

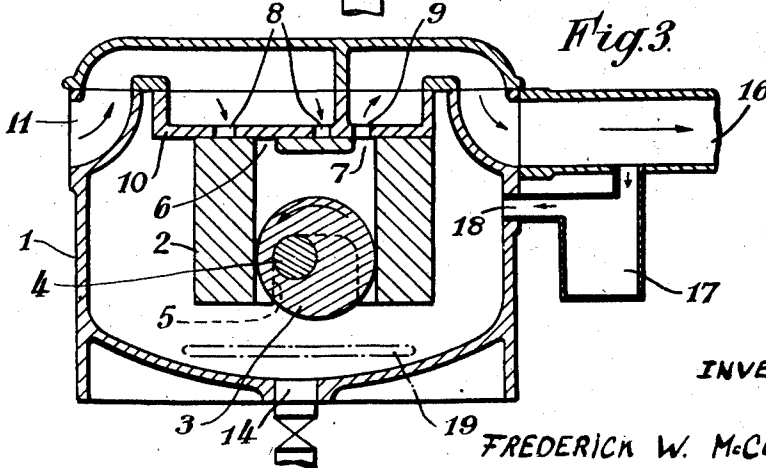
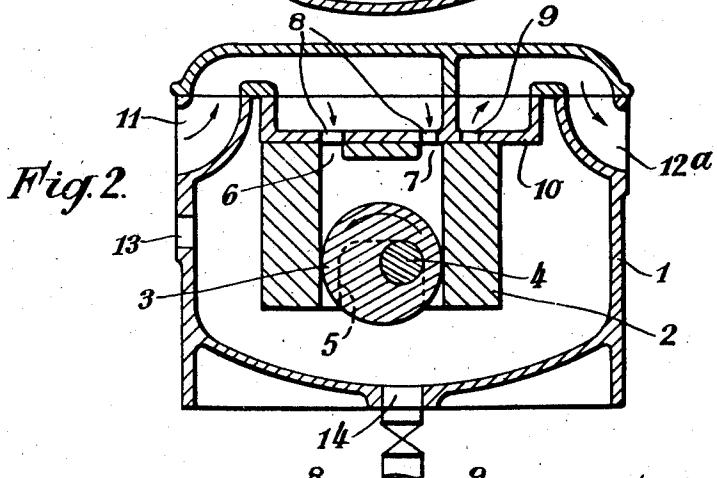
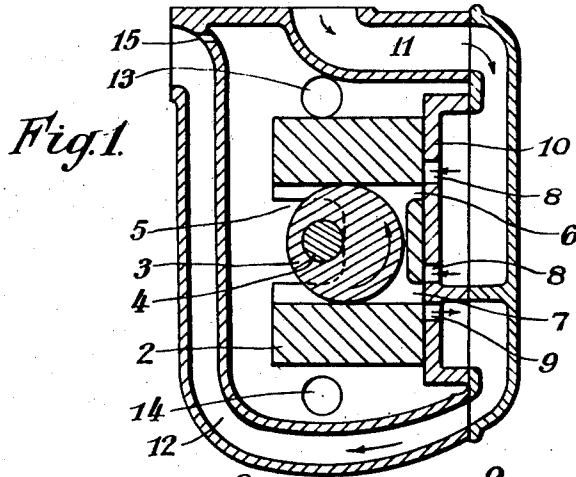
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This invention relates to pumps of the kind including a hollow member and an eccentric rotatably mounted therein and engaging the inner walls of said member at two oppositely disposed points on the eccentric's periphery and also at the sides to provide a substantially fluid-tight seal, the member being mounted for reciprocating movement in the plane of rotation of the eccentric to open and close inlet and outlet ports and to provide the necessary displacement or pumping effect, the hollow member and its associated eccentric being mounted within an outer casing. An example of such a construction of pump is disclosed by our prior British patent No. 592,432, corresponding to co-pending United States application Serial No. 666,363, filed May 1, 1946, and in that construction the reciprocating hollow member was situated on the high pressure side of the apparatus, the pressure of the fluid being pumped serving to maintain the hollow member in fluid-tight connection with the plate or other member with which it was slidably associated and at the same time provide a thin lubricating film of liquid between the relatively movable parts. When utilising such pumps for the pumping of abrasive liquids, for example, liquids such as water containing in suspension gritty substances, such as coal dust, there is considerable risk of the gritty substances finding their way between the working surfaces of the pump mechanism and into the shaft sealing means and causing excessive wear of the contacting parts.

The chief object of the invention is to evolve a construction of pump of the kind utilising a reciprocating hollow member and associated eccentric, which pump will be capable of dealing with such abrasive liquids without excessive wear of the pump parts taking place.

