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CENTRIFUGAL PUMP

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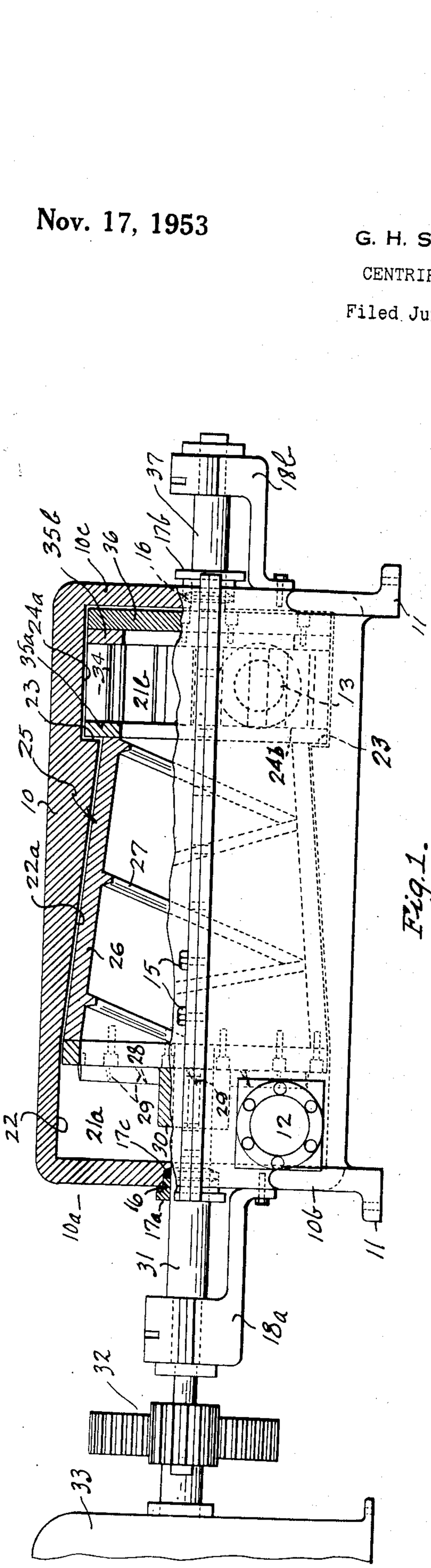

Fig. 1.

