W. C. BLUNDELL.

WATER INDICATING MEANS FOR STEAM BOILERS.

APPLICATION FILED FEB. 7, 1916.

1,221,963.

Patented Apr. 10, 1917.

3 SHEETS—SHEET 1.

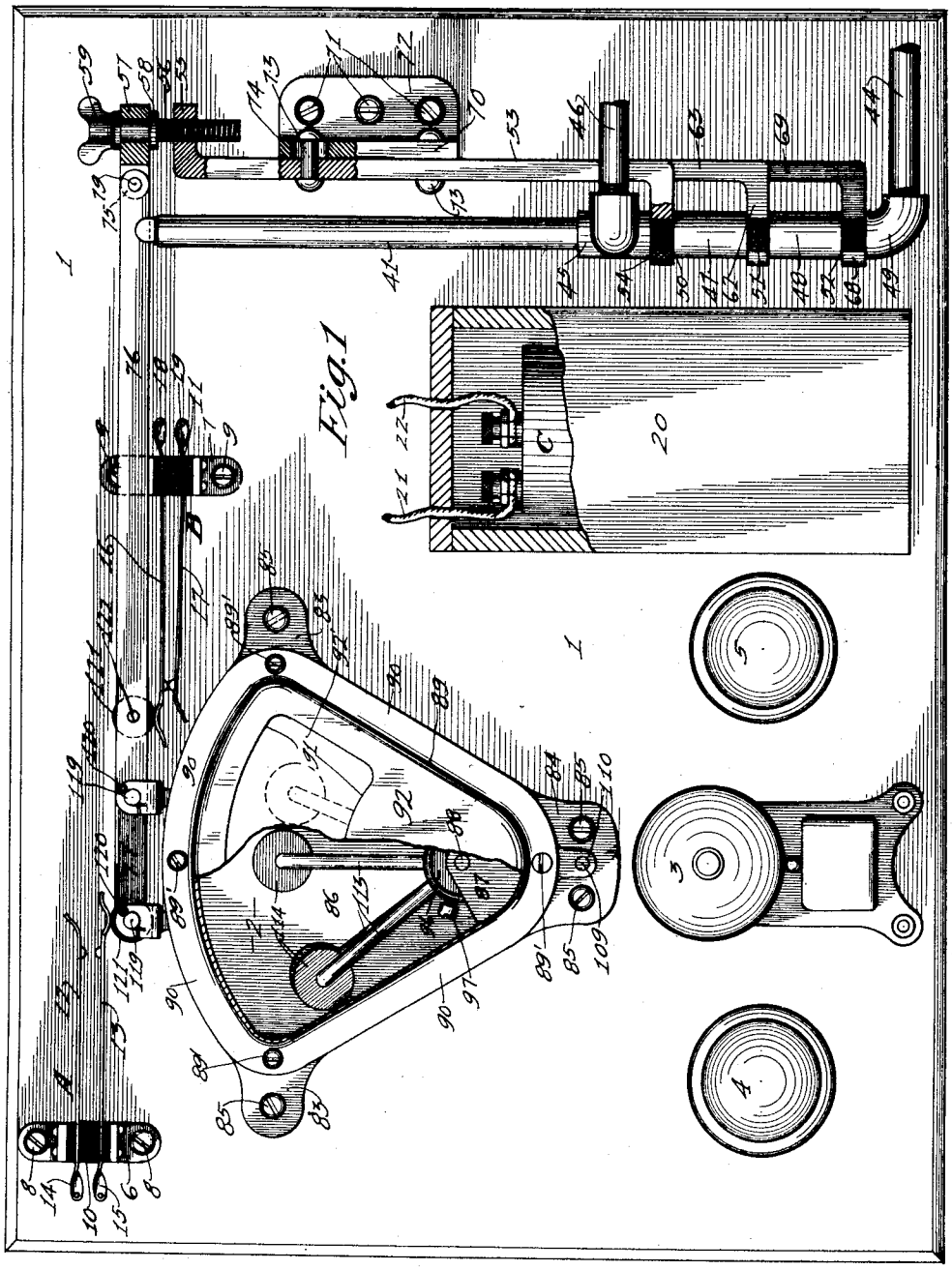


Fig. 1

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3 SHEETS—SHEET 2.

