July 18, 1933. J. W. W. DRYSDALE ET AL 1,919,097

ELECTRICALLY DRIVEN ROTARY PUMP

Filed July 30, 1931 7 Sheets-Sheet 1

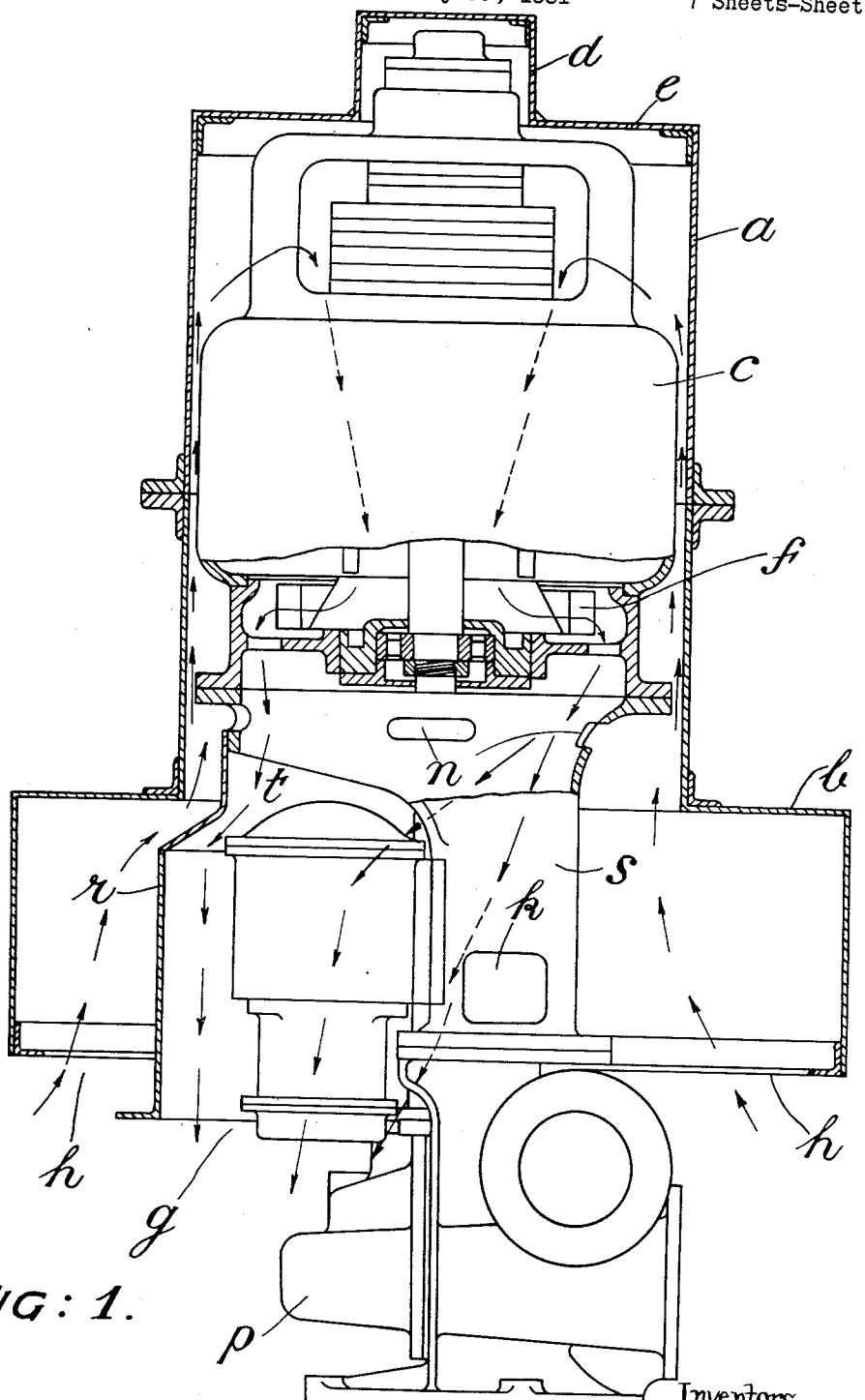


FIG: 1.