A pump of the kind set forth and intended particularly for dealing with liquids of a gritty nature or liquids containing substances which might have a harmful effect on the working surfaces of the pump is characterised in that the pumped liquid passes to the pump discharge outlet without entering that part of the pump casing containing the working parts, the parts of the casing containing the working parts being supplied with clean liquid for the purpose of maintaining a lubricating film of clean liquid over the working surfaces, such liquid being either supplied from a source of clean liquid supply or drawn from the pumped liquid and filtered if necessary to ensure it being in a clean state prior to entry into the part of the pump casing containing the working parts.

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Such an arrangement is distinct from the prior proposal in that in the earlier case the liquid being pumped had necessarily to pass through that part of the casing containing the working parts, whereas in the present arrangement the pumped liquid by-passes the casing, leaving the latter free to receive the clean liquid.

Although intended primarily for dealing with liquids which may contain grit or other substances in suspension such a pump may be used for pumping liquids of such a viscous character that they would be unsuitable to maintain a film of liquid over the bearing surfaces and between the moving pump parts or would offer undue resistance to the movement of the parts and in such a case it is proposed to utilise a proportion of the liquid pumped for lubrication and to heat such liquid to reduce its viscosity.

The pump may also be employed for pumping hot liquids which if allowed to come into contact with the working parts of the pump in a heated condition would have a detrimental effect on them. In such a case it is proposed to feed a portion of the liquid pumped to the part of the pump casing containing the working parts after cooling it to a suitable temperature. Alternatively, the liquid may be cooled by means of a cooling device placed within the pump casing. Under certain circumstances it may be more expedient to provide a supply of cool liquid from a separate source.

Such clean liquid which is used provides a lubricating film between the moving pump parts and may be drawn from a separate source of clean liquid supply or a proportion of the pumped liquid may be fed back into the pump after having been passed through a suitable filter to get rid of any abrasive material. In the case of a pump intended for use with viscous non-abrasive liquids a proportion of the pumped liquid may again be used for lubrication purposes and in such a case the viscosity of the liquid may be reduced by passing it over a suitable heater or heating surface which may either be arranged at or near the point where the liquid is fed back into the pump or alternatively in the pump casing, the latter arrangement enabling the liquid contained in the pump casing to be heated to reduce its viscosity before the pump is brought into operation.

In order that the invention may be clearly understood and readily carried into effect the invention is hereinafter described by way of example with reference to the accompanying drawings in which:

Figures 1, 2 and 3 illustrate three alternative

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constructions in accordance with the present invention.

In all three constructions illustrated the pump comprises a casing 1 containing a pumping element comprising a hollow member 2, composed of natural or synthetic rubber, surrounding an eccentric 3 for reciprocation over inlet and outlet ports 8 and 9 in a wall 10 of the casing, said wall 10 having a flat inner face against which the member 2 bears to provide a good seal therebetween. The eccentric is fixedly mounted upon a shaft 4 adapted to be driven by a suitable source of power, the member 2 fitting closely against the lateral faces and periphery of the eccentric and being cut away as at 5 to clear the shaft and permit the required reciprocatory motion of the member 2 under the action of the eccentric.

The member 2 is formed with ports 6 and 7 which are cooperative with the parts 8 and 9 for the entry and discharge of fluid to and from the pumping, expansion or displacement chamber formed by the interior of the member 2 enclosed by the eccentric 3, ports 6 and 7 communicating with twin ports 8 when the member 2 is in one terminal position to allow entry of fluid, port 7 at the other terminal position communicating with corresponding port 9 to discharge the fluid under pressure in which position ports 6 and 8 will be closed.

Referring particularly to Figure 1 the fluid to be pumped enters the pump by way of inlet connection 11 and after passing through the pumping or displacement chamber is discharged through a passage 12 having a discharge outlet at the upper end of the pump casing.

It will be appreciated that the fluid pumped which may be of a gritty nature does not actually enter that part of the pump casing containing the working parts except for any comparatively small quantities of liquid which may escape from the hollow member between the walls thereof and the adjacent surfaces of the eccentric or between the member 2 and adjacent face of the wall 10.

With the object of maintaining a film of liquid between the moving parts and at the same time preventing any grit which may escape from the hollow member entering the working parts, that part of the pump casing containing the hollow member has near its upper end a connection 13 for the entry of water or other fluid and has a second connection 14 at its lower end for the discharge of said fluid. The connection 14 may take the form of a relief valve, the fluid being supplied to the casing under pressure, the fluid escaping from the casing on a particular predetermined pressure being reached. Any gritty substances which may have found their way into that part of the pump casing will thus be discharged through the relief valve whilst, due to the fact that the fluid is under pressure, the risk of entry of gritty substances into that part of the casing will be reduced and an adequate film of fluid between the working pump parts and bearings will be maintained. An air vent 15 is provided near the discharge end of passage 12 to relieve the pump casing of any air which may accumulate in the upper part thereof.

