Oct. 4, 1966

A. S. MARLOW

3,276,385

SELF-PRIMING CENTRIFUGAL PUMP

Filed Jan. 5, 1965

4 Sheets-Sheet 1

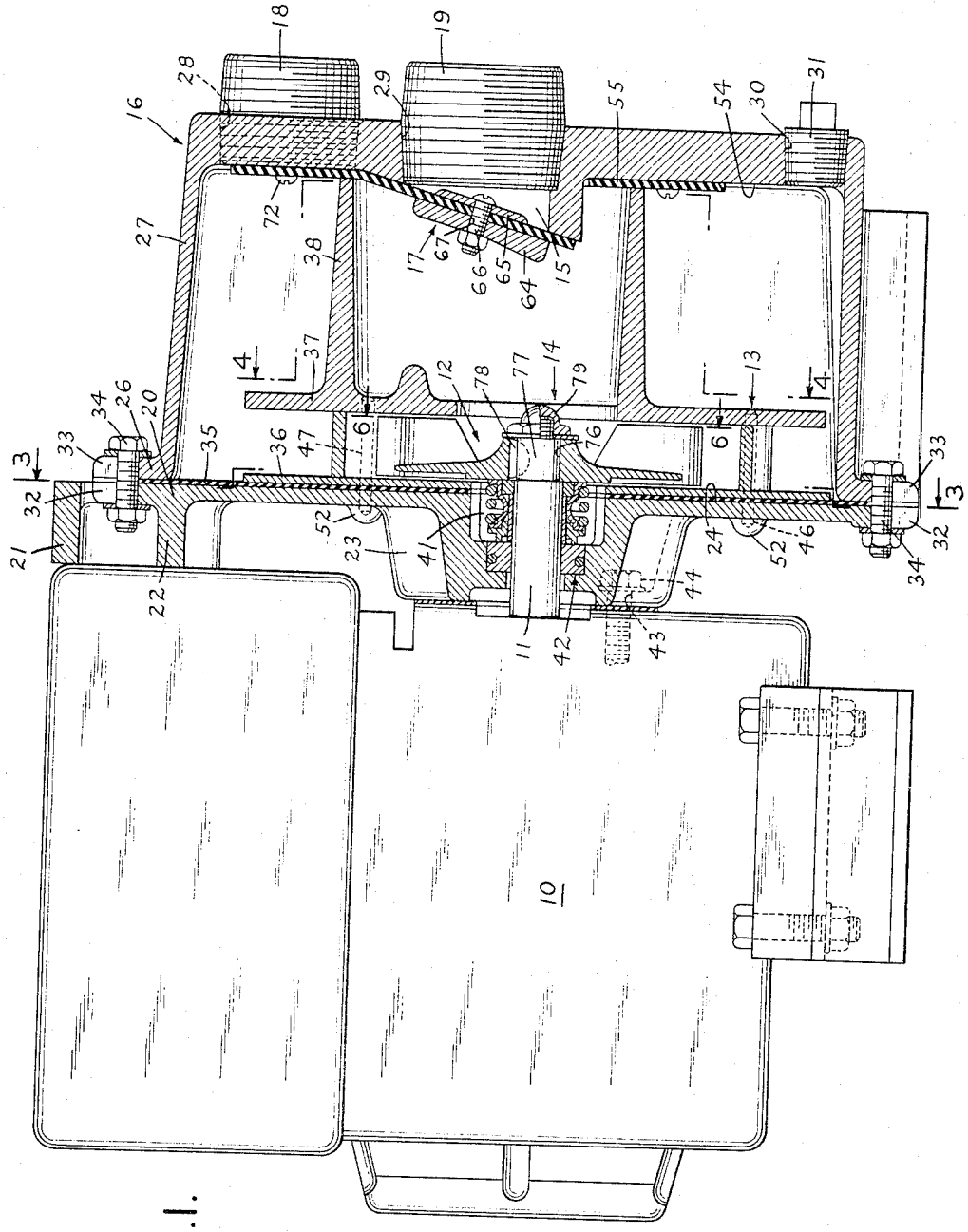


FIG. 1.

