May 2, 1967 E. EGGER 3,316,848

PUMP CASING

Filed July 6, 1965 5 Sheets-Sheet 1

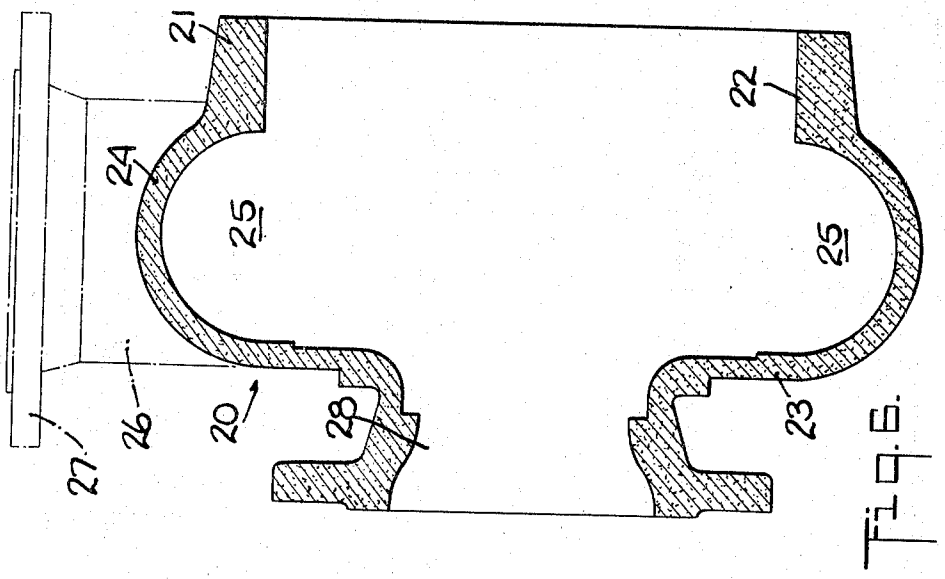


Fig. 6.

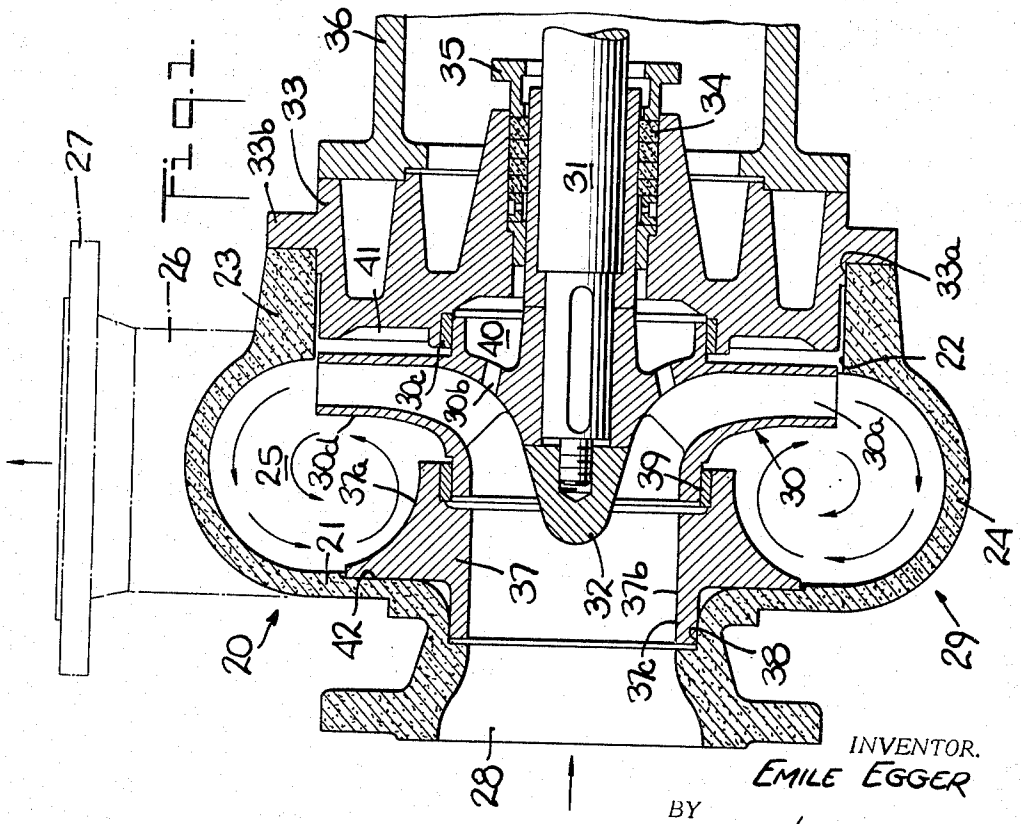


Fig. 7.

