

Jan. 7, 1941.

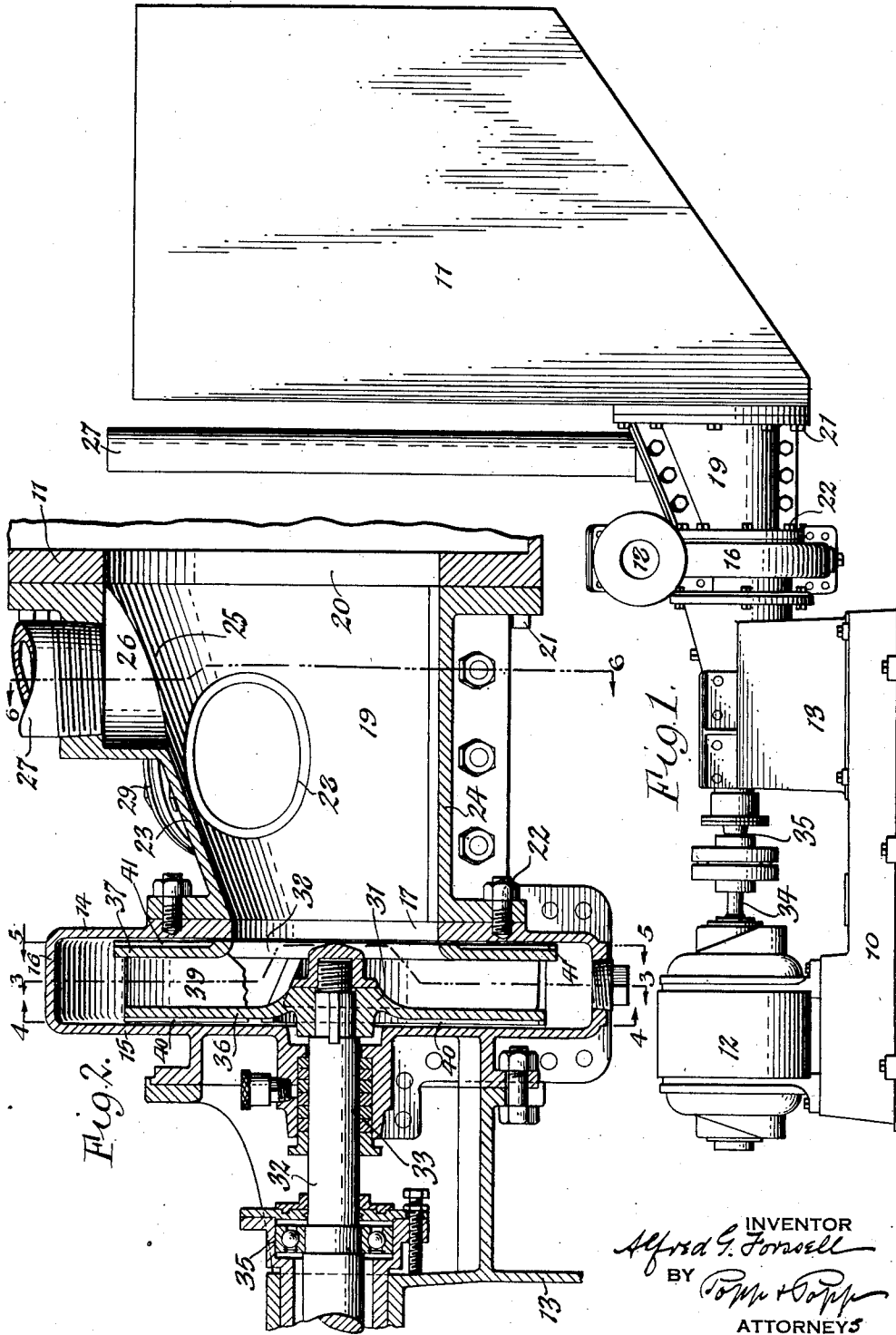
A. G. FORSSELL

2,228,207

CENTRIFUGAL PUMP

Filed Dec. 2, 1939

3 Sheets-Sheet 1



Jan. 7, 1941.

