May 7, 1957 N. E. T. YGGE 2,791,183

IMPELLER FOR CENTRIFUGAL PUMPS

Filed Dec. 14, 1953 2 Sheets-Sheet 1

Fig. 1.

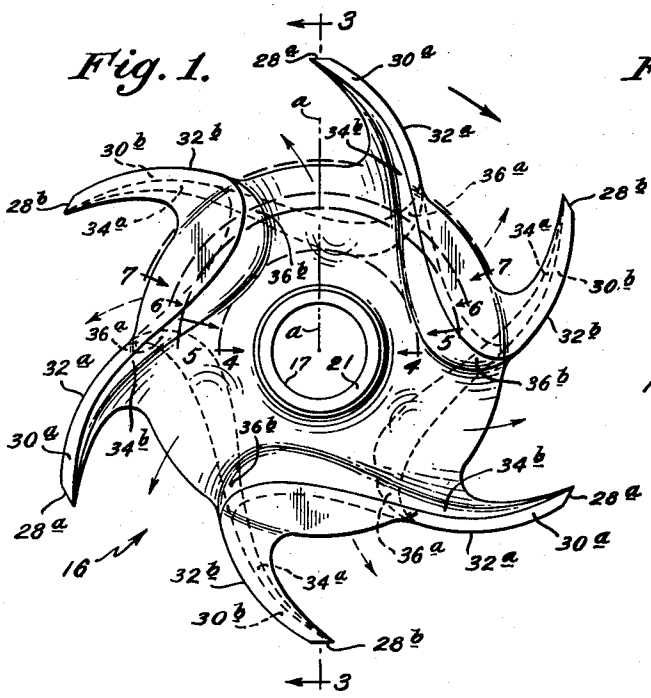


Fig. 2.

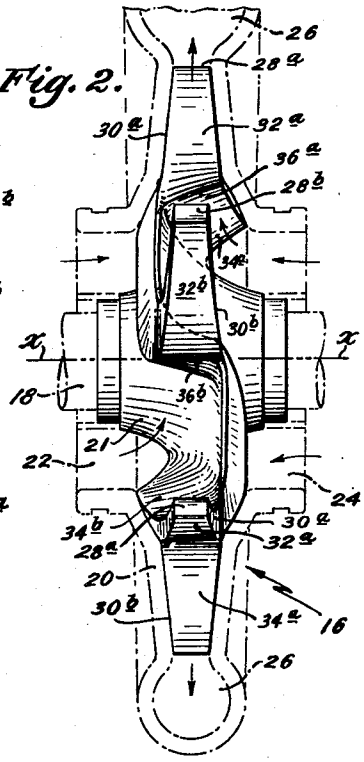


Fig. 3.

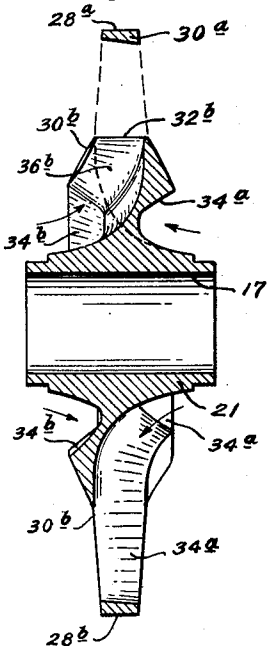


Fig. 7.

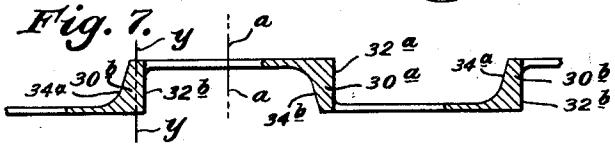


Fig. 6.

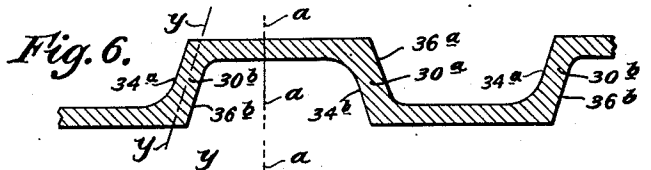


Fig. 5.

