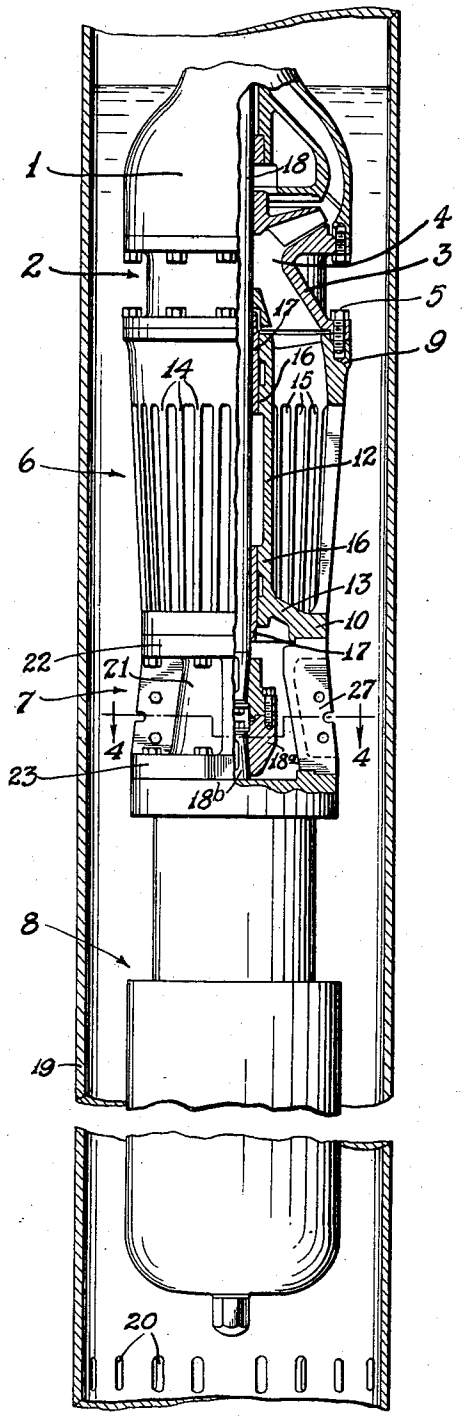
Aug. 13, 1940. A. HOLLANDER 2,210,977

STRAINER FOR SUBMERSIBLE MOTOR PUMPS

Filed Dec. 8, 1937

FIG. 1



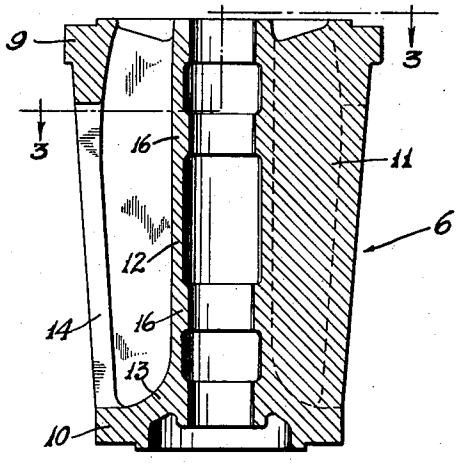


FIG. 2

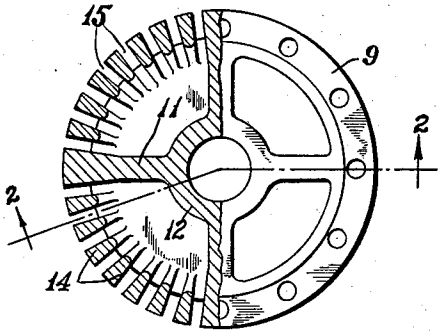


FIG. 3

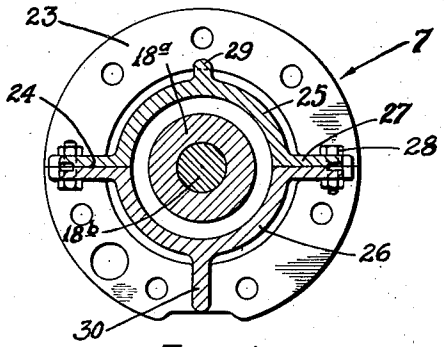


FIG. 4

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STRAINER FOR SUBMERSIBLE MOTOR PUMPS

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Application December 8, 1937, Serial No. 178,738

2 Claims. (Cl. 103—111)

This invention relates to motor pump units adapted to be suspended within a well and immersed in the liquid to be pumped.