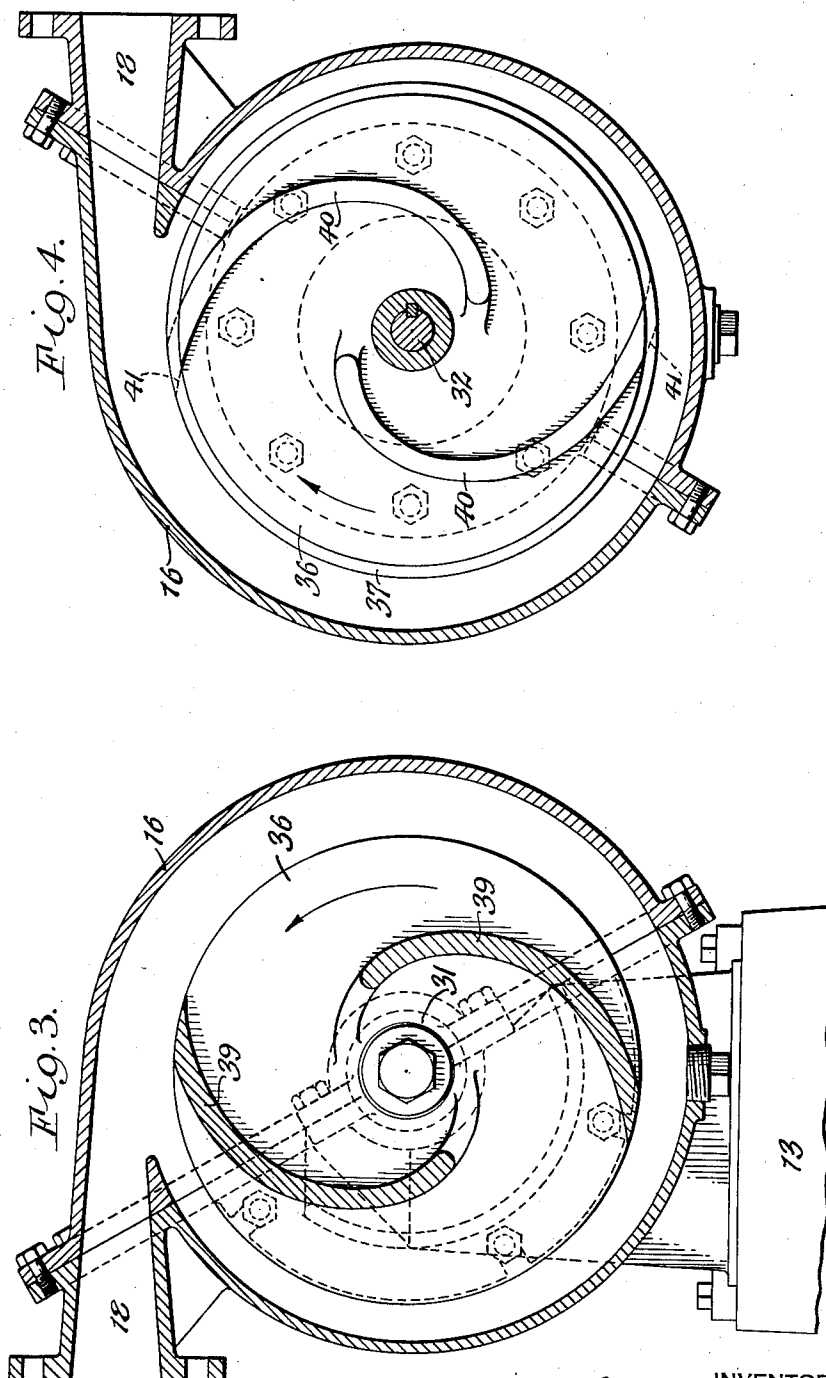
A. G. FORSELL

2,228,207

CENTRIFUGAL PUMP

Filed Dec. 2, 1939

3 Sheets-Sheet 2



INVENTOR
Alfred G. Forsell
BY *Popp & Popp*
ATTORNEYS

Jan. 7, 1941.

