

(No Model.)

F. MARKGRAF.  
CUT-OFF VALVE.

No. 541,772.

Patented June 25, 1895.

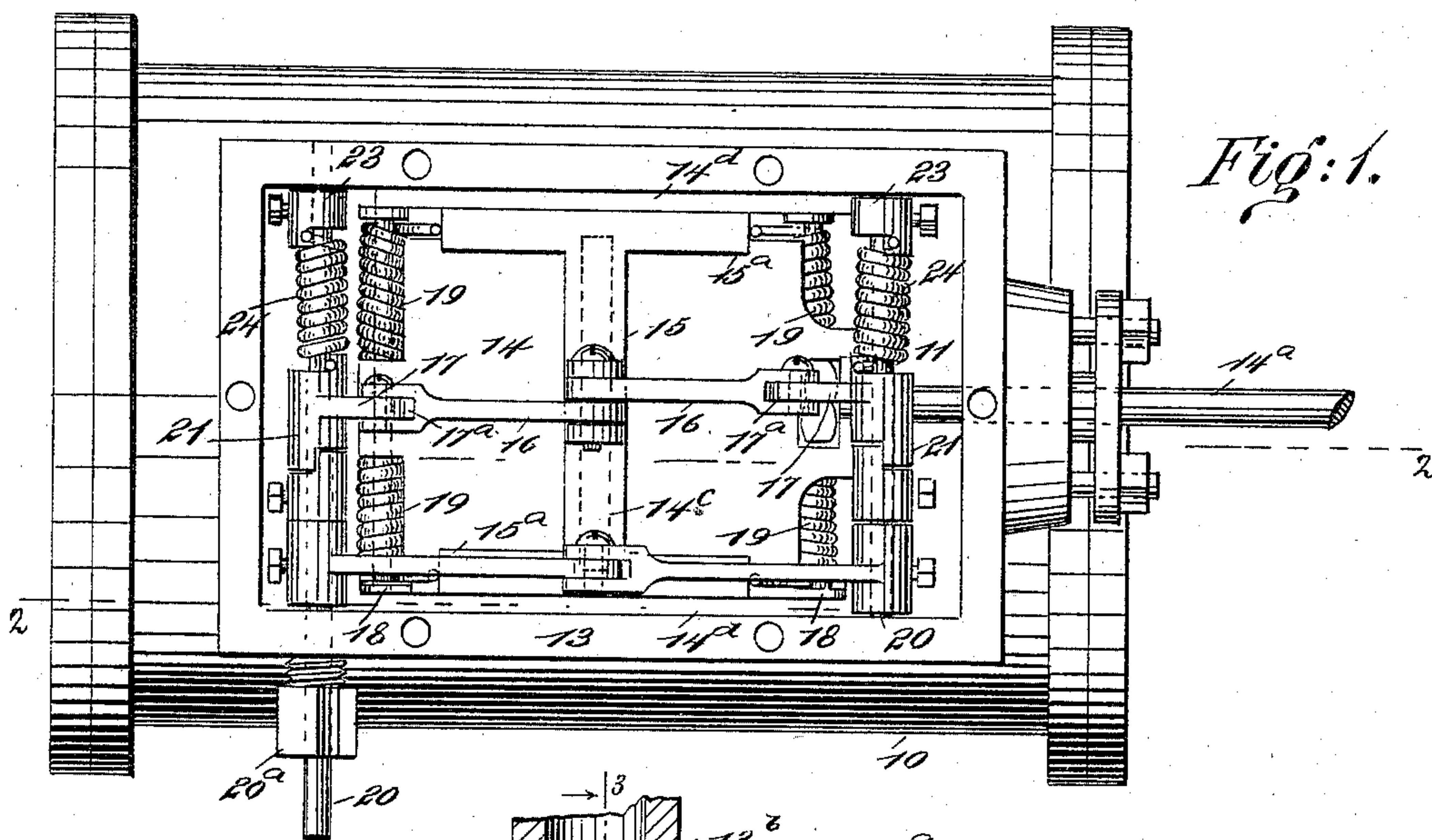


Fig: 1.

