

Feb. 2, 1937.

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2,069,261

FEEDING DEVICE AND METHOD

Filed Nov. 8, 1934

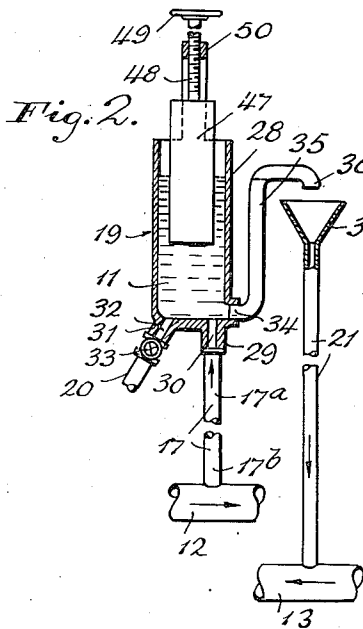
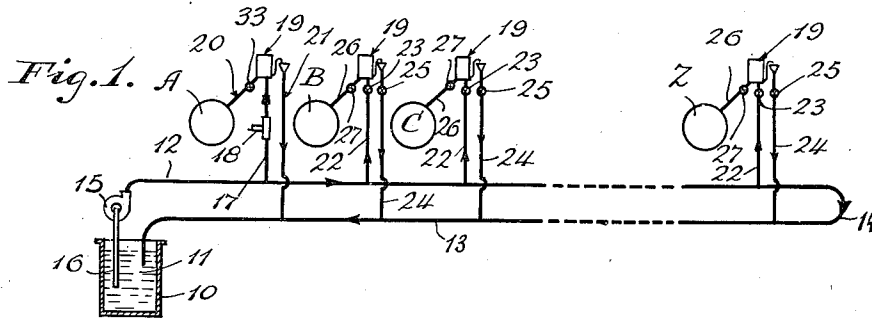
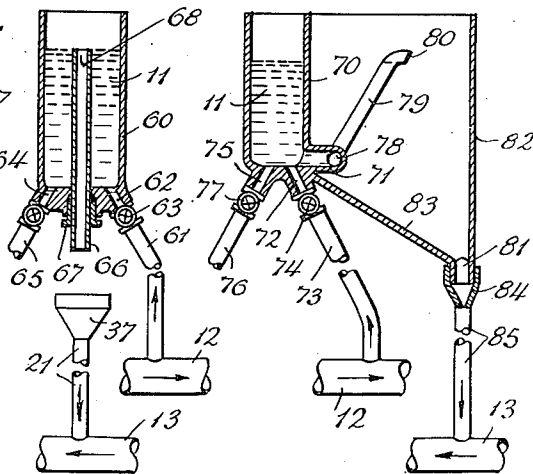


Fig. 3.

Fig. 4.



UNITED STATES PATENT OFFICE

2,069,261

FEEDING DEVICE AND METHOD

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Application November 8, 1934, Serial No. 751,979
In France November 8, 1933

10 Claims. (Cl. 51-263)

This invention relates to a feeding device and method and refers more particularly to a feeding system used for supplying liquids or mixtures of a liquid and solid substances carried by said liquid to one or more machines or the like.

The present invention is particularly concerned with regulatable means for periodically feeding abrasive mixtures used for the polishing and grinding of mirrors and sheets of glass to the grinding and/or polishing machines.

Abrasive mixtures consisting of a finely divided abrasive material mixed in water are usually caused to flow through an endless pipe circuit and are fed to so-called consuming units. A grinding or polishing machine may comprise a number of these consuming units or a single unit may be used for several grinding or polishing machines. Each of these units is usually connected by a feeding pipe with the endless pipe circuit, and is also provided with an overflow pipe through which the superfluous, unused amount of mixture is returned to the endless pipe circuit. A pump or any other suitable device is used for causing a circulation of the abrasive mixture within the endless pipe circuit and for supplying the separate consuming units with the abrasive mixture.

Each of the feeding pipes is usually provided with a valve, which is operated manually and is kept open during a period of time necessary for supplying a predetermined amount of the abrasive mixture to the consuming unit. The flow of the abrasive mixture within the feeding and overflow pipes is usually caused by the same pump which provides for the flow of the mixture within the endless pipe circuit, so that the mixture is subjected to the same pressure.

