may be determined and regulated with the greatest nicety.

It is desirable that the stop-motion above described should be rendered inoperative when the engine is to be stopped by the engineer in the regular way, and it is also very desirable that the stop-motion should, when the engine is again started, be automatically rendered operative again and without the necessity of any hand manipulation. By the construction of parts above described these results may be obtained by a single and very simple manipulation on the part of the engineer when the engine is to be stopped and without any manipulation on his part when the engine is again started. Thus all that is required to be done when the engine is to be stopped is simply to pull out the sliding rod l at the left in Fig. 4, so as to remove the disk l' attached thereto out of the path of the cam g'. As the governor-balls and governor-sleeve descend in the slowing down of the engine the cam g' will then pass behind the disk l' instead of coming in contact therewith, and with the result that the bolt d will not be moved and the two parts of the T-lever will not be disconnected. When the cam g' has thus passed behind the disk, the sliding rod may be released and the inner face of the disk will then bear against the side of the cam, and the parts will remain in that position, as indicated in Fig. 4, while the engine is stopped. By this arrangement the governor-sleeve is allowed to fall to its lowest position, as usual, and the necessity of employing a safety-dog operated either by hand or automatically to prevent such extreme movement of the governor-sleeve is entirely avoided. When the engine is next started, as the governor-balls rise they will move the cam g' out from behind the disk l', and when the cam has entirely cleared the disk the rod l will be acted upon by its spring to return the disk to its normal position in the path of the cam g', and thus the stop-motion will be again rendered operative automatically and without the necessity of any hand manipulation.

It is desirable that the attention of the engineer should be called to the engine whenever its speed has become abnormal or when it has been stopped either by reason of such abnormal speed or through the closing of the electric circuit above described. To accomplish this result, an indicator is so connected to the governor that whenever the speed of the engine becomes abnormal said indicator is operated and the attention of the engineer attracted. The form of indicator which is preferably used is an electric bell, and this bell is preferably so connected to the stop-motion above described that the bell is rung before the variation from the normal speed of the engine becomes great enough to stop the engine and continues to ring until the engine is again started or the electric circuit in which the bell is placed is broken. In the construction shown the arm h is insulated from the governor-column and the bar i is provided with a binder-post i', to which is connected the wire i^2 from the battery I, said battery being grounded through the wire i^3. An indicator in the form of an electric bell I′ is inserted in the line of wire i^2. When the engine is running at normal speed, the parts occupy the position shown in Fig. 6 and there is no current through the wire i^2; but when the speed varies from the normal, so that the cam g' contacts with either of the disks l', the wire i^2 becomes grounded through said cam and disk and the engine and a current passes through the wire i^2 and the bell I′ is rung and continues to ring until the cam g' is moved from engagement with said disk. The hand-lift disk l' is provided with a facing l^{10} of insulating material, so that the indicator will not be operated when the engine is stopped by the engineer in the regular way.

It is sometimes desirable to be able to stop the engine from some distant point, as from some other room in the building. One feature of the mechanical stop-motion above described is that it is of such character that it not only serves to stop the engine automatically when the speed of the engine rises

above or falls below predetermined limits, but also permits of the engine being stopped by electrical means from a distant point. This is made possible by the fact that the independently-movable engaging device—viz., the bolt *d*—is of such character and so combined with the other parts that while it may be operated to disconnect the two parts of the T-lever by the mechanical means above described it may also be operated by the closing of an electric circuit. To enable this result to be accomplished, an electromagnet E is arranged within the cup-shaped receptacle formed by the hub l^4 and annular flange l^5, being suspended therein by being secured to a bracket b^{11}, secured to the hub b^4 by screws b^{12}. The armature *m* of said electromagnet is secured to the bolt *d* and so that when said electromagnet is energized and the armature thereby attracted the result will be to withdraw the bolt *d* from the recess *d'* and thus effect the disconnection of the two parts of the T-lever, permitting the weight b^3 to fall and the arms *b' b'* and rods *c c* to be moved independent of the governor and so as to prevent the opening of the steam-valves, as above described. Preferably the bolt *d* is provided with a shank or extension d^2, the end of which enters a recess formed in the bracket b^{11}, as shown in Fig. 7, for the purpose of guiding the movement of the bolt *d* and attached armature *m*. A spiral spring *n*, surrounding the shank d^2 and abutting at one end against the bracket b^{11} and at the other end against the armature *m*, is also preferably employed to assist in returning the armature and bolt to their normal position and in causing the bolt *d* to enter the recess *d'* when the two are again brought into alinement.