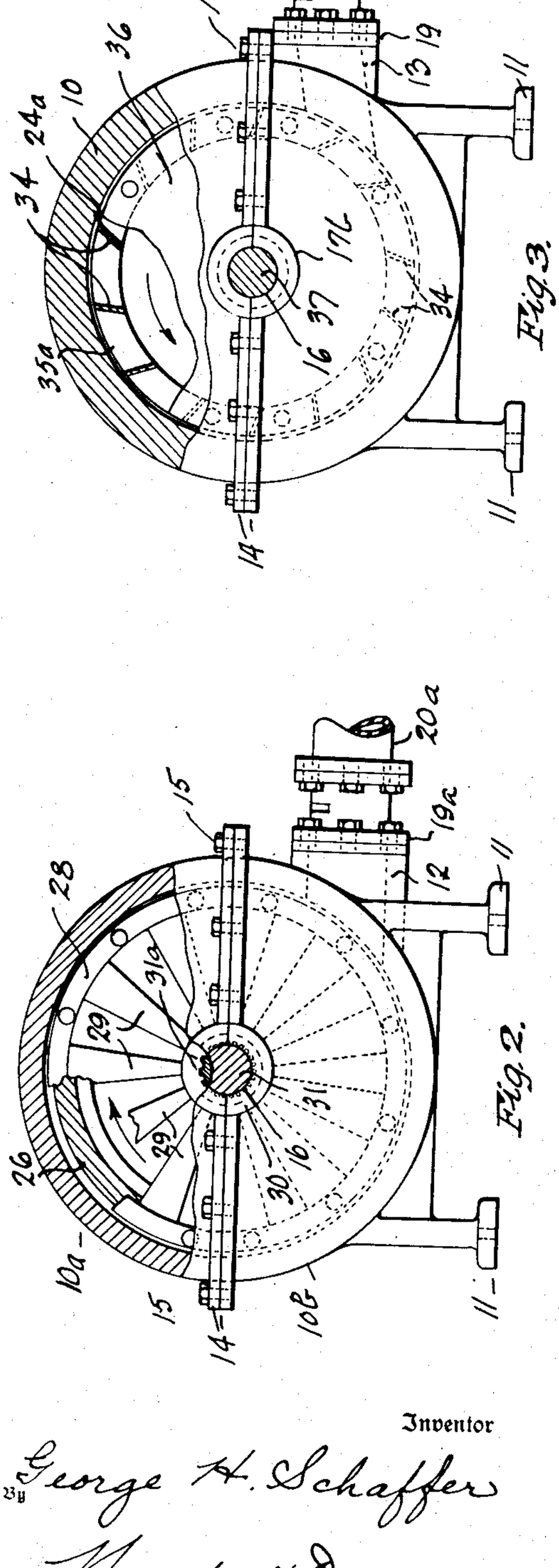

Fig. 3.

Fig. 2.

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CENTRIFUGAL PUMP

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13 Claims. (Cl. 103—88)

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This invention relates to an improvement in centrifugal pumps for pumping liquids, such, for example, as water and other liquids.

It is the main object of this invention to provide a centrifugal liquid pump of improved efficiency by reducing the frictional resistance of the liquid in its passage through the pump.

It is another object of this invention to provide a more efficient pump by providing an improved type of spiral screw conveyor, in connection with the rotor of the pump.

It is still another object of this invention to provide a more efficient centrifugal pump by combining the advantages of said improved spiral screw conveyor rotor with liquid deflecting blades at one end adapted to deflect and direct the intake liquids into the path of the screw conveyor rotor member, and a squirrel cage blade arrangement at the other end to aid in deflecting and directing the liquids at the discharge end.

With the foregoing and other objects in view, I have devised the construction illustrated in the accompanying drawing forming a part of this specification. It is, however, to be understood the invention is not limited to the specific details of construction and arrangement shown, but may embody various changes and modifications within the scope of the invention.

In this drawing:

Fig. 1 is a side view partly in section;

Fig. 2 is a left end view partly in section, of Fig. 1, and

Fig. 3 is a right end view partly in section, of Fig. 1.

In the preferred embodiment illustrated in the drawing, a longitudinal cylindrical pump housing generally designated **10** comprises an upper section **10***a* and a lower section **10***b*. The lower section **10***b* is provided with mounting legs **11**, an inlet port **12** and an outlet or discharge port **13**. Both upper and lower sections **10***a* and **10***b* are provided with co-acting continuous flanges **14** for water-tight connection around their longitudinal and transverse sides at the point where both sections are joined, said flanges being provided with spaced and aligned holes, the holes in the flange of the lower section **10***b* being preferably screw threaded to receive threaded screws or studs **15**.

In the radial center of each end of the assembled housing a circular aperture **16** is provided with screw threads around its periphery adapted to engage external screw threads of packing nuts or followers **17***a* and **17***b* for the usual packing **17***c*.

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Longitudinally extending bearing arms **18***a* and **18***b* containing one or more shaft bearings are attached to each end of the lower housing member **10***b*, so that the bearing openings align with end portions **16** and the packing nut openings.

The inlet and outlet ports **12** and **13** are provided with flanges **19***a* and **19***b* adapted for water-tight flange connection with suitable inlet and outlet conduits **20***a* and **20***b*.

The interior walls of the assembled housing generally designated **10** are formed so as to provide two communicating chambers **21***a* and **21***b*. Both chambers have circular peripheral walls substantially on center with the axis running through the bearings and packing nuts.

