W. M. FULTON.

DAMPER REGULATOR.

APPLICATION FILED JAN. 9, 1914.

1,153,214.

Patented Sept. 14, 1915.

2 SHEETS—SHEET 1.

Fig. 1.

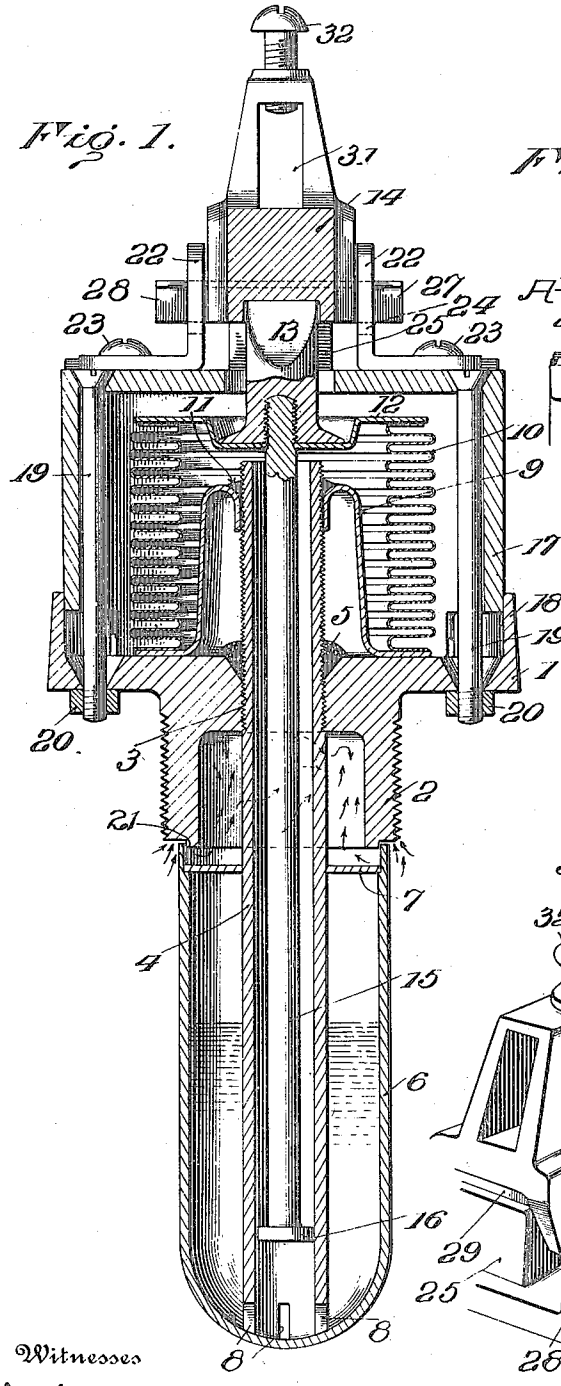


Fig. 2.

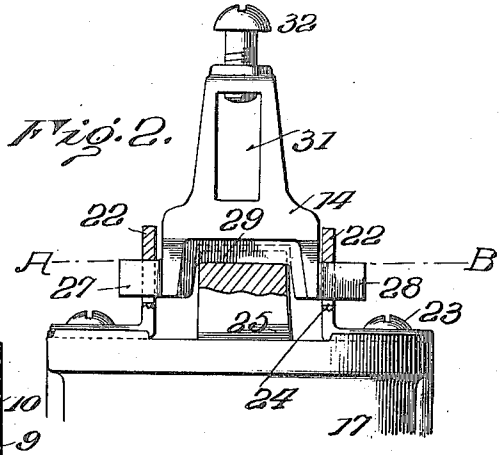


Fig. 3.

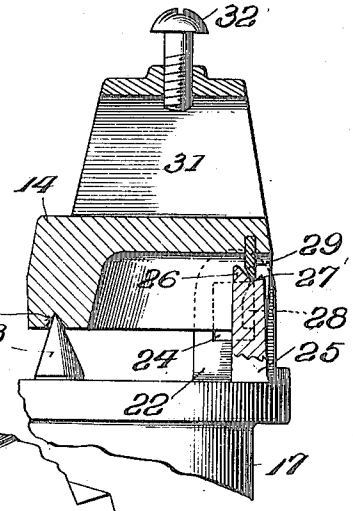
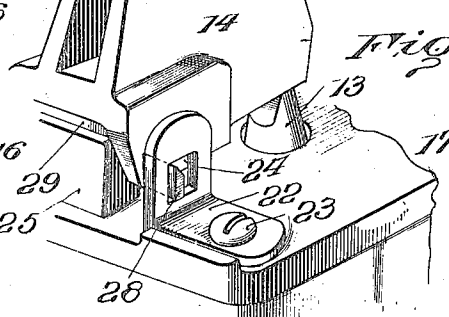


Fig. 4.