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Filed July 30, 1931 7 Sheets-Sheet 2

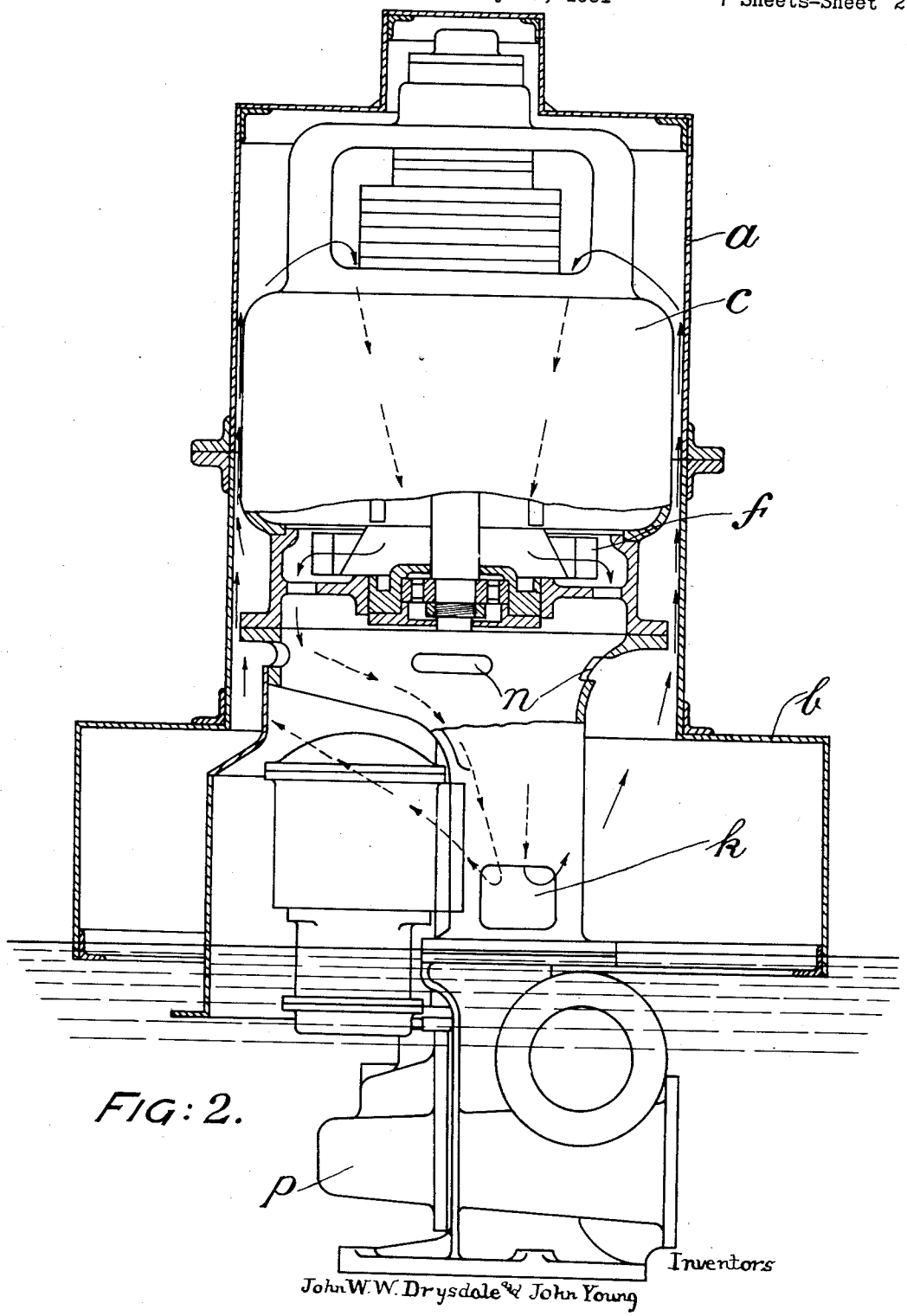


FIG: 2.

