May 30, 1933. F. B. ALLEN 1,911,737

SUMP WATER LEVEL CONTROL

Filed Jan. 23, 1930 2 Sheets-Sheet 1

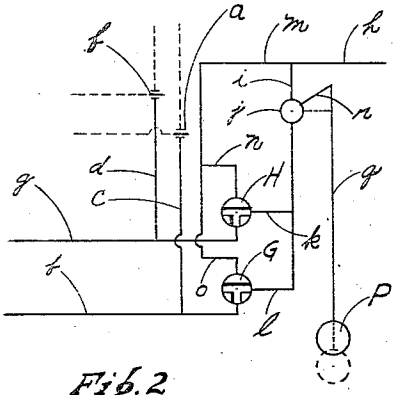


Fig. 2

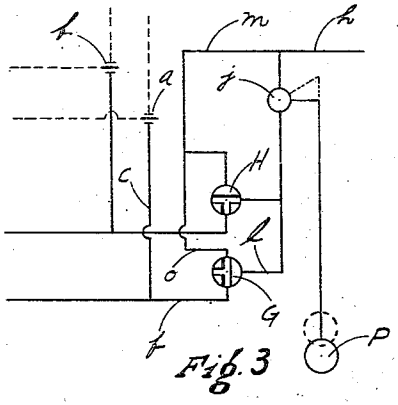


Fig. 3

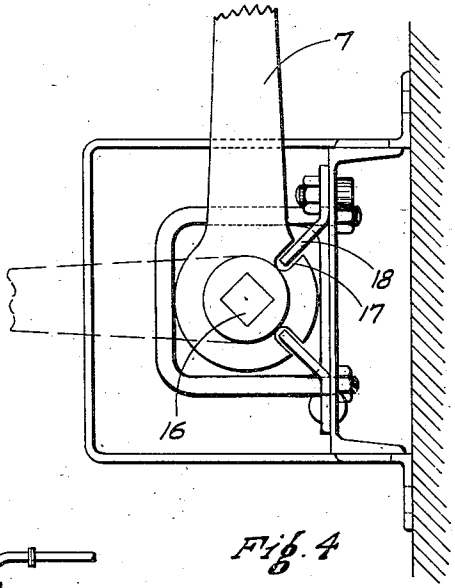


Fig. 4

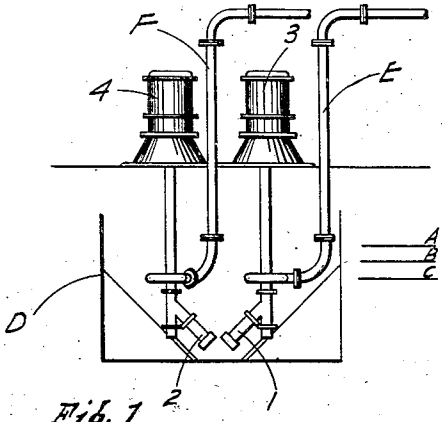


Fig. 1

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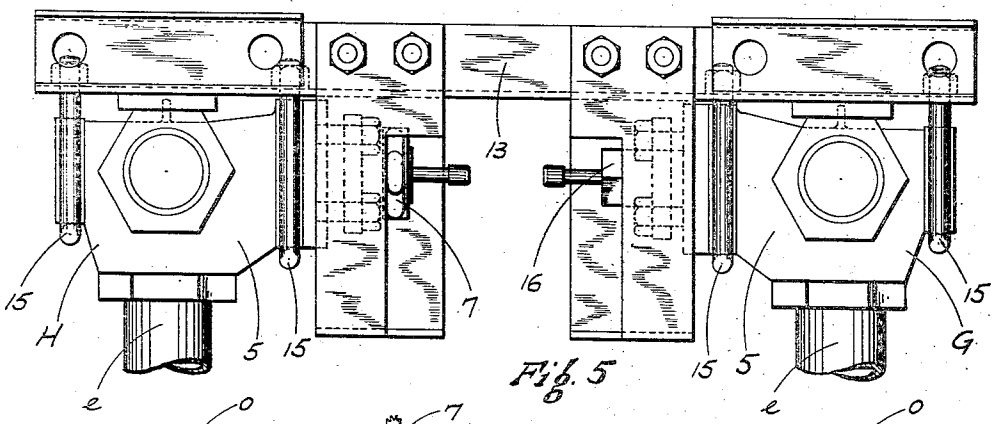