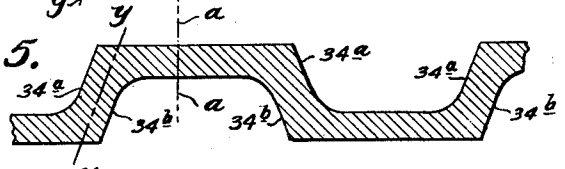
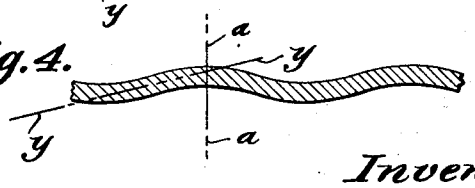


Fig. 4.



Inventor,
Nils Erik Torsten Ygge,
by A. R. Hulbert Atty.

May 7, 1957 N. E. T. YGGE 2,791,183

IMPELLER FOR CENTRIFUGAL PUMPS

Filed Dec. 14, 1953 2 Sheets-Sheet 2

Fig. 8.

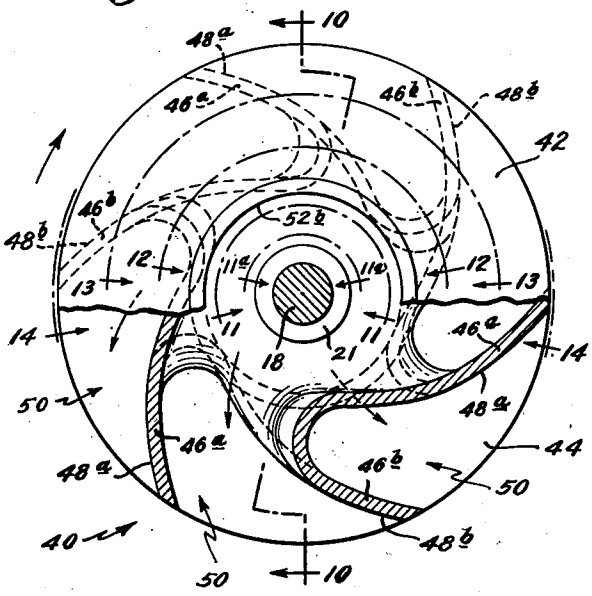


Fig. 9.

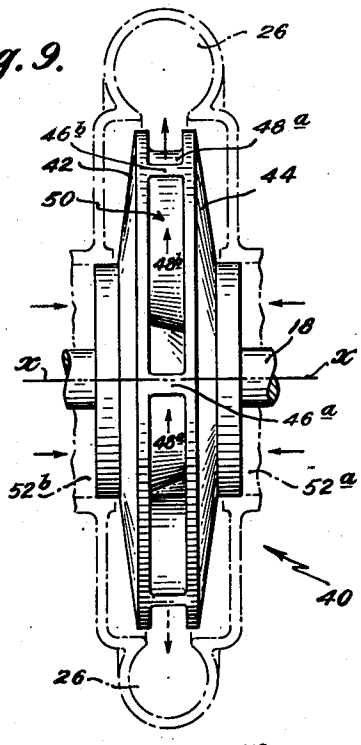


Fig. 14.

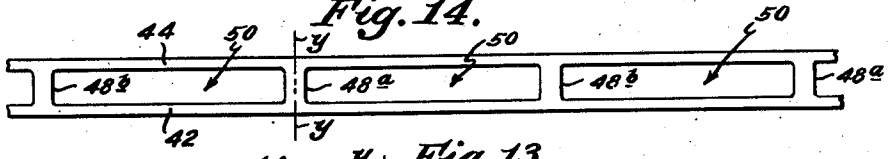


Fig. 13.

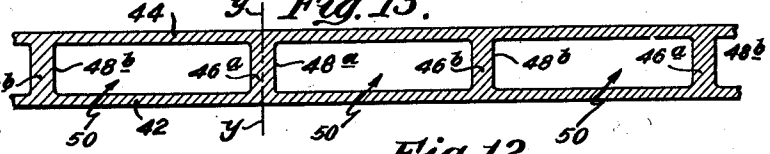


Fig. 10.