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ELECTRICALLY DRIVEN ROTARY PUMP

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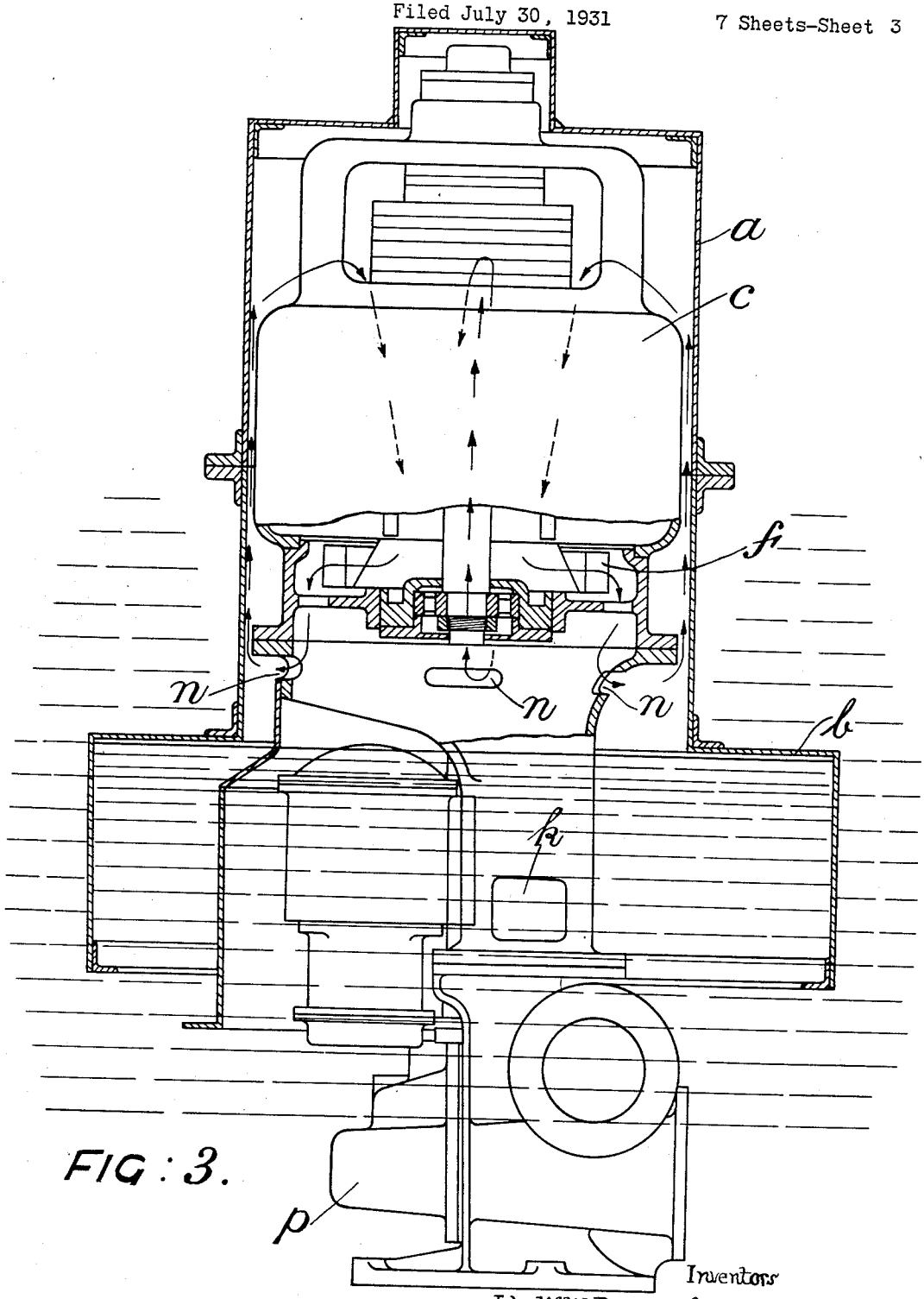


FIG: 3.