INVENTOR.
EMILE EGGER
BY
Kenyon & Kenyon
ATTORNEYS

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PUMP CASING

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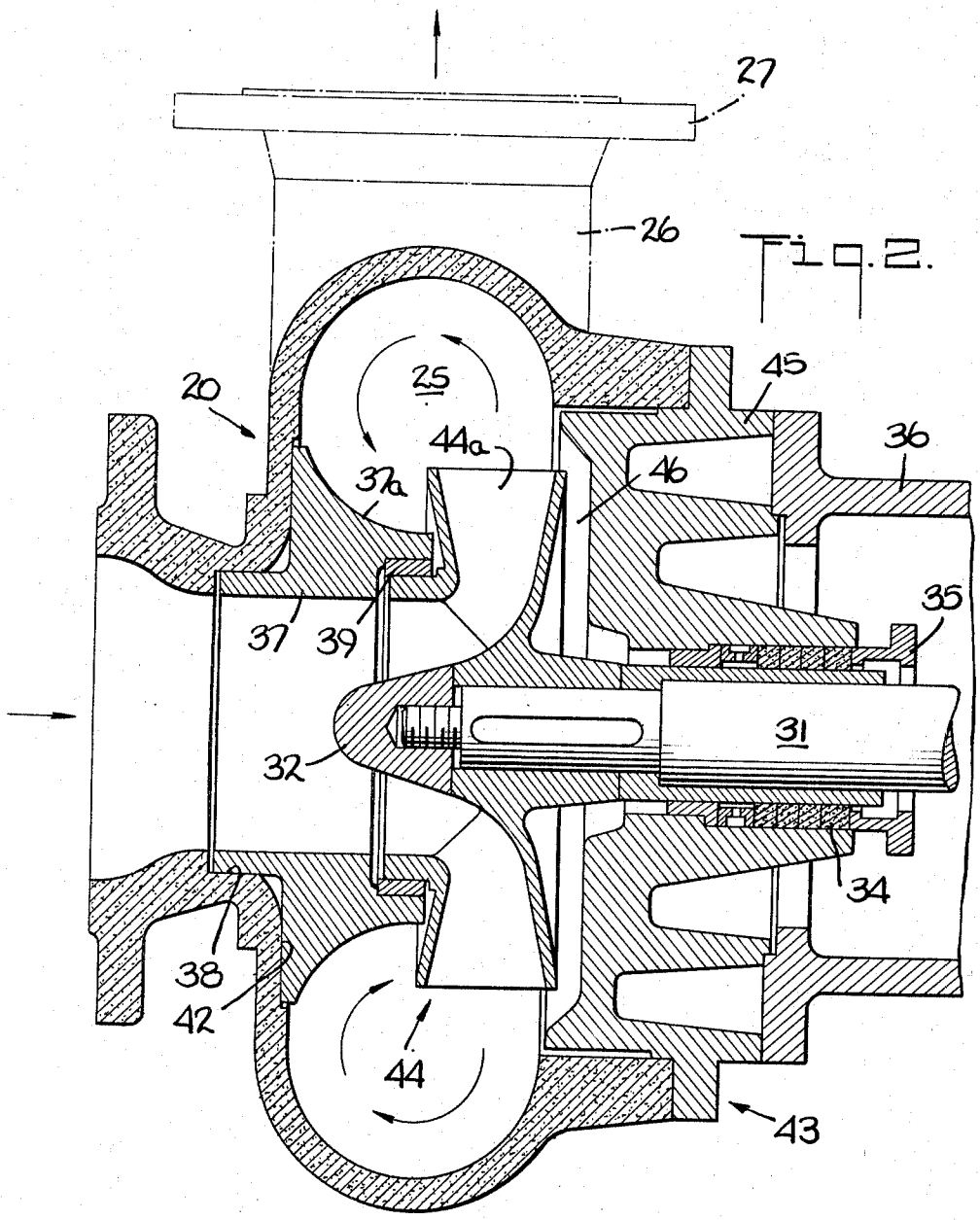


Fig. 2.

INVENTOR.
EMILE EGGER
BY
Kenyon & Kenyon
ATTORNEYS

May 2, 1967 E. EGGER 3,316,848

PUMP CASING

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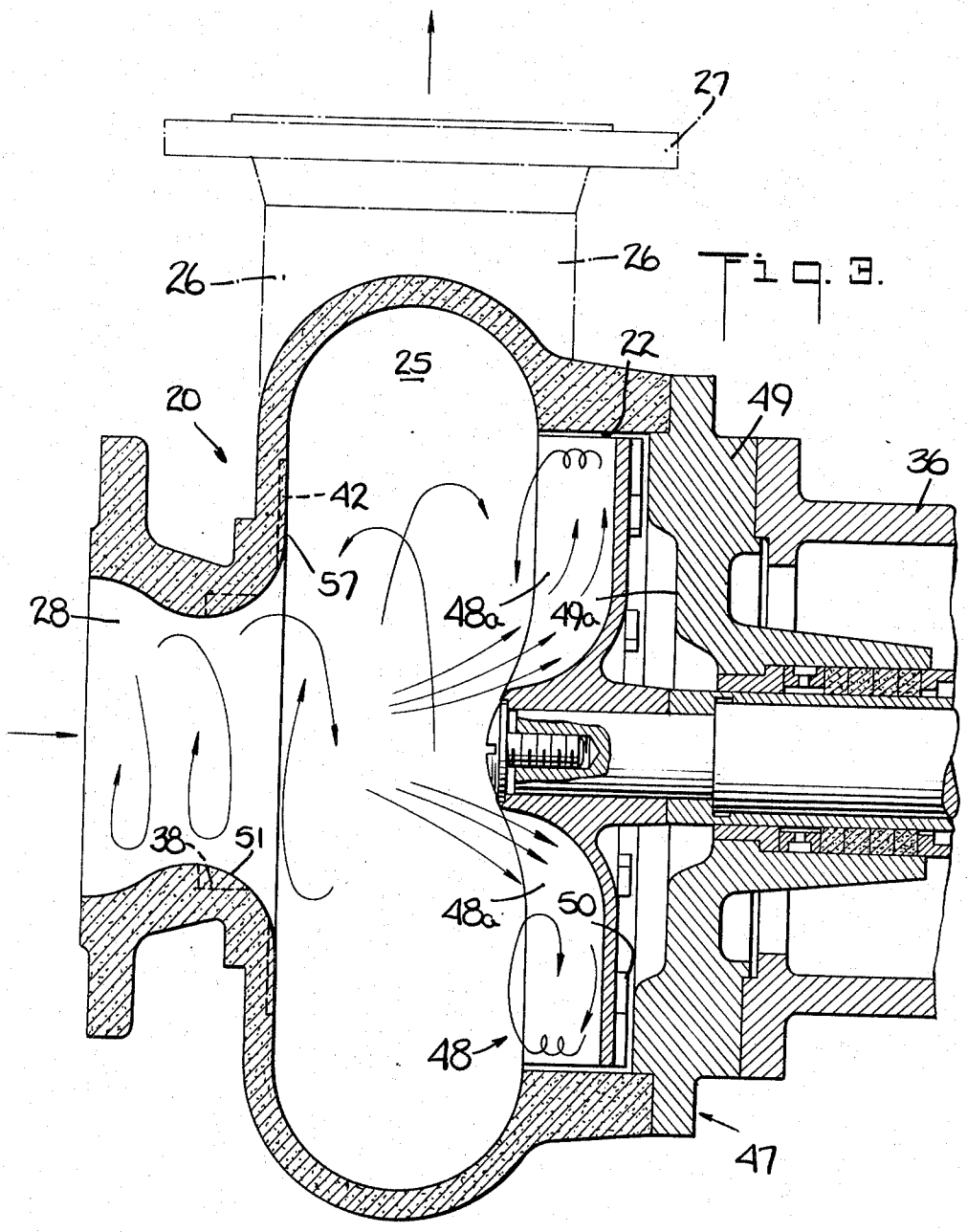


Fig. 3.

