March 12, 1946. S. SCHWARZ 2,396,290

SLUDGE PUMP

Filed March 1, 1945

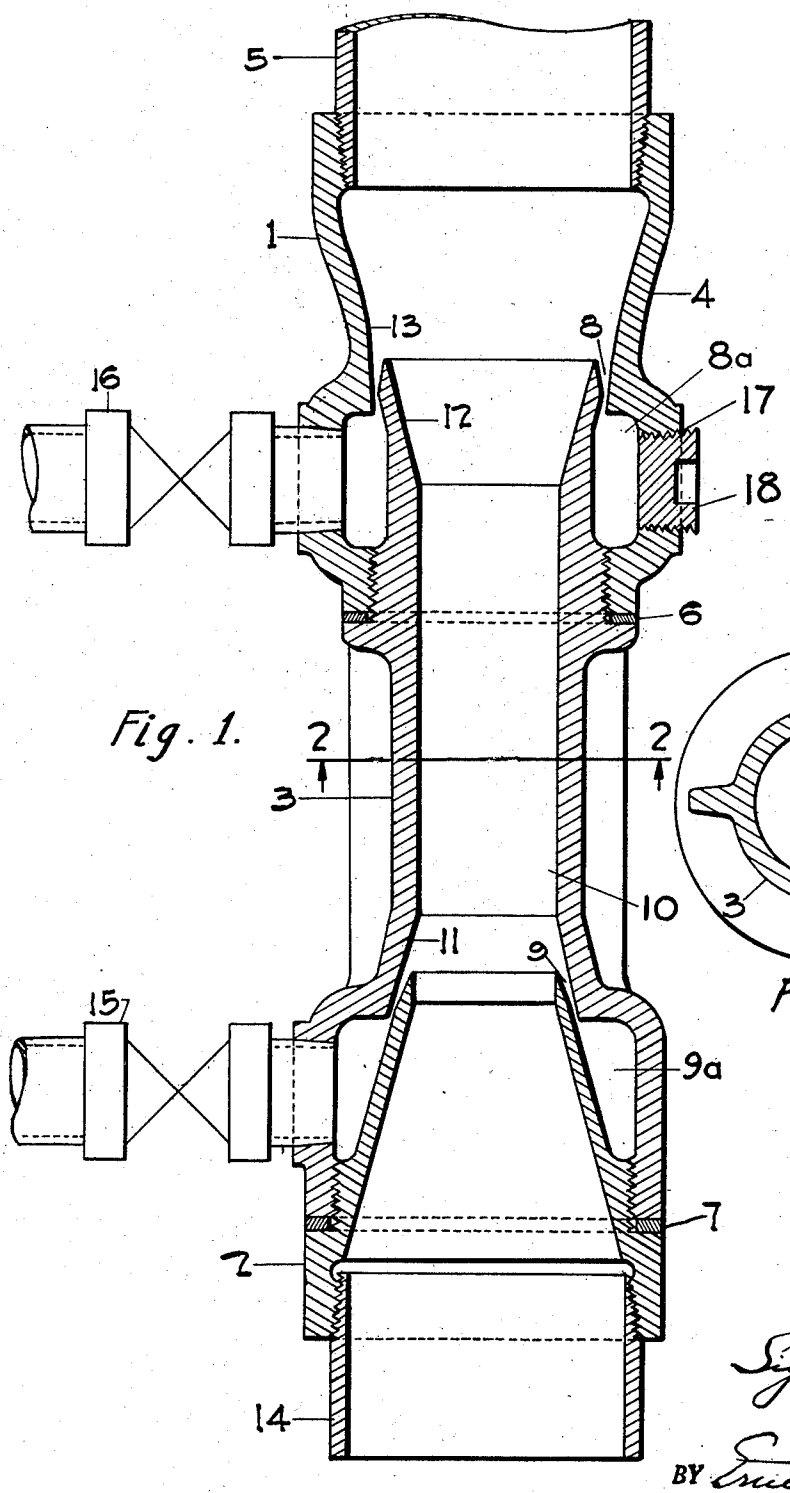

Fig. 1.