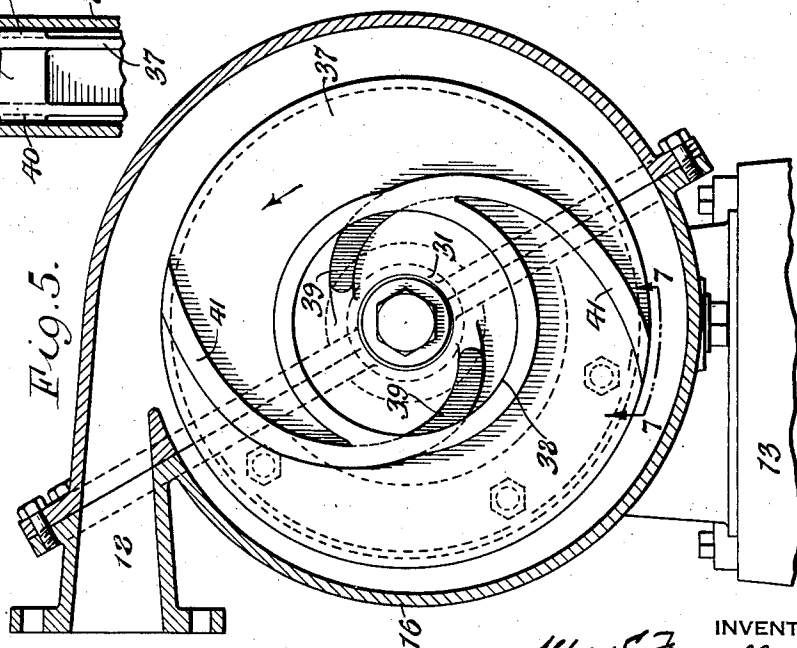
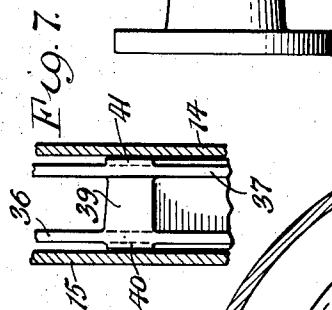
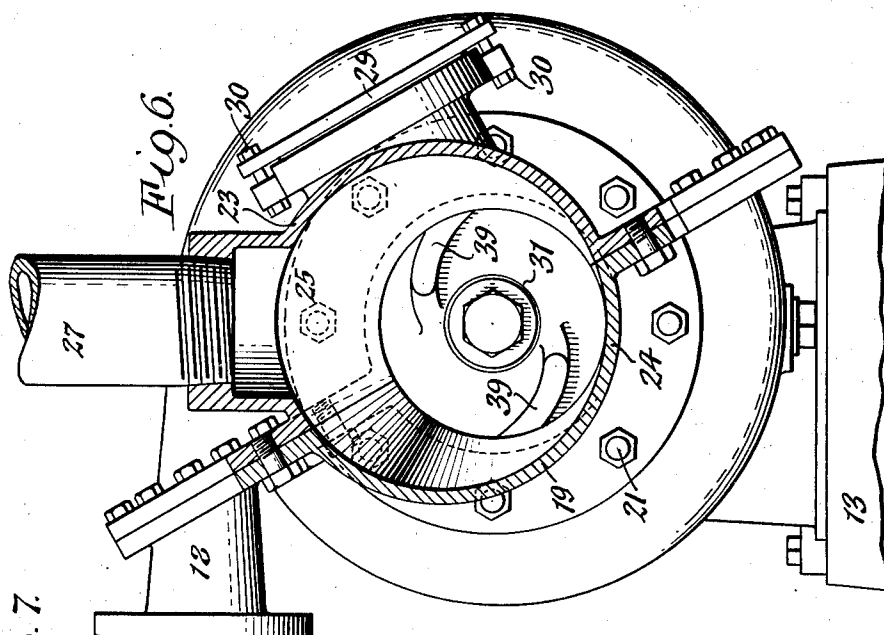
A. G. FORSELL

2,228,207

CENTRIFUGAL PUMP

Filed Dec. 2, 1939

3 Sheets-Sheet 3



INVENTOR
Alpha S. Forsell
BY *Tom Ropp*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,228,207

CENTRIFUGAL PUMP

Alfred G. Forssell, Baldwinsville, N. Y., assignor
to Morris Machine Works, Baldwinsville, N. Y.,
a corporation of New York

Application December 2, 1939, Serial No. 307,297

2 Claims. (Cl. 103—103)

This invention relates to a centrifugal pump of the type which includes a circular casing having an axial inlet for the material to be pumped and a peripheral outlet for the same, and a rotary impeller or runner arranged in the casing and adapted to suck the material through said inlet into the casing and discharge the same through the outlet thereof.

In pumps of this type as heretofore constructed any air contained in the liquid, sludge or the like which was being pumped would remain associated with the liquid while passing through the pump, thereby producing an irregular action due to the liquid being practically non-compressible while the air is compressed by the pump and expands when discharged therefrom.

In prior pumps of this character liquid could freely enter the spaces between the outer sides of the shrouds and the inner sides of the front and rear walls of the casing and thereby not only produce an unequal pressure against these walls but also interfere with securing the most uniform and efficient operation of the pump.

