No. 881,544. PATENTED MAR. 10, 1908.

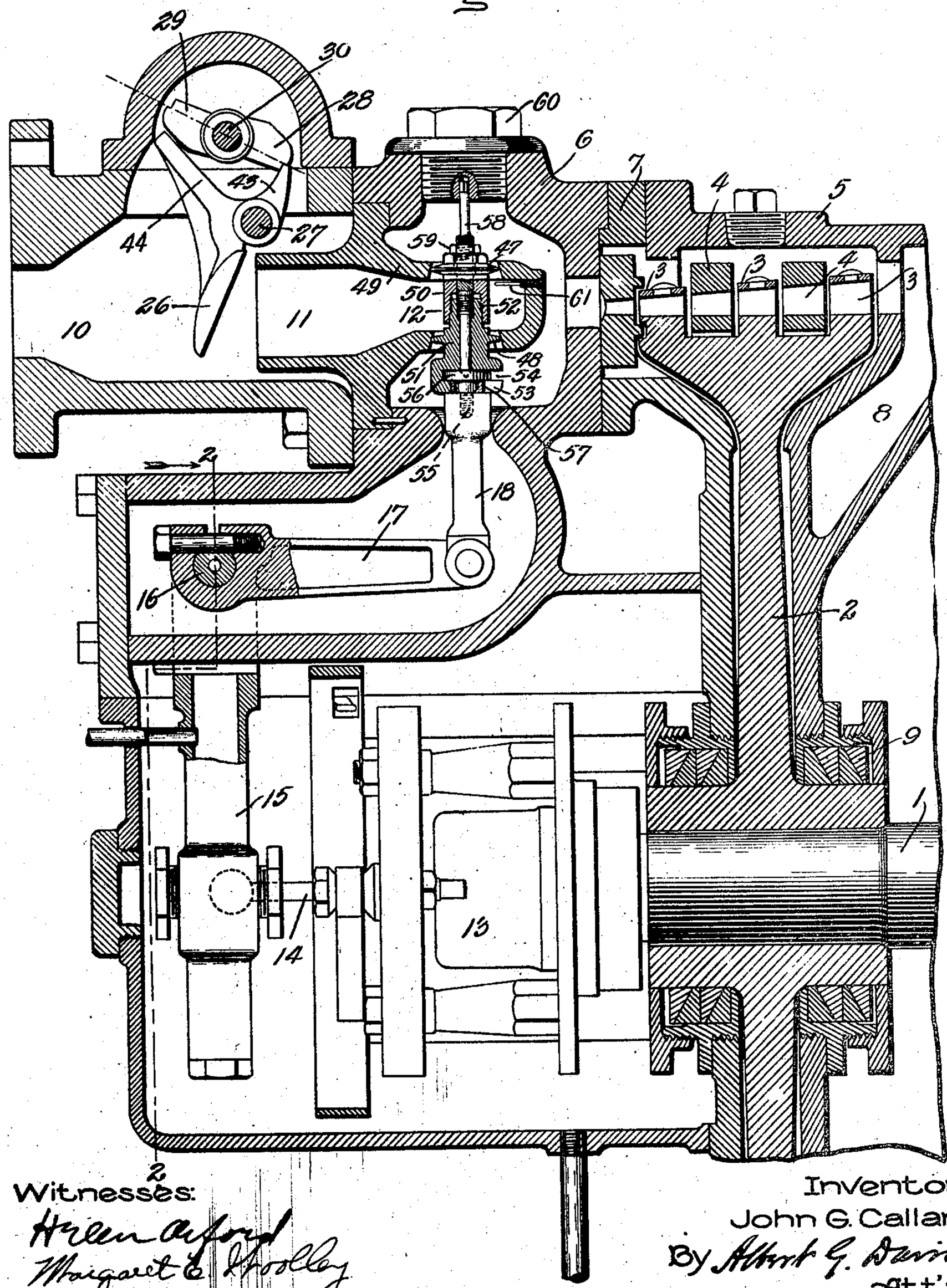
J. G. CALLAN.

GOVERNING MECHANISM FOR TURBINES.