The longitudinal circular wall **22** of chamber **21***a* is of substantially uniform diameter for a short longitudinal distance at the location near the inlet port **12**. At a point approximately just beyond the inlet port, the walls **22***a* are tapered inwardly at a slight angle so that the diameter of the chamber **21***a* constantly and uniformly diminishes until a point is reached in the longitudinal dimension approximately just before the outlet port **13**, at which the tapered wall **22***a* of the chamber **21***a* terminates, and forms the inner periphery of a shoulder **23**. Shoulder **23** constitutes one transverse end of chamber **21***b*. Transverse end wall **10***c* of the housing near the outlet port **13** constitutes the other transverse wall of chamber **21***b*. Chamber **21***b* is of substantially uniform diameter, its longitudinal walls **24***a* being substantially parallel in contradistinction to the tapered walls **22***a* of chamber **21***a*. The longitudinal dimension of chamber **21***b* is approximately one-third of the longitudinal dimension of chamber **21***a*. It is to be understood that this is only suggested and a preferred dimension, which may be varied and not intended as a critical measurement.

Both chambers communicate with each other through a substantially circular opening **24***b* at shoulder **23**.

A rotor member generally designated **25** comprises a longitudinal, tapered, tubular sleeve or shell **26**, adapted to freely rotate within wall **22***a* of chamber **21***a* and with sufficient clearance to eliminate friction. The interior wall of tapered sleeve **26** is provided with a continuous spiral rib **27** protruding inwardly for a short distance, preferably about one and one-half inches, although it may be varied as desired and depending on the size of the pump.

The tapered sleeve **26** is open at its large end on which is bolted a ring **28** carrying radially extending blades **29** which are inclined, as shown

in Fig. 1, in the direction of rotation so their forward free edges are ahead of their rear edges. The hub of the ring **28** and blades **29** is a grooved ring **30** adapted to be splined or keyed at **30***a* to a drive shaft **31** longitudinally extending out of the housing, through the packing nut **16***a*, and journalled in bearing arm **18***a* by a suitable bearing and adapted to be driven by a gear, sprocket or pulley drive **32** by power means, such, for example, as an electric or other motor **33**.

The tapered sleeve **26** is likewise open at its narrow end, and attached to the sleeve at said narrow end is a squirrel cage type of blade arrangement in which a plurality of spaced and inclined blades **34** are arranged longitudinally with the sleeve member **26** and mounted between rings **35***a* and **35***b* to rotate on the same center as the sleeve member. The blades **34** are preferably inclined as shown in Fig. 3, backwardly from the direction of rotation so their outer edges are rearwardly of the inner edges, so that their counterclockwise rotation as viewed in Fig. 3 will carry and deflect liquids into outlet port **13**. The rings **35***a* and **35***b* are of suitable size to rotate within chamber **21***b* leaving only a very small clearance between the wall **24** and the periphery of said rings.

A circular disc **36** having a laterally extending shaft **37** is bolted to ring **35***b* so that shaft **37** extends through packing nut **17***b* and journals in bearing of bearing arm **18***b*.

Clearance between outer tapered wall of sleeve **26** and inner tapered wall **22***a* of the housing should be only large enough to allow free rotation of the sleeve within the housing.

Thus it can be seen that the rotor of my pump comprises a combination of three elements, viz.: a tapered longitudinal tubular sleeve or shell **26** provided with internal spiral feed ribs **27**, a plurality of spaced, inclined deflecting blades **29** radially disposed about the axis of the sleeve and mounted transversely at the large opening on the sleeve, and a squirrel cage blade arrangement **34** connected to the sleeve at its smaller opening.

The rotor sleeve member **26** may be made integral, but it is preferred that it be cast in two longitudinal sections and bolted together to effect manufacturing economies, or the complete rotor including the radially disposed transverse deflecting blades at the large opening of the sleeve and the squirrel cage rings and blades, including the splined or keyed hub rings, may be made by casting in two longitudinal sections, each section being integral, thus eliminating the need for mounting and bolting the blade members onto each end of the sleeve.

In operation, clockwise rotation of shaft **31**, as viewed in Fig. 2, builds up a suction from inlet port **12**, the blades **29** deflect and throw the liquids entering port **12** into the interior of sleeve member **26** where the spiral ribs **27** impart a forward movement to the liquid, pushing the liquid into chamber **21***b* where blades **34** of the squirrel cage arrangement deflect and throw the liquid into and out of the outlet port **13**.