The object of this invention is to provide a pump of this character whereby the above mentioned difficulties are overcome by means which are simple in construction, efficient in operation and do not appreciably increase the cost of the pump.

In the accompanying drawings:

Fig. 1 is a side elevation of a centrifugal pump embodying these improvements.

Fig. 2 is a vertical longitudinal section, on an enlarged scale, of the casing and intake part of the pump.

Figs. 3, 4, 5 and 6 are vertical transverse sections of the pump taken on the correspondingly numbered lines in Fig. 2.

Fig. 7 is a fragmentary longitudinal section taken on line 7—7, Fig. 5.

In the following description similar reference characters indicate like parts in the several figures of the drawings:

The numeral 10 represents the main frame of the pump which may be of any suitable construction, 11 the tank containing the liquid, sludge or like material which is to be handled and 12 a motor for driving the pump and mounted on the rear part of the main frame. This motor in the present instance is of the electric type but any other kind of prime mover may be employed. On its front part the main frame is provided with a standard 13 and on this is mounted the pump which contains the present invention and which is constructed as follows:

In its general construction this pump comprises a casing, an impeller or runner rotatable in the casing and an intake whereby the liquid to be pumped is conducted from the tank to the casing of the pump.

The casing of the pump is generally of volute form and comprises a vertical front side wall 14, a vertical rear side wall 15 and a circumferential wall 16 connecting the outer edges of the front and rear walls. This casing is mounted on the standard and provided centrally in its front wall with an inlet eye or opening 17 through which the material to be pumped is introduced into the casing and provided on its periphery with a tangential outlet or delivery pipe 18 through which this material is discharged from the casing.

The material to be pumped is conducted from the lower end of the supply tank 11 to the pump casing by a tubular intake or suction pipe 19 which communicates at its front or inlet end with an outlet opening 20 on the lower part of one of the tank walls while its rear or outlet end communicates with the inlet 17 of the casing, the connection between this suction pipe and the tank and casing being effected by bolts 21, 22, as shown in Figs. 1 and 2.

It has been found in practice that any air which may be present in the material being pumped produces erratic or irregular action of the pump due to successively compressing and releasing the air during its passage through the pump and for this reason it is desirable to eliminate the air from the material on its way from the tank to the pump case. This is effected by tapering the intake or suction pipe 19 from its inlet end to its outlet end, as shown in Figs. 1 and 2 and also making this pipe of eccentric form in cross section so that the upper part 23 of its wall is arranged at greater distance from the axis of the casing inlet or eye 17 than the lower part 24 thereof, as shown in Figs. 2 and 6. By this means a pocket 25 is formed in the upper part of the suction pipe above the casing inlet 17 into which air contained in the material to be pumped can escape as it separates from this material during its passage through the suction pipe and thereby enabling the material to enter the pump casing with no appreciable amount of air, if any, being mixed therewith and thus avoiding the objectionable effects above mentioned.

Any air which is separated from the material to be pumped and enters the receiving pocket 25 is discharged to the outer atmosphere through a vent opening 26 in the high part of the upper wall of the suction or intake pipe which open-

ing is preferably connected with the lower end of a vent pipe 27 which has its upper end leading to the atmosphere and terminating on a line with or above the top of the material supply or storage tank 11 so that no material from the tank can overflow through the vent pipe in the event that the level of the material should rise in the latter.

The vent opening 26 is arranged above the top of the inlet eye 17 of the pump casing and is constantly open to the atmosphere so that air and gas bled off from the material as it passes through the suction pipe before this air or gas reaches the pump will be collected in this pocket and conducted to the atmosphere without requiring any valves for this purpose. For convenience in cleaning the inside of the intake or removing any rubbish therefrom the same is provided on one side with a hand hole 28 which is normally closed by a cover 29 removably attached to the intake pipe by bolts 30, as shown, or by any other appropriate means.

The impeller whereby the material is propelled through the pump casing from the inlet to the outlet thereof is constructed as follows:

The numeral 31 represents the hub of the propeller which is arranged centrally in the pump casing and axially in line with the inlet 17 of the same. This hub is secured to the front end of the driving shaft 32 whereby the impeller is rotated, this shaft extending through a stuffing box 33 on the rear wall of the pump casing and connected at its rear end with the shaft 34 of the motor 12 whereby the pump is driven. Intermediate of its ends the impeller driving shaft 32 is journaled by means of a suitable bearing 35 on the standard 13 of the frame, as shown in Fig. 2.