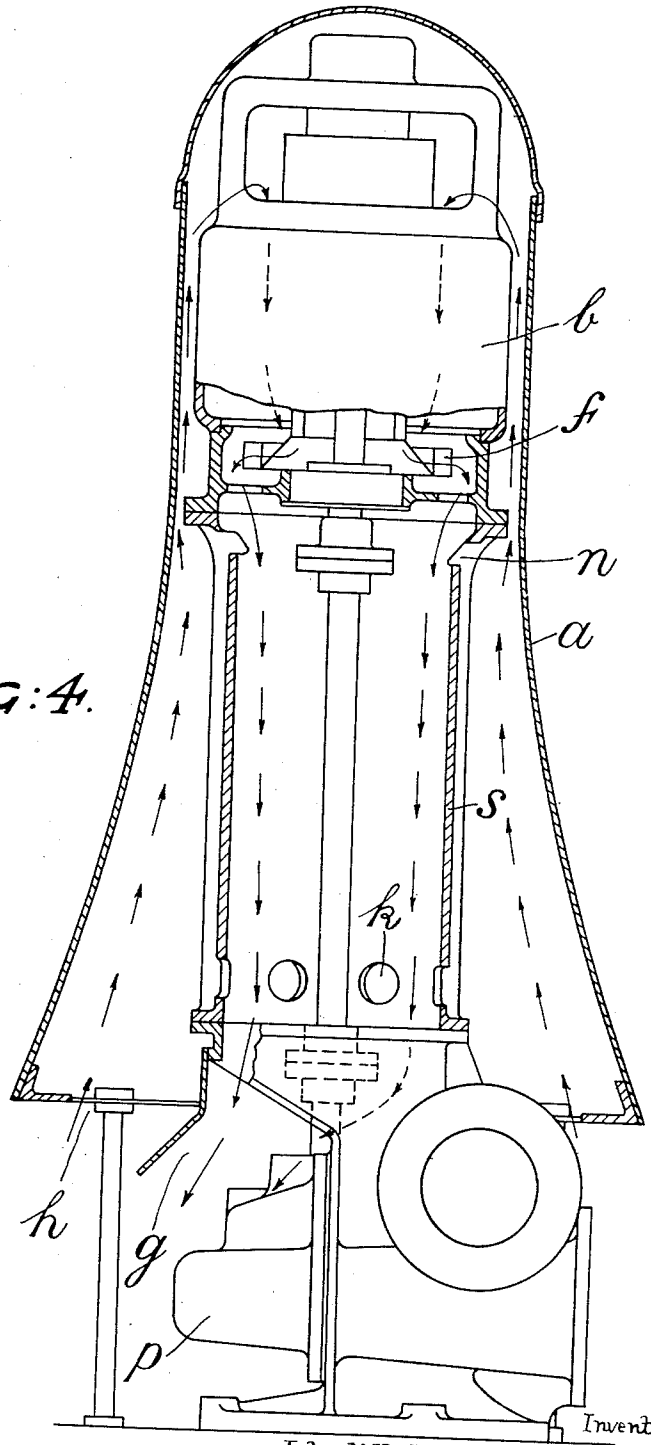
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ELECTRICALLY DRIVEN ROTARY PUMP

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FIG: 4.



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ELECTRICALLY DRIVEN ROTARY PUMP