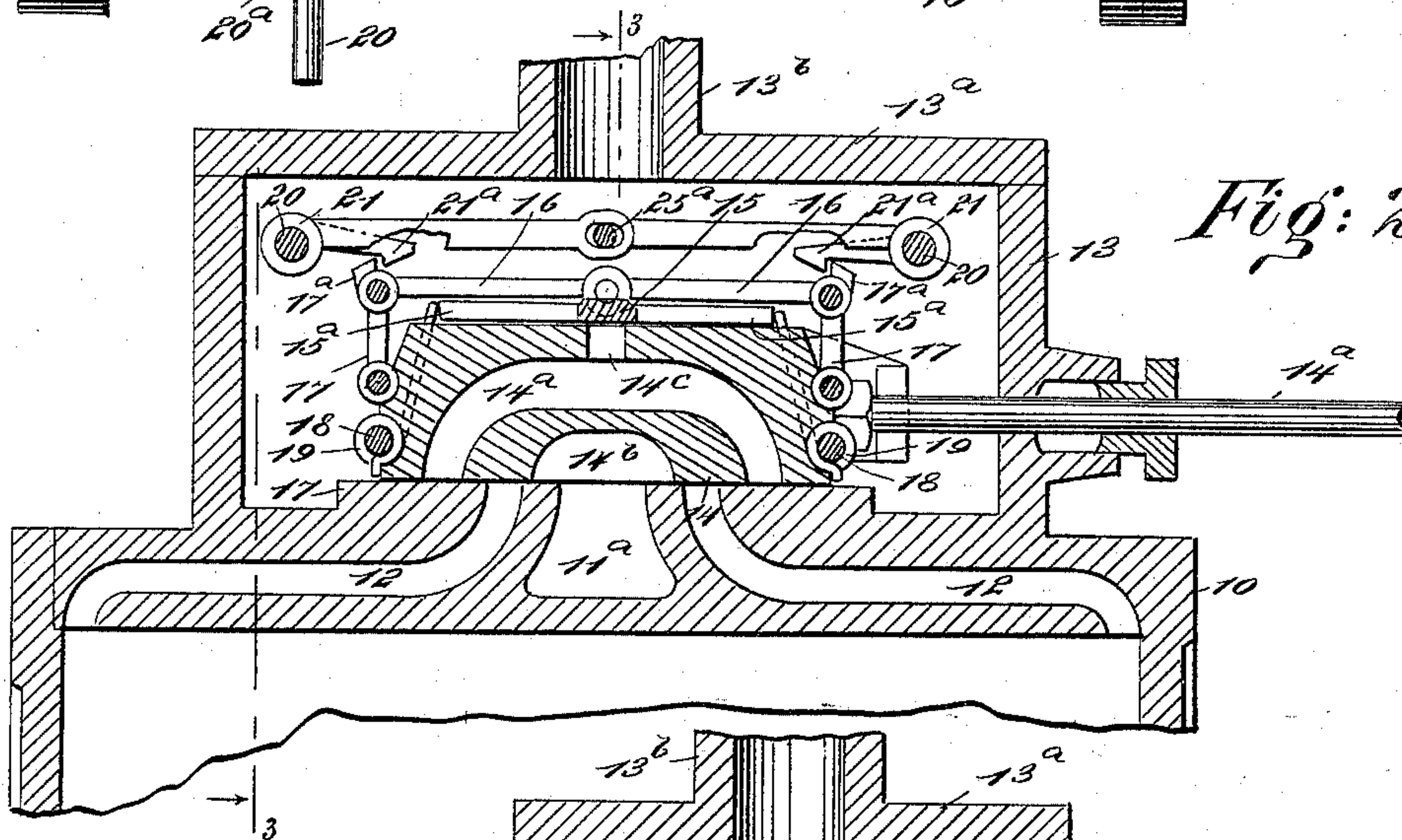


Fig: 2.