APPLICATION FILED JUNE 28, 1906.

3 SHEETS—SHEET 1.

Fig. 1.



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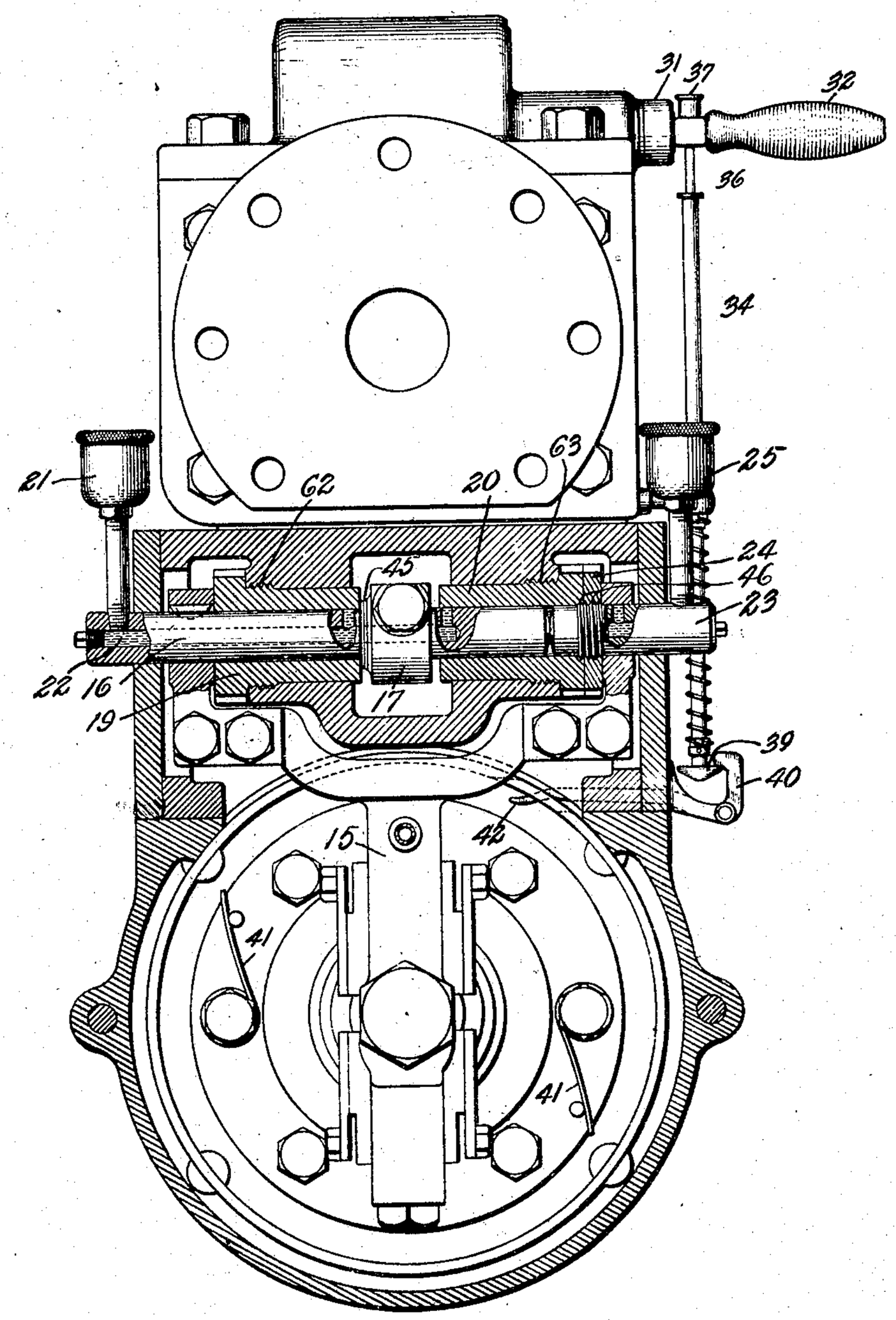
3 SHEETS—SHEET 2.

Fig. 2.