Fig. 4

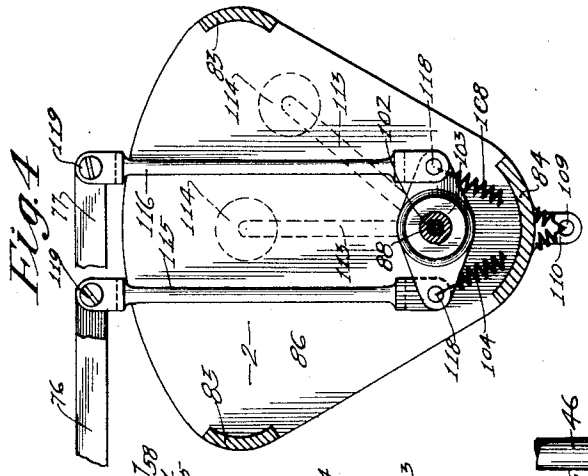


Fig. 5

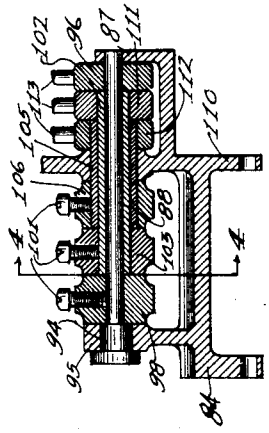


Fig. 3

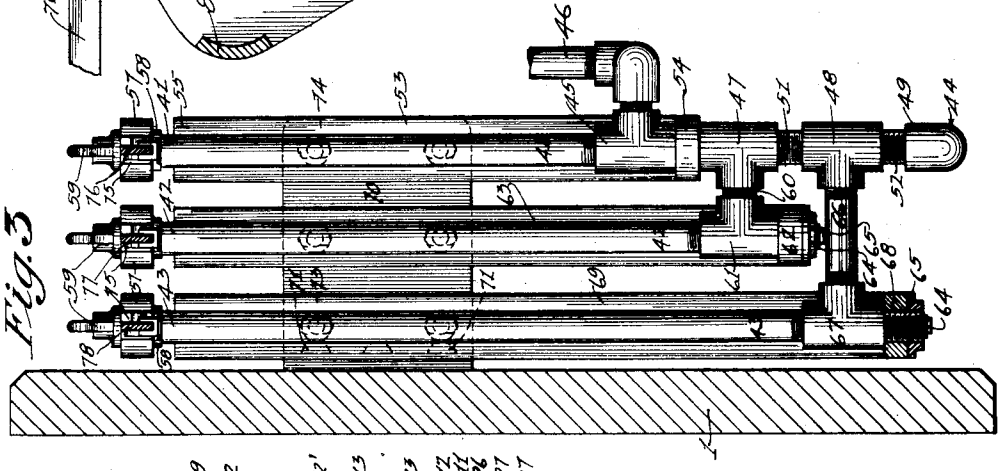
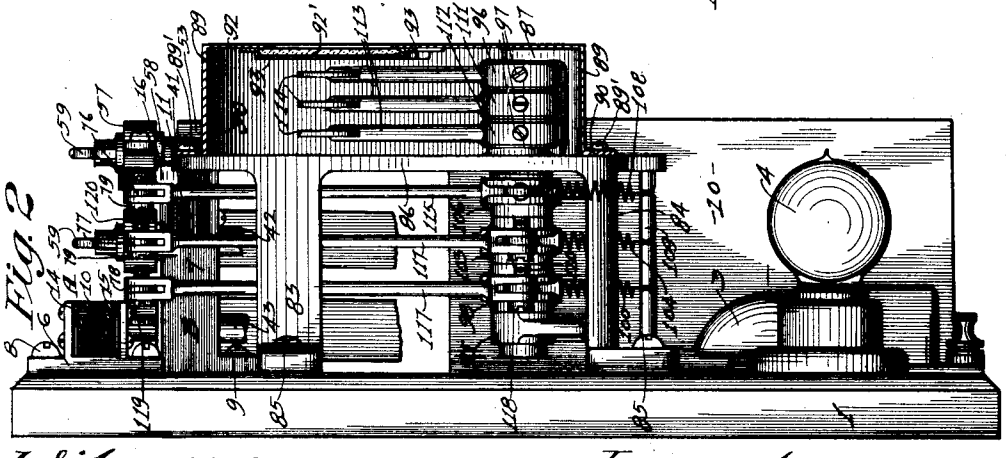


Fig. 2



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3 SHEETS—SHEET 3.