Fig. 5

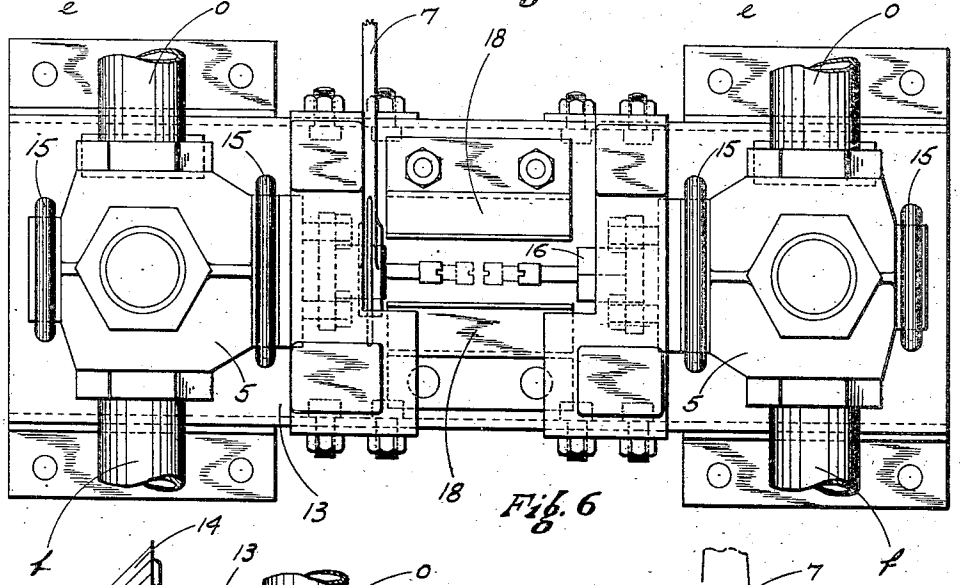


Fig. 6

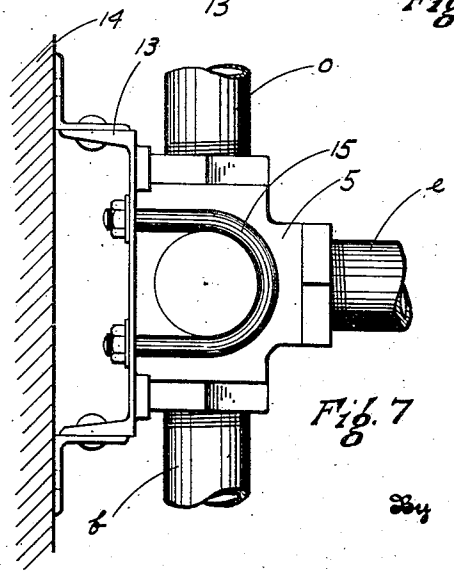


Fig. 7

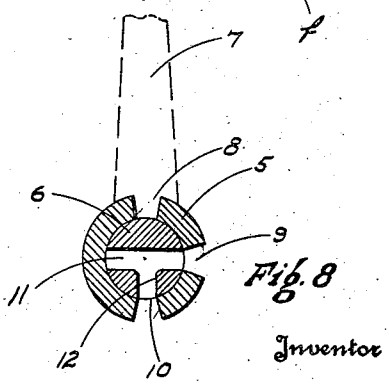


Fig. 8

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Patented May 30, 1933 1,911,737

UNITED STATES PATENT OFFICE

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SUMP WATER LEVEL CONTROL

Application filed January 23, 1930. Serial No. 422,800.

This invention relates to the art of pumping liquid and is particularly concerned with a certain novel method and apparatus for the pumping of liquid having divided material, such as ashes suspended therein.

It is common practice today in boiler houses and like places to dispose of the ashes and other unburned residue from a furnace by sluicing it away with water. Such method of disposition of the ashes naturally requires the pumping of the mixture of liquid and ashes. Ordinarily this mixture is led into a sump from which it is pumped to dispose of the same. In pumping the liquid from the sump, it is of essential importance that the liquid should not fall below a certain minimum level for if it should, the pump would lose the suction effect and the solids are liable to become concentrated and tend to pack in and about the pump inlet and necessitate a cleaning out operation before the pump could be properly used again. The present invention, therefore, has in view, as an important object, the provision of pumping means, together with mechanism for automatically discontinuing operation thereof when a certain minimum level has been reached by the liquid. The invention shown in the present instance is primarily designed for a pump control means shown and described in my copending application, Serial No. 368,289, filed June 4, 1929.