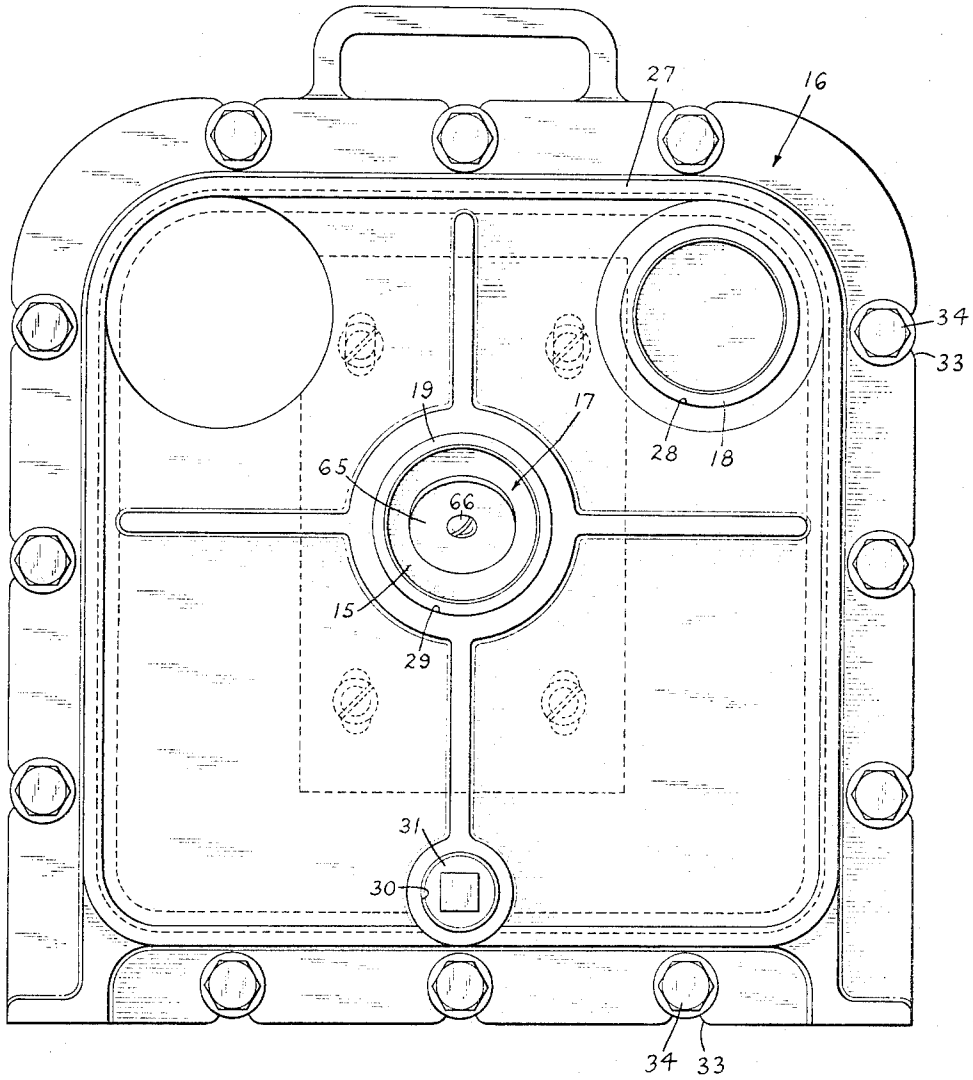
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FIG. 2.



