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COMBINED MOTOR-PUMP APPARATUS

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Fig. 1.

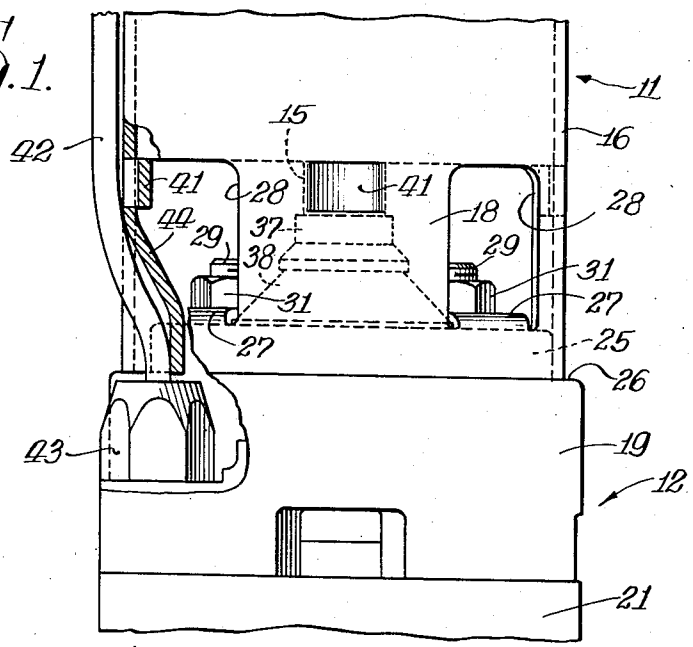


Fig. 2.

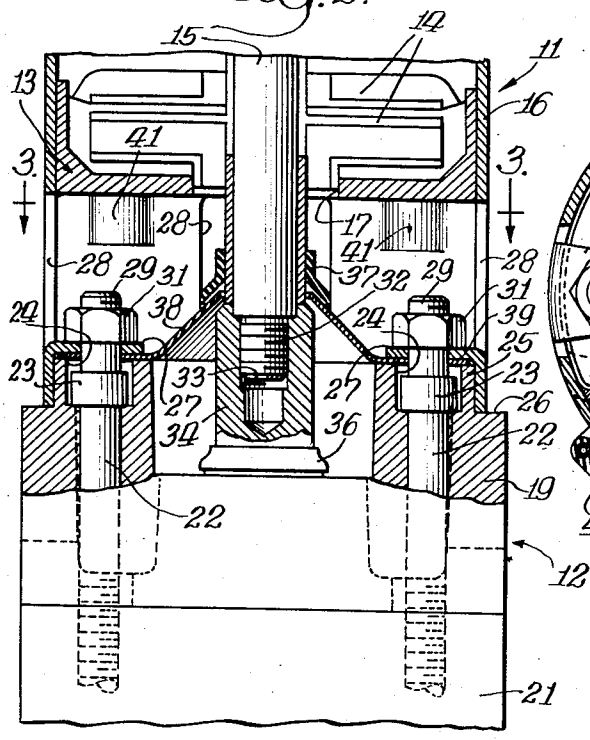
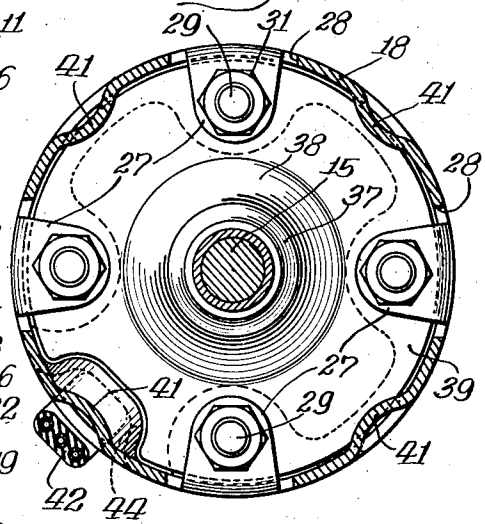


Fig. 3.