INVENTOR.
EMILE EGGER
BY
Kenyon & Kenyon
ATTORNEYS

May 2, 1967

E. EGGER

3,316,848

PUMP CASING

Filed July 6, 1965

5 Sheets-Sheet 4

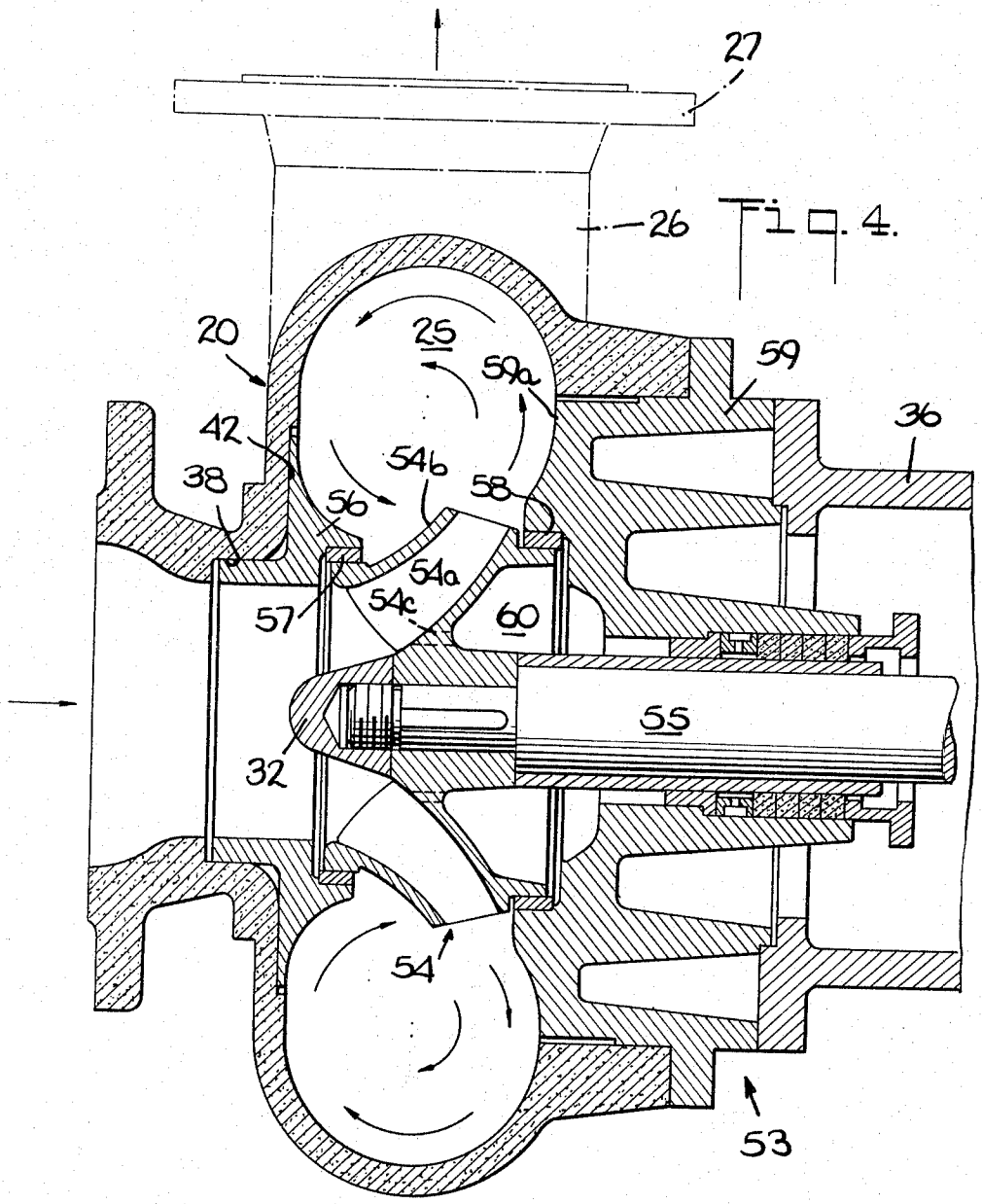


Fig. 4.