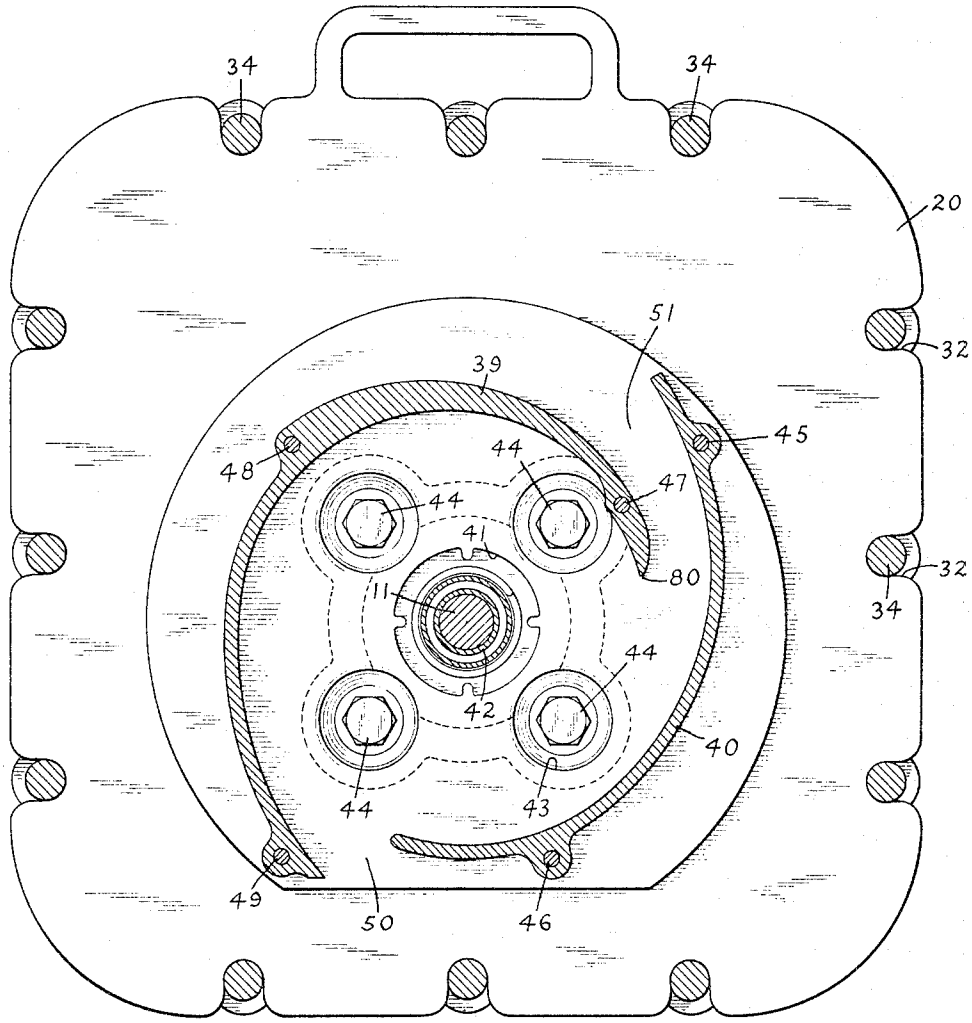
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SELF-PRIMING CENTRIFUGAL PUMP

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FIG.3.



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SELF-PRIMING CENTRIFUGAL PUMP

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FIG. 4.

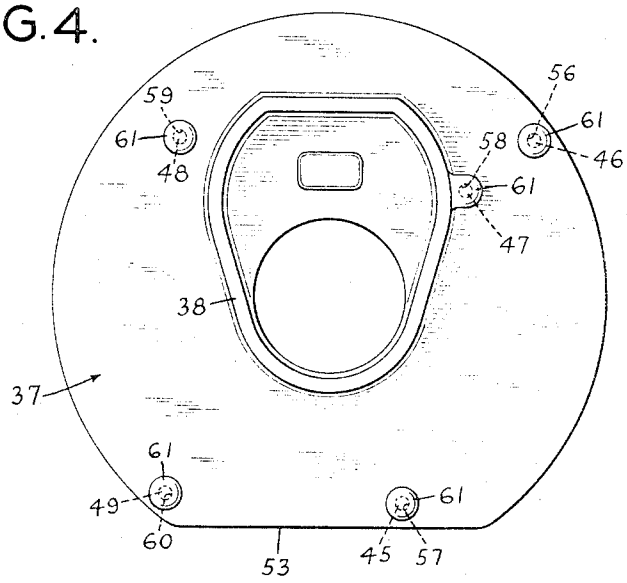


FIG. 5.

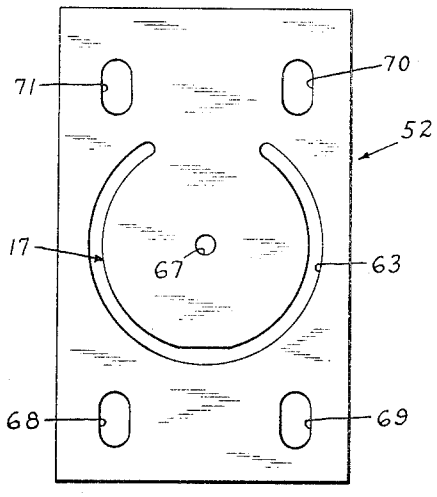
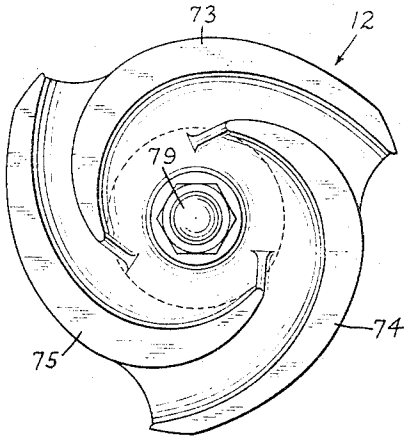


FIG. 6.