INVENTOR.

Edward J. Schaefer,

BY

Davis, Lindsey, Hibben & Noyes

Attys.

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COMBINED MOTOR-PUMP APPARATUS

Edward J. Schaefer, Fort Wayne, Ind.

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6 Claims. (Cl. 103—87)

This invention relates to improvements in combined electric motor and pump units and more particularly to improvements in submersible pumping apparatus.

In motor-pump devices, particularly those designed for submersible use in water wells or the like, it has been common practice heretofore to provide a separate intermediate casting for connecting the motor and pump sections of the apparatus. For example, a typical submersible pumping apparatus may have an electric motor unit at its lower end, a rotary pump unit at its upper end adapted to be connected to discharge piping, and an intermediate connecting section in the form of a separate casting which is secured to the lower end of the pump unit and to the upper end of the motor unit to form a unitary assembly. Usually, the intermediate connecting section also provides a fluid intake for the pump unit.

In order to simplify the construction of such devices with resultant economy of manufacture, I have now devised an arrangement for connecting such motor and pump units directly and without the use of a separate intermediate casting or other separate connecting section.

Accordingly, a primary object of the invention is to provide a combined motor-pump apparatus having novel and improved means for connecting the motor and pump sections.

Another object of the invention is to provide an improved motor-pump construction which eliminates the necessity of providing a separate intermediate connecting member as heretofore used for interconnecting the motor and pump sections of the apparatus.

A further object of the invention is to provide a motor-pump apparatus having a simplified direct connection between an elongated electric motor unit and the casing portion of an elonaged rotary pump unit.

An additional object of the invention is to provide a combined motor-pump apparatus having novel means for rigidly interconnecting the motor and pump sections of the apparatus and at the same time providing fluid inlet means for the intake of the pump unit.

Other objects and advantages of the invention will become evident from the subsequent detailed description taken in conjunction with the accompanying drawing wherein:

Fig. 1 is a fragmentary elevational view showing an intermediate section of a combined motor-pump apparatus and illustrating one specific embodiment of the invention;

Fig. 2 is a vertical sectional view of the portion of the apparatus shown in Fig. 1; and

Fig. 3 is a transverse sectional view as taken along the line 3—3 of Fig. 2.

Referring to the drawing in detail, I have shown for purposes of illustration the intermediate or connecting portion of a submersible pumping apparatus having an uppermost pump unit designated generally at 11 and a lowermost electric motor unit designated generally at 12. The pump unit 11 is of a conventional multiple stage type having a pump means 13 including a plurality of

impellers 14 mounted on a pump shaft 15. The upper end (not shown) of the pump unit 11 has the usual check valve structure and connector arrangement for attaching the pump to the discharge piping. The pump means 13 or operating portion of the pump unit is contained within an outermost tubular casing 16, and a central fluid inlet or intake 17 is provided at the lower end of the pump means 13 around the shaft 15.

The lower end portion of the pump unit casing 16 extends below the inlet end 17 of the pump means and provides a tubular extension 18 which surrounds and encloses the projecting lower end of the pump shaft 15. The upper end portion of the motor unit 12 has an upper end bell section 19 which is secured to the main body or stator portion 21 of the motor by means of a plurality of elongated screws or studs 22 which are threaded at their lower ends into the body of the stator 21 and have enlarged shoulder portions 23 adjacent their outer ends which are received in axial recesses 24 in the end bell 19 for clamping the latter to the stator 21. The end bell 19 also has a reduced diameter end extremity 25 defining a radial shoulder 26.