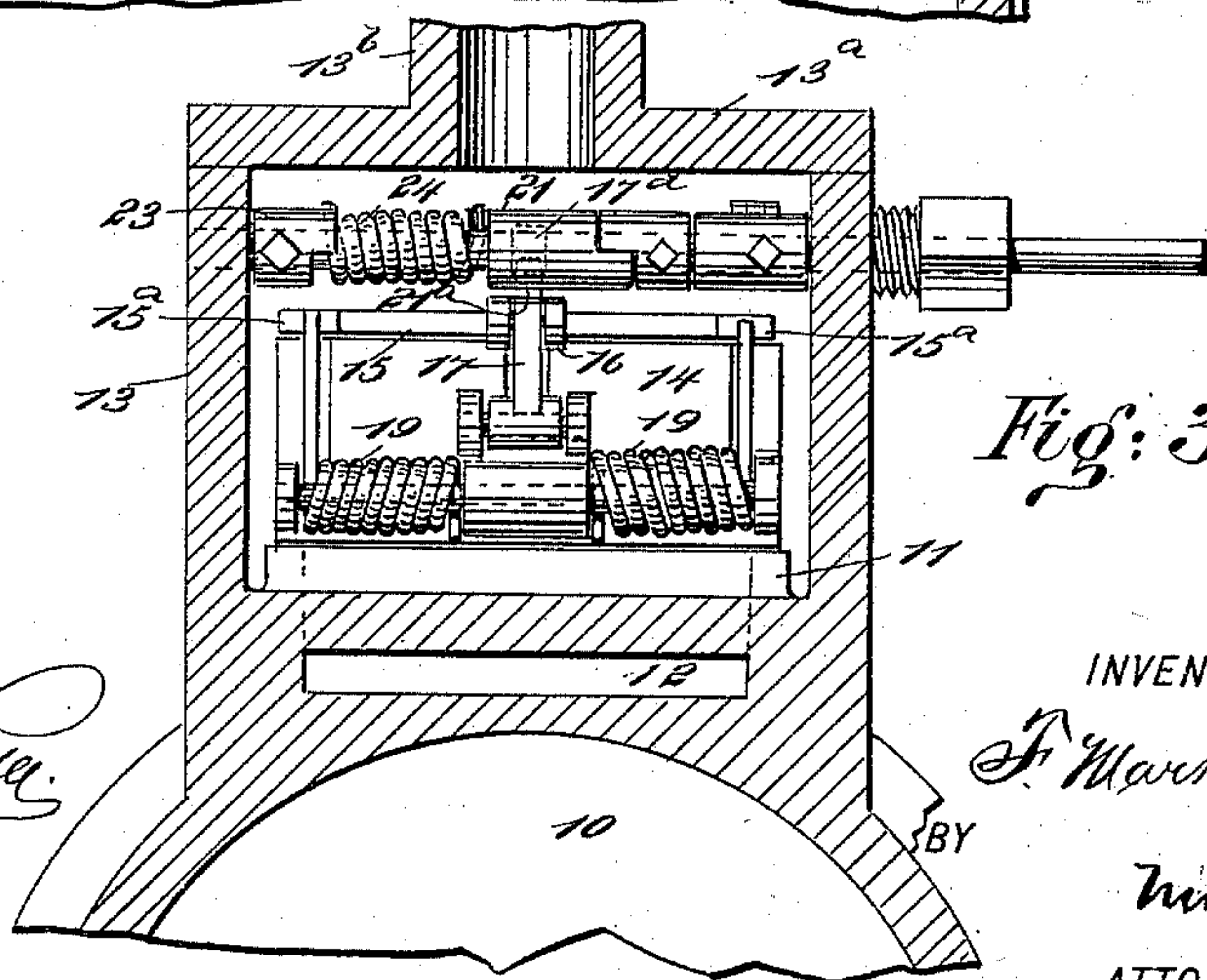


Fig: 3.

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# UNITED STATES PATENT OFFICE.

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## CUT-OFF VALVE.

SPECIFICATION forming part of Letters Patent No. 541,772, dated June 25, 1895.