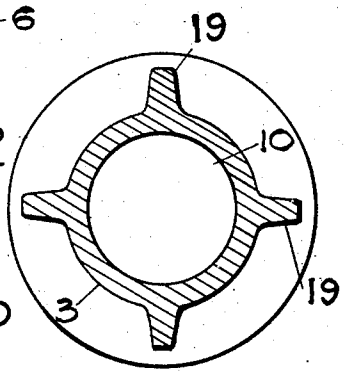

Fig. 2.

Sigmund Schwarz
INVENTOR.

BY Ernest J. McLaughlin
his Attorney

Patented Mar. 12, 1946 2,396,290

UNITED STATES PATENT OFFICE

2,396,290

SLUDGE PUMP

Sigmund Schwarz, St. Albans, N. Y.

Application March 1, 1945, Serial No. 580,297

5 Claims. (Cl. 103—267)

The invention relates to apparatus for quickly and economically removing from storage tanks the accumulation of viscous tar or semi-fluid tar, oil sludges and the like.

The principal object of the invention, generally considered, is to provide a steam jet pump or ejector which can be readily inserted in the storage tank without a partial dismantling of the same, said pump being so designed, arranged and connected as to convert the residue collected in the tank bottom, irrespective of its condition, into a fluid mixture which is conveyed to a point of disposal by conveying means attached to the said pump or ejector.

Another object of the invention is to provide a steam pump or ejector which may be readily inserted into the clean-out opening of a tank, said pump having means for collecting residue and converting the same into fluid, and further means for forcing said fluid under pressure through a conduit to its point of disposal.

Another object of the invention is to provide means for removing tank sludge from storage tanks and the like so that the sludge is converted into a fluid of such viscosity and composition that the same may be utilized as a fuel for boilers or the like.

Still another object of the invention is to provide a steam jet pump having a plurality of interiorly arranged nozzles so positioned and disposed as to receive and discharge the tank sludge or residue at a much faster rate than heretofore deemed possible and with sufficient pressure to overcome variations in discharge levels as great as twenty feet.

Other objects of the invention will hereinafter be pointed out in connection with the detailed description of the preferred embodiment of the device illustrated in the accompanying drawing, in which:

Figure 1 is a horizontal cross section of a steam jet pump embodying my invention.

Figure 2 is a vertical cross section taken substantially on the line 2—2 of Figure 1.

Throughout the specification and drawing like parts are designated by like reference characters.

Before describing the invention in detail it is believed that it will lead to a better understanding of the device to briefly point out a few of the problems which arise in connection with the cleaning of oil storage tanks in refineries, ships and the like.

The oil storage tanks of refineries are adapted to receive the crude oil directly from the well and there is always mixed with such oil sand, rust, a form of scale, water and other undesirable material. These undesirable materials tend to settle on the bottom of the tank from each filling of the tank and thus accumulate over a period of days and months, until finally this accumulation so reduces the capacity of the tank and interferes with the flow of oil from the discharge orifices that it is necessary to cut off the tank and to clean this accumulation from the bottom thereof.

In addition to the materials noted in the preceding paragraph there is always a tendency in asphaltic base oils to deposit along with the other impurities the asphaltic tars which, being of greater specific gravity than the oil, settle to the bottom of the tank, and these asphaltic derivatives and tar mix with the sand and other impurities to form in the bottom of the tank a layer of greater or less depth which, depending upon the character of oil may be viscous, semi-fluid or semi-hard, as the case may be.

It has been the common practice in the cleaning of these storage tanks to remove one or more of the sectional parts of the wall and to place men within the tank with shovels, scoops and in some cases with pick axes and the like to remove these accumulations by wheelbarrows or buckets.

Steam jet nozzles have been used and often with great success in removing this accumulation and the steam jet nozzles have been so constructed as to be handled by one or two men and to be readily insertible within the tank through the ordinary clean-out opening. Where the tank sludge is fluid or semi-fluid the ordinary steam jet nozzle will operate quite successfully and affords a much more inexpensive method of cleaning tanks than does the pick and shovel method described above.

