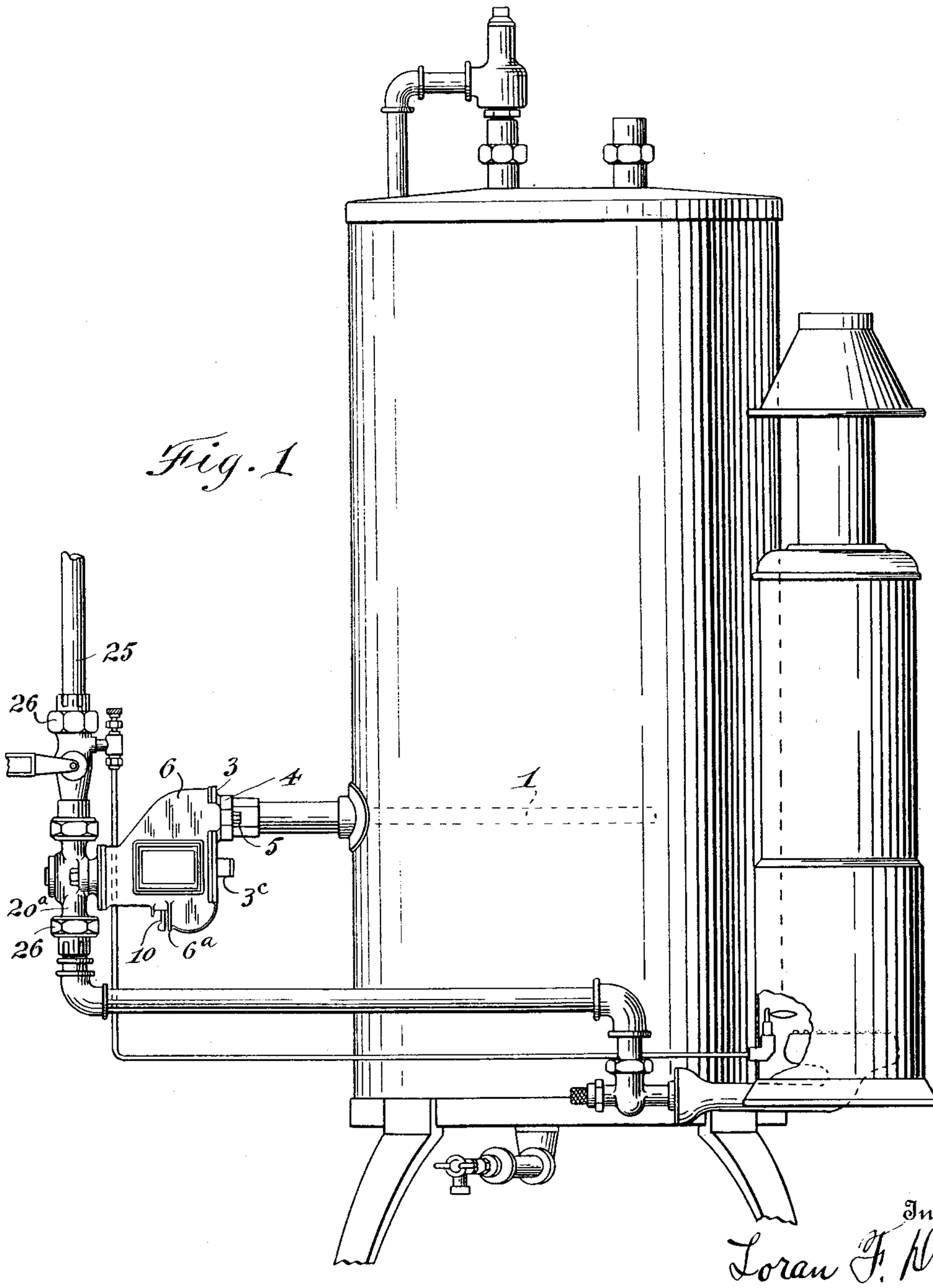
Sept. 4, 1928. 1,683,172

L. F. DOEN

THERMOSTATIC VALVE

Filed Jan. 27, 1925 2 Sheets-Sheet 1

Fig. 1



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Sept. 4, 1928.