INVENTOR.
EMILE EGGER
BY
Kenyon & Kenyon
ATTORNEYS

May 2, 1967

E. EGGER

PUMP CASING

3,316,848

Filed July 6, 1965

5 Sheets-Sheet 5

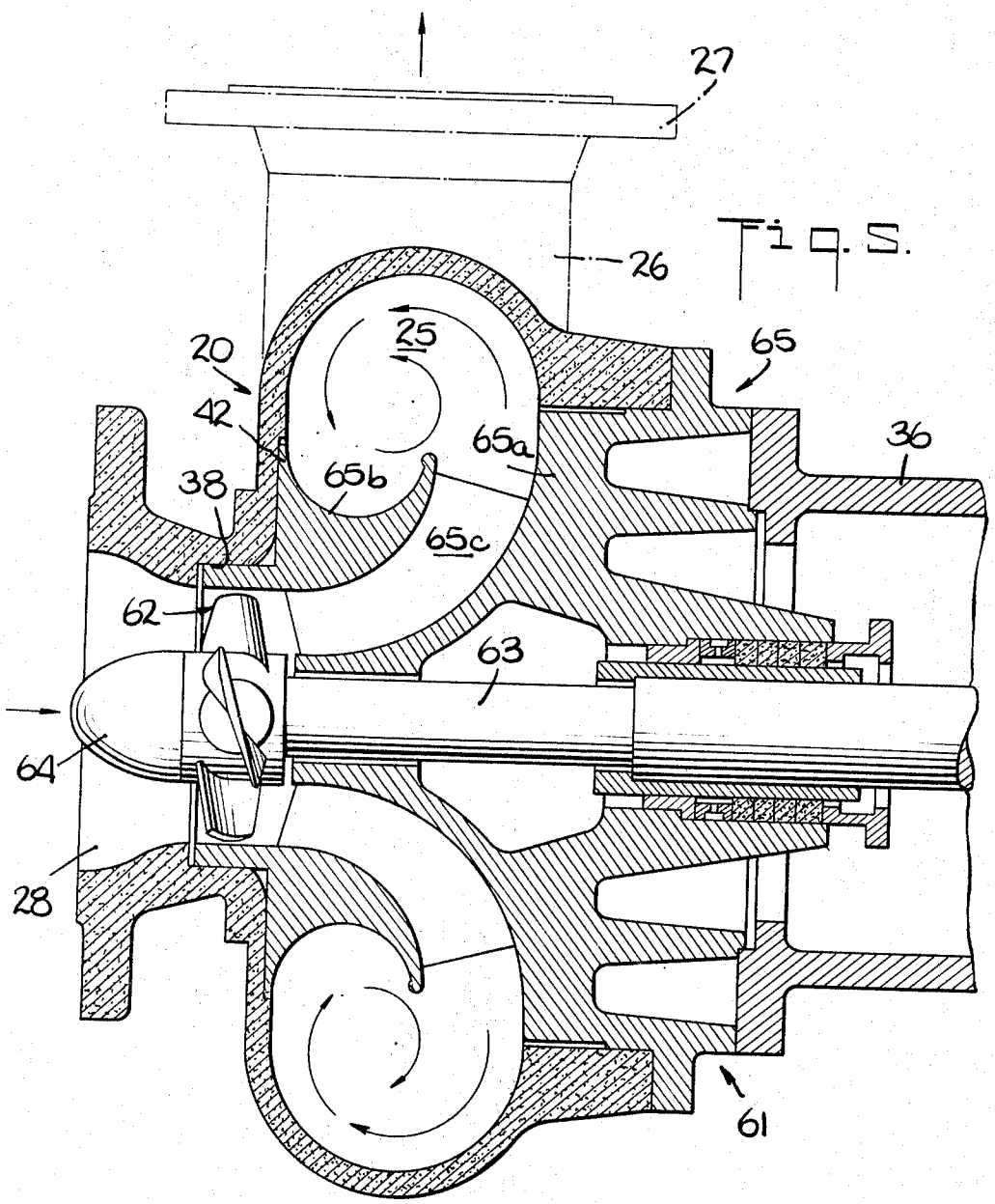


Fig. 5.

INVENTOR.
EMILE EGGER

BY

Kenyon & Kenyon

ATTORNEYS

United States Patent Office 3,316,848
Patented May 2, 1967

3,316,848

PUMP CASING

Emile Egger, Cressier, Neuchatel, Switzerland, assignor to Emile Egger & Co., AG., Cressier, Switzerland, a corporation of Switzerland

Filed July 6, 1965, Ser. No. 469,781
Claims priority, application Switzerland, July 14, 1964, 9,223/64; Nov. 28, 1964, 15,376/64
21 Claims. (Cl. 103—103)

The invention relates to a pump casing which can be employed with a variety of types of pumps and more in particular to a standardized pump casing which can be employed with any one of a plurality of different types of rotary impellers.

A variety of pumps having different types of rotary impellers and therefore different operating characteristics for pumping under a variety of operating conditions have been developed. Certain pumps have been conditioned to pump material having a relatively low viscosty such as water. Other pumps have been conditioned to handle mixtures of fluids or materials of comparatively high viscosity and in certain cases with amounts of entrained gasses. In addition pumps have been provided which are capable of handling solids suspended in fluids, such as found in process industries or in the pumping of sewerage water.

In the pump industry it has been customary to construct a specially designed pump for each of the different operating environments. Because of the variety of different fluids and materials which must be pumped, it has become necessary in the pump industry to manufacture and stock a great number of different types of pumps as well as spare parts for them. As a result, there is today practically no interchangeability of pump parts and thus large inventories of pumps and pump parts must be maintained. The failure to provide interchangeability in pump components persists even though many of the components of a plurality of different pumps are closely related in size and form. One of the reasons for this is that in spite of similarities in various pump components, it has been the practice of the pump industry to incorporate relatively slight constructional differences between related pumps in order to achieve efficient and satisfactory operation of each different type of pump.

The absence of interchangeability has continued up to the present time even though most of the different pump designs comprise an assembly of certain basic elements such as a rotary impeller, a pump casing in which the rotor is disposed, inlet and outlet openings for the casing, a rotary impeller, a casing cover and means for sealing the shaft of the impeller to the casing when the impeller is disposed therein. The lack of interchangeability of pump components can be an expensive drawback especially when it comes to the area of relatively large pumps of the type used in industry, public utilities or in connection with sewerage treatment equipment.

The lack of interchangeability is especially a problem with respect to the pump casing. The reason for this is that the pump casing is commonly the largest single element of a pump which necessarily must contain a comparatively intricate interior portion, an inlet opening, an outlet opening and an opening for receiving the impeller and the shaft upon which the impeller is mounted. In many instances the casing is formed by casting. Since in the past each different type of pump has included changes in the form of the interior of the pump casing, it has been necessary to supply patterns, molds and other casting equipment for producing each of the different casings, regardless of how small the differences are. The same is true where the casing is machined, since each different casing can require different tooling and machining procedures even where relatively minor variations exist between different types of casings.

It is therefore one of the objects of the invention to provide a standardized pump casing which can be used with any one of a plurality of different types of rotary impellers.

It is another object of the invention to provide a standardized pump casing which can be used with a plurality of different types of rotary impellers which are disposed at a variety of relative positions within the casing.

It is still another object of the invention to provide a standardized pump casing which can be used with rotary impellers having a variety of flow characteristics with respect to the interior of the casing.

It is an additional object of the invention to provide a standardized pump casing for a plurality of rotary impellers which require different inlet flow conditions.