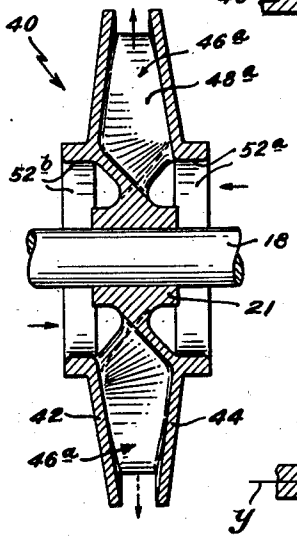


Fig. 12.

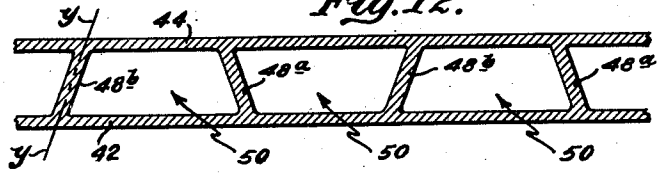


Fig. 11.

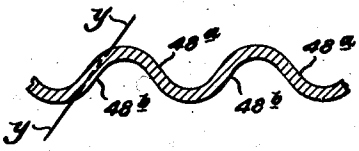
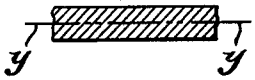


Fig. 11a



Inventor,
Nils Erik Torsten Ygge,
by Jr. A. Hulbert Atty.

United States Patent Office 2,791,183 Patented May 7, 1957

2,791,183

IMPELLER FOR CENTRIFUGAL PUMPS

Nils Erik Torsten Ygge, Gavle, Sweden, assignor to Aktiebolaget Skoglund & Olsson, Gavle, Sweden, a corporation of Sweden

Application December 14, 1953, Serial No. 398,134

Claims priority, application Sweden February 9, 1952

3 Claims. (Cl. 103—115)

The present invention relates to centrifugal pump impellers and is more particularly concerned with a new and improved double-suction impeller for centrifugal pumps for handling thick or viscous fluids or fluids containing foreign matter in suspension. The present application is a continuation in part of my pending application, Serial No. 335,183, filed February 5, 1953, now abandoned.

Clogless impellers for centrifugal pumps designed to handle thick or viscous fluids or fluids containing foreign matter in suspension, sewage pumps for example, are well known. They are called "clogless" owing to the fact that the danger of the pump becoming clogged will be reduced to a minimum.

In using such impellers, there may be drawbacks due to uneven balance because the outlet of the impeller is not active on more than half of its periphery and also because, in single suction impellers, a great axial thrust may arise since the impeller inlet is only from one side.

It is an object of the present invention to provide a new and improved centrifugal pump impeller completely overcoming the above mentioned drawbacks and yielding improved operation.

Another object of the invention is to provide a new and improved centrifugal pump impeller in which the fluid channels or passages are of optimum shape to promote fluid flow and to permit passage of solids.

A further object of the invention is to provide a new and improved impeller of the type described which may be readily cast, is economical of metal and rugged in construction.

A still further object of the invention is to provide a new and improved centrifugal pump impeller in which the channels will be readily accessible for cleaning purposes.

Still another object of the invention is to provide a new and improved impeller of the type described which may be either of the open or closed variety.

The invention is featured by the provision of a centrifugal pump impeller of the double-suction type in which the fluid passages or channels extend from both sides thereof to the circumference with an even number of vanes forming the channels. The channels are arranged in crossing pairs, with their outlets arranged in succession so that the whole periphery of the impeller is effective. The vanes are formed in such a way that their planes at the outlets are substantially parallel to the drive shaft and gradually turn over so as to be substantially at right angles to the drive shaft at the impeller hub, this turning of the planes of the vanes alternating in direction with every other vane.