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2 Sheets-Sheet 2

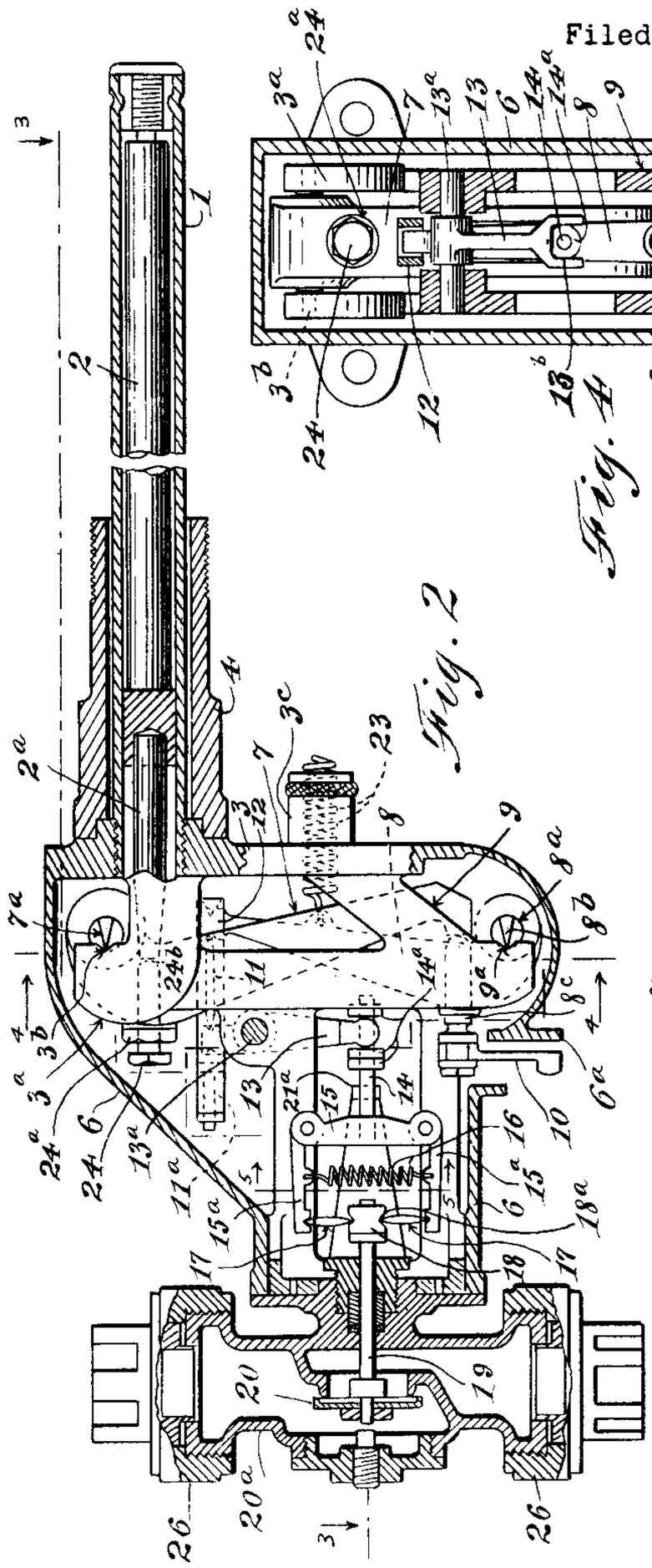

Fig. 2

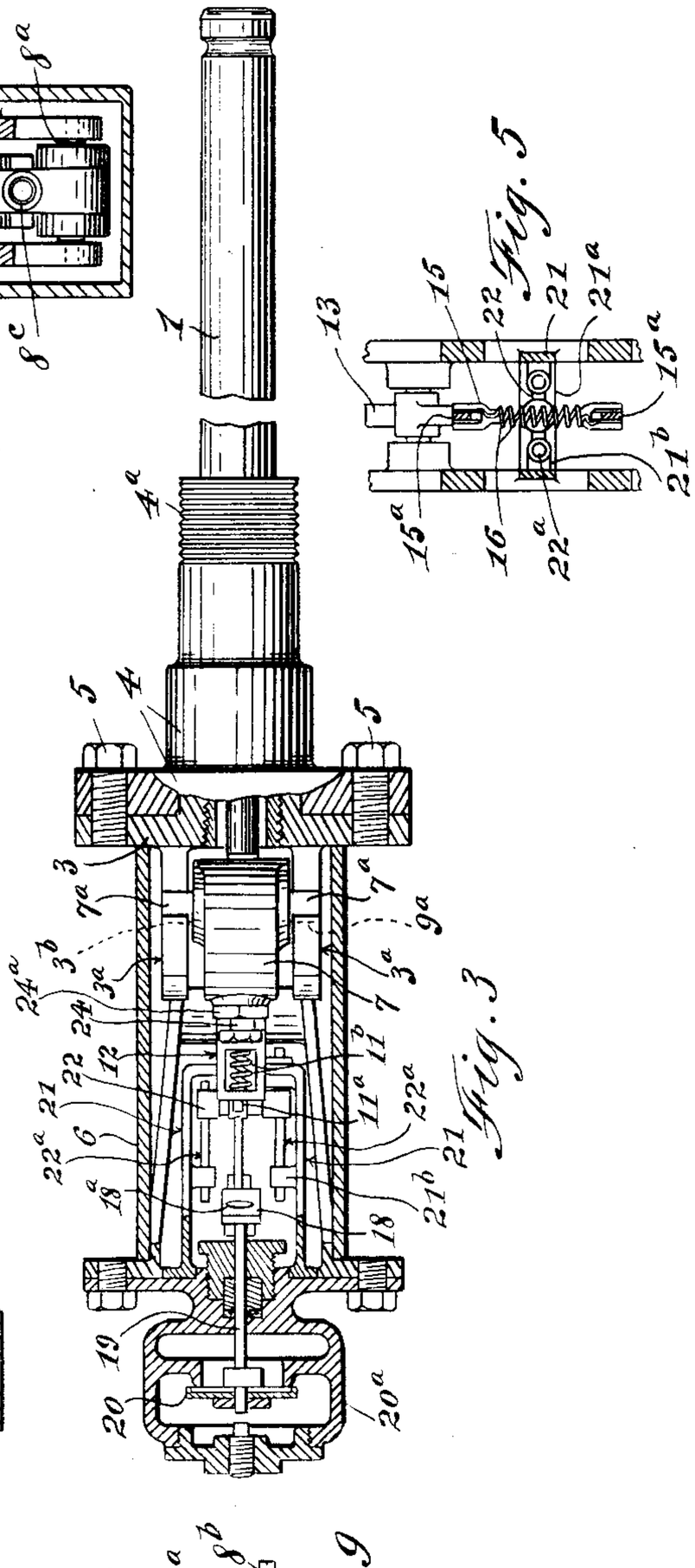

Fig. 3

Fig. 5

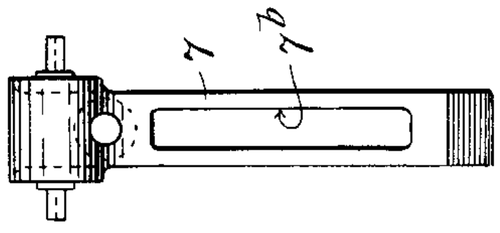

Fig. 7

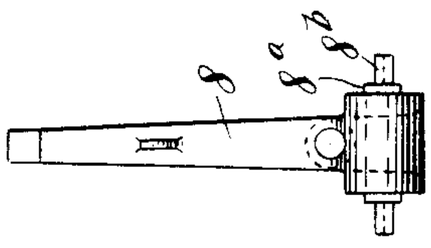

Fig. 9

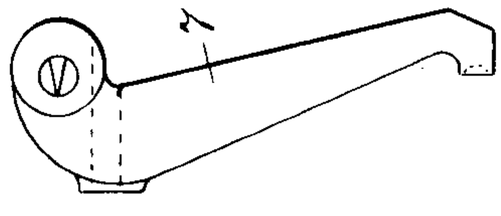

Fig. 6

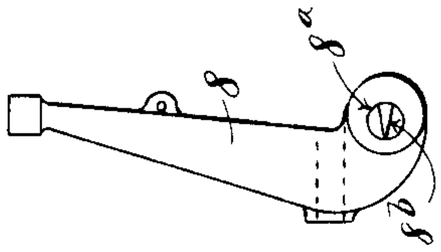

Fig. 8

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Patented Sept. 4, 1928. 1,683,172

UNITED STATES PATENT OFFICE.

LORAN F. DOEN, OF CLEVELAND, OHIO, ASSIGNOR TO THE CLEVELAND HEATER COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

THERMOSTATIC VALVE.

Application filed January 27, 1925. Serial No. 4,995.

This invention relates to improvements in thermostatic valves, the present embodiment of the invention being particularly designed and adapted for use in connection with automatic hot water heating systems in automatically controlling the supply of gaseous fuel to the hot water heater through the fuel burner, or the fuel supply control and ignition mechanism, as the case may be, so that the heat applied will be reduced or increased coincidently with an increase or decrease of the temperature of the water above or below the normal for which the thermostatic regulator has been adjusted.

