Aug. 11, 1953 S. P. JOHNSON 2,648,285

FEED PUMP LEAK-OFF SYSTEM

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FIG. 1.

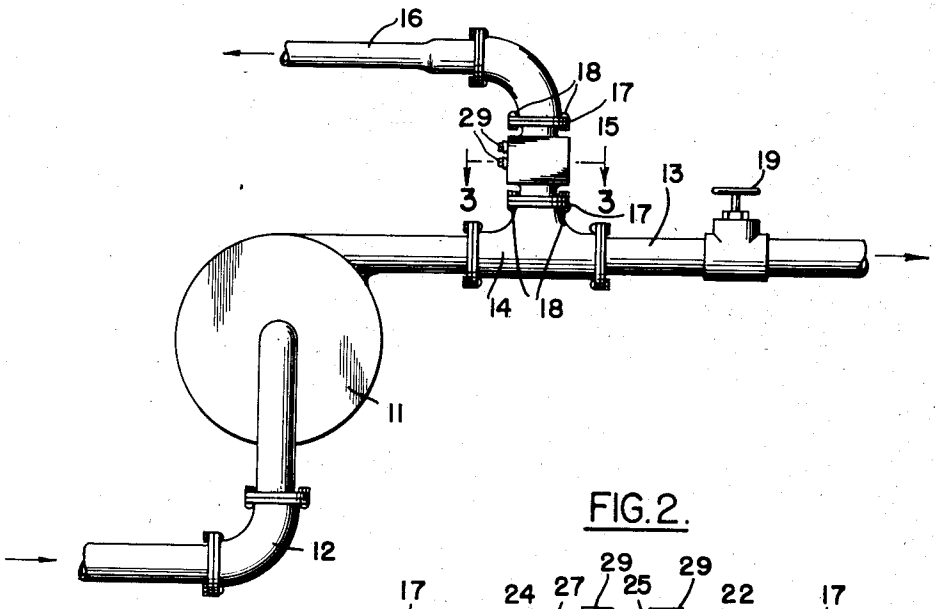


FIG. 2.

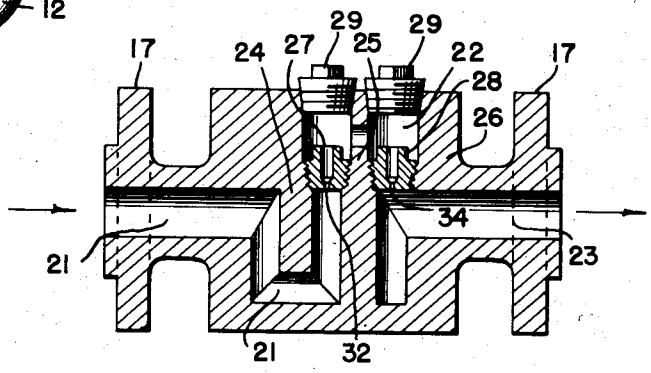
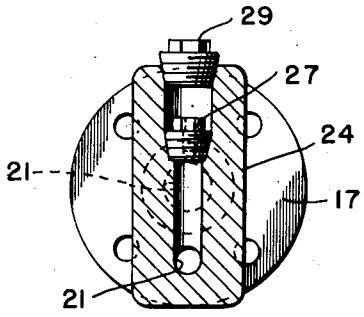


FIG. 3.



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FEED PUMP LEAK-OFF SYSTEM

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15 Claims. (Cl. 103—41)

(Granted under Title 35, U. S. Code (1952), sec. 266)

1

The present invention relates to a feed pump leak-off system and more particularly to a system employing a leak-off fitting which protects the feed pump from damage should the pump's output flow be cut off.

It is especially prevalent with rotary pumps, which have no safety devices, that should the output flow be cut off without stopping the pump, that the pump will churn the fluid until the blades become overheated or even more seriously damaged. It has been common practice in the past to employ feed systems which either have no safety facilities at all for the protection of equipment or else make use of antiquated mechanical contrivances to relieve the load on the pump if the need arises. Likewise, most mechanical contrivances, which usually consist of some type of expansion or pressure resistant linkage, have weaknesses and often fail to operate due to corrosion or lack of proper adjustment. Furthermore, the mechanical device may be somewhat slow in acting, to the detriment of the system. In any situation the feeder system is subjected to serious overloading and resulting damage, a condition which the present invention eliminates by means of a fitting containing specific orifices, and a leak-off line, tapped into the output pipe of the pump. The present invention is furthermore an improvement over prior systems in that it contains no moving parts which might wear out or get out of adjustment, and at the same time is continuous acting due to the fact that it is not necessary to start or stop the pump when a load is applied or removed.