The wires *o o* from the electromagnet E are led out through a slot of suitable length formed in the flange b^5 and through hub b^{10} to the binding-posts *p p*, secured to but insulated from the hub b^{10}, from which binding-posts the wires *o' o'* may be led to any desired distance from the engine, the circuit including a battery B or other source of electricity and a push-button or other circuit-closing device o^2. If desired, hand-circuits may extend to the different rooms of the establishment where the engine is located, each branch being provided with a push-button or circuit-closing device, and so that if it be desired to stop the engine promptly from any of said rooms it will only be necessary to push the button. A plate or cover b^{11}, pivoted at b^{12} to the face of hub b^{10}, is secured in position by means of a screw b^{13}, passing through slot b^{14}, formed in said plate.

As above stated, it is necessary in the case of a condensing-engine, in order to stop the engine promptly, not only to prevent the admission of steam to the cylinder, but also to destroy the vacuum in the cylinder and in the condenser. To accomplish this result, whenever the stop-motion above described is operated, either automatically by the mechanical means described or by the closing of an electric circuit, a valve is employed to control the admission of air to the condenser, said valve being arranged to be operated by or simultaneously with the stop-motion.

Referring to Fig. 9, F is a valve for controlling the admission of air to the condenser. This valve is arranged in a casing composed of two parts F' F^2, the part F' in the form shown in the drawings constituting a base or standard adapted to be secured to the floor, and the part F^2 constituting a cap or cover adapted to be secured to the part F'. The base F' is provided with a seat *r* for the valve and with a passage or chamber *r'* in communication with a pipe r^2, which in turn communicates with the condenser. The interior diameter of the lower portion S of the cap or cover F^2, which is preferably of cylindrical form, is considerably greater than the diameter of the valve, and is provided with a series of holes or apertures S'. The interior diameter of the upper portion S^2 of the cap F^2 is preferably only slightly greater than the diameter of the valve, and so as to constitute a dash-pot for the valve, said portion S^2 being provided with one or more holes or apertures S^3 for the gradual escape of the entrapped air. The valve-rod F^3, which may be made in two parts for the purpose of adjusting the length thereof, projects through the cap F^2 and is to be connected with some part adapted to operate the valve F at the proper time. In the arrangement shown in the drawings said valve-rod is connected with a lug *t*, projecting from the hub b^{10}, by means of a pin *t'*, projecting from the upper end of said valve-rod, and which enters an elongated slot t^2, formed in the arc of a circle in the lug *t*. This slot t^2 should be of sufficient length to permit whatever range of movement it is desired the governor-sleeve shall have in the normal working of the engine without disturbing the valve F. The parts are so arranged and combined that as long as the engine runs within the predetermined limits of speed the valve F will remain closed, being held in its closed position by the atmospheric pressure upon the top of the valve, the pin *t'* on the valve-rod playing back and forth in the slot t^2 as the governor-balls rise and fall. Whenever the rods *c c*, however, are moved, either by the rise of the governor-balls and the consequent lowering of the weight b^3 or by the fall of said weight independent of the governor, as above described, to a position where the opening of the steam-valves will be prevented, then the lug *t* will be raised sufficiently not only to cause the engagement of the lower end of the slot t^2 with the pin *t'*, but also to raise or lift the said pin and the valve-rod and valve connected therewith. The lifting of the valve F away from its seat will permit the air, which enters through the holes S', to flow between the valve and its seat and thence through the passage *r'* and the pipe r^2 to the condenser, thus destroying