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SELF-PRIMING CENTRIFUGAL PUMP

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9 Claims. (Cl. 103—113)

This invention relates to improvements in pumps and more particularly to self-priming centrifugal pumps of simplified structure and manufacture.

Centrifugal pumps of the type heretofore available include a pump casing or housing having a scroll for receiving an impeller. In most cases, the scroll is cast integral with the pump housing. In the production of such pump housings or casings, it is necessary to use molds having central cores for the production of the hollows in the casting or castings and these cores are difficult to make and position when the scroll forms an integral part of the pump casing or housing. Even when the scroll is a separate casting, internal cores are required to form the internal surfaces of the casing and the scroll to the desired shape and dimensions. The manufacture of the pump casings or housings is further made difficult by reason of the fact that surfaces of relatively large areas must be machined to relatively close tolerances to provide leak-tight joints, even with gaskets, and considerable drilling and grinding is also required to enable the various component parts of the casing, scroll, impeller and associated structure to be assembled in proper relation. As a result, production rates of the prior centrifugal pumps are relatively low and the manufacturing costs are high. In addition, when the scroll is made an integral part of the pump casing or housing, it must be provided with machined wear plates to avoid the need for replacement of the entire pump casing after prolonged use.

In accordance with the present invention, centrifugal pumps are provided which are composed of a plurality of parts which can easily be formed by simple coreless casting operations or by die casting so that the manufacture of the parts is simplified, their cost is greatly reduced and manufacturing of the pumps are greatly facilitated.

More particularly, in accordance with the invention, the pump casing or housing is a two-part structure, each part being formed by a simple casting operation and containing a scroll composed of separate, easily formed parts and readily assembled within the casing in proper relation to the impeller to provide efficient pumping of a liquid and priming of the pump. Each of the parts of the pump housing and scroll, when made in sand casting molds, requires only the grinding of relatively small surface portions thereof to insure proper fit and the drilling of a minimum number of holes therein for positioning and alignment of the parts. Surface finishing of the major areas of the parts is unnecessary without loss of efficiency or appearance of the pump and its component parts. When die cast parts are formed, even the grinding operations and drilling can be eliminated, thereby requiring only a few holes to be tapped for reception of locating and fastening elements and pump connections.

For a better understanding of the present invention, reference may be had to the accompanying drawings, in which:

FIGURE 1 is a view partially in side elevation and partially in vertical section of a typical self-priming centrifugal pump embodying the present invention;

FIGURE 2 is an end elevational view of the pump;

FIGURE 3 is a view in section taken on line 3—3 of FIGURE 1;

FIGURE 4 is a view in section taken on line 4—4 of FIGURE 1;

FIGURE 5 is a front elevational view of a check valve gasket; and

FIGURE 6 is a view in section taken on line 6—6 of FIGURE 1.

As illustrated in FIGURE 1, a typical pumping unit includes an electric motor **10**, a gasoline engine or the like, having a shaft **11** on which the impeller **12** of the pump is mounted. The impeller **12** operates in a scroll **13** having a centrally located inlet **14** communicating with the suction inlet **15** in the pump casing **16**, which may be provided with a back flow check valve **17**, although such a check valve is not required in many instances. The pump casing **16** is also provided with a discharge or pressure port illustrated as a threaded coupling **18** by means of which the liquid drawn into the inlet passage is discharged from the pump. The check valve **17**, when used, prevents back flow of liquid through the inlet passage **15** and the coupling **19** secured therein so that a head of liquid is maintained in the pump for priming purposes.