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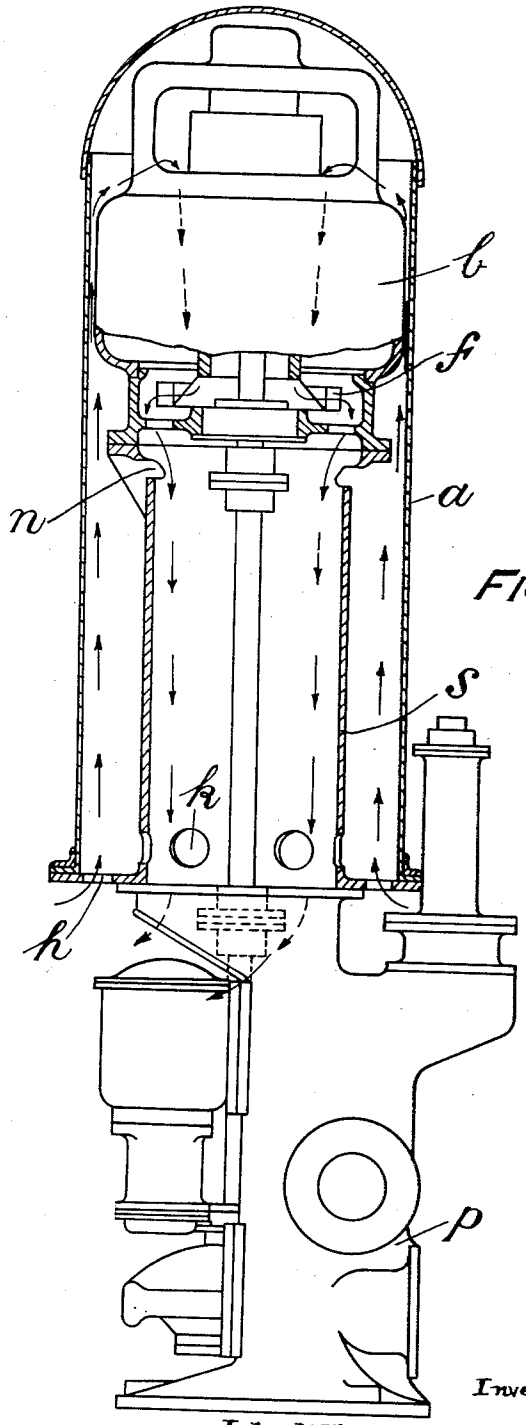


FIG: 5.

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ELECTRICALLY DRIVEN ROTARY PUMP

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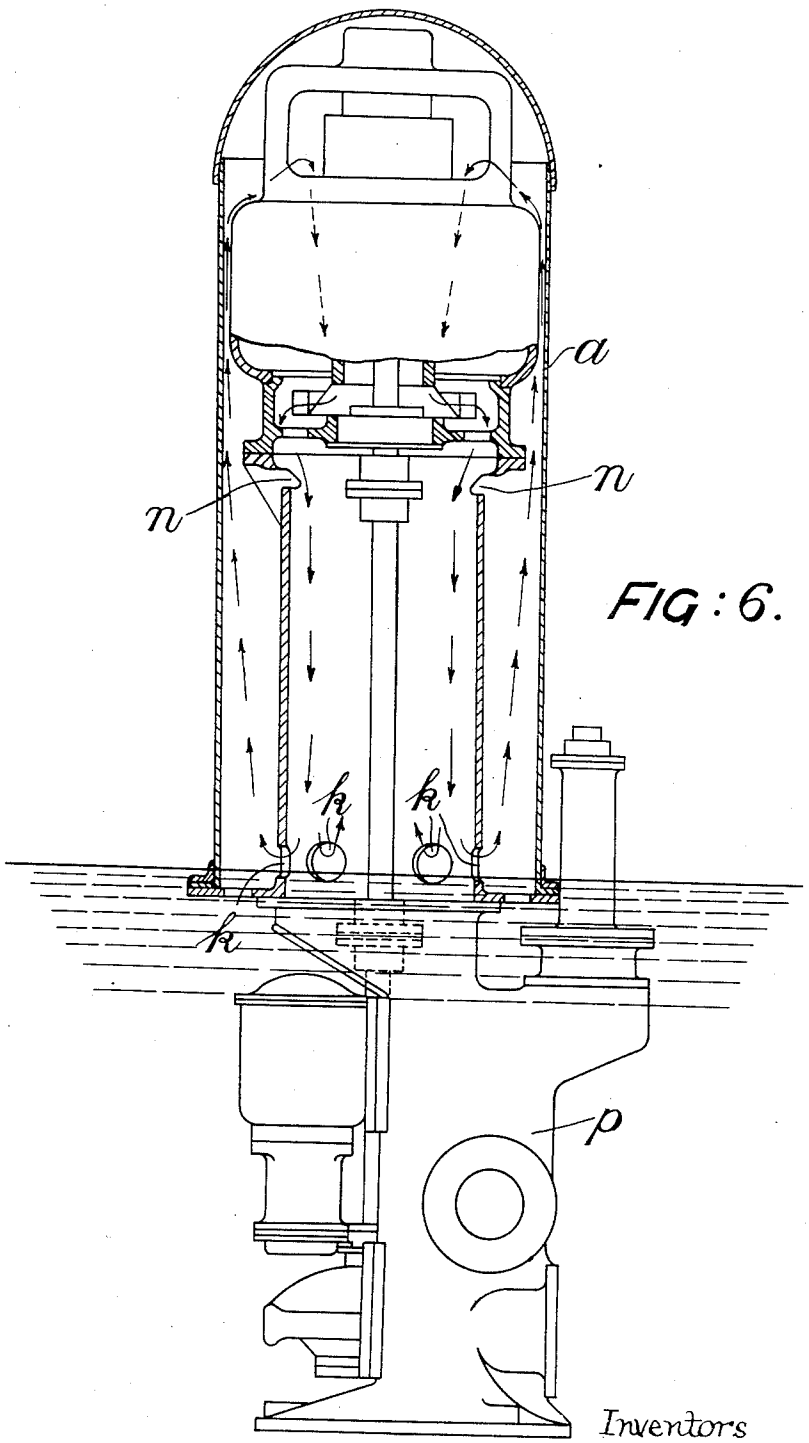