The numeral 36 represents a rear or hub shroud having the form of an imperforate disk which extends laterally from the rear part of the hub and along the inner side of the rear casing wall 15 and 37 represents a front or suction shroud of disk form which is arranged along the inner side of the front casing wall 14 and is provided with an eye or suction opening 38 which is axially in line with the inlet 17 of the casing and extends laterally from the eye or opening 38.

Between the shrouds a plurality of main vanes 39 are arranged which vanes are preferably of spiral or snail shape and formed integrally with the front and rear shrouds by casting the same of metal.

During the rotation of the impeller in the direction of the arrows in Figs. 3, 4 and 5 the material is drawn axially from the intake pipe through the inlet 17 into the casing and carried circumferentially within the casing by a main vane 39 and then discharged through the tangential outlet of the casing to the destination of the material.

It has been found by experience that, in the absence of any means to prevent it, some of the material which is being pumped flows backwardly into the spaces between the outer sides of the front and rear shrouds and the inner sides of the front and rear casing walls and thereby interferes with the working of the pump and reduces the efficiency of the same. To avoid this back flow of material the outer side of the rear shroud is provided with one or more long auxiliary rear vanes 40, preferably two, which extend radially outward from the hub of the impeller to the periphery of the rear shroud 36 and along the inner side of the rear casing wall

15, and the outer side of the front shroud is provided with one or more, preferably two, short auxiliary front vanes 41 which extend radially outward from the eye or opening 38 in the front shroud to the periphery thereof. The auxiliary vanes are preferably of the same snail shape as the corresponding main vanes and are arranged in the same planes as the corresponding main vanes and are also formed integrally with the shrouds and main vanes, as shown in Figs. 3-7, thereby forming a structure which is strong and durable and not liable to get out of order and can also be manufactured at low cost.

As the impeller rotates any liquid material in the spaces between the shrouds and the front and rear casing walls is thrown radially outward centrifugally by the front and rear auxiliary vanes and into the material which is propelled by the main vanes thereby preventing any dragging action on the impeller which otherwise occurs and instead enabling the latter to work with maximum efficiency and yield the greatest output for the amount of power consumed.

If the peripheral diameters of the front and rear shrouds were the same, the outward pressure against the rear shroud would be greater than the outward pressure against the front shroud owing to the greater area of the solid rear shroud and the greater length of the rear auxiliary vanes as compared with the area of the centrally perforated front shroud and the relatively short front auxiliary vanes, which unbalanced pressures would produce an undesirable distorting strain on the casing. To avoid this effect the front shroud is made of larger diameter than the rear shroud and the auxiliary vanes of the front shroud are correspondingly extended radially outwardly beyond the outer ends of the rear vanes, thereby compensating for the difference in area of the front and rear shrouds and causing the pressures between the shrouds and the front and rear casing walls to be uniform, or substantially so, in order to avoid the objectionable distortion mentioned. Moreover by making the suction or front shroud of larger diameter than the rear or hub shroud it is possible to increase the length of the front auxiliary vanes equivalent to the length of the main vanes and the rear auxiliary vanes and thereby provide pressures in the chambers or spaces between the shrouds and the casing which are equal to the pressure produced by the main vanes.

I claim as my invention:

1. A centrifugal pump comprising a circular casing having a horizontal inlet on its front side and a tangential outlet on its periphery, and an impeller which rotates in said casing on a horizontal axis and which includes a central hub arranged opposite said inlet, a rear annular shroud extending laterally from said hub and arranged along the rear wall of said casing, a front shroud arranged along the front wall of the casing and having a central opening which registers with the inlet of the casing, main vanes arranged between said shrouds, rear auxiliary vanes arranged on the outer side of the rear shroud, said rear shroud being imperforate and its auxiliary vanes extending from said hub to the periphery of this shroud, and front auxiliary vanes arranged on the outer side of and extending from the opening in the front shroud to the periphery of the same and said front shroud being of larger diameter than said rear shroud.

2. A centrifugal pump comprising a circular

5 casing having a horizontal inlet on its front side and a tangential outlet on its periphery, and an impeller which rotates in said casing on a horizontal axis and which includes a central hub arranged opposite said inlet, a rear annular shroud extending laterally from said hub and arranged along the rear wall of said casing, a front shroud arranged along the front wall of the casing and having a central opening which registers

with the inlet of the casing, main vanes arranged between said shrouds, rear auxiliary vanes arranged on the outer side of the rear shroud, and front auxiliary vanes arranged on the outer side of the front shroud and said front shroud and front vanes being of larger diameter than said rear shroud and rear vanes. 5

ALFRED G. FORSELL.