It is a further object of the invention to provide standardized pump casings which can be used with a plurality of different pump casing covers wihch corresponds to a number of different types of rotary impellers.

It is a further object of the invention to provide standardized pump casing which can be used with a number of different supports for the impeller shaft seal which can vary for different rotary impellers.

In one embodiment of the invention the standardized pump casing is adapted to receive a rotary impeller which is one type of a plurality of different types of rotary impellers. The pump casing includes a pair of wall portions disposed opposite and spaced apart from one another and an annular wall portion which connects together the pair of wall portions. One of the pairs of wall portions includes an opening for receiving the impeller and shaft. This wall portion adjacent the opening therein is adapted to engage the pump casing cover which corresponds to the particular rotary impeller being used. The annular wall portion is provided with an outlet opening for the casing. The other wall portion of the casing includes an inlet opening and is provided with means adjacent to the inlet opening and exposed to the interior of the casing for engaging an insert member for directing the flow of fluid moving through the inlet opening toward the impeller. The means for engaging an insert member is adapted to engage any one of a plurality of insert members, some of which include means for guiding the fluid for recirculation within the casing in additon to a cylndrical opening.

An advantage of the standardized pump casing of the invention is that it can be selectively assembled with any one type of a plurality of types of rotary impellers. Thus in order to obtain a variety of pumps, it is merely necessary to provide different rotary impellers while using a single standardized pump casing.

In another embodiment of the invention the opening in the wall portion for receiving the impeller and shaft comprises a cylindrical bore which is adapted to engage the cover of the pump casing.

In still another embodiment of the invention the means adjacent to the inlet and exposed to the interior of the casing for engaging an insert member includes a recess formed in the casing and adapted to receive an insert member. An advantage of this arrangement is that any one of a plurality of different insert members can be readily installed in the recess in order to accommodate the particular rotary impeller selected for the casing.

In an additional embodiment of the invention the interior of the casing adjacent to the inlet opening is provided with a seat to mount the insert member in conjunction with the recess adjacent to the inlet opening.

It is a further object of the invention to provide the combination of a standardized pump casing with an in-

sert member therein conditioned to correspond to the type of impeller which is to be installed in the casing.

Other objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a vertical section view of a pump having a radially directed centrifugal impeller and the standardized pump casing of the invention;

FIG. 2 is a vertical section view of a pump having another form of a radially extending centrifugal impeller and a standardized pump casing;

FIG. 3 is a vertical section view of a pump having a recessed impeller and a standardized pump casing;

FIG. 4 is a vertical section view of a pump having a combined radially and axially extending centrifugal impeller and a standardized pump casing;

FIG. 5 is a vertical section view of a pump having a propeller-type impeller and a standardized pump casing; and

FIG. 6 is a vertical section view of the standardized pump casing of the invention.

The standardized pump casing **20** of the invention, as shown in FIG. 6, includes wall portion **21** which contains openings or bore **22**. Opposite and spaced from wall portion **21** is wall portion **23**. Annular wall portion **24** connects wall portions **21** and **23** and thereby forms chamber **25** within the casing. As shown in the drawings, the section of wall portion **24** is substantially of a semi-circular form which facilitates recirculating flow moving outwardly and from wall **21**, along annular wall portion **24** and toward wall portion **23**. As shown in FIG. 6, the annular wall portion forms a portion of a toroid which extends about the pump chamber. The central axis of casing **20** is coextensive with the longitudinal axis of the shaft for the impeller which is to be disposed in the casing. In addition, the various portions of the casing, such as wall portion **21** and **23** and annular wall portion **24** are symmetrically disposed with respect to the central axis.

Outlet opening or outlet **26** extends radially in a tangential manner from chamber **25** of the casing. Flange **27** enables outlet **26** to be connected to the discharge line (not shown) to which the flow of the pump is to be delivered. Inlet opening or inlet **28** is connected to wall portion **23** and is in communication with chamber **25** of the casing.

As shown in FIG. 1, pump **29** is assembled with casing **20**. The pump includes a radial-flow type of centrifugal impeller **30** which is mounted on shaft **31** and retained thereby nut **32**. Shaft **31** extends through seal support **33** which contains packing **34** retained therein by gland nut **35**. Seal support **33** is provided with shoulder **33***a* which positions the seal support with respect to bore **22** of the casing. Flange **33***b* of the seal support limits the engagement of the support with respect to the bore. Attached to seal support **33** is housing **36** which surrounds shaft **31** and couples the pump to the housing of the electric motor or other power source which drives the pump.

Impeller **30** includes a plurality of radially extending enclosed passages **30***a* which direct the flow of fluid toward the area of wall portion **24** which is adjacent to bore **22**. As shown by the arrows in FIG. 1, the flow from the impeller follows the semi-circular section of annular wall portion **24** as the flow advances toward wall portion **21**. Since it is desired to produce a recirculating flow condition within casing **20**, as indicated by the flow lines in FIG. 1, the casing is provided with insert member or insert **37**. Insert **37** includes curved external surface **37***a* which faces toward the interior of casing **20** and is faired into the surface of wall portion **24**. As a result, surface **37***a* can reverse the flow passing along wall portion **21** toward impeller **30**. In this way the flow from the impeller is induced by insert **37** to recirculate within casing **20** in the form of a vortex.

Insert **37**, which contains cylindrical opening **37***b* is provided with flange **37***c* which engages recess **38** within the casing. Opening **37***b* receives the flow from inlet **28** and directs it toward passages **30***a* of impeller **30**. Insert **37** is provided with seal ring **39** which serves to seal the stationary insert **37** with respect to rotary impeller **30**. In addition to recess **38**, casing **20** is provided with recess or seat **42** for receiving the outer portion of insert **37**. Thus as shown in FIG. 1, insert **37** can be accurately positioned in casing **20** and thereby with respect to impeller **30** by means of recesses **38–42**. Further as shown in FIG. 1, it can be seen that surface **37***a* of the recess, inconjunction with the wall portion **23**, annular wall portion **24**, and wall portion **21**, form a chamber **25** which is substantially circular in a radially extending cross-section taken along a plane which includes the axis of shaft **31**. The vortex or recirculating flow can be maintained throughout chamber **25** since it has substantially constant cross-section. Cavity **40** behind the central portion of the reverse side of impeller **30** is vented to passage **30***a* by openings **30***b*. Impeller **30** is provided with seal ring **30***c* for separating and preventing flow between cavity **40** and cavity **41** behind the outer portion of impeller **30**.