FIG: 6.

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ELECTRICALLY DRIVEN ROTARY PUMP

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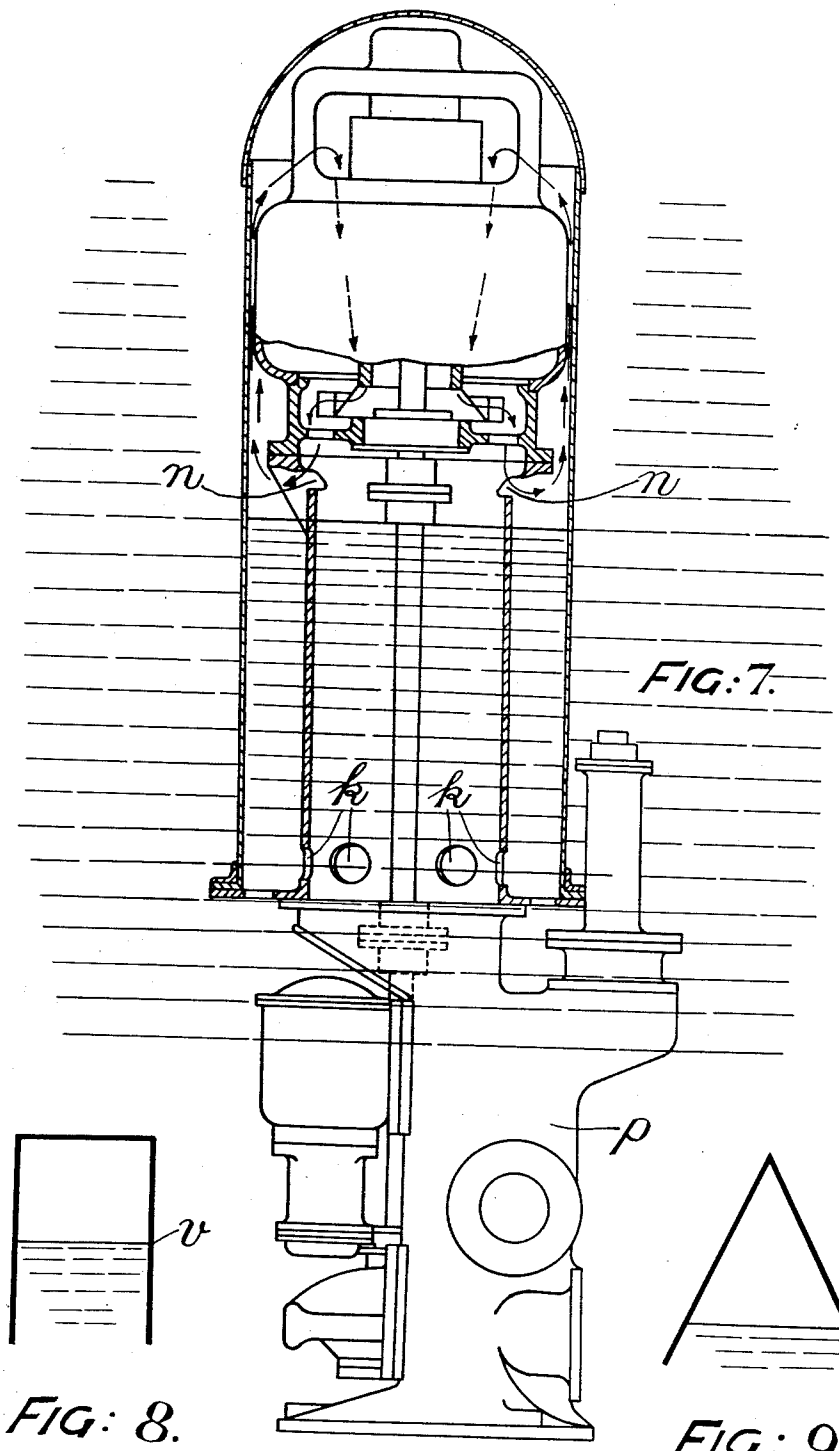