Witnesses

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2 SHEETS—SHEET 2.

Fig. 5.

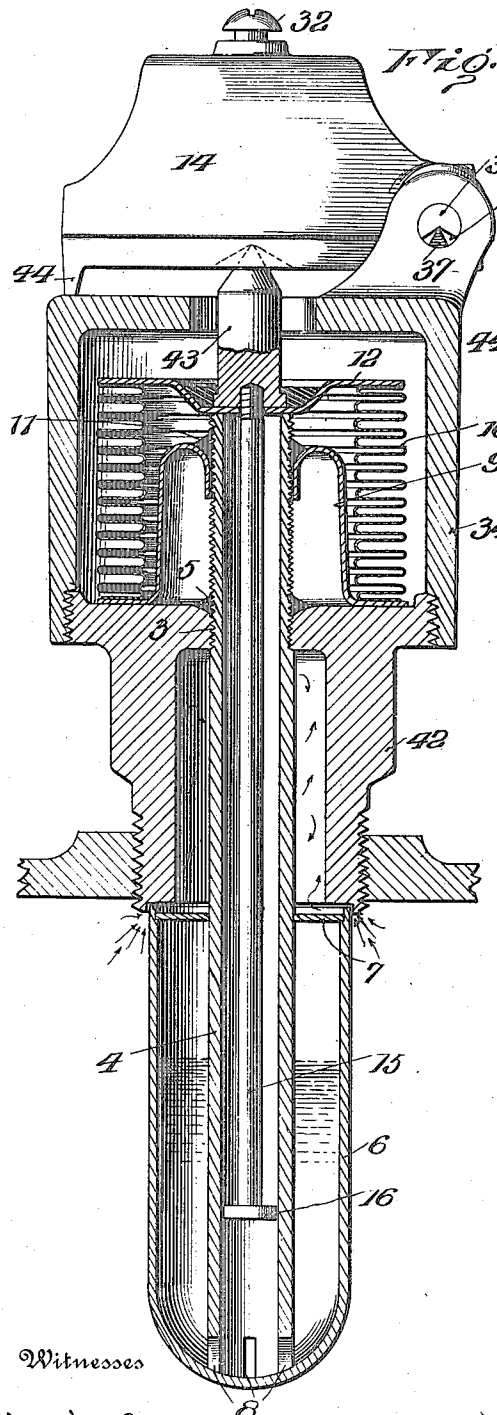
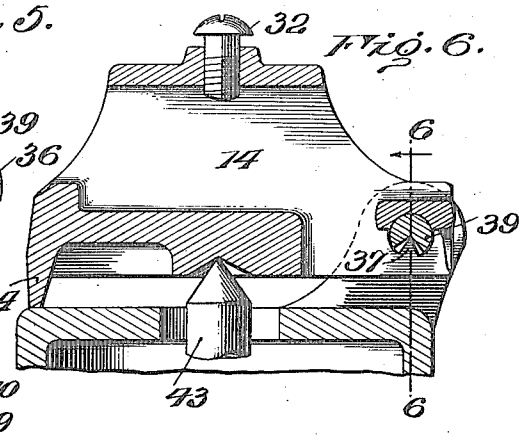


Fig. 6.



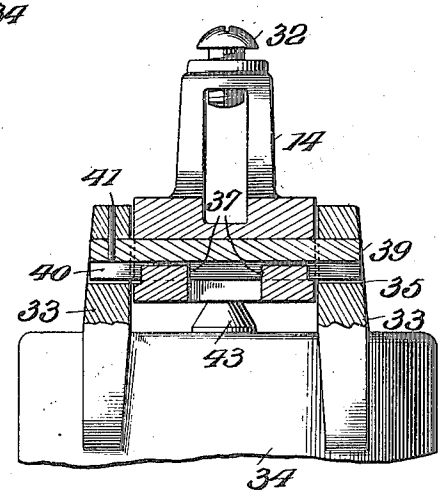


Fig. 7.