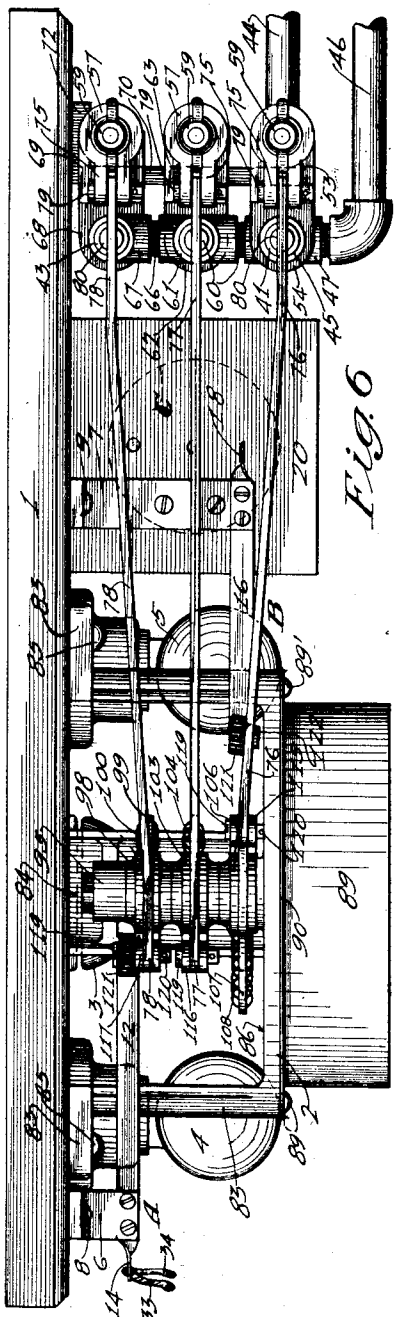


Fig. 6

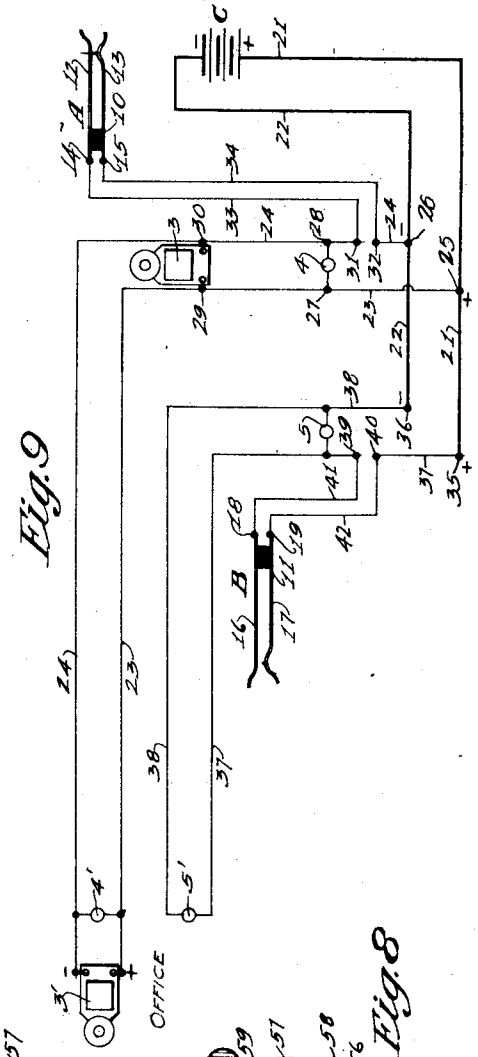


Fig. 9

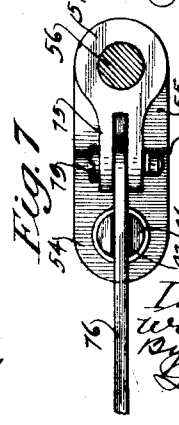


Fig. 7

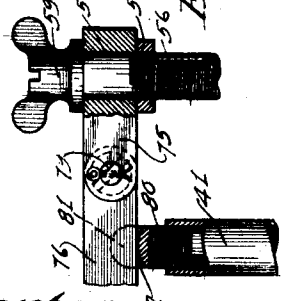


Fig. 8

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UNITED STATES PATENT OFFICE.

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WATER-INDICATING MEANS FOR STEAM-BOILERS.

1,221,963. Specification of Letters Patent. Patented Apr. 10, 1917.

Application filed February 7, 1916. Serial No. 77,101.

To all whom it may concern:

Be it known that I, WILLIAM C. BLUNDELL, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Improvement in Water-Indicating Means for Steam-Boilers, of which the following is a specification.

My invention relates to water indicating means for steam boilers and has for its object the provision of an improved indicating means which may be readily applied to any form of steam boiler such as used in stationary steam generating plants, steam propelled vessels and vehicles and any other form of stationary and portable boilers.

Another object of this invention is to provide a mechanically operated indicator to be used in lieu of the well known types of water glass indicators and whereby the objectionable features of the latter form of devices may be eliminated.

Another object is to provide a combined audible and visible indicator which may be effective in performing its functions and announcing the state of the water in the boilers at points remote from the boilers, so that in the absence of the engineer the effects of extremely high or low water in the boilers may be obviated by a person or persons other than those usually in attendance at the boilers. A further feature of this invention which results from the provision of the remotely placed alarm mentioned above, consists in the ability of the superintendent of a factory or plant, or the captain on a vessel to at all times be in touch with the conditions obtaining at the boilers so that economy in the operation of the boilers may be enforced, which with other types of indicators, is impossible.

Another object of this invention is to provide means simultaneously operable by the rise and fall of the water in the boilers for a double signal, electrically controlled, as for instance, a bell and a lamp arranged to give a simultaneous audible and visible alarm at points remote from the boiler, and further capable of giving the same alarm at the boiler proper, or at other places about the building or premises; the double alarm being in addition to the mechanical signal mentioned above.

A further object of my invention is to provide a series of expansion tubes arranged for connection with the steam supply from the boilers for operating the indicating means, and which is capable of adjustment for the purpose of setting the signaling means to conform to conditions obtaining at the boilers.

A further object is to provide means for commonly operating the mechanical, bell and lamp signaling means in order that a multiplicity of parts may be dispensed with and avoided and the greatest simplicity and economy may be practised in the manufacture and operation of my device. Other objects may appear in the detailed description of my invention which will follow.