Further objects, features and advantages of the invention will become apparent from the following detailed description and the accompanying drawings illustrating presently preferred embodiments thereof in which like numerals refer to like parts in the several views and in which:

Fig. 1 is a side elevation of an open double-ended impeller embodying the invention;

Fig. 2 is a right-hand elevational view of the same with portions of the housing in broken lines;

Fig. 3 is a vertical cross sectional view taken on line 3—3 of Fig. 1;

Figs. 4 through 6 are developed sectional views taken on the arcs 4 through 6 of Fig. 1;

Fig. 7 is a developed circumferential view around a portion of the perimeter of the impeller on arc 7—7 of Fig. 1;

Fig. 8 is a front elevational view of a modified form of impeller according to the invention having side walls with portions of one side wall broken away;

Fig. 9 is a right-hand elevational view of the same with portions of the impeller housing indicated by broken lines;

Fig. 10 is a generally vertical sectional view taken on line 10—10 of Fig. 8;

Figs. 11*a* and 11 through 13 are developed sectional views taken on arcs 11*a* and 11—13 Fig. 8; and

Fig. 14 is a developed circumferential view around a portion of the perimeter of the impeller taken along arc 14—14 of Fig. 8.

Turning to the embodiment of Figs. 1–7, an open type double-suction clogless impeller, according to the invention, is indicated generally by the numeral 16. The impeller 16 has an axial opening 17 to receive a drive shaft 18, shown in broken lines, to which it is keyed or otherwise suitably affixed to be driven thereby. The impeller may be mounted to revolve in a suitable housing 20, also shown in broken lines. The fluid to be pumped by the impeller is fed thereto near its hub 21 through inlets 22 and 24 formed in opposite sides of the casing 20. The casing has an outlet 26, also shown in broken lines, opposite the tips 28*a* and 28*b* of the impeller vanes 30*a* and 30*b*, all as best seen in Fig. 2.

In Figs. 1–7 an impeller having six vanes is illustrated. For convenience, referring to Fig. 2, those vanes whose inlet is on the right have been indicated by the numeral 30*a* and those whose inlet is on the left by the numeral 30*b* and other portions thereof in a similar manner. Each of the even number vanes 30*a* and 30*b* is formed with a driving surface 32*a* and 32*b* and a trailing surface 34*a* and 34*b*. Each driving or pumping surface 32*a* and 32*b* recurves gently as at 36*a* and 36*b* to form a curving or fluid diverter portion surface without sharp angles to prevent clogging. As shown by the developed sectional views, Figs. 4–6, and the developed circumferential view, Fig. 7, in every case the planes *y—y* of the vanes at the periphery of the impeller are substantially parallel to the axis of the drive shaft and gradually turn over so as to be substantially at right angles to the axis of the shaft near the hub of the impeller. This turning of the planes of the vanes is done alternately with every other vane in the opposite direction and perhaps is best seen in Figs. 4–7 wherein the plane of one of the vanes is denoted by the lines *y—y* and a plane through the axis *x—x* is indicated by the line *a—a*. The gently curving channels, formed by the vanes and adjacent walls of the casing, lead from the inlets on both sides of the impeller and pass to the periphery. With this arrangement it is evident that the impeller is effective over substantially its entire periphery and pulsing is thereby avoided.

With the construction illustrated, the vanes may be made as thin as in an ordinary centrifugal impeller. There is no wasting of metal as by heaping and no parts of the impeller are ineffective as in other clogless impellers.

In the form of the invention illustrated in Figs. 1–7, the impeller is of the open type. Thus the sides which cooperate with the vanes to form the outlet and fluid

passages are integral with the casing and the danger of the pump becoming clogged by foreign matter carried in the fluid will be reduced to a minimum. Furthermore, due to the special shape of the vanes, losses at the inlet of this type of impeller are reduced, the fluid flowing without shocks and more directly than in those pumps wherein the edges of the vanes interfere with fluid flow.

Additionally, this type of impeller is suitable for centrifugal pump castings having bearings on both sides. It can be used efficiently in sewage pumps with a vertical shaft and totally submerged in sewage. Furthermore, the vane channels on one side of the impeller may be made wider than those on the other side and other dimensions varied without departure from the invention. It is also evident that the impeller, according to the invention, may be adapted for use in centrifugal fans.

