

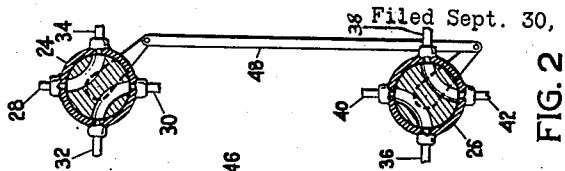
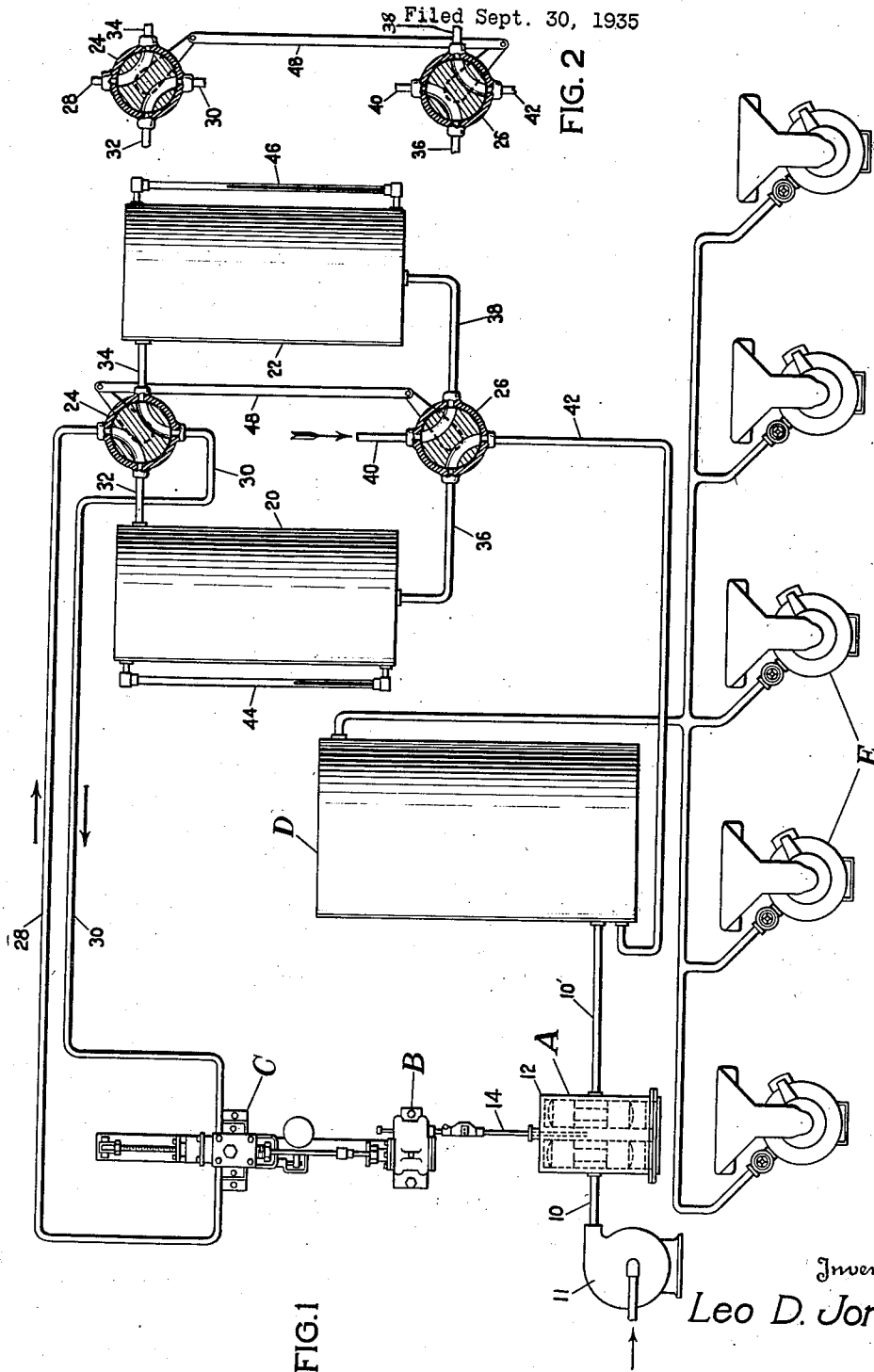
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LIQUID IMPELLING SYSTEM