The pump illustrated herein differs from prior pumps in the structure of the pump casing **16**, the scroll **13** and associated parts. As shown in FIGURES 1 and 3, the pump casing includes a back plate **20** which may be formed as a single casting having edge reinforcing flanges **21** and **22** and a hollow boss **23** in its mid portion for receiving the bearings and seals for motor shaft **11** as will be explained more particularly hereinafter. The plate **20** has one flat face **24** against which is secured the edge and peripheral flange **26** of a generally cup-shaped casing section **27** having slightly diverging walls to enable easy removal from the mold. In making the casing section **27**, the openings **28**, **29** and **30** may be formed therein for reception of the discharge coupling **18**, the inlet or suction coupling **19** and a drain plug **31**. The openings are tapped to form threads therein mating with the couplings **18** and **19** and the plug **31**.

Referring to FIGURES 2 and 3, both the back plate **20** and the casing section **27** are cast with aligned notches **32** and **33** for reception of fastening elements, such as the bolts **34**, for securing them together in face-to-face relation with a sealing gasket **35** interposed between them and preferably spanning the entire surface of the plate **20**. The notches **32** and **33** do not require drilling or finishing.

The opposed portions of the plate **20** and the casing section **27** may be surface finished on a flat grinder to the tolerances required to prevent leakage therebetween. A plurality of the plates and casing sections can be ground simultaneously.

The pump scroll **12** in the form of the invention shown comprises basically four parts, namely, a back wear plate **36**, a front plate **37** having an inlet tube **38** and a pair of scroll blades **39** and **40** as shown in FIGURES 1 and 3.

The plate **20** is drilled by means of a step drill to form a central stepped bore **41** in the boss **23** for reception of a shaft seal and bearing **42** of conventional type through which the motor shaft **11** passes. Using the bore **41** as a cutting means, four holes **43** are drilled through the boss **23** to receive screws **44** for securing the plate **20** to the motor **10**. In addition to the five holes mentioned above, the wear plate **36** is drilled to form blind holes or recesses receiving five positioning pins **45**, **46**, **47**, **48** and **49** which are used to position the wear plate **36**, front plate **37**, and blades **39** and **40** to form a scroll having a priming inlet **50** at the bottom and a discharge **51** adjacent the top as shown in FIGURE 3. If necessary, small bosses or detents **52** may be cast on the back of the plate **20** to provide additional depth to the blind holes receiving the locating pins **45** to **49**.

The front plate **37** as shown in FIGURE 4 is generally circular and has a flat lower edge **53** and the tubular extension **38** which extends forwardly into contact with the inner flat surface **54** of the front of the casing section **27**

or a gasket or flap valve member **55** to seal the tubular member around the suction inlet **15**. The left hand face of the plate **37** is ground flat as are the front and back edges of the blades **39** and **40** to form a tight fit with each other to minimize leakage between the blades, the wear plate **36** and the front plate **37**. Also, the plate **37** is drilled to form the blind holes or recesses **56**, **57**, **58**, **59** and **60** for reception of the ends of the pins **45** to **49**. Small dome-like bosses **61** may be cast on the front of the plate **37** to provide additional thickness for formation of the recesses **56** to **60**.

As shown in FIGURE 5, the check valve **17** is a part of a rectangular gasket **55** of rubber or rubberized fabric having an arcuate slot **63** formed therein defining the flap valve **17** which as shown in FIGURE 1 is provided with stiffening weights **64** and **65** secured by means of a screw **66** passing through them and a central hole **67** in the valve **17**. Elongated slots **68**, **69**, **70** and **71** are formed in the gasket **55** for reception of screws **72** to secure it to the inside of the casing section **27**.

The impeller **12** may be of any suitable type such as a member having three vanes **73**, **74** and **75** or more or fewer vanes of spiral form thereon and having a central opening **76** for reception of the reduced end portion **77** on the shaft **11** and a key **78** for securing them against rotation. The impeller **12** is also a casting and is drilled and ground to receive the shaft **11** and key **78** and is shaped to the proper diameter by grinding the tips of the blades thereon. A cap nut **79** retains the impeller on the shaft **11** in the proper relation to the wear plate **36**. With the various elements of the pump described above, the pump is assembled by first securing the back plate to the motor housing by means of the screws **44**. The gasket **35** is applied and the wear plate **36** positioned in overlying relation to the gasket. The pins **45** to **49** are then inserted in the holes in the back plate **20** through corresponding holes (not shown) in the wear plate and the gasket and the blades **39** and **40** are assembled on the pins. The cutwater **80** of the blade **39** is used as a locating point for drilling the holes in the front and back plates so that the cutwater does not require machining or grinding. By locating the blades **39** and **40** and the tips of the blades on the impeller **12** with respect to this common locating point, the positions of the locating pins **45** to **49** can be determined accurately. The impeller **12** is secured on the shaft **11** and the front plate **37** is assembled on and positioned by the free ends of the locating pins **45** to **49**. The front casing section **27** with the flap valve gasket thereon is then secured in position by means of the bolts **34** which hold the entire pump in its assembled relationship.