Referring to the drawings, in which similar characters of reference indicate the same parts throughout the several views, Figure 1 is a front elevation of my device; Fig. 2 is an end elevation of the same; Fig. 3 is a transverse sectional elevation of the same taken about midway of the ends; Fig. 4 is a rear elevation of the indicator housing and a portion of the operating means, showing the legs of the housing broken away; Fig. 5 is a fragmentary transverse sectional elevation of the indicator housing, indicators and levers; Fig. 6 is a plan of my assembled device; Fig. 7 is an enlarged plan of the mounting for one of the operating levers; Fig. 8 is an elevation of Fig. 7; and Fig. 9 is a circuit diagram showing the electrical connections between the various elements of my device.

My indicating means is preferably mounted on a board or slate slab 1 with the indicator housing 2 near the left end thereof and an alarm bell 3 with lamps 4 and 5 arranged on each side of the bell are placed below the indicator housing, or above the same if found to be more desirable, the elements named being suitably secured to the board 1.

Electric switches A and B are secured to the board 1 by means of metal brackets 6 and 7, respectively, which are held by screws 8 and 9. The switch brackets A and B have fiber or hard rubber insulating blocks 10 and 11 and rigidly held therein, and a pair of springs 12 and 13 which are adapted for intermittent contact at their outer ends are firmly held at their inner ends in the insulating block 10 of the switch A, suitable terminals 14 and 15 being provided on the ends of the springs 12 and 13

to which wires may be attached. Similar springs 16 and 17 are held in the insulating block 11 of the switch B and have terminals 18 and 19 for attaching wires thereto.

The lamps 4 and 5 are carried by sockets, preferably of porcelain or other non-conducting material. A battery C is incased in a case 20 suitably secured to the board and the case may be arranged to open at the front, side or top, as may be convenient so that the battery may be placed in position in the case or removed therefrom with facility.

The circuit arrangement and electrical connections for the various electrical elements is shown in Fig. 9, in which wires 21 and 22, forming the battery line, lead respectively from the positive and negative poles of the battery. Wires 23 and 24 are connected, respectively, at 25 and 26 with the positive and negative wires 21 and 22 from the battery and the red lamp 4 and the bell 3 are connected in multiple with these wires at points 27—28 and 29—30, respectively. A bell, as at 3′ and lamp, as at 4′ may be additionally connected in multiple with this line and located in the office or other convenient place as shown. The wire 24 of the signal line just described is broken at points 31 and 32 and wires 33 and 34 are connected at these points with the wire 24. The opposite ends of the wires 33 and 34 are connected respectively, with the terminals 14 and 15 of the red lamp switch A.

The ends of the battery wires 21 and 22 are connected at points 35 and 36 with wires 37 and 38, respectively, the wire 37 being cut at points 39 and 40 and wires 41 and 42 connected therewith. The wires 41 and 42 are respectively connected with the terminals 18 and 19 of the white lamp switch B, the white lamp 5 being connected in multiple with the wires 37 and 38 and a lamp 5′ being also connected in multiple with these wires and placed in the office or other location coincident with the additional lamps 4′, or otherwise.

Expansion tubes 41, 42 and 43 are transversely alined and mounted on the right hand end of the board 1 and the tubes are suitably connected with a common water line 44 leading to the bottom of the water column of the boiler by means which I will now describe. The outer tube 41, which is the shortest, is connected with the upper end of the T 45 and the steam line 46 is also connected with this T and leads to the steam chamber of the boiler. The T's 47 and 48 and the elbow 49 below the tube 41 and the T 45 are connected by means of short nipples 50, 51 and 52 so that a continuous passage is provided for the water from the water line 44 into the tube 41, and the steam is also admitted to this tube through the pipe 46.

A supporting bracket 53 is secured at its lower end 54 to the nipple 50 immediately below the T 45 of the tube 41, and the upper end of this bracket is bent in a direction opposite to the lower end 54, as at 55, to receive the threaded end of the adjusting screw 56 which is pivotally held in and serves as a support for the swivel 57, the screw being provided with a collar 58 at a point below the swivel and a wing head 59 above the swivel, the collar being screwed upwardly on the screw so as to support the swivel and the movement of the latter upwardly being prevented by the head 59 of the screw. This structure is best shown in Figs. 7 and 8.

The central tube 42 is connected with the T 47 by means of the short nipple 60 and the T 61, and the lower end 62 of the bracket 63 which is similar to the bracket 53 of the tube 41 but correspondingly longer, is threaded on the plug 64 at a point just beneath the lower end of the T 61 so as to support the tube similarly to the manner of supporting the tube 41. The plug 64 is sufficiently elongated to receive a retaining collar 65 which is threaded thereon below the end 62 of the bracket 63.

The tube 43 is connected with the T 48 by means of the nipple 66 and the T 67, this tube being supported in the same manner as the tube 42 by the lower end 68 of the bracket 69, the tube and the bracket being correspondingly longer than those used for the other tubes, and the plug 64 and collar 65 being provided for holding the support and tube in their proper relation.