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3 SHEETS—SHEET 3.

Fig. 3.

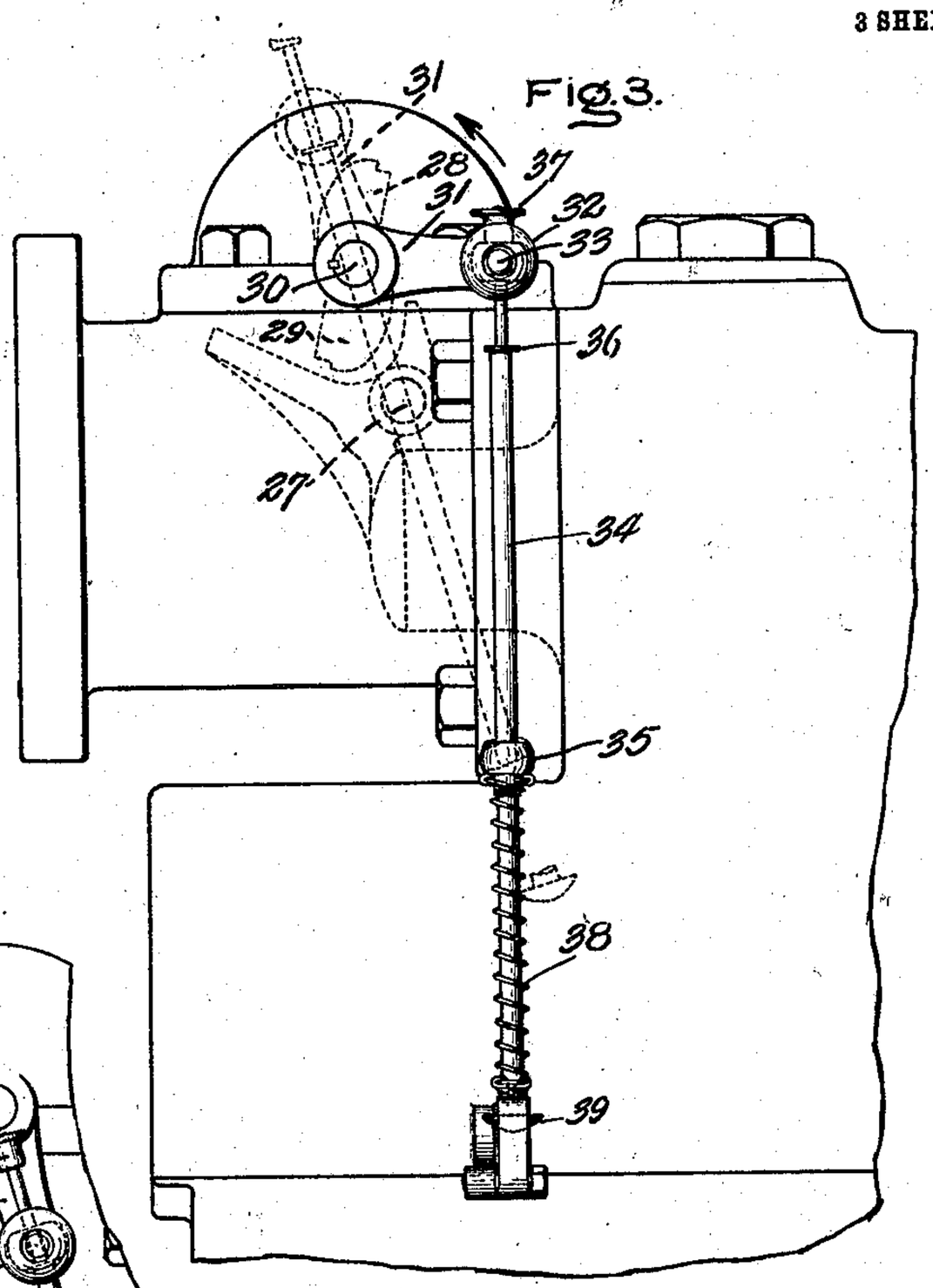


Fig. 4.