An object of the present invention is the provision of a feed pump leak-off system which functions to protect the pump from overloading, should the output flow be cut off or materially reduced.

Another object is the provision of a feed pump leak-off system which has no moving parts, which is readily installed, and requires little or no attention once it is installed.

Still another object is the provision of a feed pump leak-off system having main and auxiliary outputs in which the auxiliary output offers a maximum resistance to flow when the main output line is open, and a minimum resistance to flow when the main output line is closed.

Still another object is the provision of a feed pump leak-off system which is continuous in its operation.

Yet another object of the invention is the provision of a feed pump leak-off system which is quick acting and eliminates starting and stopping of the pump.

2

A further object of the invention is to provide a feed pump leak-off system in which critical elements are readily accessible for the checking of wear and deterioration.

Still another object of the invention is the provision of a feed pump leak-off system which is tapped off of the main feed line so as to offer no restriction to the flow of fluid in the main line.

Other objects and features of the invention will become apparent to those skilled in the art as the disclosure is made in the following detailed description of a preferred embodiment of the invention as illustrated in the accompanying sheet of drawing in which:

Fig. 1 is a view of the preferred embodiment of the invention.

Fig. 2 is a greatly enlarged sectional view of a portion of the invention, taken in the plane of the drawing.

Fig. 3 is a sectional view taken along the line 3—3 of Fig. 1 looking in the direction of the arrows.

Referring now to the drawings, wherein like reference characters designate like or corresponding parts through the several views, there is shown a feed pump 11, which may be of any well known type, but for exemplary purposes is preferably shown in Fig. 1 to be of the rotary variety.

The pump 11 has an input pipe 12 from a fluid supply such as water, and an outlet pipe 13 which leads to some intermittent load, such as a boiler. Connected into the outlet pipe 13 is a branch section or leak-off or by-pass pipe line which diverts a portion of the output of the pump 11. The pipe line comprises a branching or T-section 14, a leak-off fitting 15 and a leak-off pipe 16. The T-section 14 is on the pump side of a valve 19 in the outlet pipe 13 for cutting off the output flow of pump 11 to its intermittent load.

The fitting 15, which is more clearly shown in Fig. 2, is generally rectangular in shape and comprises a metallic body which may be formed from a single metal block, or a specially fabricated structure. The fitting 15 utilizes flanges 17, and bolts 18, to connect it to the T-section 14 and to the leak-off pipe 16. The position in which the fitting 15 is mounted may be vertical, horizontal, or any intermediate angle therebetween without having any effect on the operation of the invention.

Transversely across the longitudinal axis of the fitting 15 there extends the partitioning walls 24 and 25 which do not quite entirely traverse the fitting, thereby forming not only a somewhat circuitous path therethrough, but also a plurality of chambers 21, 22 and 23.

At a junction of the chambers 21 and 22, there is threaded into the walls 24 and 25 an orifice plug 27, which will be more fully described hereinafter, there also being a similar plug 28 threaded into the walls 25 and 26. The plugs 27 and 28 contain orifices 32 and 34 of predetermined dimensions, as will be described in greater detail hereinafter. Any suitable, removable cover, such as a threaded closing plug 29 is positioned above each of the orifice plugs 27 and 28 whereby access may be had to the orifice plugs should replacement be necessary; the plugs being reached by any standard socket wrench or suitable device.

The fact that the leak-off fitting 15 is tapped off the main output line 13 by means of the T-section 14, rather than being inserted directly into the line 13, permits the desired leak-off for the pump 11 to be obtained and at the same time offers no restriction to the flow of fluid through the main line 13.

In operation, water or the like is drawn along the input pipe 12 to the pump 11, and thence expelled along the outlet pipe 13 to a desired load as to a boiler, for example. During the entire time that the pump 11 is in operation whether there is flow along the pipe 13 beyond the valve 19 or not there is a restricted flow of fluid through the fitting 15 and the pipe 16, indicating that the leak-off is functioning and that there can be no delay in its operation. If it should become necessary, or desirable, to close the valve 19, such may be done without stopping the pump 11 or any damage resulting thereto.

