

June 2, 1936.

W. L. FORWARD

2,042,933

DRILLED WELL PUMP AND VENTURI METER

Filed Nov. 4, 1935

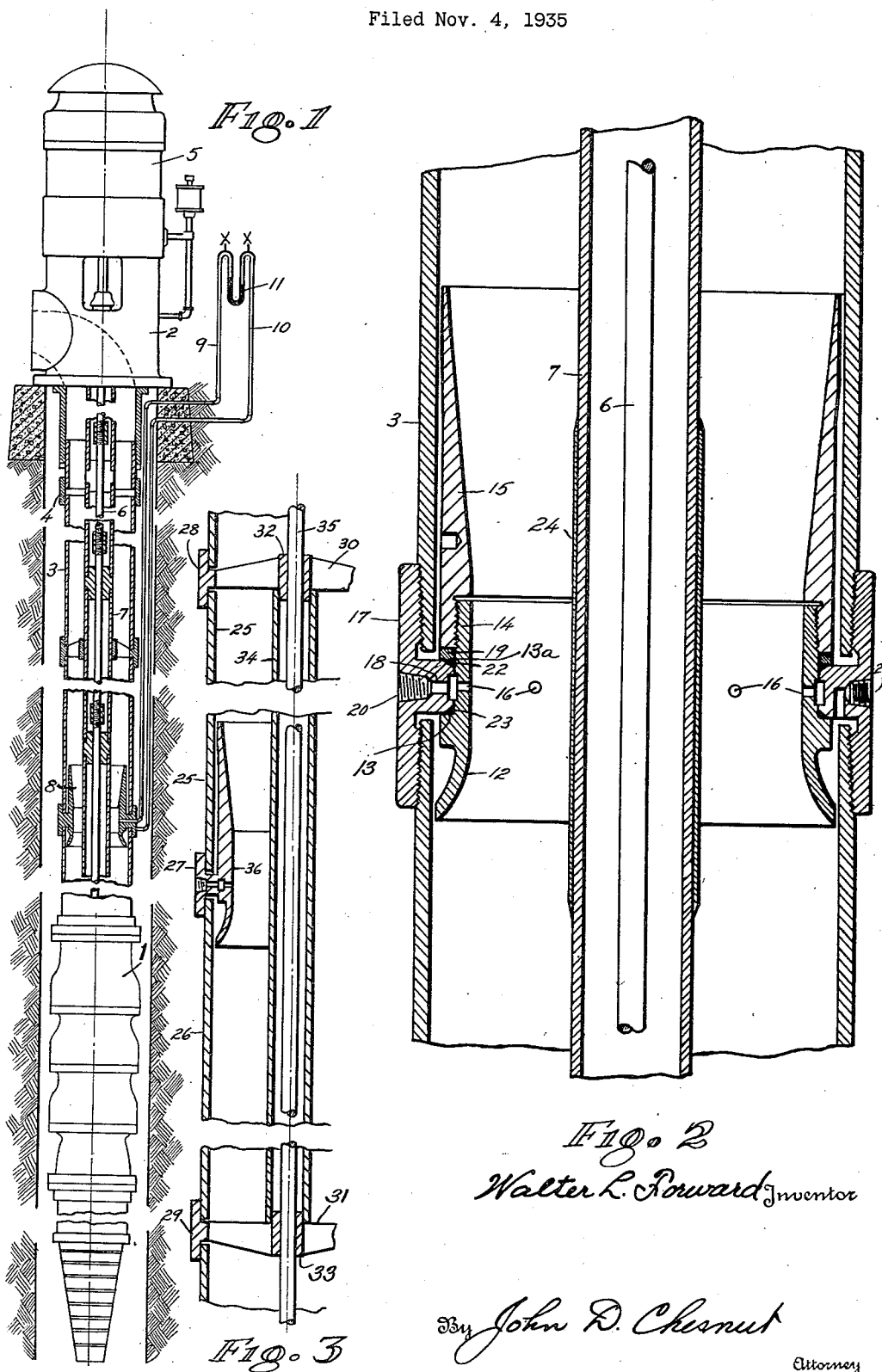


Fig. 2
Walter L. Forward Inventor

By John D. Chesnut

Attorney

UNITED STATES PATENT OFFICE

2,042,933

DRILLED-WELL PUMP AND VENTURI
METER

Walter L. Forward, Oakland, Calif., assignor to
Byron Jackson Co., Huntington Park, Calif., a
corporation of Delaware

Application November 4, 1935, Serial No. 48,106

6 Claims. (Cl. 73-198)

My invention relates to rotary or centrifugal pumps for drilled wells, and relates particularly to means for measuring the fluid flow from such pumps.