The primary object of the invention is to provide a generally improved thermostatically operated fuel valve of the type indicated, which will be simple and efficient in operation, and in which the various working parts may be readily adjusted and controlled to meet the varying exigencies of actual service.

A further and very important object is the provision of a thermostatic valve operated mechanism in which the sudden opening and closing of the gas supply valve is effected with positively and quickly acting spring resisted toggle lever mechanism and in which such gas supply valve is positively held in its respective shifted positions as against creeping or accidental opening or closing.

A still further and important object is the provision of an improved form and arrangement of movement multiplying compound levers interposed between the thermostatic elements and the toggle acting spring resisted fuel supply valve actuating levers.

With the above mentioned and other ends in view, the invention consists in the novel construction, arrangement and combination of parts, hereinafter described, illustrated in one of its embodiments in the accompanying drawings, and particularly pointed out in the appended claims.

Referring to the drawings, forming a part of this specification, Figure 1 is a side elevation of an ordinary automatic hot water heating system embodying a storage tank and hot water heater equipped with a thermostatic valve constructed and arranged in accordance with this invention.

Fig. 2, an enlarged central longitudinal sectional view of the thermostatic valve, detached, the fuel supply valve being closed.

Fig. 3, a longitudinal sectional view of the same, taken on line 3—3 of Fig. 2.

Fig. 4, a transverse sectional view, taken on line 4—4 of Fig. 2.

Fig. 5, a transverse cross sectional view of the spring resisted snap switch lever mechanism, taken on line 5—5 of Fig. 2.

Fig. 6, a side elevation of the first or primary movement multiplying lever, detached.

Fig, 7, a rear elevation of the same.

Fig. 8, a side elevation of the secondary movement multiplying lever of the compound lever system, detached.

Fig. 9, a rear elevation of the same.

Similar numerals of reference designate like parts throughout all the figures of the drawings.

In the present embodiment of the invention the thermostatic regulator, proper, is of the well known or conventional form comprising the usual thermal element or sheath 1, extending into the receptacle or container in which the liquid whose temperature is to be regulated is contained. The tubular thermal element 1, in the present instance, is threaded in a suitable threaded opening in an attaching bracket 3, the usual rod 2, being secured to the inner end of the expansible and contractible thermal element 1 and being adapted at its opposite end to engage with and impart movement to the movement multiplying levers and snap action spring resisted toggle mechanism connected to the fuel valve, as hereinafter referred to.