Referring now to Figs. 8–14, a double-inlet impeller arrangement having integral side walls and embodying the novel features of the invention is disclosed. The impeller, indicated generally by the numeral **40**, is closed at both sides by walls as seen in Fig. 9, the side wall on the left being indicated by the numeral **42** and that on the right by the numeral **44**. The vanes, which form webs between the walls, turn alternately in opposite directions, those whose inlets are on the right being indicated by the numeral **46***a* and those whose inlet is on the left by the numeral **46***b*. The driving surfaces of the vanes **46***a* are indicated by the numeral **48***a* and that of the vanes **46***b* by the numeral **48***b*.

As illustrated in the developed views of Figs. 11*a*–14, the planes *y*—*y* of the vanes at the periphery of the impeller are parallel to the drive shaft **18** and gradually turn so as to be more and more at a right angle to the shaft as the hub is approached and to be substantially at a right angle at the hub. The side walls **42** and **44** and the vanes **46***a* and **46***b* cooperate to form enclosed channels or passages **50** which turn alternately in opposite directions and connect the inlets **52***a* and **52***b* to the outlet **26**.

It will be seen that in an enclosed centrifugal pump of the ordinary double-inlet type, the novel impeller according to the invention affords numerous advantages. From the developed views of Figs. 11*a*–14, it will be observed that the channels in the new impeller have greater hydraulic radius than those of an impeller of the ordinary type, the hydraulic radius being the relation between the area of a channel and its periphery. The hydraulic radius is greatest for a circular section and smallest for a parallelogram extended in length or a rectangle. In impellers of the ordinary type, each of the channels at the inlet is divided in half by a wall necessary to bind the impeller together. The channels of the ordinary impeller, therefore, are of a less advantageous shape for free flow of the fluids than are those of the novel impeller of the invention. For example, in an ordinary impeller having six vanes there must be twelve channels in the inlet, whereas in the novel impeller as illustrated in Figs. 8–14, only six channels in the inlet are required. The resistance to fluid flow in a channel being in inverse proportion to the hydraulic radius is therefore less in the novel impeller according to the invention.

Furthermore, as already indicated, the novel construction of the new and improved impeller permits greater ease and economy in manufacture. Casting will be simpler and easier to perform. The cores for the vane channels in the mold will also be stronger at smaller dimensions of the impeller. Furthermore, the channels in the complete casting will be more accessible for cleaning.

While I have herein disclosed and described presently preferred embodiments of the invention, it will be understood that such disclosure is by way of illustration and not by way of limitation and that various modifications and changes may be made in the same, the invention being not in any way limited to the specific disclosure but only to the scope of the following claims:

I claim:

1. A centrifugal pump impeller adapted to be mounted for rotation about an axis, for double suction pumping of fluids having solids suspended therein and flowing into said impeller from opposite axial directions, which comprises an even-numbered multiplicity of vanes and a fluid diverter portion extending from said vanes toward said axis, said diverter portion having generally parallel surfaces defining a thin wall to separate said fluids flowing thereagainst from opposite axial directions, said surfaces being substantially planar and perpendicular to said axis toward said axis and being provided with a corresponding even-numbered multiplicity of axially directed undulations varying in depth smoothly from imperceptibility toward said axis to a maximum at said vanes to accelerate most efficiently the rotational velocity of said fluids from zero at input toward impeller velocity, said undulations corresponding with and merging imperceptibly into said vanes, said vanes turning over alternately in continuations of said undulations in opposite directions, the plane of each vane at the outer extremity thereof being substantially parallel to said axis, and the locus of the lateral edges of all vanes being definable by rotating any single blade around said axis.

2. An impeller in accordance with claim 1 in which said vanes as well as said diverter portion have generally parallel surfaces defining a thin sheet, said diverter portion merging imperceptibly into said vanes.

3. An impeller in accordance with claim 1 and including side walls enclosing said vanes.

References Cited in the file of this patent

UNITED STATES PATENTS

1,975,274	Hollander	Oct. 2, 1934
1,849,127	Wood	Mar. 15, 1942

FOREIGN PATENTS

18,343	Great Britain	of 1900
218,636	Switzerland	Apr. 1, 1942