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DAMPER-REGULATOR.

1,153,214. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed January 9, 1914. Serial No. 811,266.

To all whom it may concern:

Be it known that I, WESTON M. FULTON, a citizen of the United States of America, and resident of Knoxville, Tennessee, have invented a new and useful Improvement in Damper-Regulators, which invention is fully set forth in the following specification.

In my Patent No. 904,123 I have described and claimed a thermosensitive damper regulator responsive to changes of temperature in the heating fluid of a hot-water or steam heating system to control the air supply to the fuel which constitutes the source of heat.

The present invention relates to improvements therein and has for its object to provide a regulator of this class which embodies the advantages of the former device while possessing additional advantages in construction, mode of operation and economy of manufacture.

More particularly, one of the objects is to provide a structure comprising a thermosensitive bulb and a support therefor which latter can be quickly and readily screwed into position in the wall of the boiler.

Another object is to provide guide means for the vibratory vessel which will permit the upper portions of the vessel to accommodate itself to the oscillating movements of the rocking member of the regulator to secure efficient transmission of power to the rocker and reduce frictional losses by the guide means.

A further object is to reduce the amount of metallic contact between the thermosensitive bulb and its metallic support to thereby reduce transfer of heat from the bulb to its support.

The above and other objects will be fully explained in the detailed description.

In order that the invention may be readily understood, reference is had to the accompanying drawings which illustrate two constructional forms embodying my improvements; but it is understood that such drawings are designed for the purpose of illustration and not as defining the limits of the invention.

In the drawings:—Figure 1 is a vertical central sectional view showing a damper regulator provided with my improvements; Figs. 2 and 3 are detail sectional views; Fig. 4 is a detail perspective view showing parts of Fig. 1; Fig. 5 is a vertical central sectional view showing slight modifications; and Figs. 6 and 7 are sectional detail views of parts of Fig. 4.

Referring to Fig. 1, the parts of the device are supported on a base 1 which is provided with an exteriorly screw-threaded tubular portion 2 adapted to be screwed into the wall of a boiler, not shown. The base 1 has a central opening 3, preferably screw-threaded to receive a threaded tube 4 which may be made fast to the base 1 by solder 5 to insure a water-tight joint between the parts. The tube 4 extends below the base 1 and supports a thermosensitive bulb 6 by means of a plate 7 soldered or otherwise hermetically secured to both the tube 4, near its upper end, and the bulb 6. The plate 7 also forms a closure for the bulb which is to be partially filled with a volatile liquid.

It is to be observed that the tubular portion 2 of the base 1 forms a fluid circulating chamber above the themosensitive bulb 6, and to this end a loose joint is formed between the top wall of the bulb 6 and the lower end of the tubular portion 2. In the construction shown in Fig. 1, the tubular portion 2 is provided with a shoulder 21 which loosely receives the tubular end wall of bulb 6 to permit liquid to enter and circulate above the plate 7, and which also holds the bulb against displacement. Free communication between tube 4 and bulb 6 is provided through openings 8 in the wall of the tube at its lower end. The upper screw-threaded end of tube 4 which extends through the base enters the reëntering end wall 9 of the vibratory vessel 10 and forms therewith a fluid-tight joint, preferably by means of solder 11. The end of tube 4 within the vessel 10 acts as a stop for the movable end wall 12. Mounted on the wall 12, and preferably in a depression therein, is a plunger 13 having a tapered end, as shown, for transmitting power from the vessel 10 to a damper lever rocker 14. The vessel 10 is guided in its to and fro movements and kept within narrow limits from a rectilinear path by means of a guide rod 15 housed in the tube 4, said rod being provided with a threaded upper end passing through the movable wall 12 and entering into a threaded socket in the plunger 13. The lower end of rod 15 is provided with a head 16 loosely fitting tube 4. This head normally centers the lower end of rod 15 in tube 4, while permitting a slight oscillating

movement of the upper end of the rod by side displacements of the vessel 10. To protect the vibratory vessel 10 and to provide a support for the damper lever rocker and other parts, a cap 17 is provided which fits within an annular ledge 18 on base 1 and is held in place by screw-bolts 19 passing through openings in the base and secured by nuts 20.

Mounted on the top wall of the casing 17 are oppositely disposed brackets 22 secured thereto by screws 23. Each bracket is provided with a rectangular opening 24, Fig. 4, the top and side walls of these openings being in alinement with each other. Between these brackets is located a lug 25, preferably cast integral with the upper wall of the casing 17 and having an inclined shoulder 26 rising above the top surface 27′ of the lug and forming therewith an angle, the apex of which is in the plane of the upper faces of the openings 24. The two downwardly facing surfaces of the openings 24 and the upwardly facing surface of the lug form bearing surfaces for three knife edges 27, 28, 29, preferably formed integral with a damper lever supporting rocker 14, their bearing edges being in alinement. Two of these knife edges 27 and 28 are adapted to enter the bracket openings 24 and bear against the downwardly facing surfaces in these openings. The third or center knife edge 29 is adapted to rest on the upwardly facing surface of the lug 25 located between the brackets 22, 22. The forward portion of the rocker is recessed at 30 to receive the tapered head of the plunger 13 and is provided with the usual lever-receiving slot 31 and clamp screw 32.

Assuming the parts of the regulator to have been assembled as above described, and the vibratory vessel and bulb to have been charged with a volatile liquid filling the vibratory vessel 10 and partly filling the bulb 6 when in normal upright position, and that the regulator has been screwed into the wall of a boiler wherein the bulb is subjected to the heating fluid, the operation will be as follows:—The heating fluid which freely circulates around all sides of bulb 6 produces in the vapor space of the bulb vapor pressure on the contained liquid and thus pressure is transmitted to the vibratory vessel 10 through the column of liquid in the tube 4 and the liquid in the vibratory vessel. Variations of this pressure, due to variations of temperature of the heating fluid, thus cause movements of the movable end wall 12 which are transmitted by the plunger 13 to the rocker 14. It will be observed that the power is applied to the rocker 14 between the load and the fulcrum. The knife edges 27 and 28 therefore normally bear up against the downwardly facing surfaces of the openings 24 in the brackets 22 and enable the rocker to oscillate about an axis A—B which also lies in the plane of the bearing surface 27′ of the lug 25, which becomes a support for knife edge 29 of the rocker when the balanced damper lever is not carrying the weight of the damper. Displacement of the knife edges 27, 28 and 29 is prevented in one direction by the vertical rear side faces of the openings 24, and in the opposite direction by the ledge 26 in the lug 25. Freedom of movement of the knife edges is thus secured with minimum friction, while displacement of the knife edges is prevented in all directions. This feature is considered to be of important structural advantage. Normal application of power to the rocker is secured, while confining the vibratory vessel to a substantial rectilinear movement with minimum lost power due to friction, by means of the guide rod 15 which is housed in the tube 4. The plunger 13 with its attached guide rod acts in a manner similar to a pitman. The head 16 of the rod is confined to move in a rectilinear path in the tube 4, while the top of the plunger engaging the rocker describes a short circular path about the axis A—B of the rocker. The vibratory vessel is thereby guided in its to and fro movements with the least degree of friction and side guides for the vessel are avoided. The difference in temperature between the bulb 6, which is located inside the boiler, and the temperature of the metal parts of the device, located in the atmosphere outside the boiler, is normally considerable, and the flow of heat from one to the other through the connecting parts is largely proportional to this difference. To keep this flow at a minimum, in order that the bulb may closely represent the temperature changes of the heating fluid, the cross-section of the metal path between the bulb 6 and the casting is reduced to a minimum by attaching the bulb to the casting indirectly through the metal plate 7 and providing access of the heating fluid to the space above the bulb within the tubular portion 2. The shoulder 21 on the portion 2 is practically out of contact with the bulb and serves as a guard against accidental side displacement. Transfer of heat by conduction from the bulb to the casting is thus minimized and the lower portion of the casting is kept nearly at the temperature of the heating fluid, thereby further minimizing the tendency of heat to flow from the bulb to this part of the casting.

In Figs. 5, 6 and 7 is shown an embodiment of my invention in a slightly modified form. In lieu of separable brackets as previously shown, lugs 33 are cast on the cap 34. In these lugs are openings 35 which register with an opening or openings 36 formed in the rear of the rocker. Projecting into the latter opening or openings in

the rocker are knife edge pivots 37, preferably cast integral with the rocker. A rod 39 provided with a groove 40 is inserted through the openings in the lugs and passes through the opening or openings in the rocker, the groove receiving the pivots. The rod 39 is made fast to the lugs by means such as a pin 41. It will be apparent that in this construction, as in the construction just described, the rocker 5 is provided with knife edge pivots which are secured against dislodgment from normal position and friction is reduced to a minimum. Instead of securing the cap or casing to the base by rods, the cap 34 is provided with screw threads which engage threads on the base, the latter being provided with a tubular extension 42 which may be formed in a square or hexagonal shape to receive a tool for screwing the base into the boiler wall. The plunger 43 is shown provided with a conical termination, instead of wedge-shaped, to further reduce friction, and a lug 44 is provided on the rocker to seat on the top of the cap and take the load off the plunger when the latter is not operating. In other respects this form of the device is like that first described, and operates in a like manner.

What I claim is:—

1. In a damper regulator, the combination of a thermosensitive bulb provided with a tubular stem, a chambered plug adapted to enter the wall of a boiler and having an opening for receiving and supporting said stem, said bulb and stem forming with the walls of the plug a fluid-circulating chamber open to the boiler space when the plug is in position in the wall of the boiler, and damper operating means having a connection with said bulb.

2. In a damper regulator, the combination of a thermosensitive bulb adapted to be exposed to a heating fluid in a boiler and having a tubular stem, a support to which said stem is secured having a tubular member forming with the stem an annular fluid circulating chamber above the bulb, the end walls of said bulb and said member overlapping to prevent accidental displacement of the bulb and normally out of contact to reduce transfer of heat from the bulb to said support, said member being adapted to be screwed in position in the wall of a boiler.

3. In a damper regulator, the combination of a thermosensitive bulb adapted to be exposed to a heating fluid in a boiler and having a tubular stem, a support to which the stem is secured having a tubular member forming an annular fluid circulating chamber with the stem above the bulb, said member having an engagement with the wall of the bulb to prevent lateral displacement of the latter and also having threads for screwing the support into position in the wall of a boiler.

4. In a damper regulator, the combination of a vibratory vessel and a rocking member operated thereby, a thermosensitive bulb having a tubular connection with said vessel, and a guide rod movable with the movable end of said vessel and having on its free end a head loosely playing in said tube and guided thereby to move in a rectilinear direction while its opposite end is free to accommodate itself to the oscillating movement of the rocking member limited by the walls of said tube.

5. In a damper regulator, the combination of a vibratory vessel and a rocking member operated thereby, a thermosensitive bulb having a tubular connection with said vessel, and a guide rod movable with the movable end of said vessel and having its free end housed in said tube and guided thereby to move in a rectilinear direction while its opposite end is free to accommodate itself to the oscillating movement of the rocking member limited by the walls of said tube.

6. In a damper regulator, the combination of a cast iron base having a tubular threaded extension adapted to be screwed into the wall of a boiler, said base having an opening and a tube secured in said opening, a thermosensitive bulb supported by said tube on one side of the base and a vibratory vessel having its bottom wall secured to said tube on the opposite side of said base, and a guide rod housed in said tube and secured to the movable end wall of said vessel.

7. In combination, a damper operating lever, a rocking member for supporting the same provided with knife edge journals, brackets having openings for receiving said journals, another knife edge journal on said rocker intermediate the journals of said pair and having its knife edge facing opposite to the edges of said pair and a post intermediate said brackets and having a bearing face in the plane of the bearing surfaces in said openings, and a lug on said post coöperating with the sides of the bracket openings to confine the journals to their bearings.

8. In combination, a damper operating lever, a rocking member for supporting the same provided with a pair of knife edge journals. bearings for the same, another knife edge journal on said rocker having its edge in alinement with the knife edges of said pair and facing in opposite direction to the first-named pair, and a bearing surface for the second-named knife edge in the plane of the first-named bearings.

9. In combination, a damper operating lever, a rocking member for supporting the same provided with a pair of knife edge journals, bearings for the same, another knife edge journal on said rocker in alinement with the knife edges of said pair and facing in opposite direction to the first-

named pair, a bearing surface for said second-named knife edge in the plane of said first-named bearings, and means associated with said bearings to confine the journals to their bearings.

10. In combination, a lever supporting rocking member having a pair of knife-edge journals facing in one direction and an intermediate knife-edge journal facing in the opposite direction and in alinement with the first-named journals, bearings for said journals adapted to confine said journals and a pressure-actuated motor to rock said member.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:
H. T. PATTON,
JOHN M. DEMPSTER.