Application filed September 27, 1892. Serial No. 447,086. (No model.)

*To all whom it may concern:*

Be it known that I, FRANZ MARKGRAF, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented a new and Improved Automatic Cut-Off Valve, of which the following is a full, clear, and exact description.

My invention relates to improvements in automatic cut off valves for steam engines, and particularly to such engines as employ a main slide valve for the control of steam passing to the cylinder.

The object of my invention is to provide a simple and reliable cut off valve mechanism, and cut off valve that will be contained entirely within the steam chest wherein the main slide valve is located, and that will act in unison with said main slide valve for the economical transmission of steam to the engine cylinder, and furthermore, that will be automatically controlled by the same means that controls the flow of steam to the main slide valve of the engine.

To these ends my invention consists in the construction and combination of parts, as is hereinafter described and indicated in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar figures and letters of reference indicate corresponding parts in all the views.

Figure 1 is a plan view of the improvements applied to the main slide-valve of a steam-engine, the cylinder and steam-chest being shown, the lid of the chest being removed to expose the novel details of construction that are located within the chest. Fig. 2 is a sectional side view of the steam-cylinder, valve-chest, main slide-valve, and a partly sectional side view of the cut-off valve and its operating-gear taken on the line 2 2 in Fig. 1; and Fig. 3 is a transverse sectional view of the cylinder and steam-chest, showing an end view of the main slide-valve, and also of the cut-off valve and its operating-gear.

The improvement is applicable to vertical or horizontal steam engines, and for the purpose of illustrating its application, is represented in the drawings as connected with a steam cylinder that is disposed horizontally.

The steam cylinder 10 is of ordinary make

and has a valve seat 11, formed on its upper side into which the steam ducts 12, are extended. The said ducts cutting through the valve seat produce two spaced steam ports for the entrance of live steam, which is conducted by the passages or ducts 12, to each end of the cylinder as is usual in this type of engine. An exhaust port 11<sup>a</sup> is formed between the live steam ports in the valve seat.

The steam chest 13, which is rectangular incloses the valve seat 11, and has a proper clearance therefrom at each end to allow the main slide valve 14 to have a correct travel as it is moved by the valve stem 14<sup>a</sup>, back and forth in the steam chest, said valve stem being actuated by suitable mechanism (not shown) as this is not needed to explain the improvements.

The steam chest is made of such a height as will adapt it to contain the main valve, the cut off valve, and the novel mechanism for moving the latter, and as is shown in Figs. 2 and 3, the chest 13 is sealed by a lid 13<sup>a</sup> when the steam engine is in working order, and on the lid a steam inlet branch pipe 13<sup>b</sup> is formed or secured which taps the cavity of the chest to supply steam thereto.

The main slide valve 14 is furnished with a live steam duct 14<sup>a</sup> and an exhaust cavity 14<sup>b</sup>, the duct being curved so as to arch over the cavity 14<sup>b</sup> and have its terminals that cut through the working face of the valve near its ends, extended of a proper width across the valve face and parallel with its ends and also with each other. The space between the steam ports in the main slide valve is of such an extent that by giving the main valve a proper reciprocation, the said ports will alternately cover the nearest live steam ports in the valve seat, and in like manner the exhaust cavity in the valve 14 will alternately cover one of the live steam ports in the valve seat and the exhaust port 11<sup>a</sup> for the escape of exhaust steam from the cylinder.

On the upper face of the main slide valve 14, which is made true and preferably parallel with the lower face thereon, the cut off valve 15, is placed, this valve being designed to partly or entirely cover the single transverse steam port 14<sup>c</sup>, that is vertically formed and extends through the top surface of the main valve down into the steam duct 14<sup>a</sup>, at a point



about central between the ends of said steam duct, thus providing a steam induction port that communicates with the space inclosed by the steam chest.

5 The body of the valve 15 is made parallel on the side edges, and at its ends two guide wings 15<sup>a</sup> are formed or secured, these being equally projected at each side of the valve body and at right angles therewith, and if desired, the guide wings may be caused to loosely engage vertical ribs 14<sup>c</sup> that are formed on the main slide valve along its side edges, which arrangement of parts will insure the correct adjustment of the cut off valve with regard to the port 14<sup>c</sup>, that it is to control.