The tapered shape of the sleeve aids the spiral ribs in channeling the liquids into chamber **21***b* as the centrifugal force due to rotation of this sleeve throws them out to and maintains them on the inner surface of this sleeve.

One of the advantages of my invention lies in the arrangement that the interior wall of the sleeve **26** rotates with the liquids as distinguished from devices in which the propelling means

pumps water through stationary chamber walls, thereby reducing friction with the wall. Another advantage is in the arrangement eliminating screw conveyor blades of the type extending to the center or axis of rotation, and substituting in my invention a type of spiral conveyor thread on the inner surface of a sleeve or shell leaving a wide opening or free space at the center between opposite peripheral edges of the threads, thus also diminishing resistance and friction.

Another advantage of my invention is in combining the deflecting and pumping action of the blades **29** and **34** with the action of the sleeve **26**, thereby accomplishing more efficient pumping.

Having thus set forth the nature of my invention, I claim:

1. A centrifugal pump for pumping water and other liquids comprising a longitudinal housing member provided at one end with an inlet port and the other end with an outlet port, the interior walls of the housing so formed as to provide two longitudinal chambers communicating with each other, one of the chambers beginning at the transverse end wall near the inlet port and tapering inwardly from a point near the inlet port to a point just before the outlet port, the other chamber being of substantially shorter longitudinal dimension than the first chamber and of substantially uniform diameter, the diameter of the smaller chamber being larger than the diameter of the large chamber at that point where the taper terminates; a rotor member within the housing comprising a tapered, hollow, tubular sleeve adapted to freely rotate within the tapered walls of the large chamber, a continuous spiral conveyor thread protruding from the interior wall of the sleeve, radially disposed and spaced blades mounted transversely on the sleeve at its large opening, said blades being inclined to deflect liquid into the sleeve when rotated, a hub at the radial center of the blades, a drive shaft engaged in the hub and extending out of the housing, a bearing for the shaft, a squirrel cage blade assembly attached to the tapered sleeve at its smaller opening and adapted to rotate within the smaller chamber, a disc attached to the outer transverse side of the squirrel cage, a shaft attached to and laterally extending from the radial center of the disc through the housing, a bearing for the latter shaft, and power means to drive the first mentioned shaft, whereby the rotor, the first mentioned blades, and the squirrel cage will rotate simultaneously within a substantially watertight housing, draw liquid into the inlet port, the first mentioned blades deflecting the entering liquid into the rotating tapered sleeve, the liquid carried forward by the spiral conveyor threads into the smaller chamber and deflected towards and out of the outlet port by the squirrel cage blades.

2. A centrifugal pump comprising a longitudinal housing having an inlet and an outlet port, aligned bearings at opposite longitudinal ends of the housing, said housing formed on the inside to provide two longitudinal circular chambers communicating with each other, one of said chambers being longitudinally larger than the other and tapered inwardly towards the smaller chamber, the smaller chamber having a larger diameter than the diameter at the small end of of the large chamber and the diameter of the small chamber being substantially uniform throughout its longitudinal dimension; a rotor contained within the housing comprising a longi-

tudinal sleeve tapered and adapted to rotate within the tapered walls of the large housing chamber, spiral conveyor threads protruding from the interior walls of the sleeve, a plurality of angularly spaced inclined blades connected with a radially centered hub ring mounted to the sleeve at its larger opening, a drive shaft connected to the hub and extending out of the housing at one end of the housing, a squirrel cage blade member transversely connected on one side to the sleeve at its smaller opening, another hub ring in the radial center of and attached to the other side of the squirrel cage member, a shaft attached to said hub and protruding out of the housing and journalled in the other bearing, and power means to drive the first shaft, whereby rotation of the rotor member will effect a pumping action within the housing to draw liquids in through the inlet port, the liquids deflected into the sleeve by the first mentioned radially spaced blades, the spiral ribs further propelling the liquids toward the interior of the squirrel cage and the blades of the squirrel cage deflecting the liquids into and out of the outlet port.