The dimensions of the orifices 32 and 34 are carefully chosen so as to permit just the right quantity of fluid to pass therethrough at all times, because while it is desirous to have a large enough leak-off to prevent the pump blades from churning the fluid and becoming overheated when the output of the pump is cut off by the valve 19, at the same time the leak-off must not be so large as to cause serious loss of efficiency when the pump is working. It is obvious, therefore, that the size of the orifices 32 and 34 will depend upon the capacity of the pump 11.

The fluid, in passing through the fitting 15, first enters the circuitous downstream compartment 21 then goes through the orifice 32 into the intermediate or connecting chamber 22 into which the orifices 32 and 34 in the plugs 27 and 28 open, then through the orifice 34 into the upstream chamber 23 and thence into the pipe 16 which returns the fluid to its source. It is well known that where orifices have been placed in a pressure line, that there will be a reduction in pressure as the fluid, or gas, as the case may be, passes through the orifice. It is for this reason that the instant invention utilizes a plurality of orifices, in series, whereby the pressure of the fluid passing through them is lowered in proportionate steps, the orifices being of different sizes and immaterial as to whether they are in descending or ascending order. Thus it can be seen, that since the flow of a fluid is directly proportional to the pressure exerted on it, that by means of the orifices 32 and 34 the pressure is controlled so as to produce the desired amount of leak-off necessary to protect the pump 11.

The positioning of the orifice plugs 27 and 28 as well as the removable plugs 29 gives to the present invention a distinct advantage over prior known devices. As can be readily seen in Fig. 2, the plugs 27, 28, and 29 are at right angles to the axis of flow through the fitting 15, thereby offering convenient access to the orifice plugs 27 and 28 should they need replacement, as well as for the inspection and measurement of wear on the orifices 32 and 34 as by the use of gage-blocks. By the expedient of this positioning of plugs 27, 28 and 29 there is eliminated the necessity of having to remove the bolts 18 from the flanges 17 so as to uncouple completely the fitting 15 for inspection. The orifice plugs 27 and 28 are easily and readily replaceable, and preferably should be made of some erosion-resisting material.

From the foregoing description, it is obvious that the present invention provides a feed pump leak-off system which effectively protects the pump from damage due to overloading, a system which has no moving parts, and one which is quick acting and at the same time reliable.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that numerous modifications or alterations may be made therein without departing from the spirit and scope of the invention as set forth in the appended claims.

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without payment of any royalties thereon or therefor.

What is claimed is:

1. A system of a type described comprising a pumping means including a pump adapted to be operated continuously, an input pipe and an outlet pipe including a flow-controlling means, a leak-off pipe line comprising a branching section connected into said outlet pipe on the pump side of said flow-controlling means, said leak-off pipe line comprising a fitting having a downstream chamber, an upstream chamber and a connecting chamber therebetween, a first removable plug having a continuously-open orifice, said plug being between said downstream chamber and said connecting chamber, a second removable plug having a continuously-open orifice, said second plug being between said connecting chamber and said upstream chamber, said orifices of said plugs providing consecutive orifices for the flow of liquid in said leak-off pipe-system, said orifices having axes which are substantially parallel.

2. A system of a type described comprising a pumping means including a pump adapted to be operated continuously, an input pipe and an outlet pipe including a flow-controlling means, a leak-off pipe line comprising a branching section connected into said outlet pipe on the pump side of said flow-controlling means, said leak-off pipe line comprising a fitting having a downstream chamber, an upstream chamber and a connecting chamber therebetween, a first removable plug having a continuously-open orifice, said plug being between said downstream chamber and said connecting chamber, a second removable plug having a continuously-open orifice, said second plug being between said connecting chamber and said upstream chamber, said orifices of said plugs providing consecutive orifices for the flow of liquid in said leak-off pipe-system, said orifices having axes which are substantially parallel, said fitting having a liquid-entrance opening and a liquid-exit opening connected in said pipe line, said openings extending in a direction which is substantially normal to said axes of said orifices, a pair of removable cover-plugs at said connection chamber, said cover-plugs being separated from said first and second plugs and accessible from a single side of said fitting, said side being

substantially parallel to the general direction of flow in said connection chamber.