15 The cut off valve 15, is loosely connected by the links 16, with the upright rock arms 17, the latter being pivoted at their lower ends on the main slide valve, preferably by means of pintle bolts that loosely engage the perforated hubs of the rock arms, and are secured in parallel ears which are projections from the main slide valve.

25 The rock arms 17, are each furnished with a latch toe 17<sup>a</sup> that projects above the pivotal connection of the links 16, with said arms and as shown in Fig. 2, the upper edges of the toes 17<sup>a</sup> are sloped to incline them toward the ends of the valve chest.

30 There are two similar transverse springs supporting rods 18, secured across the ends of the main slide valve 14, whereon the coiled springs 19, are mounted, two of said springs being furnished for each rod, and as most clearly shown in Fig. 3, the ends of each pair of springs that are nearest the transverse center of the main slide valve, are bent so as to interlock with the top of said valve, while the longer end portions of the coiled springs that are opposite the ends of the wings 15<sup>a</sup> of the cut off valve 15, are caused to press forcibly against said ends of the wings. The strength of all the springs 19 should be equal, which will adapt them to elastically hold the cut off valve 15, centered over the steam port 14<sup>c</sup>.

45 Two similar tripping shafts 20, are journaled at their ends in the side walls of the steam chest near its ends, and parallel with the steam ports in the main valve seat 11, one of said shafts being extended through a stuffing box 20<sup>a</sup> and a proper distance outside of the latter, as shown in Fig. 3.

55 There is a clutch hub 21, loosely mounted on each shaft 20, near its center within the chest 13, and on said shafts mating clutch hubs 22, are placed and adapted for fixture by set screws or equivalent means, these latter named hubs serving to hold the hubs 21, at any desired point of rotatable adjustment. 60 The hubs 21, are each provided with an arm 21<sup>a</sup>, which arms project over the toes 17<sup>a</sup> and have hooks of proper length downwardly projected from their ends to engage with said toes, as will be further explained.

65 On the tripping shafts 20, at one end of each shaft, a locking hub 23, is mounted and

adjustably secured with a set screw, the said hubs each having a shoulder produced on the end that is facing the end of the center hub 21, and between the hubs 21, 23 on each shaft 20, a spiral spring 24, is mounted and has its ends interlocked with the hubs named as shown in Figs. 1 and 3.

70 The pitch of the coils in the springs 24, adapt their ends which have interlocking engagement with the center hubs 21, to press the arms 21, downwardly and to limit this depression to a predetermined degree, there is a check lever 25 provided for each tripping shaft, these levers that are mounted and secured on end portions of the shaft which are opposite from those engaged by the locking hubs 23, having a sufficient length to be tightly connected together, one lever having its end slotted longitudinally as represented at 25<sup>a</sup> in Fig. 2, so that the pivot bolt which connects the levers will be permitted to slide in the slot, and allow the center hubs 21, to be revolvably moved and secured on the tripping shafts, and thus effect a proper adjustment of the tripping arms 21<sup>a</sup>, toward or from the toes 17<sup>a</sup>.