Where, as in boiler houses, a breakdown in the ash handling equipment ordinarily would interrupt the operation of the entire steam generating plant, it is of essential importance to provide additional or supplemental standby apparatus, which could be used in an emergency. The pumping equipment is usually the crux of the operating situation and is therefore often duplicated to the end of prohibiting the need for shutting down the plant in the event the ash disposal system should become incapacitated. By the present invention, not only is this supplemental equipment duplicated, but it is so arranged and interrelated with the entire system that the standby equipment can be used together with the regular apparatus at any or all times or alternately with the latter, i. e., both pumping units may be operated to maintain the water between maximum and intermediate levels and either pump may be used to lower the water to the minimum level while the other pump may be used to prevent a rise above the maximum level. The pumps are so connected in the system that the intended control of the liquid levels is foolproof and cannot be varied except in the manner intended.

With the foregoing conditions in mind, the present invention has in view the provision of pump control mechanism for controlling the operation of two or more pumping units, and which control mechanism is so designed that it automatically brings both pumping units into operation when the level in the sump reaches a certain predetermined height, or which may be manually operated to bring only one of the pumping units into operation, the last mentioned operation being a selective one.

The invention also includes as an essential part thereof, the new method for maintaining a liquid level normally between certain maximum and intermediate levels and at the same time insuring circulation through the pump bearings when the pump is operating and also pumping the liquid to a certain minimum level under operation of only one of the pumps.

While the present invention is designed primarily for and is useful in connection with a sump, which has no overflow and which contains a mixture of water with ashes from the steam boler, as hereinafter described, it is to be understood that such particular use of detailed apparatus is but one of the various mechanisms or constructions in which the apparatus of the present invention may be embodied.

Various other more detailed objects and advantages will in part become apparent and in part be hereinafter stated as the description of the invention proceeds. For a full and more complete understanding thereof, reference may be had to the following description and accompanying drawings, wherein

Figure 1 is a diagrammatic showing of a sump with two pumps and other parts of a pumping system;

Figure 2 is an illustration, also somewhat diagrammatic, of the valves controlling the pumping apparatus, which are employed in connection with the apparatus shown in Figure 1;

Figure 3 is a view similar to Figure 2, but showing the parts of the control valves in different operating positions;

Figure 4 is a view from the side of the control valve and the associated manually operable mechanism therefor;

Figure 5 is a top plan view of the interrelated valve mechanism;

Figure 6 is a front view of the mechanism shown in Figure 5;

Figure 7 is a side view showing the manner of mounting the valves on a supporting framework, and

Figure 8 is a section through one of the three-way valves.

Referring now to the drawings, and particularly Figure 1, a sump which is designed to contain a mixture of ashes and liquid, such as may be received from a boiler house, is shown diagrammatically and represented generally by the reference character "D". In the sump D, the liquid is designed to be so controlled by the mechanism hereinafter described, that it will never fall below the minimum level represented by the line C and never come above the maximum represented by the line A. Preferably, the pumping apparatus will be brought into operation manually to maintain the level thereof somewhere around that indicated by the line B. Located in the sump D are a pair of pump inlets 1 and 2, which suck the mixture of ashes and water into the pump lines represented generally by the pipes E and F, and these pumps are operated by the pumping mechanism indicated at 3 and 4.

To the end of maintaining the level of the mixture of liquid and solids at or above the minimum level C, suitable mechanism for automatically admitting water into the sump when the level falls below this line, may be provided, although such mechanism is not important to the present invention.

If the mixture of water and solids in the sump D should be permitted to rise above the level A, damage might occur and possibly the plant would have to be shut down, particularly if the operating parts were flooded and rendered inoperable. Pumps 3 and 4 are of the type described in my co-pending application above referred to, and it is noted that these pumps require that the bearings thereof be lubricated by clear water when they are operating. This is to prevent damage thereto as will be readily ascertained from the above mentioned case.

Referring now to Figure 2 and the diagrammatic illustration thereof, control mechanisms for the pumps 3 and 4 are shown at *a* and *b*. These mechanisms *a* and *b* may be of the diaphragm type, which are operable under a pressure of liquid to bring either of the pumps into operation or are effective when the pressure thereon falls to discontinue the operation of the pumps. Lines *c* and *d* lead to the diaphragms *a* and *b* and convey liquid thereto under pressure. Pipe lines *f* and *g* extend to the bearings of each of the pumps 3 and 4 from the three-way control valve mechanisms indicated diagrammatically at G and H. It is noted that the lines *c* and *d* are taken off of the lines *f* and *g* so that when liquid flows through one of these sets of lines it must necessarily flow through the other. A supply of clear water, such as is designed for lubricating the pump, and for operating the diaphragms *a* and *b*, is taken in from the pipe line indicated at *h*. A branch *i* leads from the latter to the control valve *j* through the lines *k* and *l*, to the three-way valves G and H. When the valve *j* is properly operated to open communication to the line *i* and any one of the valves G and H are in proper position, then the water from the supply line *h* will be admitted through the valves G and H to the lines *f* and *g*.