The axial width of passages **30***a* on the periphery of the amplifier as shown in FIG. 1 are approximately one-fourth of the axial width of chamber **25** within casing **20**. Thus, the impeller being axially offset or eccentrically positioned with respect to chamber **25** extends through only one quadrant of the cross-section of the chamber. This construction which results in the recirculating flow enables the pump of FIG. 1 to have casing **20** with a substantially reduced outside diameter for a given flow condition. In addition to providing a recirculating flow within chamber **25**, surface **37***a* of insert **37** directs the returning flow against surface **30***d* of the impeller and due to the engagement of the flow with surface **30***d*, the fluid is accelerated. As a result of the recirculating flow of pump **29**, the pump is capable of greater output at increased efficiency as compared to a pump having a conventional centrifugal impeller arrangement with the conventional scroll casing.

A further advantage of the pump of FIG. 1 is that the central portion of the vortex is adapted to transport any air or gas entrained in the fluid being pumped, since the centrifugal accelerations in the vortex urge the denser fluids outwardly from the gas.

Pump **43** of FIG. 2 employs standardized pump casing **20** similarly as pump **29** of FIG. 1. Rotary impeller **44** of pump **43** is a centrifugal type impeller having a plurality of divergent passage **44***a*. Impeller **44** is adapted to pump material suspended in a fluid such as a liquid as well as liquids containing portions of air or gas. In addition, impeller **44** is adapted to handle fluids having a substantially high viscosity.

When using impeller **44**, it is not only possible to use standardized pump casing **20** but also to use insert **37** which is the same insert used in pump **29** of FIG. 1. Consequently pumps **29** and **43** which have distinctly different impellers can be constructed with the identical type of casing and insert. As a result the cost of a new pump or the cost of spare parts can be reduced in view of the interchangability.

Since impeller **44** only extends part way across chamber **25** within the housing, that is approximately one-quarter of the way across the chamber, it is necessary to employ seal support **45** which is contoured to form cavity **46** between the support and impeller **44**. Even though the surface of support **45** adjacent to the impeller is substantially different from that of the seal support **33**, it is posible to machine the two supports from a comon casting and thereby make a single casting interchangeable with at least two pump designs.

Pumps **29** and **43** demonstrate the capabilities of stand-

ardizing at least certain elements of pumps and still being able to provide a variety of different pumps. Thus in pumps **29** and **43** the identical casing **20** and insert **37** can be employed even though the pumps are equipped with distinctly different rotary impellers.

In FIG. 3 pump **47** again employs pump casing **20**. In pump **47** impeller **48** is withdrawn from chamber **25** of the casing into bore **22** of the casing. As a result, seal support **49** is of a reduced axial dimension as compared to seal support **33** and **45**. Surface **49***a* of the seal support is profiled to form cavities which cooperate with back blading **50** of the impeller in order to oppose a pressure build-up in the cavities which reflects the pressure within chamber **25**. The operating characteristic and the nature of the flow in chamber **47** is disclosed in my United States Patent No. 3,171,357, issued Mar. 2, 1965 and entitled "Pump."

In pump **47** it is desired to maintain a substantially open chamber **25** throughout its extent and including the region adjacent to inlet **28**. For this reason it is unnecessary in pump **47** to use an insert of the type shown in pumps **29** and **43**. In view of this, casing **20** can be employed by assembling into the pump after casting or after other forms of fabrication, but prior to the machining of recesses **38** and **42** which are shown in FIGS. 1 and 2. Thus the casting of casing **20** having a curved surface as shown in FIG. 3 can be used.

In the alternative, where casing **20** has already been machined or otherwise worked to provide recess **38** and seat **42**, the recess and seat can be filled or faired-in by the provision of inserts **51** and **52**, respectively. Thus it can be seen that pump **47**, in addition to pumps **29** and **43**, can be constructed with standardized pump casing **20**. Here it should be noted that bore **22** of the casing, which merely receives the seal support in pumps **29** and **43**, here serves as the stationary shroud for the impeller which contributes to the recirculation or the formation of a vortex adjacent to blades **48***a* of the impeller.

FIG. 4 shows a further pump **53** which utilizes standardized pump casing **20**. In pump **53** impeller **54** is of the centrifugal-type having a combined axial and radial flow pattern. Thus, passages **54***a* of the impeller, while extending radially with respect to shaft **55**, also extend radially outward from the shaft. Again insert **56** is provided to establish a substantially circular cross-section for chamber **25** by deflecting the flow inwardly toward outer surface **54***b* of the impeller. The insert is adapted to fit recess **38** and seat **42** of casing **20**. Seal ring **57** attached to insert **56** forms a seal with respect to the outside diameter of the adjacent portion of impeller **54**. In this way, leakage between the inlet and chamber **25** is prevented. Similarly, seal ring **58** mounted in seal support **59** seals chamber **25** from cavity **60** at the rear portion of the impeller. Impeller **54** can be provided with openings or vents **54***c* which are similar to vents **30***b* of impeller **30** in pump **29**. Surface **59***a* of seal support **59** forms a portion of the wall of chamber **25** in casing **20**. Consequently, surface **59***a* is profiled to substantially continue the radius of curvature passages **54***a* so that flow passes smoothly from impeller **54** to adjacent surface **59***a*. As in the other pumps, a recirculating or vortex type flow is established in casing **20**. In addition, flow passing from insert **56** to adjacent surface **54***b* of the impeller is accelerated by engagement with the impeller and thereby the vortex action is increased.