85 The operation of the improved cut off valve and its gear is as follows: The main slide valve being actuated by suitable mechanism not shown, so as to reciprocate for the alternate admission of steam at one end of the cylinder, and exhaustion of steam from the other end of said cylinder, it will be seen that the travel of the main slide valve will cause the upright arms 17 to alternately rock in a direction opposite to that in which the main slide valve 14, is moving, this rocking movement in the arms, being produced by their momentary and successive detention while their toes 17<sup>a</sup> are engaged with the hooks of the tripping arms 21<sup>a</sup>, the hubs of the upright rock arms 17, being moved along with the main slide valve. 90 The sliding motion communicated to the main valve 14, quickly overcomes the lap of the cut off valve 15, and it is caused to open the port 14<sup>c</sup>, that leads into the steam duct 14<sup>a</sup>, and at this instant the steam duct has one of its ends in communication with a live steam port in the main valve seat 11, whereby steam is inducted in graduated volume from the steam chest into the cylinder at each end alternately. 95 The extent of the rocking movement given to the arms 17, is determined by the "hold" or degree of latching contact had by the hooks on tripping arms 21<sup>a</sup>, with the toes 17<sup>a</sup> as it will be evident that the more catch said hooks have on the toes, the greater will be the rocking movement of the upright arms 17, and it will also be apparent that the opening of the steam inlet port 14<sup>c</sup> and its closure will be timed and controlled entirely by the degree of latching contact had between the hooked arms 21<sup>a</sup> and toes 17<sup>a</sup>; and as there is ample provision made for the correct adjustment of the tripping arms, by means of the adjustable hubs 22, locking hubs 23 and check levers 24, 100 105 110 115 120 125 130



a critical regulation of the cut off valve may be produced for the economical and automatic regulation of steam supply to the cylinder of the engine.

5 The end portion of the tripping shaft 20, that projects outside of the steam chest is provided for effecting a working connection between a governor that may be of any preferred make, the action of the governor being designed to control the sliding movement of the cut off valve through the links 16, if this is desired.

15 Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a main slide valve having a live steam duct, of a cut off valve that is spring pressed to cover the inlet to said duct, substantially as described.

20 2. The combination with a main slide valve having an arched steam duct, an induction port at the top of said valve entering the live steam duct, and an exhaust cavity between lower ends of the duct, of a cut off valve that is spring pressed to cover the induction port, and a cut off valve actuating device, that moves it against the stress of the springs, substantially as described.

30 3. The combination with a main slide valve having a live steam duct, of a cut off valve having transverse wings at its ends, and springs pressing on the ends of said wings to cause the cut off valve to cover the inlet port of said live steam duct, substantially as described.

40 4. The combination with an inclosed main slide valve, and means to move said valve, of a cut off valve slidably mounted on the main valve to control a live steam passage in said main slide valve, and mechanism within the inclosure of the main valve that is adapted to produce a reciprocation of the cut off valve for uncovering the port it controls, substantially as described.

45 5. The combination with a cylinder, a steam chest, a main slide valve, and a rod adapted to reciprocate the main valve, of a cut off valve arranged to slide over a steam induction port in the main slide valve, and mechanism entirely within the steam chest that is adapted to alternately remove the cut off valve from

over the induction port at its side edges a predetermined extent, substantially as described.

6. The combination with a cylinder, a valve seat thereon having two live steam ports and an intermediate exhaust port, of a slidable valve having an arched steam duct in it, the ports of which are adapted to alternately register with one of the live steam ports in the valve seat, an intervening exhaust cavity in the main valve, an induction steam port extending from the top of the main slide valve into the arched steam duct, and a cut off valve arranged to alternately open and close the said induction steam port from either side edge of said port, substantially as described.

7. In a steam supply valve mechanism for a steam engine, the combination with the main slide valve in the engine steam chest and having a vertical steam induction port, a curved steam duct intersected by the induction port, and an exhaust cavity intervening the steam duct ends, of a slidable cut off valve in T-form which is adapted to control the entrance of steam into the induction port, and cut off valve gear located entirely within the steam chest and arranged to receive motion from the reciprocating movement of the main slide valve, substantially as described.

8. In a steam supply valve mechanism for a steam engine, the combination with a cylinder, a steam chest, a valve seat, having two live steam passages that intersect said valve seat, and an exhaust port between the live steam passages, of a main slide valve adapted to reciprocate and having live steam ports within it, a steam induction port, and an exhaust cavity, a cut off valve slidable on the main valve over the steam induction port, and a cut off valve gear within the steam chest, comprising two rock arms upright on the main valve near its ends, and having toes on their upper ends, spring pressed adjustable tripping arms having hooks that are arranged to pull on the toes of the rock arms, and springs adapted to press oppositely on guide wings that are parts of the cut off valve, substantially as described.

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Witnesses:

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