By avoiding machining operations, and using relatively simple drilling and grinding equipment the manufacture of the pump is greatly simplified and its cost reduced. Moreover, the use of locating pins to establish the positions of the parts not only facilitates the assembly of the pump, but also makes very simple the disassembly of the pump for inspection and servicing as may be required.

As indicated above, the pump chosen for illustration is a self-priming pump. The casing, with or without the check valve **17**, will retain sufficient liquid therein that operation of the impeller will draw liquid up through the inlet **50**, mix it with the air and discharge the froth so formed upwardly so that the air can be displaced and the liquid returned, thereby creating a reduced pressure in the scroll and enabling very quick and efficient self-priming of the pump.

As indicated above, when the several parts of the pump casing and scroll are made by sand casting techniques, some grinding and drilling are required for proper fit and to minimize leakage. Even the drilling and grinding operations can be eliminated by precision die casting of the parts so that only tapping of the holes **28**, **29** and **30** is required to prepare the pump components for assembly.

It will be understood that the principles underlying the construction and assembly of the illustrative embodiment of the pump can be utilized in other pumps and, accordingly, the form of the invention described herein should be considered as illustrative and not as limiting the invention as defined in the following claims.

I claim:

1. A centrifugal pump comprising a back plate, a hollow casing section, means for securing said casing section to said back plate to form a pump casing, a wear plate adjacent to said back plate, a front plate spaced from said wear plate, a pair of curved scroll blades between said wear plate and front plate, a plurality of aligning pins extending transversely through said blades and said wear plate substantially perpendicular thereto, recesses in said back plate and said front plate for receiving the ends of said pins and securing said blades between said wear and front plates in the form of a spiral having an inlet adjacent the bottom thereof and an outlet adjacent the top thereof, means on said front plate and said casing section for holding said wear plate and said front plate in engagement with the edges of said scroll blades to form a pump scroll and an impeller in said scroll.

2. The pump set forth in claim **1** in which said means for securing said back plate to said casing section comprises a plurality of notches in the peripheries of said back plate and casing section and a plurality of threaded fasteners in said notches.

3. The pump set forth in claim **1** in which said casing section has an inlet opening in one side thereof and an outlet opening adjacent the top thereof and said means on said front plate and said casing section comprises an inlet tube extending from said front plate toward said casing section in alignment and in communication with said inlet opening and said scroll.

4. A centrifugal pump comprising a pump casing including a back plate portion, and a detachable front section, a front plate in said pump casing, a pair of curved scroll blades between said back plate portion and said front plate, a plurality of locating and aligning pins extending transversely through said blades, recesses in said front plate and back plate portion for receiving the ends of said pins and securing said blades in the form of a spiral having a discharge outlet, means on said front plate and said front section for holding said front plate in engagement with an edge of each of said blades to form a spiral pump scroll and an impeller rotatably mounted in said scroll.

5. The pump set forth in claim **4** in which said back plate portion, front section and front plate are coreless castings.

6. The pump set forth in claim **4** in which said means on said front plate and said front section comprises an inlet tube on said front plate communicating with said scroll substantially coaxially of said impeller and extending toward said front section, said front section having an inlet port therein aligned and communicating with said tube.

7. The pump set forth in claim **6** in which one end of one of said scroll blades is spaced circumferentially of said scroll from one end of the other scroll blade at the bottom of said scroll forming a priming opening below said inlet tube and the opposite ends of said blades are in overlapping and radially spaced relation to dispose said discharge outlet upwardly and in communication with the interior of said pump casing above said inlet tube.

8. The pump set forth in claim **6** comprising a flap valve gasket interposed between the end of said inlet tube and said front section to prevent leakage therebetween.

9. The pump set forth in claim **6** comprising a wear plate interposed between said back plate portion and said scroll blades and said impeller, said pins extending through said wear plate and positioning it relative to said back plate portion.

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