The arrangement of the upper ends of the tubes 41, 42 and 43 and the brackets 53, 63 and 69 is the same, each of the brackets being provided with one of the swivels 57 and adjusting screws 56, and all of the brackets and tubes are commonly supported on the board 1 by means of a relatively wide bracket 70 which is secured rigidly to the board 1 by means of screws 71 extending through the foot 72. The brackets 53, 63 and 69 are movably secured to the bracket 70 by means of rivets or screws 73 which extend through the vertically elongated slots 74 in the flat side of the bracket 70, for permitting the adjustment of the tubes and their supporting brackets vertically of the board 1 for the proper setting of the tubes.

Each of the swivels 57 has a bifurcated extension 75 in the central slot of which is pivoted the rear end of one of the flat bars 76, 77, or 78, as the case may be, on a screw 79. One end of the pivot screw 79 is slotted and the opposite end carries a cotter pin for preventing the displacement thereof from its seat. Each of the expansion tubes 41, 42 and 43 is provided at the top with a plug 80 which has an upward extension 81 having a slot 82 formed therein to receive the bars 76, 77 and 78 for prevent-

ing the lateral movement of the bars relative to the tubes, the bottom of the slot in the plug in each case being convex so as to eliminate friction and wear.

The central bar 77 extends from the swivel 57 in a straight line toward the left hand end of the board and to a point slightly to the left of the center of the indicator housing 2. The rear bar 78 extends from its swivel 57 to a point substantially in line with the left hand end of the bar 77, but this bar is slightly deflected forwardly so as to bring its outer end closer to the bar 77 than is its rear end. The front bar 76 extends from its swivel 57 to a point slightly to the right of the center of the indicator housing 2 and is slightly deflected rearwardly.

It is obvious that the longitudinal expansion of the tubes 41, 42 and 43 will, by means of the connections with the bars 76, 77 and 78, just described, effect a corresponding movement of the bars, the fulcrum points of the bars being above the upper ends of the tubes and the bars resting thereon, the outer or free ends of the bars will be lifted substantially. The adjustment of the screws 56 in the brackets 53, 63 and 69 serves to hold the bars 76, 77 and 78 firmly seated in the plugs at the upper ends of the tubes, as will be hereinafter more fully described.

The indicator housing 2 has feet 83 on opposite sides and a foot 84 at the bottom, which are secured to the board 1 by means of screws 85, the flat back 86 of the housing being thus substantially spaced from the board 1, and a bearing 87 is formed on the lower side of the base portion 86 which extends forward of the base to a convenient point for supporting the central indicator spindle or shaft 88. A thin metallic cover 89 for covering the indicating mechanism held within the housing 2 is secured to the base 86 by means of screws 89′ extending through the flange 90 and held in the base 86. An opening 91 is formed in the front 92 of the cover through which the indicators may be observed, and a glass 92′ is held behind the opening by means of a flanged metal retainer 93 which may be suitably secured to the front wall 92 of the cover. The cover may be removed at will from the base for the purpose of repairing, oiling or regulating the indicating mechanism, by the removal of the screws 89′.

As best shown in Fig. 5, the small and elongated shaft 88 is journaled in the forward bearing 87 of the base and its rear enlarged portion 94 is journaled in the bearing 95 which is formed on the lower foot 84 of the base, a head substantially larger than the portion 94 of the shaft being formed on the rear end of the shaft. The forward end of the shaft 88 adjacent to the bearing 87 and within the cover 89 carries red or danger indicator 96 which is adjustably and firmly held on the shaft by means of a set screw 97, and the rear end of this shaft adjacent to the rear bearing 95 carries a crank arm 98 having an extension 99 for receiving the end of a spring 100, a set screw 101 serving to hold the arm 98 in a desired position on the shaft.

A tubular shaft 102 is revolubly carried by the shaft 88 and carries a "normal" signal 111, preferably of blue, on the end within the housing at a point adjacent to the "danger" signal indicator 96, the same being held on the shaft by means of one of the set screws 97; and the rear end of the shaft 102 carries a crank arm 103 adjacent to the arm 98 which is held thereon by one of the set screws 101 and an extension being provided to receive a spring 104. A relatively short tubular shaft 105 is pivotally carried by the shaft 102 and carries a white indicator 112 on its forward end in the housing and a crank arm 106 on the rear end outside of the housing, the indicator being held on the shaft by a screw 97 and the arm by a screw 101 and an extension 107 being provided on the arm 106 to receive a spring 108. Inasmuch as all of the indicators and their associated crank arms are held in a fixed relationship with the shaft 88 by means of the set screws 97 and 101, a longitudinal movement of either of the shafts will be prevented. It may be found convenient and necessary because of certain conditions to provide separate axes for each of the indicators, and this may be accomplished by the use of three separate shafts 88 instead of the single shaft shown, the three shafts being alined horizontally in the plane of the single shaft 88 and closely spaced apart.

The tension springs 100, 104 and 108 which are attached respectively to the crank arms 98, 103 and 106 at their upper ends are attached at their lower ends to the transverse rod 109 which is held at opposite ends in the foot 84 of the indicator base 2 and a depending lug 110 on the forward portion of the base. The indicators 96, 111 and 112 have arms 113 extending radially from their axis and the ends of the arms are slotted to receive circular disks 114 of suitable size and character which serve as signals and are arranged within the indicator cover and move in a circular path behind the glass covered opening in the cover, so that their movement may be readily observed. It is preferable that the several disks should be of different color and each color indicates a different stage of the water in the boiler, the color of the disk on the indicator 96 being red and indicating "danger;" the color of the disk on the central indicator 111 being blue and indicating normal conditions at the

boiler; and the color of the disk 112 on the rear indicator being white and indicating an abnormal stage of the water.