FIG: 7.

FIG: 8.

FIG: 9.

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UNITED STATES PATENT OFFICE

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ELECTRICALLY-DRIVEN ROTARY PUMP

Application filed July 30, 1931, Serial No. 554,118, and in Great Britain May 27, 1931.

This invention relates to pump units of the submersible air bell type as covered by our Patent No. 138,753. Such pump units comprise a rotary pump with vertical axis of rotation, an electric motor arranged above the pump and driving it, and a casing or bell which envelopes the motor. This casing or bell is open at the bottom but is otherwise completely closed. When the pump is submerged, the air in the bell is compressed. The water rises in the bell but not to the same height as the water level outside the bell—due to the air pressure within the bell. The bell is carried down sufficiently far below the motor to ensure that, when the pump is submerged to the maximum depth for which it is designed or intended, the water level within the bell will be below the bottom of the motor or such parts of the motor as are liable to be damaged by submergence.

With pumps of this type as heretofore constructed there has not been, as far as we are aware, circulation, or adequate circulation, of air within the bell when the unit is submerged even when only in a lip-sealed condition. (By a lip-sealed condition is meant that the water level is just above the lower edge of the bell, thus isolating the interior of the bell.)

The construction according to the present invention provides for adequate circulation of air within the bell not only when the unit is unsubmerged but also when it is submerged to any extent from the lip-sealed condition to the maximum.

Further, with pumps of the type in question as heretofore constructed, as far as we are aware, the bell has been of cylindrical shape, that is, of uniform diameter. With submergence the pressure rises in the bell as the air within it is compressed, the pressure varying inversely as the volume as is well known.

By reducing the dimensions of the bell in the upper portion—which represents the ultimate container of the air—or increasing the dimensions in the lower part and so increasing the amount of imprisoned air, it results that, when the bell is submerged to the maximum, a greater air pressure is obtained for a given submergence. This is of great advantage as allowing of a greater submergence for a given depth of bell, or permitting of a less depth of bell for a given submergence.

According to the present invention the bell is made with increased diameter or increased lateral dimensions at the lower end, with the consequence that the requisite volume of contained air is obtained with a reduced height of bell. According to the present invention moreover the bell is made to conform as far as possible to the shape of the enclosed parts especially at the top, thus reducing the volume at the upper part of the bell.