The bracket 3 is secured, in the present instance, to a second bracket 4, by means of bolts 5, (see Fig. 3) and the bracket 4 is provided with a tubular extension having a threaded portion 4^a, for securing the thermostatic regulator and the lever housing in position as a part of the apparatus or heating system, as indicated in Fig. 1 of the drawings.

The casing or housing 6, is connected to the bracket 3 and surrounds the bearing brackets 3^a, extending longitudinally and vertically from the bracket 3.

The bearing brackets 3^a are spaced apart and are provided at the rear of their up-

wardly extending portions with bearing recesses 3^b, to receive the knife edges 7^a, of the trunnion portions of the first or primary lever 7, of the movement multiplying lever system. In the present instance, the lever 7 is provided with a longitudinal opening 7^b (see Fig. 7), and a secondary lever 8, is reversely disposed in overlapping relation with its free end extending upwardly through the opening 7^b of the primary lever. The secondary lever 8 is provided with trunnions 8^a, having knife edges 8^b, seated in recesses 9^a, of a pair of spaced brackets 9. The second lever 8 is provided near its pivoted or fulcrum portion with an adjustable element or screw 8^c, bearing against the lower or free end of the first lever 7, this screw 8^c being adjustable through a lever 10, in connection with suitable graduations or indications on the segmental plate 6^a, and constituting means for setting or adjusting the parts to the predetermined temperature desired or required to actuate the movement multiplying system and the connected toggle acting lever snap system, hereinafter referred to, for positively opening and closing the fuel valve.

The upper end of the second lever 8 bears against a link 11, and is connected to a yoke 12, said yoke 12 and link 11 being connected to a third lever 13, suitably pivoted at 13^a, in the side bracket members 9. The third lever 13 may bear against the link 11 and, in the present instance, bears against a second link or pin 11^a, in the rear end of the yoke 12 and cushioned by means of a spring 11^b. The lower end of the lever 13 is bifurcated, as at 13^b (see Fig. 4) and is connected to a longitudinally movable rod or stem 14, through the medium of suitable adjusting blocks or nuts 14^a.

As a means of providing a suitable toggle lever snap action system between the fuel valve stem and the movement multiplying lever system above referred to, the stem 14 is provided with a yoke 15, carrying a pair of pivotally mounted spring resisted arms or levers 15^a, said levers 15^a being connected by means of a spring 16, the outer ends of the spring resisted levers 15^a being notched as at 15^b to resiliently receive and form a movable toggle acting connection with a pair of toggle acting arms 17, said arms 17 being connected at their inner ends to a sleeve or block 18, mounted on the valve stem 19, which carries the fuel valve 20. The block 18 is provided with suitable notches 18^a, for receiving and forming a seat for the inner ends of the toggle acting arm 17.

By reason of the above construction it will be understood that as the yoke 15 and arms 15^a are moved longitudinally through the movement of the movement multiplying system of levers connected to the thermostatic element, a quick or snap action will take place as the toggle acting arms 20 are moved over what is known as the "dead center", thereby positively and quickly moving the valve stem 19 and consequently closing and opening the valve 20 and holding the latter in its respective shifted positions until again actuated by the mechanism above referred to.

The rod or stem 14 is adapted to slide in an opening of a guide member 21^a, carried upon the ends of a pair of arms or brackets 21. The yoke 15 carrying the spring resisted levers 15^a is prevented from turning by means of a cross head 22, provided with guide arms 22^a, adapted to slide in guide lugs 21^b, extending from the bracket arms 21.

The first lever 7 is provided with a pull-back spring 23, removably and adjustably mounted in a bracket 3^c, by means of an internally threaded adjusting nut 3^d.

The first lever 7 is provided near its fulcrum end with a bearing element in the specific form of a threaded bolt 24, adapted to be locked in position by means of a nut 24^a, the inner end of the bearing element or bolt 24 being rounded, as at 24^b, to bear against a similarly rounded end of the supplemental bearing element 2^a of the relatively movable thermostatic rod 2.