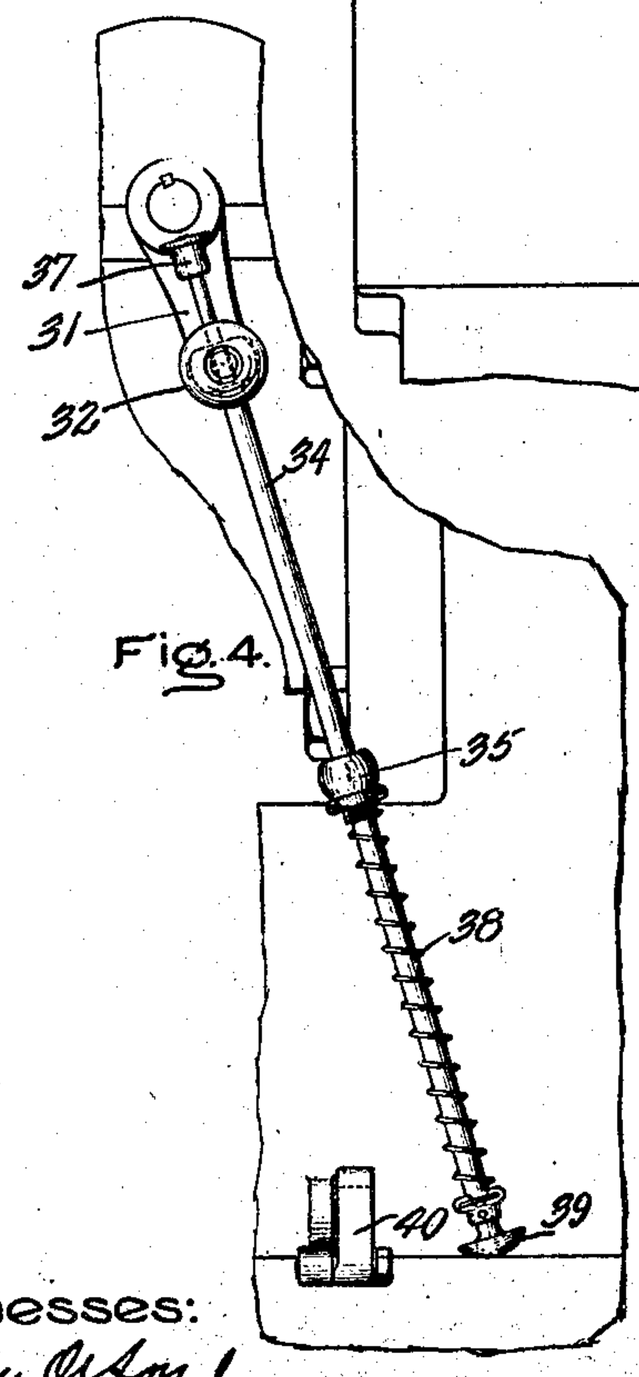
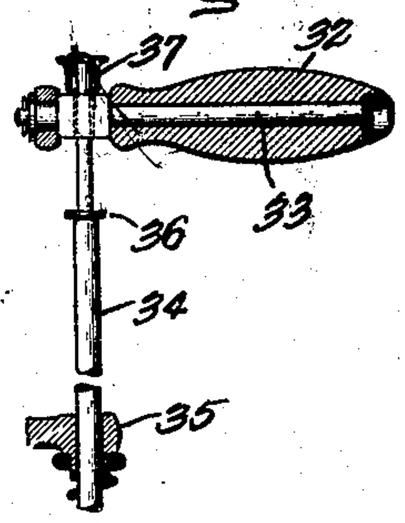


Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN G. CALLAN, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

GOVERNING MECHANISM FOR TURBINES.

No. 881,544 Specification of Letters Patent. Patented March 10, 1908.

Application filed June 28, 1906. Serial No. 323,836.

To all whom it may concern:

Be it known that I, JOHN G. CALLAN, a citizen of the United States, residing at Lynn, county of Essex, State of Massachusetts, have invented certain new and useful Improvements in Governing Mechanism for Turbines, of which the following is a specification.