It has been found, however, that where the accumulation within the tank, by reason of disuse or by reason of the particular characteristics of the oil stored therein, is extremely heavy by reason of the carbonization of the deposits that the ordinary steam jet nozzle is incapable of effecting the removal of this heavy carbonized sludge. It is therefore the principal object of my invention to provide a steam jet nozzle so arranged and constructed that this heavy carbonized sludge can be adequately and quickly handled and the fluid which results from the passage of this material through my improved pump is sufficiently fluid to be utilized as a fuel rather than becoming, as in the past, a waste product which is exceedingly difficult to dispose of and extremely costly in handling.

Having worked for a long period with steam jet pumps which are now on the market, I have determined the specific faults that these pumps possess and have devised the improved form which, in actual tests, has shown a very high degree of efficiency and a capacity far in excess of any of those steam jet pumps which are now on the market.

The steam jet pump in its entirety is indicated by the reference character 1 and comprises an intake nozzle 2 which is adapted to be screw-threadedly received into the outer end of the center throat piece 3, the throat piece 3 being in turn threadedly received within one end of the discharge nozzle piece 4 to which is attached a discharge line or conduit 5. Interposed between the throat piece 3 and the intake nozzle 2 and the discharge nozzle 4 are spacer rings 6 and 7, the thickness of which, as will be readily apparent, controls the size of the annular steam jet openings 8 and 9, respectively. The throat piece 3 is preferably formed with an intermediate circular passage 10 which, at opposite ends, merges into the tapered ends 11 and 12, respectively.

The nozzle 2 has an inwardly tapering portion which projects into the tapered portions 11 of the throat piece 3, as clearly shown in the drawing and therefore the thinner the spacer ring 7 is made the smaller is the opening 9 between the throat piece and the steam chamber 9a formed at the outer end of the portion 3. It will be obvious, therefore, that, since the taper of the outer surface of the nozzle 2 is slightly greater than the taper of the portion 11 of the throat piece 3, by increasing or decreasing the thickness of the ring 7 the circular orifice connecting the steam chamber 9a with the central opening 10 can be varied as desired, that is the thinner the ring 7 is made the smaller will be the orifice and conversely the thicker the ring 7 is made the greater will be the area of the orifice 9.

The configuration of the part 4 is such that the thinner the ring 6 is made the greater will be the area of the discharge opening 8 due to the slight taper 13 on the interior of the nozzle 4 and the conformation of the outer portion of the tapered portion 12 of the throat 3.

By the means which I have described a very accurate determination of the area of the two steam jets from the respective steam chambers 8a and 9a can be determined by the thickness of the respective rings 6 and 7 and since these rings are on the exterior of the pump they are open to inspection and by previous calibration it can be determined from this inspection the respective areas of the discharge openings from the respective steam chambers.

The intake nozzle piece 2 is provided with an internally threaded end for receiving the intake nipple 14. Separate valved steam inlets 15 and 16 are provided, the valve members being graphically illustrated by the cross lines between the steam pipes and the respective openings into the portions 3 and 4 of the pump.

Opposite the inlet for the steam jet 16 I provide an opening 17 closed by a plug 18. By this arrangement, no matter what the relative position of the part 4 bears to the part 3, it will be obvious that the steam inlets into the respective chambers 8a and 9a are never more than a quarter of a turn apart and in ready position for the attachment to a steam line without the necessity of providing a high degree of flexibility in the steam hoses 15 and 16.

It will be noted that I preferably form the relatively slender cylindrical portion of the throat piece with reinforcing ribs 19 clearly shown in Figure 2, said ribs merging at opposite ends into the thickened portions of the throat piece and thus form the throat piece of sufficient strength to withstand the high pressures which are generated within the throat piece by the passage of the sludge therethrough.

It will be further noted that the tapered portion 13 of the discharge portion 4 increases in diameter to a point adjacent its connection with the conduit 5 and I find that this increase in diameter of the discharge nozzle greatly facilitates the passage of the fluid sludge and prevents the building up of back pressures and the tendency of the steam as in prior nozzles to flash back out through the nipple 14.