The invention will be made clear by examples of construction and will be set forth definitely in the claim.

Of the accompanying drawings Figs. 1 to 7 illustrate the carrying of the invention into effect with various forms of pump. Figs. 8 and 9 are diagrammatic: they have relation to air pressures and volumes.

Figs. 1, 2, and 3 illustrate a construction of pump according to the invention and formed with an enlarged lower end of bell. The arrows illustrate the air circulation. Fig. 1 shows the circulation when the pump is running in open air, that is, non-submerged. Fig. 2 illustrates the circulation when the unit is running lipsealed. Fig. 3 illustrates the same when the unit is running under maximum submersion.

a is the bell. It is formed with an enlarged lower portion *b*. This lower part may be circular, square, rectangular, elliptical, or otherwise shaped as may be found convenient.

c is the electric motor. The bell fits closely round the motor. It will be noticed that the bell is formed at the top with a shoulder *e* and head-piece *d*, the object being to reduce the air volume at the top of the bell. *p* is the pump and *s* is a stool bolted to the pump and supporting the electric motor. *f* is the fan. It is on the electric motor spindle.

It will be seen that in the non-submerged position the circulation involves the complete discharge of the air, viz. at *g*. To obtain this discharge the stool is provided with a large opening *t* and a deflector plate *r*. Fresh cold air is admitted at *h* between the stool and the bell.

When the unit is running lipsealed as shown in Fig. 2, fresh air of course cannot be drawn in. The circulation involves the passing of the air through the ports *k* of which there are two, one on each side of the stool *s*.

When the unit is lipsealed by lowering the ports *k* are covered, the circulation is as shown in Fig. 3, the air passing through the ports of which there are four.

Fig. 4 shows the construction of unit with a conoidal bell. Circulation, shown by the arrows, is that which takes place when the unit is non-submerged.

Fig. 5 shows the circulation now submerged with a unit having a cylindrical bell with a [illegible]

Fig. 6 shows the circulation with the same unit lipsealed, the air passing through [illegible] of which there are six.

Fig. 7 shows the same unit and indicates the [illegible] conditions of maximum [illegible] the air passing through the ports [illegible] there are four.

[illegible] construction) more than [illegible] ports (such as *k*, *h*)

[illegible] the advantage of increasing [illegible] of the bell at the lower [illegible] of reducing the dimensions as far as [illegible] at the upper end the change in volume [illegible] 8 and 9 are supplied. Fig. 8 shows a [illegible] and Fig. 9 a conical bell of [illegible] 50 per cent greater [illegible] Fig. 8, when the water is [illegible] to the point *c*, which is half way up the bell, the volume of enclosed air is reduced to one-half and the pressure of the air is doubled. In Fig. 9, in order to get the same reduction in volume (to a half) and the same doubled air pressure, it is necessary for the water level in the pump to rise only to the point *a* which is 0.206 of the height of the bell.

Having thus described the invention [illegible] we claim as new and desire to secure by Letters Patent is:—

A submersible, motor driven pump unit comprising a pump having a casing, a hollow stool upstanding from said casing, a motor surrounding said stool and having provision for passage of air therethrough and to [illegible] of said stool, a bell enclosing said motor and stool, said bell separated from [illegible] stool by an interspace open to the atmosphere at its lower end when the unit is submerged, the lateral dimensions of said bell being increased below said motor [illegible] ished above said motor, and a fan [illegible] with said motor, causing air to flow [illegible] through said interspace and [illegible] through said motor and thence [illegible] from said motor into the interior of said stool, said stool having an opening [illegible] to permit downwardly directed [illegible] air into the atmosphere below the [illegible] of said bell without causing said [illegible] when the unit is submerged, said [illegible] ing member with ports disposed above the lowermost of said bell and above said [illegible] said pump affording communication [illegible] the interior of said stool and said [illegible] permitting circulation of air to and [illegible] cuit through said interspace, motor and [illegible] when the unit is submerged.

JOHN WHITTAKER MOTOR [illegible]

JOHN YOUNG.