The present invention relates to governing mechanism for elastic fluid turbines or other prime movers. Its object is the provision of a governing mechanism of improved construction which will entirely shut off the supply of motive fluid when the speed becomes abnormal, that is when it exceeds a certain prescribed limit. The mechanism is simple in structure, positive in operation and the shut-off may be readily and accurately reset by the attendant without the exercise of any special skill on his part.

In the accompanying drawings illustrating one of the embodiments of my invention, Figure 1 is a partial axial section of an elastic fluid turbine; Fig. 2 is a partial transverse section on line 2—2, Fig. 1; and Figs. 3, 4 and 5 are details of the emergency valve mechanism.

1 represents the main shaft of the turbine upon which a bucket wheel 2 is mounted. This wheel has one or more rows of buckets 3 of suitable shape. Between the rows of wheel buckets, are intermediate buckets 4 carried by a support of appropriate form. The wheel and intermediate buckets are inclosed in a casing 5. To this casing, a valve chest 6 is secured which also acts as a support for suitable nozzles or discharging devices 7 which discharge steam or other elastic fluid to drive the wheel. The motive fluid passes from the buckets into an exhaust conduit 8 which may lead to another set of nozzles and buckets if the turbine be of the multi-stage type, or to a condenser, or to the atmosphere. On the hubs of the wheel 2 are packings 9 to prevent the escape of steam from the casing.

Steam or other elastic fluid enters the chamber 10 from a source of supply and flows through the passage 11 to the interior of the chest 6 whence it passes to the nozzles 7 or other fluid discharging devices. Its flow is regulated by a throttle valve 12 under the control of a speed-responsive device 13 of any suitable construction mounted upon the end of the shaft 1 and rotating within a casing. The device 13 has a connection 14 swiveled to a lever 15 having a forked end, the left hand branch of which, Fig. 2, is keyed to a shaft 16, and the other branch is loosely mounted on a stud 23 described later. An arm 17, fast upon shaft 16, has a connection 18 to the valve 12.

The valve 12, and parts 17 and 18 being within the steam space of the turbine and the speed-responsive device being outside said space it is necessary to prevent leakage of steam along shaft 16 and its bearings which extend from one region to the other. To this end the bearings 19 and 20, Fig. 2, have a steam-tight threaded connection with the casing at 62, 63. Thrust washers 45 are placed on shaft 16 between the arm 17 and the left hand bearing 19. No washers are placed between the arm and the right hand bearing 20 so that the unbalanced pressure on said arm will force the washers against the end of the bearing and thereby prevent leakage along the shaft in that direction. To prevent leakage in the other direction, the shaft 16 extends only partly through the bearing 20 and a stud 23 is inserted in the outer end of said bearing. This stud has a steam-tight threaded connection 46 with the bearing 20 and also serves to retain the shaft 16 in position. A check nut 24 secures the stud 23 against displacement.

The bearings of shaft 16 receive lubricant through a passage 22 in the shaft from an oil cup 21. The bearing of the right hand branch of the forked arm 15 on the stud 23 is supplied with lubricant passing from an oil cup 25 through the interior of the stud.

The valve 12 is a balanced valve and has two disks 47, 48 which may engage suitable seats in the member 49. These disks have hub portions 50, 51 in threaded engagement at 52. A hexagonal projection on disk 47 provides a means for screwing or unscrewing the hub 50 to adjust the disks with relation to each other and to their seats. The lower end of the hub 51 has a bifurcated portion 53 and a slot 54. A stud 55 secured in the end of the connection 18 has a head 56 engaging the slot 54 and carries a roll 57 which enters the fork 53, thus joining the parts 12 and 18. This structure enables the hub to be slid sidewise into or out of engagement with the stud.

A conical recess in the head 56 receives the

conical end of spindle 58 which passes centrally through the valve. This spindle is threaded into the upper end of the hub 51, passes loosely through the hub 50 and has a check nut 59 which secures the disks in position after adjustment. The upper end of the spindle enters and is guided by a hole in the removable cap 60 and has a squared portion for receiving a wrench. A stop pin 61 secured in the member 49 projects into the path of the disk 47 to limit its downward movement and keep the valve from dropping out when assembling the machine.