For rigidly interconnecting the pump unit 11 and the motor unit 12 without the use of an intermediate casting or separate connecting section, the tubular extension 18 of the pump casing 16 fits in snug telescopic relation over the reduced diameter end portion 25 of the motor unit 12 and abuts the shoulder 26 so that the motor and pump units are thereby disposed in continuous end-to-end relation. At a plurality of circumferentially spaced locations the material forming the wall of the tubular extension 18 is cut or severed to form lateral ports or openings in the extension 18, and preferably the cut away material is employed as retainer lugs to secure the pump casing to the motor unit. Thus, in the presently illustrated embodiment of the invention selected portions of the tubular wall are partially cut away or detached from the main body of the tubular wall and then folded radially inwardly so as to provide a plurality of inwardly extending flanges or tabs 27 which are in this case integral with the pump casing and which overlie the upper axial end of the motor unit 12 in close proximity thereto. The inward folding of the tabs 27 leaves a plurality of circumferentially spaced openings 28 in the wall of the tubular extension 18 which serve to admit fluid to the intake or inlet 17 of the pump means 13. In this case, the openings 28 are of larger size than the tabs 27. Although four such openings 28 with the accompanying tabs 27 are shown in the illustrated embodiment of the invention, it will be understood that any suitable number of openings and inwardly folded tabs may be used as desired.

The tabs 27 extending integrally from the lower edges of the openings 28 are rigidly secured by any suitable means to the adjacent end portion of the motor unit 12. In this instance, the connection is conveniently provided by threaded extensions 29 at the upper ends of the studs 22 which project through suitable apertures in the tabs 27 and which have a plurality of nuts 31 secured thereon for rigidly clamping the mounting tabs 27 to the end portion of the motor thereby providing the desired direct interconnection between the motor and pump units. In addition to their function as inlet openings for admitting water or other fluid to the pump intake, the openings 28 in the tubular extension 18 also permit radial insertion of a suitable tool thereby providing ready access to the threaded stud extensions 29 and the nuts 31 for tightening or loosening the latter is required. Of course, it will be understood that when necessary or desirable a suitable screen or other perforated guard may be disposed around the outside of the tubular extension 18 to cover the

apertures **28** so as to prevent the entry of debris or large particles of foreign matter into the pump intake **17**.

The tubular extension **18** also houses or encloses the driving connection between the motor and pump units which, in this case, is in the form of a threaded connection between a threaded end extremity **32** on the pump shaft **15** and an internally threaded socket or bore portion **33** at the upper end of the motor shaft which projects, as at **34**, from the end bell portion **19** of the motor. A motor seal **36** of a conventional type is provided where the motor shaft **34** projects from the end bell structure, and further protection is provided adjacent the threaded connection or coupling between the motor and pump shafts by means of a sand slinger **37** of rubber or the like which is mounted on the pump shaft **14** for rotation therewith. A generally cone-shaped stationary shield **38** surrounds the pump shaft **14** closely adjacent the sand slinger **37** and cooperates with the latter to protect the coupling and the motor seal. As will readily be understood from Fig. 2, the shield **38** has a circumferential apertured flange portion **39** which is clamped between the mounting tabs **27** and the adjacent axial end of the motor unit.

For supporting the pump means **13** within the casing **16**, I preferably provide a plurality of parallel slits in the wall of the tubular extension **18** with the material between the slits being bulged or depressed inwardly to provide a plurality of inwardly extending indentations **41** underlying the lower axial end of the pump means **13** for rigidly supporting the latter in the casing **16**. As will best be seen from Fig. 3, these inwardly depressed supports **41** may conveniently be interposed in alternating relation between each of the fluid openings **28** in the tubular extension **18**.

The electrical connection to the motor unit **12** is provided through a cable **42** which extends from the ground level along the discharge piping and the pump section to a connector **43** mounted in the end bell **19** of the motor unit. As seen in Figs. 1 and 3, the connector **43** is preferably recessed within the outer confines of the end bell structure, and a portion of the tubular extension **18** is, therefore, depressed inwardly, as at **44**, to provide a recess or channel for the cable **42** which extends axially from the lower end of the extension **18**.