Heretofore it has been the custom to measure the fluid output of drilled-well centrifugal pumps by means of an auxiliary metering device of some kind applied to the discharge pipe beyond the pump head. Such devices as have been used heretofore are cumbersome to handle, require excessive space for installation (where space is usually at a premium), require expert knowledge for use and in many instances are subject to interference from solids (such as sand) in suspension in the water.

The object of the present invention is to provide a simple and inexpensive means for measuring the fluid flow from drilled-well centrifugal pumps.

A further object is to provide a Venturi meter located in the pump column.

Another object is to provide means for preventing the pump shaft from affecting the meter reading.

Another object is to provide a construction whereby the Venturi tube is a part of a coupling adapted to connect adjacent sections of pipe column.

Other objects and advantages will appear from the following description and drawing wherein:

Figure 1 is a diagrammatic view, partly in cross section, of a well casing containing my invention.

Figure 2 is a cross sectional elevation of one form of my invention as applied to a well having inner and outer pipe columns.

Figure 3 is a cross sectional elevation of another form of my invention as applied to a well casing having no inner column.

Referring to Figure 1 of the drawing, a typical drilled-well centrifugal pump is indicated at 1 connected to a pump head 2 by means of the usual pipe column 3 which is made up of a number of pipe sections connected together by pipe couplings 4. The pump is driven by a motor 5 through the shaft 6. The shaft 6 is enclosed in an inner pipe column or casing 7 made up of a number of sections of pipe connected together. The inner casing 7 carries the shaft bearings and is filled with lubricating oil. The fluid pumped by the pump 1 passes upwardly through the column 3 and around the inner casing 7 and is discharged through the pump head 2. At a suitable point in the outer column 3 at least twenty column diameters above the pump 1 and

below the pump head 2 I insert my Venturi meter 8. Pressure conduits 9 and 10 lead from the Venturi throat tap and the Venturi approach tap, respectively, to a point adjacent the pump head where they are connected to a suitable manometer or pressure gauge 11.

Figure 2 shows a detailed view in fragmentary cross sectional elevation, of the Venturi meter 8 as used in a well having an inner casing 7 as shown in Figure 1. The outer column is indicated at 3, the inner casing at 7 and the pump shaft at 6. The Venturi tube is shown at 12 and consists of a tubular member having an outer diameter slightly smaller than the inside diameter of the outer column 3 so as to fit loosely therein. The inner surface of the tubular member 12 conforms to the usual contour of a Venturi tube. The Venturi tube 12 is provided near its down-stream end with an external, annular shoulder 13. The upper end of the tube 12 is threaded externally as shown at 14 to receive the threaded end of the tapered discharge nozzle 15 (which may or may not be used), and the threaded lock ring 19. The Venturi tube is provided with a throat tap 16 between the shoulders 13 and 13A. To secure the Venturi tube in place in the outer column 3 I provide a special pipe coupling 17 threaded at both ends to engage the threads of the outer column sections 3. The coupling 17 is provided near its middle section 30 with an inwardly extending annular rib 18 adapted to fit between the shoulder 13 and the lock ring 19. Coupling 17 is also provided with a pair of pipe taps 20 and 21. The tap 20 communicates the throat tap 16 with the exterior of the coupling, while the tap 21 communicates the space below rib 18 with the exterior of the coupling. The Venturi tube is assembled in the column 3 by first inserting the tube 12 in the coupling 17 so that the rib 18 rests upon the shoulder 13. The lock ring 19 is then screwed against rib 18 to lock the tube to the coupling. If the nozzle 15 is used, it is screwed on the Venturi tube 12 before the latter is inserted in the column. Flexible packing rings 22 and 23 are provided to make a tight seal between the shoulder 13 and rib 18 and between the ring 19 and rib 18. The coupling 17 is then screwed onto the lower column section 3, and then the upper column section 3 is screwed into the upper end of the coupling 17. This construction and assembly results in the throat tap 16 communicating with the pipe tap 20 while the approach tap 21 communicates with the space below the Venturi tube. The pipe taps 20 and 21 are con-

nected by suitable conduits (9 and 10 in Figure 1) to the pressure gauge 11 at the top of the well.