The line *h*, however, is continued past the branch *i* in the form of the line *m*, which has branches *n* and *o* extending to the three-way valves. When the valve *j* is closed, manual operation of either of the three-way valves G and H will admit the clear water to either of the lines *f* and *g* and their corresponding branches *d* and *e*. Mechanism for automatically operating the valve *j* is shown in the form of the float indicated diagrammatically at *p* and the arm *q* extending upwardly therefrom to operate the valve *j* through the arm *r*.

With the apparatus above described and the condition illustrated in Figure 2, both of the three-way valves G and H are closed as by manual operation, and the valve *j* is effective under the influence of the float *p* to automatically bring both of the pumps 3 and 4 into operation admitting clear water to the lines *c*, *d*, *f* and *g* or to render the same inoperative as when the level of the water is below that indicated by the line C.

Referring now more particularly to Figure 3, the apparatus is represented in a somewhat different position. The float *p* is in position closing the valve *j* and the three-way valve H is also closed. Moreover, the valve G has been opened by manual operation to admit the clear water from the supply *h* through the lines *n* and *o* to the lines *f* and *c* whereby the pump 3 is rendered effective to pump water through the inlet 1 out of the sump D.

In accordance with the precepts of this invention, either of the valves G and H are intended to be operated manually, but never both of them. The only condition under which both of these valves will be operated

simultaneously is when the level in the sump D rises above that indicated by the line A. Under this condition the float *p* automatically causes both of these valves and their pumps to operate simultaneously. Just which of the pumps G or H should be operated to change the level between those indicated by the lines A and C are left to the selection of the operator. The control valves G and H are, however, so arranged and interlocked with one another, that only one of them can possibly be operated manually at one time. This mechanism will now be described in connection with Figures 4, 5, 6, 7 and 8.

First referring to Figure 8, one of these valves G which is a duplicate of valve H, is shown as comprising casing 5, in which operates the valve member 6 under the influence of an operating member 7. The casing 5 has openings 8, 9 and 10 therein, any two of which may be brought into communication by the passages 11 and 12 in the valve member 6. When the openings 8 and 10 are placed in communication by proper positioning of the passage 11, then water flows from the supply line *h* to the line *m* and line *o*, to line *f*. However, when the passages 9 and 10 are placed in communication by proper positioning of passages 11 and 12, then the liquid passes through the passage *i*, valve *j*, and line *l* and through valve G to line *f*.

Valves G and H are mounted on a bracket 13, as by yokes 15, while the bracket 13 is fastened to a suitable supporting structure 14 in any suitable manner. The lines diagrammatically indicated in Figures 2 and 3 are shown at *l*, *f* and *o*. These parts *l*, *f* and *o* being the same with reference to valve G in Figures 2 and 3.

The operating member 7 is slidable on either of the squared shafts 16 and is slidable from one shaft 16 to the other under the control of the guide-ways 17, and guides 18 when the member 7 is properly aligned therewith, to be brought into operative position with respect to either of the valves G and H. It is notable that these guides and guideways 18 and 17 are so arranged that the operating member 7 can be brought into operating engagement with either of the valves G and H only when the latter are in a position closing the lines *o* and *n*, or rather, the passes 8 in the valve casings 5. After the operating member 7 has been properly positioned with respect to either of the valves, it may be swung to operate the same as indicated by the dotted line in the position of figure 4. It is notable also that the operating member 7 can be disengaged from either of the valves G or H only when the latter are in closed position with respect to the openings 8. This arrangement renders the control mechanism foolproof as it is physically impossible to bring both of the pumps 3 and 4 into operation at the same time under manual control. This condition of simultaneous operation of both the pumps can exist only when the level in the sump D rises above the line A.

What I claim is:

1. In apparatus of the class described, the combination, with a sump adapted to receive and contain a mixture of liquid and divided solids, of a plurality of pumping mechanisms for pumping the mixture from the sump, means for automatically bringing all of the pumping mechanisms into effective operation when the level of the mixture in the sump rises above a certain predetermined level and manual control means for bringing any one of the pumps into effective operation, said manual control means being adapted to bring into operation only one of said pumps at a time.