the vacuum in said condenser and in the engine-cylinder simultaneously with the cutting off of steam from the cylinder, thereby causing the engine to be brought quickly to a full stop. By adjusting the length of the valve-rod F^3 the parts may be so adjusted that the opening of the valve F shall be effected at just the right time. As above stated, the arrangement or adjustment of the parts may be such that the rods *c c* will be moved to the necessary position to prevent the opening of the steam-valves by the rise of the governor-balls before or at the time the bolt *d* is operated to disconnect the two parts of the T-lever, and in such case the valve F may be and, if the parts be adjusted so that the opening of the valve is to be exactly simultaneous with the cutting off of steam from the cylinder, would be likewise operated by the rise of the governor-balls. It is preferable, however, that the parts should be so adjusted that the opening of the valve F will be effected by the fall of the weight b^3 after the bolt *d* has been operated to disconnect the two parts of the T-lever. With such arrangement the portion E^2 of the cap F^2 will serve as a dash-pot to resist the movement of the valve and the connected weight b^3 and to limit the fall of said weight. If the vacuum-valve attachment above described is not employed, then any other suitable means may be employed for arresting and limiting the fall of the weight—as, for instance, the hub b^{10} may be provided with a projecting lug *u* and the hub b^4 provided with a corresponding lug *u'*, carrying adjusting-screw u^2, the parts being so arranged that as the hub b^{10} is turned by the fall of the weight b^3 the lug *u* will come in contact with the end of the adjusting-screw u^2, and thereby prevent the further turning of the hub b^{10} and consequently the further fall of said weight. By adjusting the position of the screw u^2 in the lug *u'* the position to which the weight b^3 will fall may be accurately regulated.

What we claim as our invention, and desire to secure by Letters Patent, is—

1. The combination with the governor, and the mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, one of said parts being provided with an independently-movable engaging device, a cam attached to and moving with said connecting mechanism for operating said engaging device to disconnect the parts of said connecting mechanism and an abutment for actuating said cam, whereby the parts of said connecting mechanism may be automatically disconnected whenever the speed of the engine becomes abnormal, substantially as described.

2. The combination with the governor, and the mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, one of said parts being provided with an independently-movable engaging device, a cam attached to and moving with said connecting mechanism for operating said engaging device to disconnect the parts of said connecting mechanism and an abutment for actuating said cam, and means for adjusting the position of said abutment with relation to said cam, substantially as described.

3. The combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, one of said parts being provided with an independently-movable engaging device for engaging the other part, a cam attached to and moving with said connecting mechanism for operating said engaging device to disconnect the parts of said connecting mechanism, and two abutments for actuating said cam, one of said abutments being located on each side of said cam, whereby the two parts of said connecting mechanism will be automatically disconnected whenever the speed of the engine rises above or falls below predetermined limits, substantially as described.

4. The combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, one of said parts being provided with an independently-movable engaging device for engaging the other part, a cam attached to and moving with said connecting mechanism for operating said engaging device to disconnect the parts of said connecting mechanism, an abutment for actuating said cam, and means for moving the valve-regulating mechanism independent of the governor when the parts of said connecting mechanism are disconnected, substantially as described.

5. The combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, one of said parts being provided with an independently-movable engaging device for engaging the other part, means for mechanically operating said engaging device to disconnect the two parts of said connecting mechanism automatically when the speed of the engine becomes abnormal and means for operating said engaging device by an electric circuit, substantially as described.

6. The combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said connecting mechanism comprising two

parts detachably connected together, mechanical devices for effecting the detachment of the parts automatically when the speed of the engine becomes abnormal and an electromagnet carried by said connecting mechanism for effecting the detachment of the parts by the use of an electric circuit, substantially as described.

7. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts, an independently-movable engaging device carried by one of said parts an electromagnet carried by said connecting mechanism for operating said engaging device and independent devices for operating said engaging device when the speed of the engine becomes abnormal, substantially as described.

8. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts, an independently-movable engaging device carried by one of said parts, an electromagnet carried by said connecting mechanism for operating said engaging device, a cam carried by said connecting mechanism for operating said engaging device and an abutment in the path of the cam, substantially as described.

9. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said mechanism comprising two parts detachably connected together, means for effecting the detachment of the parts comprising a cam attached to and moving with said connecting mechanism, an arm secured to the governor-standard, a bar carried by said arm and an abutment adjustably mounted on said bar and arranged in the path of said cam, substantially as described.

10. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said mechanism comprising two parts detachably connected together, means for effecting the detachment of the parts comprising a cam attached to and moving with said connecting mechanism, an arm secured to the governor-standard, a cross-bar adjustably carried by said arm and an abutment adjustably mounted on each arm of said cross-bar and arranged in the path of said cam, substantially as described.

11. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, devices for disconnecting said connecting mechanism whenever the speed of the engine becomes abnormal, including a movable part under the control of the attendant whereby said devices may be rendered inoperative and the engine stopped without detaching the valves, substantially as described.

12. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, of devices for disconnecting said connecting mechanism comprising a cam and a movable abutment, whereby the abutment may be moved out of the path of the cam and the engine stopped without detaching the valves, substantially as described.

13. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, of devices for disconnecting said connecting mechanism comprising a cam and a laterally-yielding abutment, whereby the abutment may be moved out of the path of the cam and the engine stopped without detaching the valves and the abutment automatically returned to its normal position when the engine is started, substantially as described.

14. The combination with the governor and mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts, an independently-movable engaging device carried by one of said parts, a cam operating said engaging device and a movable abutment in the path of said cam, whereby the engine will be automatically stopped when its speed becomes abnormal, or the abutment may be moved out of the path of the cam when the engine is to be stopped by the engineer, substantially as described.

15. The combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism connecting said governor and said regulating mechanism, said connection comprising two parts detachably connected together, means for effecting the detachment of the parts comprising a cam carried by said connecting mechanism, and means for adjusting said cam, substantially as described.

16. In a stop-motion for a steam-engine an arm adapted to be secured to a stationary part of the engine, a bar carried by said arm, an abutment adjustably mounted on said bar and a device for engaging said abutment, substantially as described.

17. In a stop-motion for steam-engines an arm adapted to be secured to a stationary part of the engine, a bar adjustably carried by said arm an abutment mounted on said bar and a device for engaging said abutment, substantially as described.

18. In a stop-motion for steam-engines an arm adapted to be secured to a stationary part of the engine, a cross-bar adjustably carried by said arm an abutment adjustably mounted

on each arm of said cross-bar and a device for engaging said abutment, substantially as described.

19. In a condensing-engine the combination with the governor and the mechanism for regulating the detachment of the valves, of means for moving said regulating mechanism to prevent the admission of steam to the cylinder, and means for destroying the vacuum in the condenser and the parts connected therewith, substantially as described.

20. In a condensing-engine the combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism for detachably connecting said governor and said regulating mechanism and means controlled by said connecting mechanism for destroying the vacuum in the condenser, substantially as described.

21. In a condensing-engine the combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts detachably connected together, means for effecting the detachment of said parts, a valve adapted to be connected to the condenser and controlled by said connecting mechanism, substantially as described.

22. In a condensing-engine the combination with the governor and the mechanism for regulating the detachment of the valves, of mechanism for connecting said governor and said regulating mechanism, said connecting mechanism comprising two parts, an independently-movable engaging device carried by one of said parts, means for automatically disengaging said engaging device when the speed of the engine becomes abnormal, a valve adapted to be connected to the condenser and a connection between said valve and said connecting mechanism, substantially as described.

23. The combination with the governor, of an indicator and connections between said governor and said indicator whereby the indicator is operated whenever the speed of the engine rises above or falls below the normal, substantially as described.

24. The combination with the governor, of an indicator an electric circuit for operating said indicator, and means for closing said circuit whenever the speed of the engine rises above or falls below the normal, substantially as described.

25. The combination with a stop-motion for a steam-engine, of an indicator and connections between said stop-motion and said indicator whereby the movement of the stop-motion in stopping the engine causes the indicator to be operated, substantially as described.

26. The combination with a stop-motion for a steam-engine comprising a cam and an abutment, of an indicator, and electric connection between said cam, said abutment and said indicator whereby the indicator is operated whenever said cam engages said abutment, substantially as described.

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