3. The combination in a centrifugal pump comprising a longitudinal substantially cylindrical housing provided with an inlet and an outlet port, the walls of the housing being formed to provide two longitudinal round communicating chambers, one of said chambers being longer than the other, the longer chamber being tapered inwardly toward the shorter chamber, the diameter of the shorter chamber being larger than the opening at the small end of the tapered chamber, and a rotor member comprising a longitudinal, tubular, tapered sleeve provided with spiral conveyor threads on its interior wall, a foraminous disc made up of a center hub ring and radially spaced and inclined blades connected transversely across the large opening of the sleeve, a squirrel cage blade member connected to the other end of the sleeve, a center hub ring attached to the other side of the squirrel cage member, a pair of separate shafts each attached to one hub and protruding out of the ends of the housing, bearings for the shafts, and power means to drive one of the shafts, whereby rotation of the rotor will draw liquids into the housing from the inlet port and deflect the liquids into the sleeve, the spiral threads propelling the liquid into the squirrel cage, and the squirrel cage blades deflect the liquid out of the outlet port.

4. The combination in a centrifugal pump comprising a housing provided with an inlet and an outlet port, means for mounting the housing to a base, bearing means for a shaft protruding out of the housing, the walls of the housing being formed to provide two longitudinal communicating round chambers, one of said chambers being longer than the other, the longer chamber being tapered inwardly toward the shorter chamber, the diameter of the shorter chamber being larger than the opening at the small end of the tapered chamber, a rotor member comprising a longitudinal tubular tapered sleeve provided with spiral conveyor threads on its interior wall, a foraminous disc made up of a plurality of radially spaced and inclined blades connected transversely across the large opening of the sleeve, a squirrel cage blade member connected to the other transverse end of the sleeve, shaft means journalled in the bearings adapted to rotate the rotor member, and power means to drive the shafting, whereby rotation of the rotor will draw liquid into the housing from the inlet port and deflect the liquid into the sleeve, the spiral threads propelling the liquid into the squirrel cage, and the squirrel cage blades deflecting the liquid out of the outlet port.

5. The combination in a centrifugal pump, of a rotor member comprising a longitudinal tubular sleeve provided with protruding spiral ribs on its interior wall, said sleeve being tapered so as to provide a larger opening and a smaller opening in its opposite transverse ends, a disc transversely connected to the sleeve at its larger opening, said disc comprising a plurality of radially spaced and outwardly inclined deflector blades and drive shaft connecting means in its radial center, a squirrel cage blade member attached to the sleeve at its smaller end with shaft connecting means provided in its radial center adapted to rotate on the same center line as the foraminous disc, and housing means enclosing the rotor member, the interior walls of the housing being of such shape and contour as to receive the rotor member for rotatable movement within the housing with a minimum of clearance between the outer periphery of the sleeve and the adjacent walls of the housing, said housing being provided with an inlet and an outlet port, bearing means at the exterior of the housing in alignment with the longitudinal axis of the rotor member and adapted to rotatably engage the shaft means, power means to drive the shaft means, whereby rotation of the rotor member within the housing will provide a pumping action to draw liquids into the housing and deflect them into the sleeve where the spiral ribs will further propel them into the squirrel cage where the action of the blades of the squirrel cage will deflect the liquid towards and out of the outlet port.

6. In a centrifugal pump, the combination of a rotor member comprising a tapered tubular sleeve provided with spiral ribs protruding a short distance from its interior wall, a plurality of blades radially spaced about the longitudinal axis of the sleeve attached at the transverse end of the sleeve and inclined to deflect liquid into the sleeve, a plurality of spaced longitudinal blades at the outlet end of the sleeve and connected with the sleeve to rotate with it, a housing enclosing the rotor member, the housing being provided with an inlet and an outlet port, drive shaft means connected to the rotor member, bearing means, the shaft means protruding out of the housing and journalled in the bearing means, and power means to drive the rotor, whereby rotation of the rotor member within the housing will provide a pumping action to draw liquids into the housing and deflect them into the sleeve where the spiral ribs will further propel them into the path of the longitudinal blades at the oulet end where the action of the last mentioned blades will deflect the liquid toward the outlet port.