When assembling the parts, the spindle 58 is either removed or it is unscrewed to draw its conical end within the hub 51. The lower portion of the hub is then slipped over the head of the stud 55 and the spindle is screwed down to seat its conical end in the recess in the head 56 to bring the valve and the connection 18 into alinement. The disks 47 and 48 having been previously adjusted may now be secured against displacement by the check nut 59.

To prevent injury resulting from an abnormal increase of speed, I provide an emergency valve 26, which is loosely mounted on a stud 27, fixed in the upper part of the chamber 10, so that it may when released from a catch 28, 29 swing downward and close the entrance to passage 11, thus shutting off the steam supply and stopping the turbine. The steam pressure in chamber 10 keeps the valve closed until it is reset by the attendant. For convenience in manufacturing and assembling the mechanism, both parts 28, 29 of the catch are notched but the notch in part 29 may be omitted.

The catch 28, 29 is fixed to a shaft 30, rotatably mounted above stud 27 in the upper part of the chamber 10 with one end projecting through a wall of said chamber. An arm 31, Fig. 3 is fixedly mounted on this projecting end in such relation to part 28 that the arm is substantially horizontal when the parts 28 and 43 are in engagement, Fig. 1. The arm has a handle 32 on a stud 33 secured in the end of said arm. A rod 34 mounted to slide in a swivel bearing 35 on the casing has a reduced end portion passing freely through the stud 33 between the handle and the arm. The movement of the rod with relation to the arm is limited by the shoulder 36 and the nut 37 and may be adjusted by means of said nut.

A spring 38 secured at one end to the bearing 35 and at the other to the rod 34 normally tends to force the rod upward through the bearing toward the arm. The lower end of the rod is enlarged at 39 to form a shoulder to engage a trigger 40 mounted upon the casing. One arm of the trigger projects inward through the casing into proximity to the speed-responsive device 13. Springs 41 upon this device forming an emergency governor are forced outward as the speed increases and the mechanism is so adjusted that these springs will strike the arm 42 and trip the trigger 40 permitting the latter to release the shut off valve 26 when the speed reaches a prescribed limit.

Under normal conditions, the parts are in the position shown in full lines in Figs. 1, 2 and 3 with the catch 28 in engagement with the projection 43 on the valve 26 and the portion 29 of the catch overlying the projection 44 on said valve. But when the speed exceeds the desired limit and the trigger is actuated, the spring 38 imparts a quick upward movement to the rod 34 bringing the shoulder 36 into contact with the stud 33 adjacent the arm 31. The impact of the shoulder against the stud turns the arm 31 and shaft 30 releasing the catch 28 from the projection 43 and bringing the part 29 forcibly against projection 44 with a hammer-like blow to overcome any possible sticking of valve 26 and to move it quickly into approximately closed position where the steam pressure will effectively close it and hold it closed. The resultant position of the mechanism just described is shown in dotted lines Fig. 3.

When it is desired to reset the mechanism before starting up again, the attendant shuts off the steam by a hand valve in the supply pipe and turns the arm 31 by means of its handle in the direction of the arrow, Fig. 3. The cam-like portion of the catch member 29 engages the projection 43 and opens the valve 26 after the arm has moved through approximately 90° from its dotted position, Fig. 3. Further motion first releases the valve from the member 29. Then continued rotation of the arm through about 180° to full line position, Fig. 3, causes the cam portion of the member 28 to again open the valve and brings the projection 43 into engagement with the notch in the end of the catch member 28 where it is held by the weight of the valve and the action of the steam upon the valve after steam is turned on to start up again. The notch being in line with the center of the shaft 30 the pressure on the valve has no tendency to turn the catch. Fig. 4 shows the parts in a position intermediate the dotted line position Fig. 3 and the normal position to which they are being moved. After the valve and catch are set in open position, Fig. 1 as above described, the arm 31 is in position for the attendant to force the rod 34 downward against the tension of spring 38 and engage the shoulder 39 with the trigger 40.