It has been found that it is practically impossible to maintain a constant pressure within the endless pipe circuit, with the result that the supply of the mixture to the grinding or polishing machines is often quite irregular. Furthermore, the solid abrasive material carried by the water often clogs the feeding pipes and the valves carried by these pipes, thus interrupting the flow of the abrasive mixture to the machines.

It also happens that the valves regulating the flow of the liquid through the pipes are not opened completely by the operator, so that the finely divided abrasive material is deposited around these valves and prevents a free flow of the mixture.

An object of the present invention is the provision of a method of supplying an abrasive mixture to grinding and/or polishing machines

through the use of which the variations in pressure of the feeding pump will not disturb the continuous and regular flow of the mixture through the various pipes to the machine or machines.

Another object is the provision of means supplying an abrasive mixture from an endless pipe circuit to a grinding or polishing machine, which means can be easily cleaned and freed from deposits of the finely divided abrasive material contained in the abrasive mixture.

A further object is the provision of means which will readily control the supply of abrasive mixture to a grinding or polishing machine, but which will prevent the abrasive material from clogging the passages or pipes leading to this machine.

The above and other objects of the present invention may be realized through the provision of a separate feeding unit for each consuming unit, each feeding unit being connected by pipes to its consuming unit and with the endless pipe circuit. Each feeding unit comprises a hollow container, the volume of which may be changed by an easily operable regulating device. The abrasive mixture flows constantly through the container during the so-called filling period, i. e. while the abrasive mixture is not supplied to the consuming unit. During the feeding period, i. e. while the consuming unit is supplied with the abrasive mixture, this mixture is fed to the consuming unit from the container, which is thus emptied by the end of the feeding period.

The pipes connected with the container may be provided with valves consisting of elastic tubes which can be closed or opened by compressed air or by any suitable mechanical means. These valves may be conveniently operated from a distance and serve the purpose of facilitating the examination of the various pipes leading to and from the container.

The volume of the hollow container may be regulated by a piston or any other suitable device adapted to change the level of the abrasive mixture within the container and to empty the superfluous amount of said mixture into the endless pipe circuit.

Due to this regulation of the container volume, the amount of the mixture supplied to each consuming unit may be easily and conveniently regulated.

The invention will appear more clearly from the following detailed description when taken in connection with the accompanying drawing showing preferred embodiments of the inventive idea.

In the drawing:

Figure 1 is a diagrammatic illustration of a system of feeding units constructed in accordance with the principles of the present invention.

Figure 2 shows on a larger scale one of the feeding units illustrated diagrammatically in Fig. 1.

Figures 3 and 4 show, partly in section and partly in side elevation, two differently constructed feeding units.

Figure 5 shows in section a valve illustrated diagrammatically in Fig. 1.

Figures 6 and 7 show in section two differently constructed valves.

The device illustrated in Figures 1, 2 and 5 of the drawing comprises a container 10 which is filled with an abrasive mixture 11, said mixture consisting of water and any suitable finely divided abrasive material, such as sludges of sand, emery or rouge.

The container 10 is connected with an endless pipe circuit comprising an inlet pipe 12 and an outlet pipe 13, which leads into the interior of the container 10 and which is connected with the inlet pipe 12 by the intermediate pipe 14.

A pump 15 of any suitable construction is connected with a pipe 16 projecting into the interior of the container 10.

The pump 15 circulates the abrasive mixture through the endless pipe circuit 12, 13, the mixture flowing in the direction of the arrows (Fig. 1) through the inlet pipe 12, the intermediate pipe 14 and the outlet pipe 13.

The endless pipe circuit 12, 13 is used for the purpose of supplying a number of consuming units A, B, C, and Z, with the abrasive mixture 11 situated within the container 10.

The device connecting the consuming unit A with the endless pipe circuit 12, 13 comprises a feeding pipe 17 which is provided with a valve 18 and is connected to a feeding unit 19. The feeding unit 19 is connected by a pipe 20 with the consuming unit A, and is also provided with an overflow pipe 21 connecting the unit 19 with the outlet pipe 13 of the endless pipe circuit 12, 13.