7. The combination in a centrifugal pump of a rotor member comprising a longitudinal tubular sleeve provided with spiral ribs protruding a short distance from its interior wall, a plurality of inclined blades connected to the sleeve to rotate therewith and radially disposed in the center of the inlet end of the sleeve to deflect liquid into the sleeve, and a squirrel cage blade rotor attached to the other transverse end of the sleeve to rotate with it and having its radial center in alignment with the first blades, a housing enclosing the rotor member and provided with an inlet and an outlet port at the opposite ends thereof, and shaft means engaging the rotor for rotating it, and driving means for the shaft means.

8. The combination in a centrifugal pump of a rotor member comprising a longitudinal tubular sleeve provided with spiral ribs protruding a short distance from its interior wall, a plurality of inclined blades radially disposed about the longitudinal axis of the sleeve and attached transversely to the inlet end of the sleeve to rotate with it and to deflect liquid into the sleeve, a squirrel cage blade member attached to the other end of the sleeve to rotate with it, a housing having an inlet and an outlet port at opposite ends of the sleeve and enclosing the rotor member, bearing and shaft means for supporting and rotating the rotor member, whereby rotation of the rotor member within the housing will provide a pumping action to draw liquids into the housing and deflect them into the sleeve where the spiral ribs will further propel them into the squirrel cage where the action of the squirrel cage blades will deflect the liquids out of the outlet port, and means for rotating the shaft.

9. The combination in a centrifugal pump comprising a housing having an inlet and an outlet port, a rotatable longitudinal tubular sleeve having spiral screw thread ribs protruding a short distance into the sleeve from its interior wall, rotatable means adapted to deflect and propel fluids into one end of the sleeve, rotatable means at the other end of the sleeve adapted to propel and deflect fluid from the sleeve to the outlet port, the housing enclosing all of the rotatable members within itself, means to rotate the rotatable members, whereby the rotation of the rotating members will produce a pumping action to draw in liquids through the inlet port and direct or deflect the liquids into the sleeve where they are further propelled by the spiral ribs toward the other rotatable deflecting means and by the last mentioned means propelled and deflected out of the outlet port.

10. In a centrifugal pump, the combination comprising a housing having an inlet and an outlet port and a longitudinal tubular sleeve rotatably contained in the housing, spiral conveyor screw threads of rib-like construction protruding a short distance from the interior wall of the sleeve, means at one end of the sleeve and rotating with the sleeve to deflect liquids into the sleeve, means at the other end of the sleeve and rotating with it to deflect liquids from the sleeve into the outlet port, and means to rotate the deflecting means and the sleeve within the housing.

11. The combination in a centrifugal pump of

a rotor comprising a longitudinal tubular sleeve provided with spiral thread of rib-like construction protruding a short distance from the interior wall of the sleeve so as to leave the central portion open and unobstructed, and a housing provided with an inlet and an outlet port and containing the rotor within itself in rotating position, deflector blades at the inlet and outlet ends of the sleeve and rotatable therewith to respectively deflect liquids from the inlet port into the sleeve and from the sleeve to the outlet port, and means for rotating the rotor.

12. The combination in a centrifugal pump of a rotor member comprising a longitudinal tubular sleeve provided on its interior surface with a spiral conveyor thread projecting a short distance above said surface, a spaced blade disc attached transversely to one end of the sleeve to rotate therewith, the blades of the disc being radially disposed about the longitudinal axis of the sleeve and inclined to deflect liquid into the sleeve, and a housing having an inlet and an outlet port, the housing containing the rotor member, and means to rotate the rotor member within the housing.

13. The combination in a centrifugal pump of a rotor member comprising a longitudinal tubular sleeve provided with spiral conveyor thread on its interior surface projecting a short distance above said surface, a squirrel cage blade member connected to the outlet end of the sleeve, the interior chamber of the squirrel cage communicating with the chamber of the sleeve, means at the inlet end of the sleeve and rotatable with the sleeve to deflect liquids into the sleeve, and housing means including an inlet and an outlet port enclosing the sleeve and the squirrel cage, and means for rotating the sleeve and squirrel cage within the housing.

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