The location of the governor outside the steam space makes it easily accessible for inspection and adjustment. Access to the governor valve for the same purposes is af-

forded by the cap 60. While the emergency valve is reset by the simple operation of turning a handle and engaging a rod with a trigger. The governing mechanism has been illustrated in connection with one type of turbine but it may be used with any form of elastic fluid turbine.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention together with the apparatus which I consider the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a governing mechanism, the combination of a valve that has a tendency at all times to close, a catch which normally prevents the valve from closing, and a means for rotating the catch after it has released the valve to reset it.

2. In a governing mechanism, an emergency valve, a catch which may engage the valve to hold it open, means for rotating the catch to engage it with the valve, and means rendered operative by an increase of speed above a prescribed limit which releases the valve from the catch.

3. In a governing mechanism, an emergency valve, a catch which may engage the valve to hold it open, means rendered operative by an increase of speed above a prescribed limit to release the valve, and means for rotating the catch to open and reset the valve.

4. In a governing mechanism, an emergency valve, a catch having a plurality of members one of which engages a portion of the valve to hold it open while another is located adjacent another portion of the valve, means rendered operative by an increase of speed above a prescribed limit which actuates the catch to release the valve and to impart a blow to the second portion of the valve, and means for rotating the catch to reset the valve in open position.

5. In a governing mechanism, an emergency valve having a plurality of projections, a catch having oppositely disposed members one of which engages one of the projections while a second member is adjacent another projection, and means rendered operative by an increase of speed above a prescribed limit which actuates the catch to release the first projection and to impart a blow to the other projection to close the valve.

6. In a governing mechanism, an emergency valve having a plurality of projections, a catch having oppositely disposed members one of which engages one of the projections while a second member is adjacent another projection, means rendered operative by an increase of speed above a prescribed limit which actuates the catch to release the first projection and to impart a blow to the other projection to close the valve, and means for resetting the valve.

7. In a governing mechanism, an emergency valve, a catch having oppositely disposed members one of which engages the valve to hold it open while another member is located adjacent a portion of the valve, means rendered operative by an increase of speed above a prescribed limit which actuates the catch to release the valve and to impart a blow to said portion to close the valve, and a means for rotating the catch to open and reset the valve.

8. In a governing mechanism, a stud, an emergency valve loosely mounted on the stud and having a projection substantially in line with the valve and another projection at an angle to said valve, a pivoted catch having two oppositely disposed members one of which engages the first projection to hold the valve open while the other overlies the second projection, and means rendered operative by an increase of speed above a prescribed limit which actuates the catch to release the first projection and to impart a hammer-like blow to the other projection to close the valve.

9. In a governing mechanism, an emergency valve, a catch which normally holds the valve open and is also employed to reset it after being closed, and a means for operating the catch to reset the valve.

10. In a governing mechanism, the combination of an emergency valve, a catch to hold the valve open, a device for releasing the catch when it is desired to close the valve, and a means for moving the catch in a manner to reset the valve.

11. In a governing mechanism, an emergency valve, a catch for the valve having oppositely disposed members including a notch and cam-like portions, projections on the valve one of which engages the notch while the other is disposed adjacent a cam portion, means rendered operative by an increase of speed above a prescribed limit which releases the valve from the notch and brings the cam portion into forcible contact with its adjacent projection, and means for manually operating the catch to bring a cam portion into engagement with the first mentioned projection for resetting the valve and catch.

12. In a governing mechanism, an emergency valve, a catch which engages the valve to hold it open, a shaft upon which the catch is mounted, an arm upon the shaft, a rod having a sliding connection with the arm, a swivel bearing for the rod, abutments on the rod for limiting the sliding movement, a spring tending to move an abutment into engagement with the arm to actuate the catch

and release the valve, a trigger for holding the rod against the action of the spring, a speed-responsive device which actuates the trigger to release the rod when the speed rises to a prescribed limit, and a handle on the arm for manually resetting the catch and valve.

In witness whereof, I have hereunto set my hand this 25th day of June, 1906.

JOHN G. CALLAN.

Witnesses:
JOHN A. McMANUS, JR.,
HENRY O. WESTENDARP.