In the device shown by way of example in Fig. 1 of the drawing, the means connecting the consuming units B, C and Z to the endless pipe circuit 12, 13 are similar to each other, each of said means comprising a feeding pipe 22 which connects the inlet pipe 12 with the feeding unit 19, and which is provided with a valve 23. Each feeding unit 19 is connected by an overflow pipe 24 provided with a valve 25 with the outlet pipe 13 of the endless pipe circuit 12, 13. Each feeding unit 19 is connected by a pipe 26 provided with a valve 27 to its respective consuming unit.

The feeding unit 19 is illustrated on a larger scale in Fig. 2 of the drawing; it comprises a container 28 comprising a hollow flange portion 29 surrounding an inlet opening 30 and connected with the pipe 17 through which the mixture 11 is supplied to the interior of the container 28 from the inlet pipe 12.

Another flange portion 31 situated at the bottom of the container 28 is connected with the pipe 20 and forms an opening 32, through which the abrasive mixture 11 is supplied to the consuming unit A. The pipe 20 is provided with a valve 33.

Another opening 34 provided at the bottom of the container 28 is in communication with the interior of a bent pipe 35 having an opening 36 which is situated above the converging walls 37

of the pipe 21 connecting the feeding unit 19 with the outlet pipe 13.

The valve 18 shown on a larger scale in Fig. 5 of the drawing is used for interrupting the flow of the mixture through the feeding pipe 17.

The pipe 17 connecting the inlet pipe 12 with the unit 19 consists preferably of two parts 17a and 17b which are interconnected by a tube or sleeve 38 made of elastic material, such as rubber. A cylinder 39 is placed close to the elastic tube 38 and is connected by a coiled spring 40 with a piston 41 which is slidably mounted within the cylinder 39. The piston 41 is hollow and the chamber 42 formed by the side walls of the piston 41 is in communication with an opening 43 provided in the cylinder 39. An air pump or any other suitable device used for producing compressed air and not shown in the drawing, is connected by a pipe 44 with the cylinder 39, so that compressed air will flow through the pipe 44 and the opening 43 into the interior 42 of the piston 41.

A stop piece 45 is placed close to the elastic pipe 38 opposite the piston 41.

The device is operated as follows:

During that period of time while the consuming unit A is to be supplied with the abrasive mixture, the valve 33 is opened while the valve 18 is closed.

In order to close the valve 18, compressed air is supplied through the pipe 44 and the opening 43 into the chamber 42. Then the compressed air will move the piston 41 to the right (looking in the direction of Fig. 5) causing an extension of the spring 40 and pressing the elastic tube 38 against the stop piece 45 until the tube 38 is completely closed. This last position is shown by broken lines in Fig. 5.

While the overflow pipe 21 of the unit A is not provided with any valves, the overflow pipes 24 of the units B, C, and Z, are provided with valves 25. Obviously, it is possible to construct devices the overflow pipes of which are provided with valves 25, and other devices which do not have such valves.

During the feeding period, while the abrasive mixture 11 is supplied to the consuming units B, C, and Z, the valves 27 should be opened and the valves 23 and 25 should be closed.

The volume of the hollow container 28 should be adjusted in such manner that the container 28 is substantially emptied by the end of the feeding period.

In the device shown in Fig. 2 of the drawing the volume of the container 28 is varied through the provision of a piston 47 at least a part of which is situated within the container 28. The piston 47 is carried by the threaded rod 48 provided with a handle 49 and carried by a support 50, which is rigidly connected with the container 28.

Furthermore, the level of the mixture within the container 28 may be adjusted by the bent pipe 35, since this pipe will maintain the level of the abrasive mixture within the container 28 at the height of the opening 36, the superfluous amount of the mixture flowing through the opening 36 and the pipe 21 back into the outlet pipe 13.

When the feeding period is at an end and the container 28 has been emptied, the operator closes the valve 33 and opens the valve 18.

The valve 18 is preferably opened by interrupting the connection between the air pump which is not shown in the drawing, and the pipe 44 so that compressed air contained within the chamber 42 can escape into the open. Then the

spring 40 will pull the piston 41 from the position shown by broken lines in Fig. 5 to the position shown by full lines in that figure, with the result that the abrasive mixture 11 will be able to flow freely through the inlet pipe 12, the portion 17b, the elastic pipe 38, the pipe portion 17a, and the opening 30 into the interior of the container 28.

After the container 28 has been gradually filled with the abrasive mixture 11, the superfluous amount of this mixture will flow through the opening 34, the pipe 35, the opening 36 and the pipe 21 back into the outlet pipe 13.

Obviously, if the outlet pipes 24 (Fig. 1) are provided with valves 25, these valves should remain open while the abrasive mixture 11 flows into the container 28, in order to prevent an overflow.

A characteristic feature of the operation of the described feeding system consists, therefore, in that during a predetermined period of time the container 28 is filled with the abrasive mixture. During that time the operative connection between the container 28 and its consuming unit is interrupted, while, obviously, the container 28 remains connected with the inlet pipe 12 and the outlet pipe 13 of the endless pipe circuit. During a following period of time, the container 28 is operatively connected with its consuming unit, while its connections with the inlet pipe 12 and the outlet pipe 13 are interrupted. During that time the contents of the container 28 are gradually emptied, so that the container is substantially empty at the time when its connection with the inlet pipe 12 and the outlet pipe 13 is re-established.

Since the abrasive mixture 11 is continuously flowing through the container 28, there is no danger that the finely divided abrasive material will be deposited and will clog the passages of the feeding system. The amount of the mixture which is to be supplied to each consuming unit during the feeding period can be conveniently determined and does not depend upon the condition of the pipes or their valves, provided that the container is completely filled while the feeding is not taking place, and is completely emptied during the feeding period. This can be easily accomplished by determining the period of time during which the mixture is supplied to the container and the period of time during which the contents of the filled container are emptied. The container can be easily inspected and cleaned and it is possible to inspect conveniently the pipes connecting the container to the consuming unit and to the endless pipe circuit.

Figure 3 shows a filling unit of a somewhat different type, which can be conveniently used as a part of the system shown in Figure 1. The device comprises a container 60 provided with a passage 62, which connects the interior of the container with a pipe 61, the opposite end of which is connected with the inlet pipe 12. A valve 63 is carried by the pipe 61. Another passage 64 provided in the bottom of the container 60 connects the interior of the container with a pipe 65, which is used for supplying the abrasive mixture to a consuming unit.

The level of the abrasive mixture 11 within the container 60 is determined by an adjustable pipe 66, which is slidably mounted in a sleeve 67 provided in the bottom of container 60. The pipe 66 is situated above the pipe 21 which is provided with converging walls 37 and connected to the outlet pipe 13.

The level of the abrasive mixture 11 within

the container 60 is determined by the position of the opening 68 of the pipe 66. In order to diminish the amount of the abrasive mixture filling the container 60 it is merely necessary to lower the pipe 66, while to increase the amount of the mixture the pipe 66 has to be raised within the container 60.

The filling unit shown in Figure 4 of the drawing comprises a container 70 filled with the abrasive mixture 11 and firmly connected with a pipe 71, formed at the bottom of the container 70. The bottom of the container 70 is further provided with an opening 72, connected with a pipe 73 which carries a valve 74 and which is connected with the inlet pipe 12. Another opening 75 provided at the bottom of the container 70 communicates with the interior of the pipe 76, used for supplying the abrasive mixture to a consuming unit. The pipe 76 carries a valve 77.

The end 78 of the pipe 79 is rotatably mounted in the pipe 71, so that the inclination of the pipe 79 with respect to the container 70 may be adjusted at will. The opening 80 of the pipe 79 is situated over the opening 81 formed by the walls 82 and 83 which are connected with or form a part of the container 70. The converging walls 84 of the pipe 85 surround the opening 81. The pipe 85 is connected with the outlet pipe 13 of the endless pipe circuit.

In this device the amount of abrasive mixture in the container 70 is regulated by the position of the rotatable pipe 79. When the pipe 79 is placed in a position substantially parallel to the container 70, the level of the abrasive mixture within the container 70 will be determined by the length of the pipe 79. When the pipe 79 is inclined with respect to the container 70, the level of the abrasive mixture within the container 70 will be determined by the position of the opening 80 of pipe 79. It is thus possible to regulate the amount of the mixture within the container 70 by changing the position of the pipe 79.

The superfluous amount of the mixture 11 flowing out of the opening 80 of the pipe 79 will flow along the inclined wall 83 and pass through the opening 81 and the pipe 85 into the outlet pipe 13 of the endless pipe circuit.

The valve 18, which in the example illustrated is used in connection with the pipe 17, may also be conveniently used as a substitute for the valve 33, carried by the pipe 20, or the valves 25 and 27 carried by the pipes 24 and 26 respectively. The valve 18 may be replaced by valves of slightly different constructions. Two of these constructions are illustrated by way of example in Figures 6 and 7 of the drawing.

The valve shown in Figure 6 comprises a flexible or elastic plate or diaphragm 90, which constitutes a wall of a hollow container 91 provided with an opening 92. A pipe 93 surrounds the opening 92 and is connected to an air pump which is not shown in the drawing. The diaphragm or plate 90 is placed close to an elastic tube 94 which may be made of rubber and which joins the ends of the two pipe portions 17a and 17b. A stop piece 95 is placed close to the tube 94 opposite the container 91.

When it is desired to close the valve and to interrupt the connection between the pipe portions 17a and 17b, compressed air is introduced through the pipe 93 and the opening 92 into the interior 96 of the container 91. The compressed air will press against the diaphragm 90 which will expand and in its turn press against the walls of the flexible tube 94, which reaches

the position shown by broken lines in Figure 6. Then the valve is closed and the flow of the mixture between the pipe portions 17a and 17b is interrupted. In order to open the valve it is merely necessary to provide a connection between the interior 96 of the container 91 and atmospheric air. The compressed air situated within the chamber 96 will escape, so that the diaphragm 90 will return to the position shown in full lines in Figure 6.

The valve shown by way of example in Figure 7 of the drawing comprises pipe portions 100 and 101 which are interconnected by a casing 102, having a larger diameter than that of the pipe portions 100 and 101 and surrounding the adjacent ends of these pipe portions. The casing 102 is provided with an opening 104, which is surrounded by pipe 105 connected with an air pump or a similar device not shown in the drawing. An elastic tube 103 interconnects the tubes 100 and 101.

In the position shown in full lines in Figure 7, the abrasive mixture can flow through the pipe 100, the tube 103, and the pipe 101. In order to close the valve, compressed air is supplied through the pipe 105 and the opening 104 into the interior 106 of the casing 102. Compressed air within the casing 102 will press against the walls of the tube 103, causing it to occupy the position shown by broken lines in Figure 7. Then the valve is closed and the flow of the mixture between the pipes 100 and 101 is interrupted.

In order to open the valve it is merely necessary to remove the compressed air from the chamber 106. Then the tube 103 will again assume the position shown by full lines in Figure 7 and the flow of the mixture between pipes 100 and 101 will be resumed.

Obviously, any of the valves illustrated in Figures 5, 6 or 7 may be used as a substitute for any one of the valves illustrated in Figure 1, while any of the feeding units shown in Figures 2, 3 or 4 may be substituted for any of the feeding units illustrated diagrammatically in Figure 1.

What is claimed is:

1. In combination with a pipe adapted to transmit an abrasive substance, a pinch valve comprising an elastic tube forming a part of the pipe carrying said valve and adapted to transmit said substance, a member adapted to press against said elastic tube to close the same, and means supplying compressed air to said member in order to press said member against said elastic tube.

2. In combination with a pipe adapted to transmit an abrasive substance, a pinch valve comprising an elastic tube forming a part of the pipe carrying said valve and adapted to transmit said substance, a piston adapted to press against said tube in order to close the same, a cylinder supporting said piston, and means for supplying compressed air into the interior of said cylinder to operate said piston in order to close said tube.

3. In combination with a pipe adapted to transmit an abrasive substance, a pinch valve comprising an elastic tube forming a part of the pipe carrying said valve and adapted to transmit said substance, a flexible member situated close to said elastic tube, and means for supplying compressed air to press said flexible member against said tube in order to close the same.

4. In combination with a pipe adapted to transmit an abrasive substance, a pinch valve comprising an elastic tube forming a part of the pipe carrying said valve and adapted to transmit said substance, a casing surrounding said elastic tube,

and means for introducing compressed air into the interior of said casing.

5. The combination with a polishing or grinding apparatus; of a system for the periodic feeding of abrasive fluid, comprising a closed main pipe circuit for continuous circulation of said abrasive fluid, a secondary pipe circuit comprising a container for collecting a predetermined amount of said abrasive fluid, and means connecting said container with said main circuit and comprising a valve for isolating the amount of abrasive fluid collected in said container at predetermined intervals, whereby the continuous circulation of the fluid through the secondary circuit is temporarily interrupted; a pipe connecting said container with said apparatus, whereby an amount of the abrasive fluid is fed to said apparatus, a valve carried by said pipe, the last-mentioned valve being closed during the interval between two successive feedings, whereby the circulation of the fluid through the secondary circuit may be resumed, and means connected with said container for regulating the capacity thereof.

6. The combination with a polishing or grinding apparatus; of a system for the periodic feeding of abrasive fluid, comprising a closed main pipe circuit for continuous circulation of said abrasive fluid, a secondary pipe circuit comprising a container for collecting a predetermined amount of said abrasive fluid, means connecting said container with said main circuit and comprising a valve for isolating the amount of abrasive fluid collected in said container at predetermined intervals, whereby the continuous circulation of the fluid through the secondary circuit is temporarily interrupted; said secondary circuit also comprising an overflow pipe connected with said main circuit for returning a superfluous amount of said fluid from said container to said main circuit; a pipe connecting said container with said apparatus, whereby an amount of the abrasive fluid is fed to said apparatus, a valve carried by said pipe, the last-mentioned valve being closed during the interval between two successive feedings, whereby the circulation of the fluid through the secondary circuit may be resumed, a piston at least partially situated within said container, and means adjustably supporting said piston within said container.

7. The combination with a polishing or grinding apparatus; of a system for the periodic feeding of abrasive fluid, comprising a closed main pipe circuit for continuous circulation of said abrasive fluid, a secondary pipe circuit comprising a container for collecting a predetermined amount of said abrasive fluid, means connecting said container with said main circuit and comprising a valve for isolating the amount of abrasive fluid collected in said container at predetermined intervals, whereby the continuous circulation of the fluid through the secondary circuit is temporarily interrupted; said secondary circuit also comprising a pipe pivoted at one end to an axis in said container, whereby the vertical position of the opposite end of the pipe may be altered; a pipe connecting said container with said apparatus, whereby an amount of the abrasive fluid is fed to said apparatus, and a valve carried by the last-mentioned pipe, the last-mentioned valve being closed during the interval between two successive feedings, whereby the circulation of the fluid through the secondary circuit may be resumed.

8. The combination with a polishing or grinding apparatus; of a system for the periodic feed-

ing of abrasive fluid, comprising a closed main pipe circuit for continuous circulation of said abrasive fluid, a secondary pipe circuit comprising a container for collecting a predetermined amount of said abrasive fluid, a pipe slidably mounted in said container, at least a portion of said pipe being situated within said container, and an overflow pipe connected with said main circuit and adapted to return the superfluous amount of said fluid passing through the first-mentioned pipe to said main circuit; a pipe connecting said container with said apparatus, whereby an amount of the abrasive fluid is fed to said apparatus, and a valve carried by the last-mentioned pipe, the last-mentioned valve being closed during the interval between two successive feedings, whereby the circulation of the fluid through the secondary circuit may be resumed.

9. A system for the periodic feeding of abrasive fluid, comprising a closed main pipe circuit for continuous circulation of said abrasive fluid, a secondary pipe circuit comprising a container for collecting a predetermined amount of said

abrasive fluid, and means connecting said container with said main circuit and comprising a valve for isolating the amount of abrasive fluid collected in said container at predetermined intervals, whereby the continuous circulation of the fluid through the secondary circuit is temporarily interrupted; and means connecting said container with a consuming unit to supply an amount of said fluid to said consuming unit and comprising a valve which is closed during the interval between two successive feedings, whereby the circulation of the fluid through the secondary circuit may be resumed.

10. In combination with a pipe adapted to transmit an abrasive substance, an elastic tube constituting a part of said pipe and adapted to transmit said abrasive substance, a pinch valve, said elastic tube constituting a part of said pinch valve, and compressed air-actuated means for compressing said elastic tube to interrupt the flow of said abrasive substance through said tube.

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