From the foregoing, it will be seen that my invention provides an exceedingly simple and highly economical means for directly interconnecting the motor and pump sections of a unitary motor-pump apparatus of the submersible type. In addition, the connecting structure of the present invention provides a unique and highly compact combination of mounting tabs with inlet fluid openings for the pump, the inlet openings also providing ready access to the fastening elements which complete the rigid interconnection between the motor and pump units. Thus, by means of the present invention the usual intermediate casting or separate connection structure has been completely eliminated so as to simplify the final structure and materially reduce the cost thereof.

Although the invention has been described with reference to a particular structural embodiment thereof, it is to be understood that various modifications and equivalent structures may be resorted to without departing from the scope of the invention as defined in the appended claims.

I claim:

1. In combination, a motor unit, a pump unit, an outer casing around one of said units and disposed in end-to-end relation with the other of said units, said casing being provided with a plurality of inlet openings for admitting fluid to the pump unit, a plurality of mounting tabs folded from the metal taken from said opening and integral with said casing and extending radially inwardly from the edges of said inlet openings, and fastener means securing said tabs to said other unit for rigidly interconnecting the motor and pump units.

2. In combination, an elongated pump unit having an outer tubular casing with a fluid inlet at one end thereof, an elongated motor unit disposed in end-to-end relation with said pump unit at the inlet end of the latter, said casing having a plurality of circumferentially spaced openings through the wall thereof for admitting fluid to the inlet of the pump unit, a plurality of radially extending retainer lugs folded inwardly in forming said openings and located at the lower edges of said openings, and fastener means extending through said lugs into said motor unit for rigidly interconnecting said pump and motor units.

3. In combination, a motor unit having at one end thereof a reduced diameter end portion defining a radial shoulder, a pump unit having a tubular outer casing with one end thereof fitted telescopically around said reduced diameter end portion of the motor unit and abutting said shoulder, said casing being provided adjacent said one end thereof with a plurality of inlet openings for admitting fluid to the pump unit, a plurality of integral mounting tabs formed from the metal taken from said openings and folded radially inwardly from said casing at the edges of said openings and closely overlying the axial end of said one end portion of the motor unit, and fastener means securing said tabs to said one end portion of the motor unit for rigidly interconnecting the motor and pump units in end-to-end relation.

4. In combination, a motor unit having a motor shaft projecting from one end thereof, a pump unit having an outer tubular casing, pump means in said casing with a fluid inlet at one end of the casing, a pump shaft extending from the pump means at said inlet, said casing having an extended portion projecting beyond said pump means at the inlet end thereof and surrounding said pump shaft, means within said extended portion of said casing providing a driving connection between said shafts, a stationary shield surrounding said connection, said extended portion of the casing also having a plurality of circumferentially spaced openings in the wall thereof for admitting fluid to the inlet of said pump means, a plurality of mounting lugs extending radially inwardly from said openings and coacting with the casing at said openings, and fastener means coacting between said lugs and said one end of said motor unit for rigidly interconnecting the motor and pump units, said shield having a portion thereof interposed between said lugs and said one end of the motor unit whereby said shield is also retained in place by said fastener means.

5. In combination, a motor unit having an end portion, a pump unit having an outer tubular casing and pump means disposed therein with a fluid inlet at one end thereof, said casing having an extended portion extending beyond the inlet end of said pump means and in end-to-end relation with said end portion of the motor unit, means comprising a plurality of inwardly depressed wall portions in said extended portion of the casing for engaging and supporting said pump means at the inlet end thereof whereby to support said pump means in the casing, said extended portion of the casing also having a plurality of openings in the wall thereof for admitting fluid to the inlet of the pump means, a plurality of mounting lugs extending inwardly from the edges of said openings, and fastener means securing said lugs to said end portion of the motor unit for rigidly interconnecting said motor and pump units.

6. The combination of claim 5 further characterized in that said inwardly depressed wall portions and said openings are alternated in circumferentially spaced relation around said extended portion of the casing.

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