In the present instance, the fuel valve 20 is mounted in a valve body 20^a, connected to the sections of the fuel supply pipe or conduit 25 by means of suitable coupling members 26.

Having thus described one of the embodiments of my invention, without having attempted to set forth all the forms in which it may be made, or all the modes of its use, what I claim and desire to secure by Letters Patent is,—

1. A thermostatic valve, comprising a lever housing provided at one side with a thermostatic regulator and at the other with a fuel feed pipe and supply valve, a pair of oppositely arranged primary and secondary movement multiplying levers arranged in said housing, said primary lever being adjustably connected to said thermostatic regulator and said secondary lever being adjustably connected to the free end of said primary lever, a third lever operatively connected to said secondary lever, a cross head connected to said third lever, spring resisted lever arms connected to said cross head, and toggle acting links connected to said fuel supply valve and the free ends of said spring resisted levers for positively opening and closing said fuel valve with a snap action when predetermined temperatures are reached as determined by said thermostatic regulator and said connections.

2. A thermostatic valve, comprising a lever housing provided at one side with a thermostatic regulator and at the other with a fuel feed pipe and supply valve, a pair of oppositely arranged primary and secondary

movement multiplying levers arranged vertically in overlapping relation in said housing, said primary lever being adjustably connected near its fulcrum portion to said thermostatic regulator and said secondary lever having its fulcrum portion provided with a temperature indicating device adjustably connected to the free end of said primary lever, a third lever operatively connected to the free end of said secondary lever, a cross head connected to said third lever, spring resisted longitudinally movable lever arms connected to said cross head, and relatively movable toggle acting links flexibly connected to said fuel supply valve and the free ends of said longitudinally movable spring resisted levers for positively opening and closing said fuel valve with a snap action when predetermined temperatures are reached as determined by said thermostatic regulator and said connctions.

3. In a device of the character described, a fuel supply valve, a thermosatic regulator, reversely arranged overlapping compound levers operatively connected to said thermostatic regulator, a yoke operatively connected to said levers, pivotally mounted spring resisted levers carried thereby, toggle acting arms in operative engagement at their inner ends with the valve and interposed between the spring resisted levers and the valve to form a toggle acting connection between the valve and the levers.

4. A thermostatic valve structure comprising an enclosing casing provided with a thermostatic regulator and a fuel supply valve, reversely arranged overlapping compound levers in said casing, an adjustable spring to urge said compound levers against said thermostatic regulator; toggle acting arms, having their inner ends in opposite engagement with the valve and thermostatically responsive means resiliently connecting the outer ends of said toggle acting arms to said compound levers.

5. In a thermostatic valve structure, a thermostat, a crosshead, a compound lever system to provide for the positive actuation of the crosshead by the thermostat in one direction and an adjustable follow-up spring to actuate the crosshead in the opposite direction, a valve having a valve stem aligned with the crosshead, a pair of toggle arms seated at their inner ends in notches on the valve stem, spring held means to maintain contact between the outer ends of said toggle arms and the crosshead whereby movement of the crosshead instituted by the thermostat oscillates the outer ends of the toggle arms to a position just beyond the dead center position of the toggle arms whereupon the spring held means acting through the toggle arms and valve stem snap the valve to a fully open or fully closed position.

6. A thermostat control mechanism comprising a compound lever system embodying a primary lever connected to an actuating device near its fulcrum, a secondary lever actuated from a point adjacent to its fulcrum by the primary lever, one of said levers being arranged to extend through the other of said levers, a tertiary lever underlying both said primary and said secondary levers, a link connecting the free end of said secondary lever with said tertiary lever at a point adjacent to its fulcrum, a yoke positively actuated by said compound lever system, a pair of opposed spring resisted arms each pivotally carried by said yoke, a valve stem, a valve head carried by said valve stem, and a pair of opposed toggle arms interposed between said pivotally carried arms and said valve stem whereby said valve head is operated to its extreme positions by a snap action upon movement of the compound levers to predetermined positions.

In testimony whereof I have affixed my signature.

LORAN F. DOEN.