2. The combination, with a pumping system for handling a mixture of water and ashes and the like, including a pair of pumping mechanisms, of control means for controlling the operation of the pumping mechanisms, said control means including a manual operating member, and means associated therewith whereby only one of the pumping mechanisms can be brought into operation at one time under manual control, and means for automatically bringing both of the pumping mechanisms into operation at the same time.

3. Control mechanism of the class described, comprising, in combination, fluid pressure means for controlling the stopping and starting of a pair of pumps, a pair of three-way valves, a line of communication between one port of each of the three-way valves and a pressure means, a source of supply of fluid under pressure, pressure conducting lines leading from said source to each of the three-way valves at its two other ports, manually operable means for actuating either of said three-way valves to connect one of said pressure conducting lines to a fluid pressure means, and automatic means for controlling the connections from another of said pressure conducting lines to said three-way valves.

4. Control mechanism of the class described, comprising, in combination, a pair of diaphragms for controlling the stopping and starting of a pair of pumps, a pair of three-way valves, a line of communication between one port of each of the three-way valves and a diaphragm, a source of supply of fluid under pressure, pressure conducting lines leading from the said source to each of the three-way valves at its two other ports, manually operable means for actuating either three-way valve to connect one of said pressure conducting lines to a diaphragm, and automatic means for controlling the connection from another of said pressure conducting lines to both of said three-way valves.

5. Control apparatus for pumping mechanism comprising a plurality of pressure operated mechanisms for bringing a corresponding number of pumping systems into operation, a corresponding number of three-way valves, a single line of communication between one port of each of the valves and a pressure mechanism, lines of communication between the other two ports of each of said valves and a source of supply of fluid under pressure, manually operable means for actuating either three-way valve to connect one of said last mentioned lines of communication to a fluid pressure operated mechanism, and automatic means for controlling the connection from another of said last mentioned lines to said three-way valves.

6. Control apparatus for pumping mechanisms comprising a plurality of pressure operated mechanisms for bringing a corresponding number of pumping systems into operation, a corresponding number of three-way valves, a line of communication between one port of each of the said valves and a pressure mechanism, lines of communication extending from each of said valves to a pumping system to carry sealing fluid to the said pumping systems, a source of supply of fluid under pressure, lines of communication between the other two ports of each three-way valve and said source of fluid pressure, said three-way valves controlling the passage of fluid under pressure to the pressure operated mechanisms and to the pumping system to lubricate the latter, manually operable means for operating either three-way valve to control the flow of fluid under pressure to said pressure operated means and pumping system from one of said last mentioned lines of communication leading from said source of supply, and automatic means for controlling the flow of fluid under pressure through another of said last mentioned lines of communication between said three-way valves and said source of fluid pressure.

7. Control apparatus for pumping mechanisms comprising a source of supply of fluid under pressure, a valve, means for automatically operating the valve, a pair of three-way valves, a line of communication between the first named valve and each of the three-way valves, a line leading from the source to the first named valve, a line leading directly from the source to the three-way valves, means for manually operating either of the three-way valves, pressure diaphragms and controlling the pumping mechanisms, a line extending from each of the three-way valves to a pressure diaphragm, lines extending to a pair of pumping mechanisms to convey fluid to the latter for sealing purposes.

8. Control apparatus for pumping systems, comprising a plurality of control valves, an operating member adapted to be engaged with any one of the valves to operate the same, mechanism controlling engaging and disengaging actions of the operating member whereby the said member can be engaged or disengaged from any one of the valves only when the valve is in a certain predetermined condition, and means for guiding the movement of said operating member from engagement with one valve into engagement with another valve.

9. Control apparatus for pumping mechanism comprising a source of supply of fluid under pressure, a valve, means for automatically operating the valve, a pair of three-way valves, conduits between the first named valve and one port of each of said three-way valves, a conduit leading from said source of supply of fluid under pressure to said first named valve, a conduit leading directly from said source of fluid under pressure to a second port of each of said three-way valves, pressure actuated means for controlling the operation of the pumping mechanism and conduits leading from the third port of each of said three-way valves to said pressure actuated means.

10. Control apparatus for a pair of pumps comprising a source of supply of fluid under pressure, a valve, means for automatically operating the valve, a pair of three-way valves, a line of communication between the first named valve and each of the three-way valves, a line leading from said source to the first named valve, lines leading directly from the source to each of the three-way valves, means for manually operating either of the three-way valves, pressure actuated mechanisms for controlling the operation of each of said pumps, and a line of communication extending from each of said three-way valves to a pressure actuated mechanism.

In testimony whereof I hereunto affix my signature this 16th day of January, 1930.

FRANK B. ALLEN.