The indicators 96, 111 and 112 are operably connected with the expansion tubes 41, 42 and 43 by means of the bars 76, 77 and 78 and connecting rods 115, 116 and 117, the crank arm 98 associated with the indicator 96 being connected with the lower end of the connecting rod 117 by means of the pivot screw 118 and the upper end of this rod being similarly connected by means of the screw 119 with the free end of the horizontal bar 78. The crank arm 103 of the indicator 111 is pivotally connected with the lower end of the connecting rod 116 by means of a screw 118 and the upper end of this rod is connected by means of one of the screws 119 with the free end of the central bar 77. The crank arm 106 associated with the indicator 112 is similarly connected by means of the connecting rod 117 and screws 118 and 119 with the free end of the front bar 76.

Thus, by means of the connections described, it is to be observed that the red or "danger" indicator 96 on the forward end of the shaft 88 is operably connected with the expansion tube 43, the blue or "normal" indicator 111 is connected with the central expansion tube 42, and the white or "abnormal" indicator at the rear of the indicator housing is connected with the front expansion tube 41. The danger and normal indicators 96 and 111 normally rest in the position in Fig. 1 against the left hand side of the indicator housing, and the white indicator 112 normally rests in the position indicated in the same figure, in a true vertical position, the indicators 96 and 111 moving to the right in a clockwise direction when the tubes with which they are connected are expanded, and the indicator 112 moving in an anti-clockwise direction when the tube with which it is connected is expanded. This difference in direction is effected by connecting the operating bars of the cranks on opposite sides of the axis of the cranks, as shown in Fig. 6.

Cotter pins 120 are provided for insertion through the extended ends of the pivot screws 118 and 119 in the connecting rods 115, 116, and 117 to prevent the displacement of the screws from position. The front operating bar 76 carries an insulating roller 121 which is held on the bar by means of a screw 122 and is adapted to engage the upper spring 16 of the switch B, the pair of springs 16 and 17 of this switch being forced into contact for completing the circuit and lighting the lamp 5 when the indicator 96 moves into normal position, the switch B being supported in position immediately below the path of the roller 121, as shown in Fig. 6. A similar roller is held on a screw 119 in the end of the rear bar 78 immediately above the upper spring 12 of the switch A, and the operation of the bar 78 for moving the indicator 112 effects the contact of the pair of springs 12 and 13 of this switch and completes the circuit of the lamp 4, causing the lamp to light simultaneously with the movement of the associated indicator into signaling position. As shown and described, it is to be observed that the switch A is normally open while the switch B is normally closed, thus conforming to the movement in opposite directions of their respective indicators in the housing 2.

The water from the boiler is admitted to the expansion tubes 41, 42 and 43 by means of and through the water pipe 44, the water rising in the tubes to the level of the water in the boiler. Steam from the boiler is admitted to the expansion tubes through the steam pipe 46, this pipe being connected directly with the shortest tube 41 at a point above the connections of the other tubes therewith. When the water rises in the tube 41 to a point above the steam pipe 46, the steam is prevented from entering the tube and the bar 76 and the indicator 112 with which it is connected and which indicator is colored white rests normally upon the upper end of the tube 41 permitting the switch B to remain closed and the lamp 5 to remain lighted as long as such a condition obtains, and the signal thus produced indicates that the water is too high in the boiler. When the water falls in the tube to a point below the inlet of the steam pipe 46, the steam is admitted to the tube 41, heats the tube and causes its expansion longitudinally, thus raising the bar 76 and by means of the connections with the indicator 112, the latter is gradually moved in an anti-clockwise direction until it rests against the left hand side of the indicator housing 2, thus permitting the opening of the switch B, breaking the circuit of the lamp 5 and deënergizing the same.

The supply of water in the boiler being gradually reduced, when the level of the water in the tube 41 and its connections has reached a point below the inlet connection 47 of the tube 42, the steam from the pipe 46 is permitted to rise in the tube 42, whereupon the tube 42 is expanded by the heat from the steam, the bar 77 resting upon the top thereof is raised and the indicator 111 in the housing with which it is connected and which is colored blue, is moved in a clockwise direction in the housing until it assumes a position indicated by broken lines in Fig. 1, thus indicating a normal stage of water in the boiler.

When the water reaches a level below the T 48 with which the tube 43 is connected and the steam is permitted to enter this tube, the bar 78 is raised by the expansion

of the tube from the heat of the steam and the indicator 96, which is the red or "danger" signal, is moved in a clockwise direction in the housing 2 to a position in alinement with the indicator 111, thus indicating an extremely low stage of water, and the movement upwardly of the bar 78 effects the closing of the switch B, the circuit of the lamp 4 and the bell 3, together with the additional bells 3′ and lamps 4′, is completed, the bells sound the alarm, and the lamps are energized, for warning against danger from low water in the boiler. The alarm thus given will continue until more water has been supplied to the boiler and the condition of affairs remedied, when the mechanism will gradually be restored to normal position and relationship.