It will be noted that the pump shaft 6 passes through the center of Venturi tube 12. The inner casing 7 encloses the shaft 6 and prevents the rotation of the shaft and the viscosity of the fluid being pumped from affecting the meter reading. Because the inner casing is usually made of iron pipe which may rust or become pitted, I prefer to encase the inner casing in a thin sleeve 24 of brass or other non-corroding metal. The sleeve 24 is approximately as long as the Venturi tube.

Figure 3 shows a form of Venturi meter for use in wells which do not have an inner casing as shown at 7 in Figures 1 and 2. Two sections of outer column are indicated at 25 and 26, connected together by a special coupling 27 similar to coupling 17. The pump shaft is shown at 35. The columns 25 and 26 are connected at their ends to adjacent sections of column by means of couplings 28 and 29. These couplings 28 and 29 are provided with spiders 30 and 31 containing shaft bearings 32 and 33. Supported between the spiders 30 and 31 is a tubular casing 34 surrounding but spaced from the shaft 35. The column section 25 is approximately one-half the length of column section 26 so that the Venturi tube 36 (which is supported from the special coupling 27 as shown in Fig. 2) is located about two thirds of the distance up the casing 34. This location is desirable because the disturbance to flow caused by the upstream spider 30 is less harmful to the meter accuracy than the disturbance caused by the downstream spider 31.

Although it would be possible to omit the casing 34 from the arrangement shown in Fig. 3, I prefer to employ a stationary inner casing because otherwise it would be necessary to provide different meter calibrations for the closed and open type of columns (Figs. 2 and 3) and for different rates of shaft revolution.

I claim:

1. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a Venturi tube interposed in the column between the ends thereof and provided with pressure taps, a pressure-responsive indicator located at the top of the well and pressure conduits communicating the indicator with the taps in the Venturi tube.

2. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a Venturi tube interposed in the column between the ends thereof and provided with pressure taps, a stationary inner casing enclosing the pump shaft and extending through the Venturi tube, a pressure responsive indicator located at the top of the well and pressure conduits com-

municating the indicator with the pressure taps in the Venturi tube.

3. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a coupling connecting adjacent sections of the column, a Venturi tube positioned within said coupling, pressure taps in said coupling communicating with the throat and the approach to said Venturi tube, a pressure responsive indicator located at the top of the well and pressure conduits communicating said pressure taps with said indicator.

4. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a coupling connecting adjacent sections of said column, a Venturi tube positioned within said coupling, a stationary inner casing positioned within said column enclosing said pump shaft and extending through the length of said Venturi tube, pressure taps in said coupling communicating with the throat and the approach to said Venturi tube, a pressure responsive indicator located at the top of the well and pressure conduits communicating said pressure taps with said indicator.

5. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a coupling connecting adjacent sections of said column, a Venturi tube positioned within said coupling and surrounding said shaft, means for detachably connecting said Venturi tube to said coupling in sealing engagement therewith, pressure taps in said coupling communicating with the throat and the approach to said Venturi tube, a pressure responsive indicator located at the top of the well and pressure conduits communicating the indicator with the taps in said Venturi tube.

6. In combination with the column of a drilled-well pump having a rotary pump shaft extending through the length of the column and a pump connected to the shaft at the lower end thereof, a coupling connecting adjacent sections of said column, an annular radially inwardly extending rib formed on said coupling, a Venturi tube adapted to be positioned within said coupling and to surround said shaft, an annular radially outwardly extending rib formed on said Venturi tube adapted to seat on the rib in said coupling, threaded means for securing said Venturi tube to said coupling in sealing relation thereto, pressure taps in said coupling communicating with the throat and the approach to said Venturi tube, a pressure responsive indicator located at the top of the well and pressure conduits communicating said indicator with said taps.

WALTER L. FORWARD.