More particularly, the invention is directed to improvements in a motor pump unit in which the motor is suspended below the pump in axial alignment therewith, and the pump intake is located intermediate the pump and the motor.

In a unit of the aforementioned type a strainer is usually provided for the purpose of limiting the maximum size of solid particles entering the pump. Inasmuch as the strainer section is interposed between the pump and the motor, it serves to support the weight of the motor and also to transmit the reaction torque of the motor to the pump casing. Furthermore, the strainer is of an appreciable length, in order to provide a flow capacity commensurate with the pump capacity, thus giving rise to the necessity of providing a bearing support for the pump shaft at a point intermediate the pump and the motor.

In prior devices of the aforementioned type embodying a strainer, the well liquid is deflected radially inwardly as it enters the strainer from the well casing, and is then again deflected in an upward direction. This change in direction seriously impedes the flow of the liquid, and causes turbulence therein at the point of entry of the liquid into the throat of the pump. By the provision of the novel strainer hereinafter described, in conjunction with a suction piece of novel construction interposed between the strainer and the pump, this difficulty is overcome and there is provided substantially straight-line flow from the well casing to the pump.

The suction piece referred to in the preceding paragraph functions additionally as an adapter between the pump and the strainer, the basic design of the suction piece being such as to render it susceptible of construction in a wide variety of relative upper and lower diameters. Irrespective of the particular relative diameters, however, it cooperates with the strainer to effect substantially straight-line flow of liquid from the well casing to the pump.

A principal object of this invention is to provide a strainer of novel and improved construction, having incorporated therein a shaft bearing support as an integral part thereof.

A further object of the invention lies in the provision of a strainer which provides substantially straight-line flow of fluid from the well casing to the pump, thus offering a minimum of resistance to flow of fluid therethrough.

Another object of the present invention is the provision of a strainer which is constructed to withstand torsional as well as tensile strains imposed thereon by the motor, while retaining features of compactness and good hydraulic design.

Another object of the invention lies in the combination of a novel strainer with a novel suction piece, the combined effect of which is to provide a path for the liquid, from the well casing to the pump, which is substantially free from direction-changing surfaces.

Individual well requirements as to flow capacity and head, as well as well diameter limitations, call for the selection from a wide range of pump sizes and of motor sizes for most efficient operation. It is a further object of this invention to provide a novel motor pump assembly which permits of the use of a wide range of pump sizes with an equally wide range of motor sizes, without the necessity of supplying a different size of strainer for each motor pump size combination.

For obvious reasons, the weight of the motor casing in a motor pump unit of the type referred to herein is carried by the superposed sections, independently of the motor shaft. Furthermore, access to the interior of the unit in the region of the upper end of the motor casing is required during assembly of the unit after the sections have been connected together and the unit is suspended from above. Yet another object of the invention resides in the novel arrangement affording free and unobstructed access to the interior of the unit between the motor and the pump while the unit is suspended from above.

A still further object of the invention is to provide a novel motor pump assembly wherein an adapter is interposed between the motor and the strainer for the purpose of adapting motors of varying casing diameters to a single strainer, the adapter supporting the motor and being divided longitudinally into two or more sections whereby one section may be removed to provide unobstructed access to the interior thereof while another section supports the motor.

Other objects and advantages will be apparent to those skilled in the art, and will be made evident from the following description, taken in conjunction with the accompanying drawing, wherein:

Figure 1 is a view, partly in side elevation and partly in vertical section, of a motor pump assembly embodying the invention;

Figure 2 is a vertical sectional view of the strainer, taken on line 2—2 of Fig. 3;

Figure 3 is a horizontal section through the

strainer taken on line 3—3 of Figure 2; and

Figure 4 is a horizontal section through the split adapter, taken substantially on line 4—4 of Fig. 1.

Referring to Fig. 1 of the drawing, a pump 1, herein shown as a centrifugal pump, is adapted to be attached to the lower extremity of a string of pipe (not shown) and lowered into a well and immersed in the liquid to be pumped.