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LIQUID IMPELLING SYSTEM

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The present invention relates to mechanisms and methods for feeding fluids in separate conduits and it was conceived with reference to the problem of effecting a relative control of the rate of feed of liquids through a plurality of such conduits. It relates to the general class of apparatus designed to effect an adequately controlled feed of this type with accurate volumetric maintenance of the proportions of liquid fed through the various conduits. It includes a metering device whose operation is controlled by the feed of liquid in a controlling conduit and positive means for impelling liquid in a controlled conduit or conduits which are operable in response to the volume of liquid flowing through said metering device.

A system of this general character is disclosed in my prior Patent No. 2,009,890 and the present invention may be regarded as an improvement over the disclosure of that patent. In the performance of operations of this character damage to frictionally engaging surfaces, such as pistons and cylinders and valve parts of the impellers of the controlled conduits, is frequently encountered because of the corrosiveness of the liquid whose flow is controlled, and the particular object of the present invention has been to provide an apparatus and process by which such corrosion or other undesired phenomena encountered by reason of contact of impelled liquid with impeller parts may be avoided.

The system of the present invention may be employed in the treatment of various types of substances, and I am of the opinion that it will find one of its principal uses in the acid treatment of petroleum oils and it will therefore be described with reference to an operation of that character. This method of presentation is chosen solely for the purpose of clarity of description, and I do not have any intention of limiting the scope of my patent protection to this particular use, as my system may be used in many other connections.

In the drawing, Figure 1 is a more or less diagrammatic view illustrating the general arrangement of apparatus in accordance with my invention and its application to a system for feeding liquids to a mixer, and Figure 2 is a detail view of valves forming a part of the invention and wherein the valves are in a position reverse from that shown in Figure 1.

The system involves in general, separate sources of supply from which the oil and acid are fed to a mixing chamber, the oil being passed through a displacement meter 12 in the illus-

trated embodiment. This meter is provided with moving parts which are displaced in exact proportion to the amount of oil which flows there-through and in turn control a valve which controls the operation of a prime mover or other mechanism to effect a feed of acid in direct volumetric proportion to the amount of oil which flows through the displacement meter. The conduit including the displacement meter through which the oil is fed is indicated generally at A and the prime mover or other mechanism for driving, the impelling mechanism for effecting the feed of acid is indicated at B. The impelling mechanism proper is designated at C and the mixer to which oil and acid are fed at D. In the particular system illustrated, the mixture of oil and sludge is fed to a battery of centrifugal separators E in parallel. A displacement meter 12 in the oil feed line A controls the operation of the prime mover B to effect an operation of this prime mover, this operation being directly controlled by the volume of oil flowing in the line A and accordingly controlling the impeller C to effect a proportionate flow of acid to the mixer D.

In my prior Patent No. 2,009,890, I have disclosed a system for feeding fluids which embodies the general arrangement of parts outlined in the above paragraph. In the disclosure of that patent an impeller comprising relatively movable parts is illustrated. It has been my experience that when an acid or other highly corrosive liquid is passed through an impeller comprising such moving parts, the corrosive liquid is so destructive to the moving parts that frequent replacement of expensive and intricate mechanism becomes necessary.

Therefore, in the operation of feeding systems where one of the liquids to be measured is very corrosive, as in the treatment of petroleum oil with fuming sulphuric acid, I have conceived the idea of preventing contact between the liquid and moving impeller parts. To this end I force a proportionate amount of a non-corrosive liquid which is immiscible with the treating liquid, such as highly treated petroleum oil, into a container of fixed volume, which has been filled with the corrosive treating liquid. By this method the treating liquid will be displaced and will be delivered to the treating zone at the same rate at which the non-corrosive liquid is measured through the impeller into the container holding the corrosive liquid.