Figure 2 shows the invention applied to a horizontal form of pump as distinct from the vertical arrangement illustrated in Figure 1, the horizontal arrangement enabling the construction to be somewhat simplified, the comparatively long passage 12 shown in Figure 1 being dis-

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pensed with, a simple discharge connection or opening 12a being all that is necessary. The remaining parts are generally similar to those shown in Figure 1 and consequently similar reference numerals are employed. The relief valve 14 situated at the bottom of the casing will effectively take care of the discharge of any grit or sludge which may be present in the casing and which when the pump is idle will tend to settle on the bottom of the casing.

Figure 3 shows an arrangement of pump in which a proportion of the discharged fluid is fed back into the pump casing for the purpose of maintaining a film of liquid between the moving pump parts. As the liquid discharged may contain gritty substances the discharge pipe 16 is fitted with a combined pump and filter 17 having a branch outlet connection 18 leading back to the pump casing, the casing being fitted at its lower end as before with a suitable relief valve or discharge connection. A heater 19 may be arranged in the lower part of the casing by means of which the viscosity of the lubricating fluid can be reduced if required. Such a heater is particularly useful when pumping liquids which, due to their high viscosity, will not provide the desired thin lubricating film of fluid between the moving pump parts. The heater may alternatively take the place of the filter hereinbefore described. Where hot liquid is being pumped the heater may be replaced by a cooler consisting, for example, of a coil through which cold water is passed. The fluid contained in the casing may, if necessary, be discharged from time to time through the suitably positioned relief valve or discharge connection 14 shown.

For the purpose of showing more clearly the manner of working of the pump the hollow member 2 is shown in three positions. In Figure 1 the hollow member is shown in an intermediate neutral position in which all the ports are closed. In Figure 2 ports 8 are open for the admission of fluid to the pumping chamber within the member 2, and in Figure 3 the ports 8 are closed, port 9 being open for the discharge of fluid from the pumping chamber.

It will be appreciated from the foregoing description that the pumped fluid, in the case of the construction of pump shown in Figures 1 and 2, is excluded from the main part of the pump casing containing the moving pump parts, any fluid which may accidentally find its way into the casing past the eccentric being effectively removed by the service fluid entering the casing by way of the connection 13. In the case of Figure 3, where no special supply of service fluid is provided for and wherein a quantity of the pumped fluid is fed back into the pump casing after filtering, the pumped liquid is again excluded from the main part of the pump casing until any grit or other solid substances are removed. In any case it is proposed that the pressure of fluid in the bearing containing part of the pump casing shall be such as to hold the hollow member in sliding contact with the adjacent wall 10. The construction shown in Figure 3 can, however, be used for pumping viscous liquids which do not necessarily contain gritty substances in which case the viscosity of the pumped liquid may be unchanged except for a small proportion which is fed back into the pump casing and has its viscosity reduced by the action of the heater to facilitate its penetration between the moving parts to give good lubricating properties.

The spring controlled relief valve may be de-

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signed to maintain in the pump casing a pressure slightly in excess of the delivery pressure, the relief valve providing an outlet for the surplus clean liquid to atmosphere that is visible and therefore gives an indication that the quantity of clean liquid entering the pump is in excess of the slip.

In the case of a pump intended for use underground, e. g. in a coal or other mine, water for the purpose of lubricating the pump parts may be supplied from the surface where it is usually available in a clean state, the clean water being delivered to the pump casing by means of a small pump situated at the surface, the small pump delivering a quantity of water slightly in excess of the slip of the main pump, the surplus water being exhausted visibly to atmosphere or connected into the main discharge. It will be appreciated that the small pump operating at the surface only has to create sufficient pressure to overcome pipe friction and to provide the slight surplus pressure required in the casing over and above the discharge pressure of the pump. An additional pressure equal to the static head on the main pump is acquired by the fact that the water is being pumped down the mine. The delivery of this clean water at the required pressure does not therefore involve the consumption of appreciably more power than in the case of a normal pump without clean water service because the water supplied from the surface takes the place of the water that in an ordinary pump would slip back between the working parts. In other words, although the clean water entering the pump has to be returned to the surface through the main discharge pipe, the net quantity that the main pump delivers is the same as in an ordinary pump without the clean water service.