In pump **61** of FIG. 5, again standardized casing **20** is employed. Here the rotary impeller includes propeller **62** mounted upon shaft **63** and retained in place by nut **64**. In pump **61**, contrary to the other pump arrangements, the insert to be mounted adjacent to the inlet opening of the casing is integrated with the seal support in the form of support assembly **65**. Thus, the support assembly includes seal support **65***a*, insert portion **65***b* and a plurality of divergent passages **65***c* which extend in an axial and an outward radial direction from propeller **62**. Passages **65***c* are formed by guide blades extending therebetween which serve to direct the flow from propeller **62** toward chamber **25**. The passages blend into seal support **65***a* and subsequently to the inner surface of casing **20**.

Again insert portion **65***b* is adapted to engage recess **38** and seat **42** of casing **20**. As a result, pump **61** comprises another embodiment which can be built about the standardized pump casing **20** of the invention.

A further advantage of pump **61** is that propeller **62** can serve to produce a mixing action of any material suspended in the fluid being delivered to inlet **28**. In addition, due to the propeller characteristic, pump **61** can be employed where there is a desire to handle a comparatively large flow at a reduced head. Where any portion of support assembly **65** is subjected to relatively rapid wear, the support assembly can be formed from a plurality of separate support elements so that elements experiencing wear can be replaced without the need of replacing the entire assembly.

The standardized casing of the invention and its insert member not only simplify the pump construction problems of a pump manufacturer and reduce the number of different components which he must manufacture and also keep in inventory, but it also directly benefits the purchaser of the pump. After having bought one or more pumps with a given type of impeller, the purchaser may find that he no longer can use the particular impeller to advantage. In such a case the purchaser can safeguard the major portion of his pump investment by converting to the types of impeller which meets his new needs. In converting, the purchaser may merely have to change impellers. In other cases a new insert or seal support may be required with the new impeller. In any event however, the purchaser is able to continue to use at least the casing and the driving equipment of the original pump.

What is claimed:

1. A pump casing assembly adapted for receiving a rotary impeller mounted upon a shaft, the rotary impeller being any one type of rotary impeller selected from a plurality of different types of rotary impellers, each of the plurality of types of rotary impellers having a pump casing cover and means for sealing said shaft with respect thereto, said pump casing assembly comprising a standardized pump casing having a pair of wall portions disposed opposite and spaced apart from one another and an annular wall portion connecting together said pair of wall portions, said annular wall portion having an outlet opening for said casing, one of said pair of wall portions having an additional opening disposed therein for receiving the impeller and shaft, said one wall portion adjacent said additional opening being adapted to engage the pump casing cover when the impeller is disposed within said casing, the other of said pair of wall portions having an inlet opening; and an insert member disposed adjacent to said opening and being exposed to the interior of said casing, said insert member being any one form of a plurality of different forms of insert members each of the plurality of insert members having a cylindrical opening for directing the flow of fluid moving through said inlet opening toward the impeller and certain of the plurality of insert members additionally having means for guiding the fluid for recirculation within the casing, whereby said standardized pump casing can be selectively assembled with any one type of the plurality of types of rotary impellers.

2. A pump casing assembly in accordance with claim **1** in which said insert member has a central opening in line with said inlet opening and a circumferential surface extending about the central axis of said casing, said surface being at a varying radial distance from said central axis, which is maximum adjacent to the other of said pair of wall portions and minimum opposite thereto.

3. A pump casing assembly in accordance with claim **2** in which a cross-section of the circumferential surface

of said insert member taken along a plane which includes the central axis of the casing corresponds substantially to a portion of a circle, whereby said insert member converts the interior of the casing substantially into a toroidal form.

4. A pump casing assembly in accordance with claim 1 in which said insert member includes means for sealing said cylindrical opening thereof with respect to the impeller, whereby the incoming flow is directed to the impeller.

5. A pump casing assembly in accordance with claim 4 in which said means for sealing said cylindrical opening of said insert member with respect to the impeller comprises a sealing ring mounted on said insert member and adopted substantially to engage the impeller.

6. A pump comprising a shaft, a rotary impeller mounted upon said shaft and being any one type of rotary impeller selected from a plurality of different types of rotary impellers, a pump casing including a pair of wall portions disposed and spaced apart from one another and an annular wall portion connecting together said pair of wall portions to form a chamber, said annular wall portion having an outlet opening for said chamber, one of said pair of wall portions having an additional opening disposed therein for receiving the impeller into said chamber, said impeller being disposed within said chamber and offset toward said one wall, said impeller extending from adjacent the plane of said one wall portion toward the interior of said chamber, the flow from said impeller being directed radially outwardly along said one wall portion toward said annular wall portion, a pump casing cover having a passage therein through which said shaft extends, said one wall portion adjacent said additional opening being adapted to engage said pump casing cover when the impeller is disposed within said casing, the other of said pair of wall portions having an inlet opening, an insert member which is any one of a plurality of different forms of insert members, each of the plurality of insert members having a cylindrical opening for directing the flow of fluid moving through said inlet opening toward the impeller and certain of the plurality of insert members additionally having means for guiding the fluid for recirculation within the casing, and means adjacent said inlet opening and exposed to the interior of said casing for engaging said insert member, whereby said standardized pump casing can be selectively assembled with any one type of plurality of types of said impellers.

7. A pump in accordance with claim 6 in which said impeller comprises structure forming a plurality of radially extending tubular passages curving from the central axis of the pump in an outward radially extending direction, the peripheral openings of said passages being disposed within said chamber and adjacent to said one wall portion, whereby the flow from said impeller passes adjacent to said one wall portion and toward said annular wall portion for establishing recirculation in the chamber of said casing.

8. A pump in accordance with claim 7 in which the tubular passages of said impeller have a diverging transverse cross-section taken in a plane passing through the length of the central axis of said pump.

9. A pump in accordance with claim 6 in which said passages of said impeller extend axially and radially outwardly from adjacent said inlet opening to adjacent said one wall portion, the flow from the periphery of said impeller being directed within the chamber along the surface of said one wall portion toward said annular wall portion, whereby recirculation within the chamber is maintained.

10. A pump in accordance with claim 9 in which said passages of said impeller converge from adajcent said inlet opening toward the peripheral portion of said impeller.