In the preferred form of my invention, two containers of fixed volume may be used whereby oil may be measured from one to the other and

whereby acid is allowed to flow into the first container while acid is being displaced by oil in measured amounts from the second container. When the first container is nearly filled with acid and the second is nearly filled with oil, the respective connections on the oil and acid lines may be reversed with respect to the two containers, whereby oil may be pumped from the second container into the first container to displace acid in measured amounts from the first container.

In the following description I have attempted to disclose the invention in a simple form and it will be shown hereinafter how modifications may be made in the practice of the invention without departing from its scope.

Referring to the drawing more specifically by reference characters, the oil to be purified is fed to the conduit 10 by a device capable of supplying it at constant pressure, such for example, as centrifugal pump 11. Oil supplied through conduit 10 is passed to conduit 10' through a metering device 12 which contains a movable part or parts which are positively displaced to an extent and frequency whose product is directly proportionate to the volume of oil flowing through the system.

In accordance with the preferred form of the present invention the amount of liquid, e. g., acid, the feed of which is effected by the impelling mechanism C, is controlled by the movement of pistons within the cylinders constituting a part of the metering device, as described in my prior patent identified above. To this end a packed rod 14 is passed through an opening in the casing of the metering device 12 and provided with a projection which extends from this rod into the path of the pistons in one of the sets of cylinders. Thus, the arm extending from the rod 14 is adapted to be alternately reciprocated in opposite directions by the pistons as they approach the inner ends of their strokes. It will be seen that the rod 14 is reciprocated in opposite directions once for each complete cycle of the metering device; i. e., it undergoes one reciprocation every time a quantity of oil corresponding to the sum of the volumes of the cylinders passes through the metering device. This rod 14 in turn controls the movement of a valve which controls the operation of a prime mover or other device for actuating the impeller for effecting feed of the acid or other controlled liquid to the mixer, in the manner I am now about to describe.

In a simple form of my invention I provide two containers 20 and 22 which are of equal and known capacity. The containers 20 and 22 are interconnected by means of four-way valves 24 and 26. To the inlet port of the valve 24 is connected a conduit 28 which leads from the discharge side of the impeller C. The inlet side of the impeller C is connected with the discharge port of the valve 24 by means of a conduit 30. The intermediate ports of the valve 24 are connected to the top of the containers 20 and 22 by means of conduits 32 and 34 respectively.

The bottoms of containers 20 and 22 are also in communication with the intermediate ports of the valve 26 by means of conduits 36 and 38 respectively. The inlet port of the valve 36 is connected with a suitable source of acid supply by means of a conduit 40, while the outlet port of the valve 26 discharges into a conduit 42 which leads to the mixer D. If the corrosive liquid to be measured is lighter than the non-corrosive liquid used as a displacing liquid, intermediate

connections of valves 24 and 26 will be reversed with respect to the bottom and top respectively of containers 20 and 22.

When the container 22 is substantially filled with non-corrosive liquid and the container 20 is substantially filled with acid and the valves are in the position shown in Fig. 1 of the drawing, and the impeller C is in operation, it is evident that liquid will be drawn from the top of the container 22 through the valve 24 into the conduit 30, through the impeller C and the conduit 28 into the inlet port of the valve 24 and through the intermediate valve port and conduit 32 to the container 20. At the same time, acid is fed to the conduit 40 and passes through the valve 26 and through the conduit 38 into the container 22 to replace any liquid which is being removed from the top of the tank. At the same time the liquid which is being forced into the container 20 by means of the impeller C displaces acid in the container 20 through the conduit 36, through the valve 26, into the conduit 42 and therethrough into the mixer D.

The containers 20 and 22 may be provided with sight glasses 44 and 46, respectively, and the valves 24 and 26 may be interconnected for simultaneous reversal by means of a hand rod 48.

Assuming the above described flow of liquid through the respective conduits, the sight tubes 44 and 46 may be observed to determine when substantially all of the acid in container 20 has been displaced by the non-corrosive liquid and similarly when the container 22 has been substantially filled with acid. When this condition is reached the hand rod 48 may be operated to reverse the position of the valves 24 and 26 as shown in Fig. 2 of the drawing, so that while the impeller C is operating continuously the non-corrosive liquid will now be taken from the container 20 and will be forced into the container 22 to displace the acid from the container 22 in measured and proportionate amounts. In this manner the operation may be continued so that the system is in fact continuous and the acid may thereby be efficiently fed to the mixer in accurate proportion to the amount of oil passing through the pump 11 without contacting the moving parts of the impeller C. Inasmuch as the valve barrels move only intermittently, the corrosive action of the acid thereon is not so vigorous, and furthermore non-corrodible valves may be conveniently provided.

Since the acid volume of the containers 20 and 22 is known, its weight at a given level may be readily determined and because of this fact either of the containers 20 and 22 may be placed on a balance to which may be affixed two electrical contacts in positions to make a circuit with one of said contacts when the acid in the container has reached a given weight in order to effect solenoid actuation of the valves 24 and 26 and to make a reverse circuit and effect reverse actuation upon fall below another given weight.

While I have shown two containers for alternately holding acid and oil, it is obvious that the method of feeding may be successfully carried out by using a single container for acid and a second and separate container for oil, and while the system has been described as a continuous one the same may be operated intermittently if conditions should render such an operation desirable. It is obvious that, since the system is a closed one and is under pressure, and since the operation of the impeller C is dependent on the flow of oil through the pump 11, any suspension

in the operation of the pump 11 will suspend the operation of the entire system without disturbing the liquid balance in any part of the system.

Other and further modifications in the apparatus for performing my method may become apparent to those skilled in the art and it is therefore my intention to avoid limit of my invention to the specific form of apparatus shown and to limit the scope of my invention in no way except as the same may be limited by the scope of the subjoined claims.

I claim:

1. A system for effecting proportionate feed of two or more liquids comprising in combination, a controlling conduit through which one of said liquids is adapted to be fed, means for feeding liquid in said controlling conduit, a metering device associated with said controlling conduit, an impeller, means for controlling the operation of said impeller by the operation of said metering device, a conduit containing a displacing liquid interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit by valve means, means for selectively actuating said valve means to place one or the other of said containers in communication with said last mentioned conduit, a conduit interconnected with each of said containers and through which controlled liquid is adapted to be fed under the impelling effect of the displacing liquid, valve means interconnecting each of said containers with said controlled liquid conduit and means for selectively actuating said last mentioned valve means for placing one or the other of said containers selectively into communication with said controlled liquid conduit.

2. A system for effecting proportionate feed of two or more liquids comprising in combination, a controlling conduit through which one of said liquids is adapted to be fed, means for feeding liquid in said controlling conduit, a metering device associated with said controlling conduit, an impeller, means for controlling the operation of said impeller by the operation of said metering device, a conduit containing a displacing liquid interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit by valve means, means for selectively actuating said valve means to place one or the other of said containers in communication with said last mentioned conduit, a conduit interconnected with each of said containers and through which controlled liquid is adapted to be fed under the impelling effect of the displacing liquid, valve means interconnecting each of said containers with said controlled liquid conduit, means for selectively actuating said last mentioned valve means for placing one or the other of said containers selectively into communication with said controlled liquid conduit, and means interconnecting said valve means for conjoint operation whereby the container placed into communication with the conduit interconnecting said impeller and containers is at the same time placed into communication with the controlled liquid conduit.

3. A system for effecting proportionate feed of two or more liquids comprising in combination, a controlling conduit through which one of said liquids is adapted to be fed, means for feeding liquid in said controlling conduit, a metering device associated with said controlling conduit, an impeller, means for controlling the operation of said impeller by the operation of said metering device, a conduit containing a displacing liquid

interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit, a return displacing liquid conduit from said containers to said impeller, valve means selectively interconnecting said containers with said displacing liquid conduit and said return displacing liquid conduit and means for selectively operating said valve means to place one of said displacing liquid conduits into communication with one of said containers and the other of said displacing liquid conduits into communication with the other of said containers.