Bolted or otherwise secured to the lower end of the pump is a suction piece 2, comprising an upwardly and inwardly converging neck portion 3 defining a throat 4 communicating with the impeller chamber of the pump.

The lower, or intake, end of the suction piece 2 is connected, by cap screws 5 or other suitable means, to the upper end of a strainer, designated generally by reference numeral 6.

Supported from the lower end of strainer 6 is an adapter 7, interposed between strainer 6 and an electric motor 8 deriving current from the surface through an electric cable, (not shown). It will thus be seen that each element of the assembly is subjected to the weight of those elements suspended below it, and also that the reaction torque of the motor is transmitted successively through each element to the pump above.

Referring now to the novel strainer 6, in its preferred embodiment it is formed as an integral structure, as by casting. An upper annular flange member 9 and a lower annular flange member 10, of lesser diameter than the upper member, are connected by a plurality of radially extending ribs 11 (Figs. 2 and 3), herein shown as four in number. These ribs are formed as radial projections on a centrally disposed hub member 12 extending substantially the entire length of the strainer.

As will be seen from Figs. 2 and 3, the upper end of the strainer is open, the annular space between the upper flange member 9 and the hub 12 being bridged only at spaced intervals by the ribs 11, to provide passage for the flow of liquid to the suction piece. However, the lower end is closed by the flaring base portion 13 formed at the lower end of the hub 12 and uniting the latter with the lower flange member 10.

Inasmuch as the strainer is subjected to the reaction torque of the motor, it is essential that the torque-transmitting portions thereof be of sufficient strength. In prior devices wherein the strainer portion is utilized to transmit torque, it has been found necessary to provide an excessively large strainer in order to furnish the requisite strength and also provide sufficient openings for the flow of liquid to the pump. By the provision, however, of a torque-transmitting member entirely distinct and separate from the strainer elements, whereby the latter need not be relied on for this purpose, the strainer elements may be of appreciably lighter construction, affording a much higher ratio of flow area to strainer surface. As a result, the size of the strainer may be reduced appreciably while retaining the requisite flow capacity and torsional strength.

According to the invention, the strainer elements comprise spaced bars 14 extending longitudinally of the strainer between the peripheral portions of the upper and lower flanges 9 and 10. The slots 15 formed between adjacent bars constitute channels for the passage of fluid from the well to the pump, while excluding solid particles exceeding a predetermined size. As shown in Fig. 3, the bars 14 taper radially inwardly, in order that the width of the slots 15 shall be at least equal, throughout their depth, to the width at the outer periphery. In this way the possibility of solid particles becoming wedged in the slots is precluded. As shown in Fig. 1, the bars 14 also taper downwardly in order to provide slots of uniform width from top to bottom; it has been found that by this arrangement more uniform flow conditions are obtained, as will be explained more in detail hereinafter.

Formed within the hub member 12 are spaced bearing supports 16, 16 for the reception of sleeve bearings 17, 17 (Fig. 1) in which is journaled the pump shaft 18 extending from the motor to the pump and coupled at 18a to the motor shaft 18b. By the provision of a bearing support integral with the strainer, adequate lateral support of the pump shaft is assured at this point. As shown in Fig. 1, the pump shaft terminates a short distance below the strainer, and the advantages of providing a bearing within the strainer will be readily apparent.

An important feature of this invention is the downwardly tapered construction of the strainer, in conjunction with the full length strainer slots and the suction piece. Motor pump units of this type are usually installed in a well at some point above the well screen forming a part of the well casing 19. The clearance between the motor casing and the well casing provides an annular space for the passage of liquid from the perforations 20 of the well screen upwardly around the motor casing and into the strainer. By the present invention, this upward course of the liquid is continued until it reaches the pump impeller, with only a gradual deflection radially inwardly, in contrast to the relatively abrupt deflection inwardly and then upwardly which characterizes the usual cylindrical strainer with short, staggered openings. It will be obvious to those skilled in this art that improved operation of the pump will be effected by the elimination of turbulence at the pump intake as the result of this invention.