The connections between the expansion tubes and the indicators is such that a very slight expansion of the tubes will effect a substantial movement of the bars 76, 77 and 78 and their associated indicators 96, 111 and 112, and the relative movement of any of these elements may be adjusted by increasing or reducing the leverage of the cranks and bars or by the movement of the fulcrum points of the bars toward or away from the upper ends of the tubes.

It should be understood that the action of the indicators is gradual and corresponds exactly to the expansion of the tubes, so that no shock or jar is produced by the action of the mechanism for effecting the movement of the indicators. The adjustment of the screws 56 which support the rear ends of the operating bars serves to establish the relationship between the tubes and operating bars, for obviously, the tightening of the screws 56 relative to the supporting brackets for the tubes, will draw the bars and tubes closer together and overcome and prevent any lost motion so that the slightest movement of the tubes may be indicated by the movement of the bars.

When the tubes are set in the proper positions, the supporting brackets 53, 63 and 69 are moved vertically to correspond to the movement of the tubes on the bracket 70 which supports the brackets on the board 1; the rivets 73 moving in the slots 74 in the side of the bracket 70 and yet preventing any transverse movement of the tubes or their brackets relative to the board, the rivets being then tightened so as to hold the tubes firmly in position on the board.

The mechanism shown and described while practical and serviceable for the purposes set forth and serving to illustrate my invention, is capable of modification and alteration in many respects without enlarging the scope or departing from the spirit of my invention, and as only a few of the uses to which my invention may be put are hereinenumerated, it is obvious that the utility of this invention may be established and demonstrated in other ways than those enumerated.

Having thus described my invention, what I claim is:

1. A water indicating system for steam boilers including a series of visible mechanically actuated signals arranged at the boiler and adapted to be operated when the water in the boiler reaches certain levels, visible electric signal means capable of operation therewith, and audible electric signal means connected with one of said mechanical signals for sounding the alarm for a predetermined stage of the water in said boiler.

2. A water indicating system for steam boilers and the like including a series of visible mechanically actuated signals at the boiler for indicating different stages of the water therein, means intermediate of the boiler and said signals for operating the signals to correspond with the rise and fall of the water in said boiler, and auxiliary electric signal means operable by and with said mechanical signals.

3. A water indicating system for steam boilers including visible mechanical signals at the boiler for indicating different stages of the water therein, means intermediate of the boiler and said signals for operating the signals when the water rises and falls to certain points, and auxiliary electric signal means coöperating with the mechanical signals for producing an alarm at points remote from the boiler.

4. A water indicating system for steam boilers including coöperatively associated visible mechanical and electric signals at the boiler for indicating different stages of the water therein, expansion tubes commonly connected with the steam and water portions of said boiler, there being a single tube for each of said signals, and means intermediate of said tubes and said signals for moving the signals to correspond to the expansion of the tubes.

5. A water indicating system for steam boilers including visible mechanical signals and expansion tubes having a common connection with the steam and water portions of the boiler and arranged to indicate different stages of the water therein, one of said signals being for high and one for low water, and electric signal means connected with and arranged for operation by said high and low water signals.

6. A water indicating system for steam boilers including visible mechanical signal means at the boiler, a series of expansion tubes also at the boiler and commonly connected with the steam and water portions thereof and arranged to operate said signals when the water in the boiler attains certain levels, and electric signal means connected with and operable by said mechanical sig-

nal means for indicating the extreme high and low water stages at points remote from the boiler.

7. A water indicating system for steam boilers including independently operable visible mechanical signals, operating means therefor commonly connected with the steam and water portions of the boiler for indicating the normal and extreme stages of the water in the boiler, visible electric signal means operable by said mechanical means for indicating the extreme stages of the water at remote points, and an auxiliary audible signal for indicating the lowest stage of the water at the danger point.

8. A water indicating system for steam boilers including independently operable, mechanically actuated visible signals, operating means therefor commonly connected with the steam and water portions of the boiler for indicating different stages of the water therein, electric signals associated therewith arranged for visibly indicating the stages of the water at remote points and one of said electric signals being arranged for sounding an audible alarm at a remote point, and means for operably connecting all of the signals.

9. A water indicating system for steam boilers comprising a set of inter-connected expansion tubes commonly connected with the steam and water portions of the boiler, a set of visible mechanical signals capable of operation by the expansion of the tubes for indicating the different stages of the water in the boiler, and electric signal means operable by and simultaneously with said mechanical signals.

10. A water indicating system for steam boilers comprising a series of inter-connected expansion tubes having common connections with the steam and water portions of the boiler and arranged at different elevations relative to and for indicating different stages of the water therein, mechanical signal means arranged for operation by the expansion of said tubes, and electric signal means connected with and simultaneously operable with the mechanical signals for indicating the extreme stages of the water at remote points.