4. A system for effecting proportionate feed of two or more liquids comprising in combination, a controlling conduit through which one of said liquids is adapted to be fed, means for feeding liquid in said controlling conduit, a metering device associated with said controlling conduit, an impeller, means for controlling the operation of said impeller by the operation of said metering device, a conduit containing a displacing liquid interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit, a return displacing liquid conduit from said containers to said impeller, valve means selectively interconnecting said containers with said displacing liquid conduit and said return displacing liquid conduit, valve means interconnecting said containers selectively with a source of controlled liquid under pressure and interconnecting said containers selectively with a conduit through which said controlled liquid is adapted to be fed, and means for actuating said last-mentioned valve means to place one of said containers selectively into communication with the supply of controlled liquid and with the return displacing liquid conduit while placing the other of said containers into communication with the feed line of the displacing liquid conduit and into communication with the controlled liquid feed conduit.

5. A system for effecting proportionate feed of two or more liquids comprising in combination, a controlling conduit through which one of said liquids is adapted to be fed, means for feeding liquid in said controlling conduit, a metering device associated with said controlling conduit, an impeller, means for controlling the operation of said impeller by the operation of said metering device, a conduit containing a displacing liquid interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit, a return displacing liquid conduit from said containers to said impeller, valve means selectively interconnecting said containers with said displacing liquid conduit and said return displacing liquid conduit, means for selectively operating said valve means to place one of said displacing liquid conduits into communication with one of said containers and the other of said displacing liquid conduits into communication with the other of said containers, valve means interconnecting said containers selectively with a source of controlled liquid under pressure and interconnecting said containers selectively with a conduit through which said controlled liquid is adapted to be fed, means for actuating said last-mentioned valve means to place one of said containers selectively into communication with the supply of controlled liquid and with the return displacing liquid conduit while placing the other of said containers into communication with the feed line of the displacing liquid conduit and into communication with the controlled liquid feed conduit, and means for

controlling all of said valve means for simultaneous operation.

5 6. A liquid feeding system comprising an impeller, a conduit containing a displacing liquid interconnected with said impeller, two containers, a return displacing liquid conduit from said containers to said impeller, valve means selectively interconnecting said containers with said displacing liquid conduit and said return displacing liquid conduit and means for selectively operating said valve means to place one of said displacing liquid conduits into communication with one of said containers and the other of said displacing liquid conduits into communication with the other of said containers.

10 7. A liquid feeding system comprising an impeller, a conduit containing a displacing liquid interconnected with said impeller, two containers, valve means interconnecting said containers selectively with a source of controlled liquid under pressure and interconnecting said containers selectively with a conduit through which said controlled liquid is adapted to be fed, and means for actuating said last-mentioned valve means to place one of said containers selectively into communication with the supply of controlled liquid and with the return displacing liquid conduit while placing the other of said containers into communication with the feed line of the displacing liquid conduit and into communication with the controlled liquid feed conduit.

8. A liquid feeding system comprising an impeller, a conduit containing a displacing liquid interconnected with said impeller, two containers for controlled liquid interconnected with said last mentioned conduit, a return displacing liquid conduit from said containers to said impeller, valve means selectively interconnecting said containers with said displacing liquid conduit and said return displacing liquid conduit, means for selectively operating said valve means to place one of said displacing liquid conduits into communication with one of said containers and the other of said displacing liquid conduits into communication with the other of said containers, valve means interconnecting said containers selectively with a source of controlled liquid under pressure and interconnecting said containers selectively with a conduit through which said controlled liquid is adapted to be fed, means for actuating said last-mentioned valve means to place one of said containers selectively into communication with the supply of controlled liquid and with the return displacing liquid conduit while placing the other of said containers into communication with the feed line of the displacing liquid conduit and into communication with the controlled liquid feed conduit, and means for controlling all of said valve means for simultaneous operation.

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