11. A pump in accordance with claim 6 in which said impeller comprises structure forming a plurality of curved tubular passages extending from adjacent the central axis of the impeller toward the periphery thereof, the peripheral openings of said passages being disposed inwardly from said wall portion toward the interior of the chamber and in which said insert member comprises a body having a central opening for connection to said inlet opening and an external outer surface converging from adjacent said other wall portion toward said impeller, whereby the flow of fluid from adjacent said other wall portion is directed toward said impeller.

12. A pump in accordance with claim 11 in which means are provided for sealing said insert member with respect to said impeller.

13. A pump comprising a shaft, a propeller-type impeller mounted upon said shaft, a pump casing including a pair of wall portions disposed and spaced apart from one another and an annular wall portion connecting together said pair of wall portions to form a chamber, said annular wall portion having an outlet opening for said chamber, one of said pair of wall portions having an additional opening disposed therein for receiving the impeller into said chamber, said one wall portion adjacent said additional opening being adapted to engage said pump casing cover when the impeller is disposed within said casing, the other of said pair of wall portions having an inlet opening, said impeller being disposed adjacent to said inlet opening, and means disposed within said chamber for directing the flow from said impeller in an outward radial direction toward said one wall portion, whereby the flow is directed for recirculation within said chamber.

14. A pump in accordance with claim 13 in which said means for directing the flow from said impeller in an outward radial direction toward said one wall portion comprises a center body having a plurality of passages curving radially outwardly from adjacent said propeller-type impeller for directing the flow therefrom to adjacent said one wall portion.

15. A pump in accordance with claim 14 in which said center body includes a flange extending toward the interior of said chamber from said other wall portion and flaring outwardly with respect to the central axis of said chamber, said flange directing flow adjacent said other wall portion to recirculate within said chamber.

16. A standardized one piece pump casing adapted for receiving a rotary impeller mounted upon a shaft, the rotary impeller being any one type of rotary impeller selected from a plurality of different types of rotary impellers, each of the plurality of different types of rotary impellers having a different one of a plurality of pump casing covers with means therein for supporting the impeller shaft with respect to the pump casing cover and a different one of a plurality of insert members corresponding to the different impellers, said one piece pump casing having a central axis and comprising a wall portion extending radially with respect to the central axis of said one piece casing which is substantially coincidental with the axis of rotation of an impeller, an annular wall portion extending from about the periphery of said wall portion and having a curved inner surface facing toward the central axis of said casing, said curved inner surface being substantially semi-circular in section when taken along any plane which includes the central axis of said casing, said annular wall portion having an outlet opening for said casing, an additional wall portion extending from said annular wall portion and away from said wall portion, said additional wall portion having a cylindrical bore with its axis coincidental with the central axis of said casing, said bore being substantially aligned with the diameter of the semi-circular section of said annular wall portion, said cylindrical bore being adapted to receive at least a portion of the pump casing cover when an impeller is disposed in said one piece casing to enable the inner surface of the pump casing cover to cooperate with said wall portion and said annular wall portion in forming a cavity in communication with said impeller, said wall portion having an inlet opening and means adjacent said inlet opening and exposed to the interior of said casing for engaging at least

one of the plurality of different insert members, each of the plurality of different insert members having a cylindrical opening for directing the flow of fluid moving through said inlet opening toward said impeller and certain of the plurality of insert members additionally having means for guiding the fluid for recirculation within the casing, whereby said standardized pump casing can be selectively assembled with any one type of the plurality of types of rotary impellers.

17. A standardized pump casing in accordance with claim **16** in which said means adjacent said inlet opening and exposed to the interior of said casing for engaging at least one insert member comprises at least one recess in said other wall.

18. A standardized pump casing in accordance with claim **16** in which said means adjacent said inlet opening and exposed to the interior of said casing for engaging at least one insert member comprises a counterbored opening disposed about said inlet opening and extending outwardly from the interior of said casing along the central axis thereof.

19. A standardized pump casing in accordance with claim **16** in which said means adjacent said inlet opening and exposed to the interior of said casing for engaging at least one insert member comprises a seat formed by a relieved portion of said other wall portion, said relieved portion extending in a radial outward direction from said inlet opening.

20. A pump assembly adapted for the construction of a plurality of various pump types comprising a standardized one piece pump casing including a substantially radial wall portion having an inlet opening, an annular wall portion extending from about the periphery of said radial wall portion, said annular wall portion having an outlet opening, said radial wall portion and said annular wall portion forming a chamber within the casing, and a substantially cylindrical portion extending from said annular wall portion opposite and away from said radial wall portion, said cylindrical portion having a cylindrical bore disposed opposite said inlet opening; one of a plurality of impellers

of various types being disposed in said casing; one of a plurality of different inserts of various types each associated with a different one of said plurality of impellers being disposed in said casing about said inlet opening and facing said chamber; one of a plurality of different support members each associated with a different one of said plurality of impellers being disposed in said cylindrical bore; each of said inserts, said impellers and said support members being adapted to be inserted through said cylindrical bore with said support member closing said cylindrical bore with respect to said chamber.

21. A pump assembly in accordance with claim **16** in which each of said inserts have a curved outer surface adapted to form an annular chamber of substantially circular cross section together with said annual wall portion of the casing.

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DONLEY J. STOCKING, *Primary Examiner.*

HENRY F. RADUAZO, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,316,848 May 2, 1967

Emile Egger

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 20, for "viscosty" read -- viscosity --; line 23, for "gasses" read -- gases --; column 2, line 20, for "wihch" read -- which --; line 22, for "It is a further object of the invention to provide standardized" read -- It is also an object of the invention to provide a standardized --; line 46, for "additon" read -- addition --; same line 46, for "cylndrical" read -- cylindrical --; line 59, for "inlet and" read -- inlet opening and --; column 3, line 24, for "openings" read -- opening --; column 4, line 8, for "portion" read -- portions --; line 13, for "inconjunction" read -- in conjunction --; line 18, for "has substan-" read -- has a substan- --; lines 21 and 51, for "passage", each occurrence, read -- passages --; line 71, for "of the seal" read -- of seal --; column 5, line 10, for "support" read -- supports --; column 10, line 15, for "annual" read -- annular --.

Signed and sealed this 21st day of November 1967.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents