

Nov. 18, 1930.

G. H. DAVIN

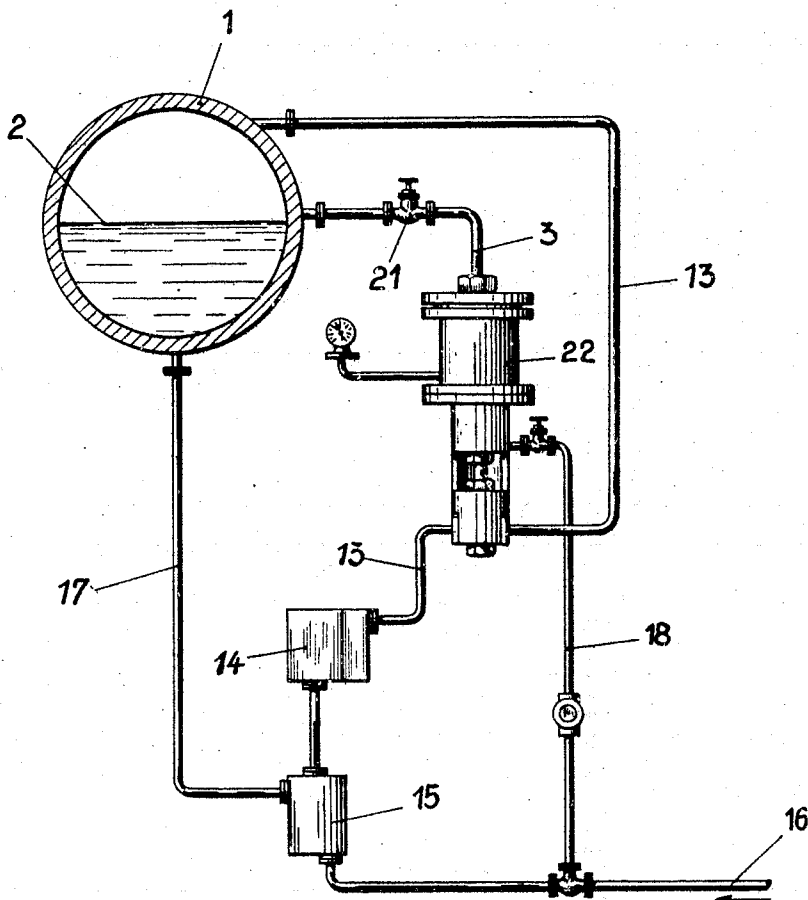
1,781,749

APPARATUS FOR MAINTAINING A PREDETERMINED WATER LEVEL IN STEAM BOILERS

Filed May 18, 1928

2 Sheets-Sheet 1

FIG. 1.



Inventor

George Henrich Davin

By

George P. Davin
Attorney

Nov. 18, 1930.

G. H. DAVIN

1,781,749

APPARATUS FOR MAINTAINING A PREDETERMINED WATER LEVEL IN STEAM BOILERS

Filed May 18, 1928

2 Sheets-Sheet 2

FIG.2.

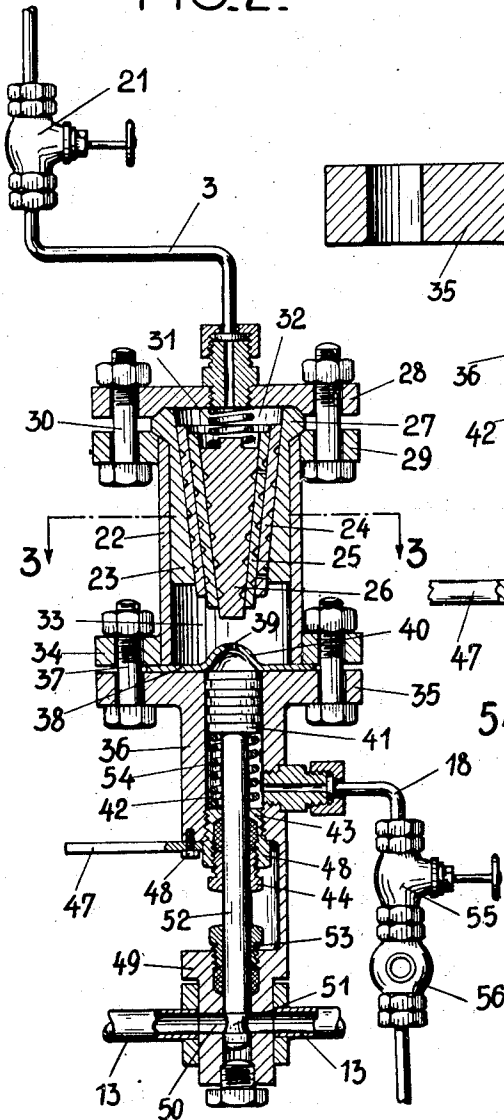


FIG.4.

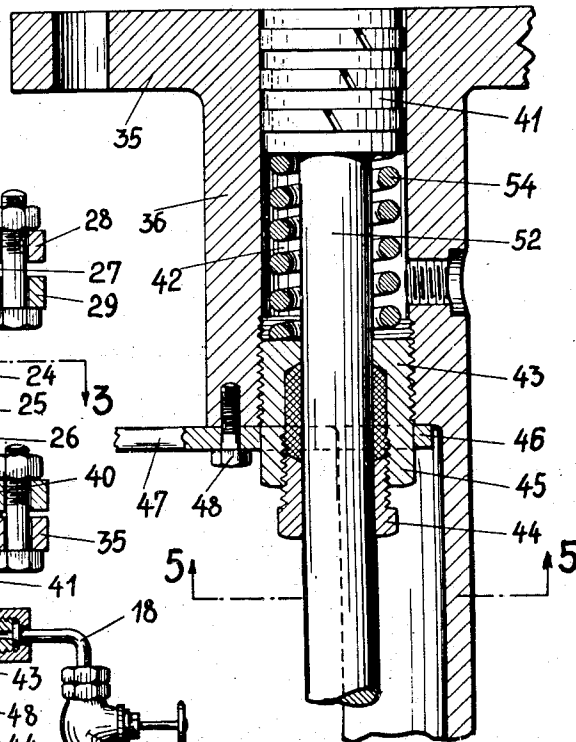


FIG.3.

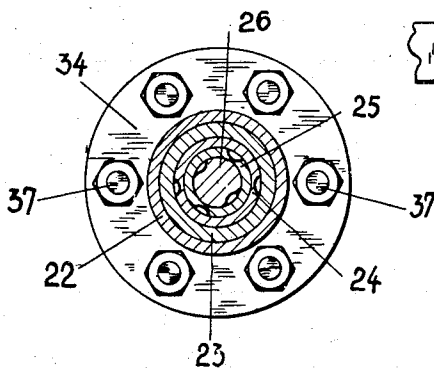
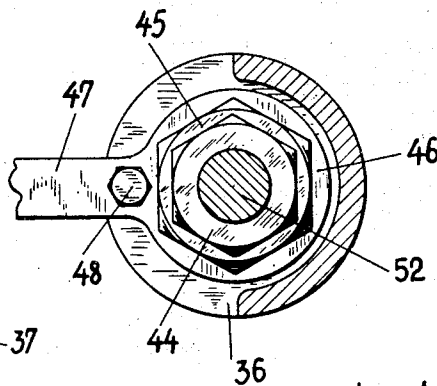


FIG.5.



Investor

George Henrich Davin

By

George Henrich Davin
Atty

UNITED STATES PATENT OFFICE

GEORGE HEINRICH DAVIN, OF CASSEL, GERMANY, ASSIGNOR TO SCHMIDT'SCHE HEISS-DAMPF G. M. B. H., OF CASSEL-WILHELMSHOHE, GERMANY, A CORPORATION OF GERMANY

APPARATUS FOR MAINTAINING A PREDETERMINED WATER LEVEL IN STEAM BOILERS

Application filed May 18, 1928, Serial No. 278,834, and in Germany July 11, 1927.

This invention relates to apparatus for maintaining a predetermined water level in steam boilers, particularly those of the type in which a substantial part of the boiler volume is to be utilized for steam generation and storage, and in which the pressure and water level are constantly fluctuating due to temporary overloads. In carrying out the invention, a device which regulates the admission of feed water to the boiler is positioned in a regulating chamber which is located in a line between the boiler and feed water suction pipe. The functioning of this regulating device depends on whether steam or water passes through the regulating chamber.

The invention consists primarily in a throttling or choking device in the form of a labyrinth stuffing box contained in the regulating chamber. Through this stuffing box only a very small weight-(quantity) of steam can pass which condenses in the labyrinth grooves and appears at the other end in liquid form. This small quantity of condensed material can pass freely through a second throttling means which is located beyond the regulating chamber. If, however, the surface of the water in the boiler rises to such a height that it flows directly into the labyrinth stuffing box, a great quantity of water will flow into the regulating chamber due to the well known fact that a stuffing box of this nature offers very much less resistance to the passage of water than to steam at the same pressure. In consequence the pressure in the regulating chamber becomes relatively high, the regulating device will be displaced and the admission of feed water to the boiler might be stopped altogether. The present invention now possesses the advantage that a considerable difference of pressure is available with which to operate the regulating means. A further advantage lies in the fact that the loss of heat is very small because of the small flow of steam through the grooves of the labyrinth stuffing box.

A particularly advantageous construction of the regulating means of the present invention is obtained by so constructing the plunger which regulates the flow of feed water that it will serve at the same time as a throttling

means. To accomplish this the regulating piston does not fit tightly into the cylinder bore in which it is arranged to move, but enough clearance (play) is left so that the flow of water will be impeded but not totally prevented.

One embodiment of my invention is illustrated in the accompanying drawings, in which:

Figure 1 shows, somewhat diagrammatically, the complete organization of elements.

Figure 2 shows on a larger scale a vertical section of the regulating chamber and its two throttling means.

Figure 3 is a cross-section on line 3—3 of Figure 2.

Figure 4 shows the lower throttling means of Figure 2 on a still larger scale; and

Figure 5 shows a cross-section on 5—5 of Figure 4 as seen from below.

In Figure 1 the numeral 1 designates a boiler whose normal water level 2 it is the object of this invention to maintain. A pipe 3 provided with a valve 21 leads from the boiler at the water level to the first throttling means in the regulating chamber. The pipe 13 leads from the boiler to the steam engine 14 which drives the feed pump 15. Pipe 16 is the suction pipe of the pump, 17 is the pressure line from the feed pump to the boiler and 18 is the discharge pipe from the regulating chamber, this pipe being connected to the suction pipe 16. The two throttling devices, the regulating chamber, and the means for controlling the feed water supply form a unitary structure whose housing consists of two parts. The upper part 22 contains the labyrinth throttle (see Figures 2 and 3) which consists of conically formed pieces 23, 24, 25, 26 whose contacting conical surfaces are provided with spirally arranged grooves which form continuous labyrinth throttle passages. The outer cone 23 has its upper rim 27 supported by the upper edge of the housing 22 and it is held in place by a cover 28 which in turn is connected with a flange 29 forming part of the housing 22, by means of bolts 30. The pipe 3 passes through the cover 28. Between the cover 28 and the inner conical member 26 there is arranged a helical

spring 31 whose object it is to keep the several conical pieces of the labyrinth throttle in their relative correct position. In this position their upper edges form with the cover 28 a space 32 having a stepped inner peripheral surface, and these conical pieces project with their lower ends in step formation into a space 33 at the lower end of the housing 22. This space 33 constitutes the actual regulating chamber. The annular flange 34 formed at the lower end of the housing 22 is, by means of bolts 37, detachably secured to a corresponding flange 35 at the upper end of a cylinder 36. Between the two flanges 34, 35 there is clamped an intermediate plate 38 formed with a semispherical bulge 40, which bulge is provided with an opening 39 at its peak. In the cylinder 36 is movably positioned a regulating piston 41 the construction of which is such that a small clearance (Figure 4) is left between the piston and the wall of the cylinder 36. The body of this cylinder is constructed in the form of a so called lantern frame. The bore 42 of the cylinder is closed at its lower end by means of a bushing 43 threaded into the cylinder, and a stuffing box 44 within the bushing. The lower end of the bushing 43 which projects into the open space of the lantern-like frame of the cylinder 36 has the form of a hexagonal nut 45 (Figure 5). A key (wrench) 47 having a ring like end (46) is positioned on this nut and is locked in adjusted position by the screw 48. The lower end 49 of the frame is provided with a transverse passage 50 to the two ends of which the steam pipe 13 leading to the cylinder 14 is joined. Through the hole 50 the lower end 51 of the piston rod 52 projects, this rod being guided not only by the stuffing box 44 but also by a second stuffing box 53 mounted in the lower part of the frame 49. Within the cylinder bore 42 there is a helical spring 54 mounted on the piston rod 52 which tends to hold the regulating piston 41 in its upper position in which position the steam pipe 13 is open. From the lower end of the cylinder bore 42 the drain pipe 18 leads to the suction pipe 16 to which it is connected. The drain pipe 18 comprises a throttle valve 55 and also a sight glass 56.

It is a well known fact that if water passes through a throttling aperture, the weight in a given time exceeds by many times the weight of steam which could pass through the same aperture, if the pressure drop across the aperture is equal in both cases. With a pressure drop of approximately 12 atmospheres, the ratio of the weights of steam and water passing through the aperture is about 17 to 1.

The operation is as follows: When the level of the water in boiler 1 lies below the opening of the pipe 3, steam will flow through the latter through the labyrinth throttle de-

vice in whose passages it is condensed, losing its pressure in so doing. Since but a small quantity of steam can pass through the throttle device a correspondingly small quantity of water will be discharged under no pressure and in the form of drops from the lower end of the throttle device into the space 33. The lower part of this space as well as the space 32 lying above the conically shaped parts of the labyrinth throttle serve as collectors of impurities. As soon as the level of water in space 33 has reached the convex protuberance 40 of the intermediate bottom 38, the water will flow through the hole 39, and, since there is some clearance between the piston and the wall of the cylinder, it will collect in the lower part of the cylinder from where it will be discharged through the pipe 18. This condenser water because of its slight weight will exert no pressure or in any case very little pressure on the regulating piston 41 so that the spiral spring 54 will not be compressed and the piston will remain in its highest position, in which case the steam passes freely through the pipe 13 to the steam chest of the feed pump engine 14. In this condition the maximum amount of water is fed into the boiler.

When the water level in boiler 1 rises above the pipe 3 water, in addition to steam, will be conducted to the labyrinth throttle. Since the resistance of the latter to the passage of water is much less than to that of steam, more water will pass through and its weight will force the regulating piston partially down and the passage of steam through pipe 13 will be throttled. Finally, when nothing but water passes through the labyrinth throttle, the full boiler pressure diminished by the frictional resistance in the labyrinth throttle will force down the plunger and the admission of steam will be cut off altogether. As soon as the water level goes down again to normal the pressure on the regulating piston will be removed.

By means of the valve 21 the flow of the steam through pipe, and by means of valve 55 the flow of water through pipe 18, can be regulated. In this way the operation of the whole regulating device can be so adjusted that it functions continuously, i. e., without great intermissions. In order that but little steam may be condensed in the labyrinth throttle, the housing should be covered with heat insulating means. Since but little steam is condensed the formation of scale, when hard water is used, will be comparatively small and the danger of the stopping up of the various passages is correspondingly small. By means of the sight glass 56 the operation of the device can be observed, and in case of scale-forming feed water it can be seen how far the obstructing of the steam and water passages has been advanced.

The construction of the whole device is

very simple and admits of easy taking apart for the purpose of cleaning. It is only necessary to loosen the union joint below the valve 21 and to remove the bolts 30 from the flange 29 and to remove the cover in order to make the labyrinth throttle accessible. The conical member can then easily be removed and then be separated by knocking at their lower step-like arranged ends. In equally easy manner the piston 41 can be taken out by removing the bolts 37. The pressure of the spring 54 on the piston 41 can be regulated while the apparatus is in operation by means of the wrench 47. The lantern shape of the housing and the ring formation of the wrench allow a removal of the wrench, a remounting of the wrench in a new position, and the turning of the same. After the adjustment has been made the stuffing box 43 will be locked in its position by the screw 48 passing through the wrench into the cylinder 36.

While I have shown and described the preferred embodiment of my invention, I wish it to be understood that various changes in the construction and arrangement of parts may be made, limited only by the scope of the appended claims.

What I claim is:

1. Apparatus for maintaining a predetermined water level in a steam boiler comprising a drum containing water and steam, a feed pump for maintaining a water level in the drum, a steam supply line to said feed pump, a throttling device in said supply line, and means inserted between the drum and the feed line of the pump for controlling said throttling device, said means comprising a chamber, a labyrinth throttle having passages of considerable length at one end of said chamber, and a pressure operated plunger communicating with the chamber adjacent said throttle and connected thereto.

2. In combination with a steam boiler and feed pump therefor, a device for controlling the operation of the feed pump to maintain a substantially constant water level in the boiler drum, said device comprising a chamber having a connection with the drum at a selected water level, a labyrinth throttle having passages of considerable length at one end of said chamber for impeding the passage of steam while allowing water to pass therethrough, a plunger within the other end of said chamber having a slight clearance for permitting the passage of a limited amount of water, a drain beyond said plunger, and means controlled by said plunger for regulating the steam supply to the feed water pump.

3. A device as claimed in claim 1, said chamber, throttle and plunger being contained in a single housing.

4. A device as claimed in claim 1, said chamber, throttle and plunger being contained in the same housing, said housing be-

ing formed of a plurality of detachable parts.

5. A device as claimed in claim 1, having a spring pressing said plunger toward said throttle, and means for adjusting the tension of said spring.

6. A device as claimed in claim 2, a bushing for closing the lower end of said chamber screw-threaded in the wall of said chamber, a spring supported by said bushing below said plunger and acting on said plunger, the end of said bushing having the form of a nut, a wrench adapted to fit on said nut, and means for securing said wrench to the lower wall of said chamber.

7. A device as claimed in claim 1, said throttle comprising a plurality of telescoping frustro-conical members having helical grooves in the outer side thereof extending from end to end, the smaller ends of the frustro-conical members being stepped, the end of the central frustro-conical member extending beyond the end of the adjacent frustro-conical member.

8. In a device of the character described, means for controlling the flow of steam to a feed pump which feeds water to a boiler comprising a chamber, a labyrinth throttle at one end thereof adapted to connect said chamber to said boiler at a desired water level, and a pressure operated plunger communicating with the chamber adjacent said throttle and connected to said throttle, said plunger controlling the supply of steam to said feed pump.

In testimony whereof, I have hereunto set my signature.

GEORGE HEINRICH DAVIN.