The adapter 7, interposed between the strainer and the motor casing, comprises a frustro-conical housing 21 provided with upper and lower bolting flanges 22 and 23. In the preferred form, the housing and flanges are split longitudinally at 24 on a diametral plane (Fig. 4) forming two mating sections 25 and 26, and for the purpose of securing the two sections in assembled relation each section has formed thereon, at opposite sides thereof, a pair of radial flanges 27 extending between upper and lower flanges 22 and 23 and bolted together as at 28. In order to render the adapter capable of withstanding torsional strains imparted thereto by the motor, strengthening ribs 29 and 30 are provided.

As clearly shown in Fig. 1, the end faces of the flanges 22 and 23 and the corresponding abutting faces on the lower end of the strainer and the upper end of the motor housing are provided with complementary centering shoulders machined to provide a true centering fit between these parts, assuring proper alignment of the shafts 18 and 18b and of the mating halves of the coupling 18a. Thus it is only necessary to secure one of the sections 25 or 26 of the adapter between the strainer and the motor housing in order to establish and maintain proper alignment of these elements and consequently of the shafts, the interior of the adapter being fully exposed and accessible for assembly of the coupling and inspection of the alignment of the shafts.

For various reasons, it is necessary to provide

access to the interior of the adapter without disturbing the assembled relation of the motor, adapter, and strainer. By the provision of an axially split adapter, one section thereof may be removed to provide free and unobstructed access to the interior thereof, while the other section remains intact, providing a support for the motor and maintaining the motor, adapter, and strainer in rigid assembly. It will be understood that after the unit is assembled and the motor casing is filled with a dielectric fluid, as is customary, it must be suspended in vertical position while performing various final assembly operations, such as axial adjustment of the pump, etc. It is in this connection that the split adapter affords a convenient means for obtaining access to the interior while still supporting the motor therefrom, and maintaining axial alignment of the shafts.

Referring to the assembly as a whole, it will be observed that an adapter is provided both between the strainer and the pump and between the strainer and the motor. For the great variations of flow capacity, pumping head, and well diameter, it will be appreciated that a large number of pump sizes and of motor sizes are required, and the number of combinations of pump sizes and motor sizes is correspondingly greater. If the pump and motor were connected directly to opposite ends of the strainer, it is obvious that not only would a strainer of a different size be required for each combination of motor and pump, but it would be impossible to provide in all cases a strainer of inverted frustro-conical shape having the improved hydraulic properties discussed previously. By the provision of an adapter at each end of the strainer, it is possible to provide a relatively small number of strainer sizes, each of which is of the proper relative upper and lower diameters to provide the desired taper. Furthermore, it will be observed that both the lower split adapter and the upper combined suction piece and adapter are of simple construction and capable of being manufactured at low cost, and consequently the capital investment involved in maintaining a stock of a wide variety of sizes of such adapters would be much less than would be the case if individual strainers were provided for each combination of pump and motor.

From the foregoing it is believed that the novel features of my invention may be readily understood by those skilled in the art. It is to be understood that the particular embodiment shown and described is for illustrative purposes only, and that various changes and modifications may be made without departing from the spirit of the invention.

I claim:

1. A strainer adapted to be connected between the pump and motor of a submersible motor pump unit, said strainer comprising upper and lower end portions connectible respectively to said pump and to said motor, said upper end portion being substantially of the same diameter as the suction inlet of said pump and adapted to be in open communication therewith, said lower end portion being of lesser diameter than said upper end portion and being closed, and strainer bars extending in spaced relation between said end portions and defining therebetween an inverted frustoconical cage, the circumferential width of the strainer bars being decreased from top to bottom, whereby the spaces between the bars are of substantially constant width throughout their length.

2. A combined strainer and bearing support adapted to be connected in supporting and torque-transmitting relation between the pump and motor of a submersible motor pump unit, comprising upper and lower end portions connectible respectively to said pump and to said motor, said upper end portion being substantially of the same diameter as the suction inlet of said pump and adapted to be disposed in open communication therewith, said lower end portion being of lesser diameter than said upper end portion and being closed, a plurality of substantially radially extending ribs connecting said end portions in supporting and torque-transmitting relation, a centrally disposed hub connecting the inner edges of said ribs, pump shaft bearing means in said hub, and longitudinal strainer bars extending in spaced relation between said end portions and defining therewith an inverted frusto-conical cage, the circumferential width of the strainer bars being decreased from top to bottom to provide strainer slots of substantially constant width throughout their length.

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