11. A water indicating system for steam boilers comprising combined electrical and mechanical signal means at the boiler, additional associated electric signal means remote from the boiler, a series of expansion tubes commonly connected with the steam and water portions of the boiler for operating said signals, said mechanical means serving to indicate the normal and extreme stages of the water and the electric means to indicate only the extreme stages at near and remote points simultaneously.

12. A water indicating system for steam boilers comprising combined electric and mechanical signal means at the boiler, a series of expansion tubes for operating said signals, means for commonly connecting all of said tubes with the water and steam portions of the boiler for admitting the steam and water thereto, means for operating said signals when said tubes are expanded, and means for simultaneously indicating the stages of the water at points remote from the boiler, with the operation of the mechanical signals.

13. A water indicating system for boilers comprising a set of independently operable mechanically actuated visible signal means at the boiler, visible electric signals at and remote from the boiler coöperatively associated with said mechanical signals and expansion means for operating the signals including connections for indicating the different stages of water in the boiler at a plurality of points.

14. A water indicating system for boilers comprising combined mechanical and electrical signaling means including visible and audible signals located at points near and remote from the boiler and coöperatively associated, a series of communicating expansion tubes commonly connected with the water and steam portions of the boiler having independent connections with said signals, and means for operating said signals simultaneously at a plurality of points for indicating the stage of water in the boiler.

15. A water indicating system for boilers comprising combined mechanical and electrical signaling means including visible and audible signals located at points near and remote from the boiler and coöperatively associated, a series of expansion tubes commonly connected with the water and steam supply of the boiler, said tubes being supported at different elevations to permit the rise of the water from the boiler therein and the admission of steam from the boiler thereto when the water stage in the boiler has attained certain levels, and means whereby the signals may be operated when the admission of the steam to the tubes causes the expansion thereof.

16. A water indicating means for boilers comprising a plurality of visible and audible signals arranged at points near and remote from the boiler and adapted to simultaneous operation, expansion tubes connected with the water and steam supply of the boiler for operating said signals, and means for interconnecting said tubes for permitting the entrance of the water and steam from said boiler thereto, for effecting the expansion thereof and the operation of said signals.

17. A water indicating system for boilers comprising coöperatively associated visible and audible electric signaling means located at different points and mechanical signals at the boiler, expansion tubes for connecting

said signals with the boiler and for operating said signals when the water in the boiler attains certain levels, and means whereby the water and steam from the boiler may be admitted to said tubes for expanding and contracting the tubes relative to the stage of the water in the boiler.

18. A water indicating system for boilers comprising signaling means located at a plurality of points and arranged for simultaneously indicating the stage of the water in the boiler at points near and remote from the boiler, a series of communicating expansion tubes commonly connected with the water and steam portions of the boiler for operating said signals at different stages of the water in the boiler, said tubes being arranged at different levels to correspond to the stages of the water to be indicated, and means for operating the signals with and by the expansion and contraction of said tubes.

19. A water indicating system for boilers comprising a plurality of remotely separated visible and audible signals capable of simultaneous operation, tubes connected with the water and steam supply of the boiler capable of expansion and contraction relative to the level of the water in said boiler for operating and regulating said signals, and means for independently and movably supporting said tubes in operable relation with said signals.

20. A water indicating system for boilers including a plurality of signaling means for indicating different stages of the water in the boiler, having independent operating means connected with the boiler including a separately supported expansion tube for each of the signals, all of said tubes being in communication with each other and commonly connected with the steam and water chambers of the boiler for registering the stages of the water therein.

21. A water indicating system for boilers comprising a plurality of signaling means commonly mounted and arranged to indicate the different stages of the water in the boiler, a set of expansion tubes supported at different elevations and commonly connected with the steam and water chambers of the boiler, said tubes corresponding in number to said signaling means, and independent operating means for each of the signals associated with each of the tubes.

22. A water indicating system for boilers including a set of commonly supported and independently operable signaling means for registering the different stages of water in the boiler, a set of primary operating elements therefor having a common connection with the boiler for admitting the steam and water thereto, and a set of auxiliary operating members connected with said primary elements and said signaling means.

23. A water indicating system for boilers including a plurality of signaling means for registering different stages of water in the boiler, having independently supported operating means with common connections with the steam and water chambers of the boiler and arranged for operating the signaling means when the level of the water is lowered to admit the steam to the operating means.

24. A water indicating system for boilers including a set of signaling means provided with independent operating means, said operating means including a set of expansible and contractible tubes connected at different elevations with the steam and water portions of the boiler to permit the rising of the water from the boiler in the tubes to correspond to the level in the boiler and the admission of steam to the tubes in succession as the level of the water is lowered.

25. A water indicating system for boilers including a plurality of signaling means having a corresponding number of expansion elements connected at different elevations with the steam and water portions of the boiler, capable of registering corresponding stages of water therein to the stages in the boiler and of receiving a supply of steam therefrom as the volume of water decreases and the stage is lowered.

Signed at Los Angeles, in the county of Los Angeles, and State of California, this 2nd day of February, 1916.

WILLIAM C. BLUNDELL.

Witnesses:

MARY R. BLUNDELL,

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."