I claim:

1. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and discharge of working fluid, an eccentric revolvably mounted in said casing in spaced relation to said slideway, a hollow member slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to be reciprocated by said eccentric over the slideway, said hollow member interiorly cooperating with said slideway and the enclosed periphery of said eccentric to define an expansion chamber for alternate communication with said ports upon reciprocation of said hollow member to pump working fluid through said inlet and outlet ports, the walls of said casing except for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the casing spaced from the hollow member for the admission of lubricating fluid under sufficient pressure into said lubricant chamber and around said hollow member and eccentric to lubricate the bearing surfaces of the eccentric and hollow member and to retain said member in sealing engagement with said slideway, and an outlet opening in the casing for the discharge of the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

2. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and discharge of working fluid, an eccentric revolvably mounted in said casing in spaced relation to said slideway, a hollow mem-

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ber slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to be reciprocated by said eccentric over the slideway, said hollow member interiorly cooperating with said slideway and the enclosed periphery of said eccentric to define an expansion chamber for alternate communication with said ports upon reciprocation of said hollow member to pump working fluid through said inlet and outlet ports, the walls of said casing except for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the upper portion of the casing spaced from the hollow member for the admission of lubricating fluid under sufficient pressure into said lubricant chamber and around said hollow member and eccentric to lubricate the bearing surfaces of the eccentric and hollow member and to retain said member in sealing engagement with said slideway, and an outlet opening in the bottom portion of the casing for the discharge of the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

3. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and discharge of working fluid, an eccentric revolvably mounted in said casing in spaced relation to said slideway, a hollow member slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to be reciprocated by said eccentric over the slideway, said hollow member interiorly cooperating with said slideway and the enclosed periphery of said eccentric to define an expansion chamber for alternate communication with said ports upon reciprocation of said hollow member to pump working fluid through said inlet and outlet ports, the walls of said casing except for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the casing spaced from the hollow member for the admission into said lubricant chamber of lubricating fluid under pressure at least as high as the discharge pressure of the working fluid to lubricate the bearing surfaces of the eccentric and hollow member, and a pressure relief valve controlled outlet opening in the casing for developing a selected pressure of lubricating fluid in said lubricant chamber for maintaining said hollow member in good sealing engagement with said slideway and for the discharge of the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

4. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and discharge of working fluid, an eccentric revolvably mounted in said casing in spaced relation to said slideway, a hollow member slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to be reciprocated by said eccentric over the slideway, said hollow member interiorly cooperating with said slideway and the enclosed periphery of said eccentric to define an expansion chamber for alternate communication with said ports upon reciprocation of said hollow member to pump working fluid through said inlet and outlet ports, the walls of said casing ex-

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cept for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the upper portion of the casing spaced from the hollow member for the admission of lubricating fluid into said lubricant chamber and around said hollow member and eccentric to lubricate the bearing surfaces of the eccentric and hollow member, and a pressure relief valve controlled outlet opening in the bottom portion of the casing for developing a selected pressure of lubricating fluid in said lubricant chamber for maintaining said hollow member in sealing engagement with said slideway and for the discharge of the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

5. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and a discharge of working fluid, an eccentric revolvably mounted in said casing in spaced relation to said wall, a hollow member slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to define an expansion chamber between said wall and said eccentric and to be reciprocated by said eccentric over the slideway for alternate communication with said ports to pump fluid through said inlet and outlet ports, the walls of said casing except for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the casing spaced from said hollow member, a passage in communication with said outlet port and leading to a discharge, a filter unit in communication with said discharge passage to receive at least a portion of the fluid therefrom and having an outlet in communication with said casing inlet opening for supplying a clean fluid as a lubricating fluid into said lubricant chamber and around said hollow member and eccentric to lubricate the bearing surfaces of the eccentric and hollow member and to retain said hollow member in sealing engagement with said slideway, and an outlet opening in the casing for discharging the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

6. A pump or the like, comprising a casing having a wall defining a slideway, inlet and outlet ports in said wall for respective communication with a source and a discharge of working

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fluid, an eccentric revolvably mounted in said casing in spaced relation to said wall, a hollow member slidably mounted in said casing against said slideway over said ports and diametrically surrounding said eccentric in sealing engagement therewith to define an expansion chamber between said wall and said eccentric and to be reciprocated by said eccentric over the slideway for alternate communication with said ports to pump fluid through said inlet and outlet ports, the walls of said casing except for said slideway being spaced from said hollow member and said eccentric to define a lubricant chamber, an inlet opening in the upper part of the casing spaced from said hollow member, a passage in communication with said outlet port and leading to a discharge, a filter unit in communication with said discharge passage to receive at least a portion of the fluid therefrom and having an outlet in communication with said casing inlet opening for supplying a clean fluid as a lubricating fluid into said lubricant chamber and around said hollow member and eccentric to lubricate the bearing surfaces of the eccentric and hollow member, and a pressure relief valve controlled outlet opening in the bottom part of the casing for developing a selected pressure of lubricating fluid in said lubricant chamber for maintaining said hollow member in sealing engagement with said slideway and discharging the lubricating fluid and any gritty substance that may work its way into the lubricant chamber.

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