3. In boiler feed water apparatus, a pump adapted to operate continuously and having an intake means and a discharge means, and by-pass means connecting said discharge means with said intake means for returning liquid to the latter including a control device for restricting the flow through said by-pass means, said control device having a passage extending therethrough and a plurality of continuously-open flow-retarding orifices in series relation in said passage.

4. An invention as defined in claim 3 but further characterized by said pump being a rotary pump, said passage being circuitous and a pair of consecutive orifices of said plurality of orifices having substantially parallel axes.

5. In a liquid flow control device of the character described, a fitting having a continuously open circuitous passage extending therethrough, said passage having substantially parallel inlet and outlet passage-portions for the flow of liquid into and from said fittings, said passage having an intermediate passage-portion comprising a plurality of chambers extending transversely to said inlet and outlet passage-portions, a pair of said chambers meeting said inlet and outlet passage-portions for substantially the full width thereof, and flow control orifice-means at ends of certain of said chambers.

6. An invention as defined in claim 5 but further characterized by said orifice-means comprising flow-restricting plugs containing orifices of predetermined sizes.

7. An invention as defined in claim 5 but further characterized by said orifice-means comprising removable flow-restricting plugs containing orifices of different predetermined sizes, orifices in consecutive plugs having axes which are parallel.

8. An invention as defined in claim 7 but further characterized by said fitting comprising removable access-plugs at one side of side of said fitting.

9. In a liquid flow control device of the character described, a metal body having a pair of spaced parallel chambers, an inlet chamber and an outlet chamber for liquid entering and leaving said metal body, said inlet and outlet chambers being substantially parallel and openly meeting said pair of chambers transversely thereto, a connecting chamber connecting said pair of chambers, a continuously-open orifice means at each end of said connecting chamber and opening into the associated one of said pair of chambers.

10. An invention as defined in claim 9 but further characterized by said orifice-means comprising removable plugs containing orifices.

11. An invention as defined in claim 10 but further characterized by access plugs removably attached to said metal body for providing access to said orifice-plugs.

12. In a system comprising a pumping means having an input and a main output; a means for continuously diverting a portion of the output of said pumping means, said diverting means comprising a plurality of serially connected circuitous chambers, and a plurality of continuously-open orifices between different pairs of said chambers; said main output having a capacity greater than said diverting means, and having a flow-controlling means therein.

13. In a system comprising a fluid circulating means having an input and output, a means for

continuously diverting a portion of the output of said circulating means, said diverting means comprising a metallic fitting for limiting the flow of said diverted portion, said fitting comprising a plurality of serially-connected chambers including circuitous chambers, each intermediate pair of consecutive chambers having an apertured plug of predetermined fixed dimensions separating said consecutive chambers, each apertured plug being positioned so that its axis is normal to the axis of flow through the fitting, said fitting having a removable cover over each of said plugs, and means connected to the final one of said chambers for returning said diverted portion to the input of the fluid circulating means.

14. A liquid flow control device of the character described comprising a fitting having a continuously open circuitous passage extending therethrough, said passage having inlet and outlet passage portions for the flow of liquid into and from said fitting, said passage having an intermediate passage-portion having portions extending to and meeting said inlet and outlet passage-portions, said intermediate passage-portion comprising a pair of parallel chambers and a straight interconnecting portion extending transversely to and between said chambers and meeting each chamber intermediate of its ends, each of said chambers having a hollow cylinder shape and extending to an outer face of said fitting, each of said chambers removably receiving at an inner part thereof a plug having an open orifice therein of predetermined dimensions, each of said chambers removably receiving a closing plug at its end which is at said face of said fitting, said closing plugs being alongside each other at said face of said fitting.

15. A liquid flow control device comprising a fitting having a continuously open passage and comprising a pair of spaced chambers, an inlet passage portion openly meeting a first of said pair of chambers, an outlet passage portion openly meeting the second of said pair of chambers, a removable continuously open orifice means at an end-portion of said first of said pair of chambers, a removable continuously open orifice means at an end-portion of said second of said pair of chambers, said end portions being the ends of said pair of chambers which are removed from said inlet and outlet passage-portions, and a connection chamber between said pair of chambers on the sides of said orifice means away from said inlet and out passage-portions.

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