The action of the pump is as follows:

The two steam jet openings having been properly adjusted by means of the rings 6 and 7 to provide clearance of approximately $\frac{3}{32}$ of an inch between each nozzle and the adjacent portion of the pump, the steam valves are opened and high pressure steam will enter the steam chambers 8a and 9a and discharge through the respective openings 8 and 9. With the steam at approximately one hundred pounds pressure per square inch the velocity of the steam will be, through the jet openings, approximately three thousand feet per second. This, of course, will create a terrific suction through the nipple 14 and will at the same time provide sufficient heat to reduce the sludge to a readily flowable fluid.

It will be noted that in the device described the interaction between the two steam jets automatically takes place, the intake nozzle acting as a suction nozzle which discharges the material taken in through the nipple into the relatively narrow throat passage, while the discharge jet through the orifice 8 breaks up the material into fragments and provides a powerful steam stream through the conduit 5 which is thus able to carry a fluid or semi-fluid material despite any variation in elevation between the steam pump and the major portion of the conduit which would be the case should the steam jet pump be used for instance in cleaning the storage tank of a vessel and consequently the conduit would have to be formed as a gooseneck in order that the discharge from the storage tank could be lifted above the elevation of the tank and through the opening through which the conduit would extend.

As I have previously pointed out, when the device is in operation, and assuming that the material to be removed is relatively hard, it will be obvious from the restricted portion of the throat 10 that this hardened material will be compressed and at the same time subjected to a terrific heat caused by the high pressure steam from the opening 9 so that actually the lumpy material picked up by the nipple 14 is converted into a fluid by the time it passes through the throat into the enlarged chamber of the part 4, at which time it will be again subjected to the powerful influence of the second steam jet issuing from the nozzle 8.

I claim:

1. A jet pump comprising a throat body having an outwardly flared portion adjacent one end thereof, an intake nozzle extending into said body at one end thereof, a central opening in said intake nozzle, means directing a column of fluid out of said intake nozzle for drawing material through said central opening into said throat body, a discharge nozzle at the flared end of said throat body, means directing a column of fluid

out of said discharge nozzle for drawing material out of said throat body, and means associated with said throat body for adjusting each of said nozzles.

2. A jet pump comprising a throat body having an outwardly flared portion adjacent one end thereof, a hollow conical member extending into and threadedly associated with said throat body adjacent one end thereof to form an intake nozzle means communicating with the interior of said throat body adjacent said member for causing a column of fluid to pass through said intake nozzle for drawing material into said throat body, another member sleeved over and threadably associated with the opposite end of said throat body to form therewith a discharge nozzle, means communicating with said second member for causing a column of fluid to pass through said discharge nozzle and drawing material out of said throat body, and exterior adjusting means interposed between both of said members and throat body for controlling the openings of both of said nozzles.

3. A jet pump comprising a tubular throat body having a large end, restricted intermediate portion and flared end, a tubular member extending into said large end to form an intake nozzle, adjusting means interposed between said large end and tubular member for determining the opening of said intake nozzle, a second member sleeved over and secured to said flared end to form a discharge nozzle, and adjusting means interposed between said second member and tubular throat body for determining the opening of said discharge nozzle.

4. A jet pump comprising a tubular throat body having oppositely flared ends, hollow conically shaped means removably secured to and extending into one end of said tubular throat body to form an intake nozzle, means surrounding and removably secured to the opposite end of said tubular throat body to form a discharge nozzle, and adjusting means interposed between exterior portions of both of said means and said tubular throat body for determining the openings of said intake and discharge nozzles.

5. A jet pump comprising a throat portion having a central opening therein, said opening terminating in oppositely directed outwardly flared portions, the intermediate portion of said opening being circular in cross section, a nozzle portion entering one of said flared portions and threadably connected to the throat portion, a second nozzle sleeved over the opposite end of said throat portion, said last named nozzle having an inwardly tapering interior wall, said nozzles and the adjacent portion of the throat forming a plurality of spaced jet openings, and means for adjustably regulating the size of said jet openings.

SIGMUND SCHWARZ.