Dec. 25, 1934. J. D. HASKELL ET AL 1,985,569

REFINING ENGINE

Filed May 22, 1933 3 Sheets-Sheet 1

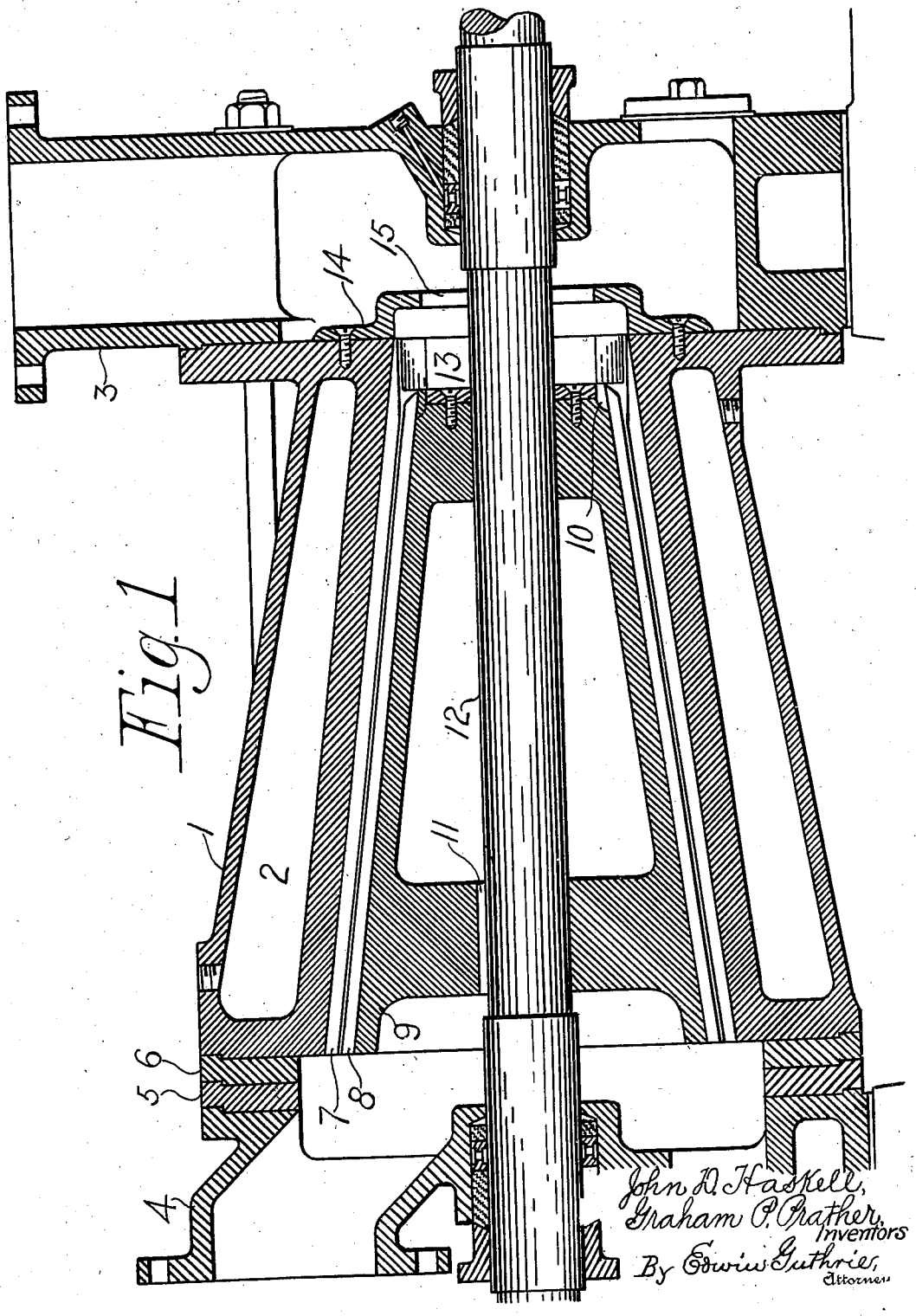


Fig. 1

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REFINING ENGINE

Filed May 22, 1933 3 Sheets-Sheet 2

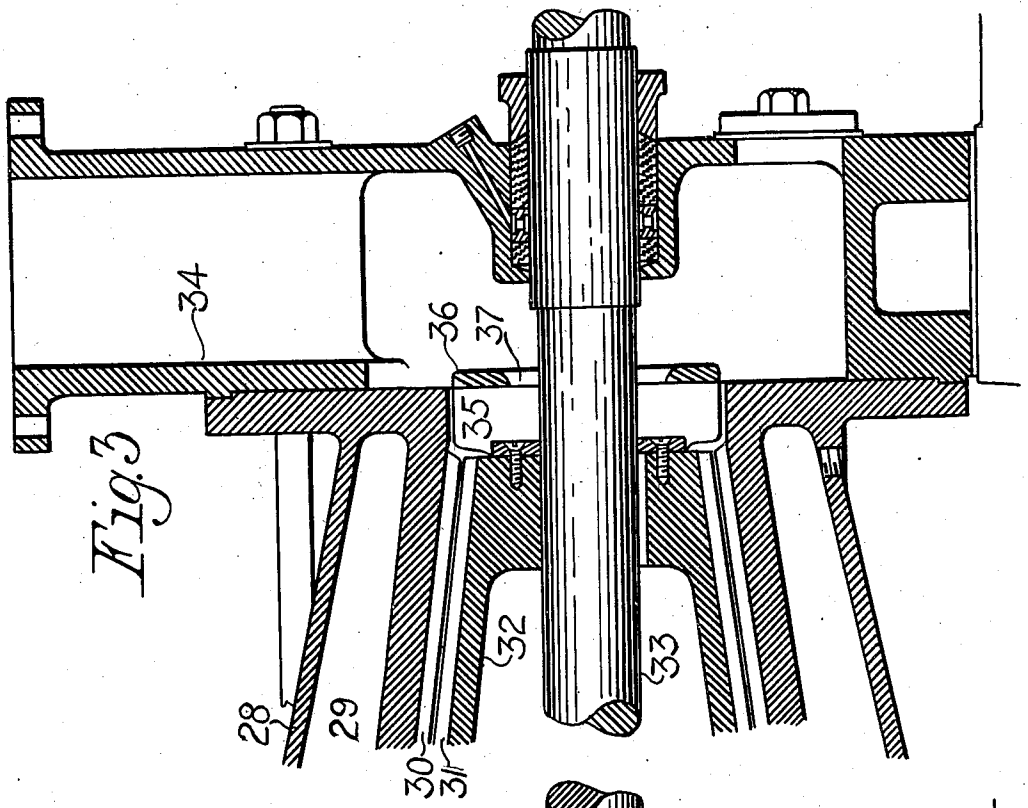


Fig. 3

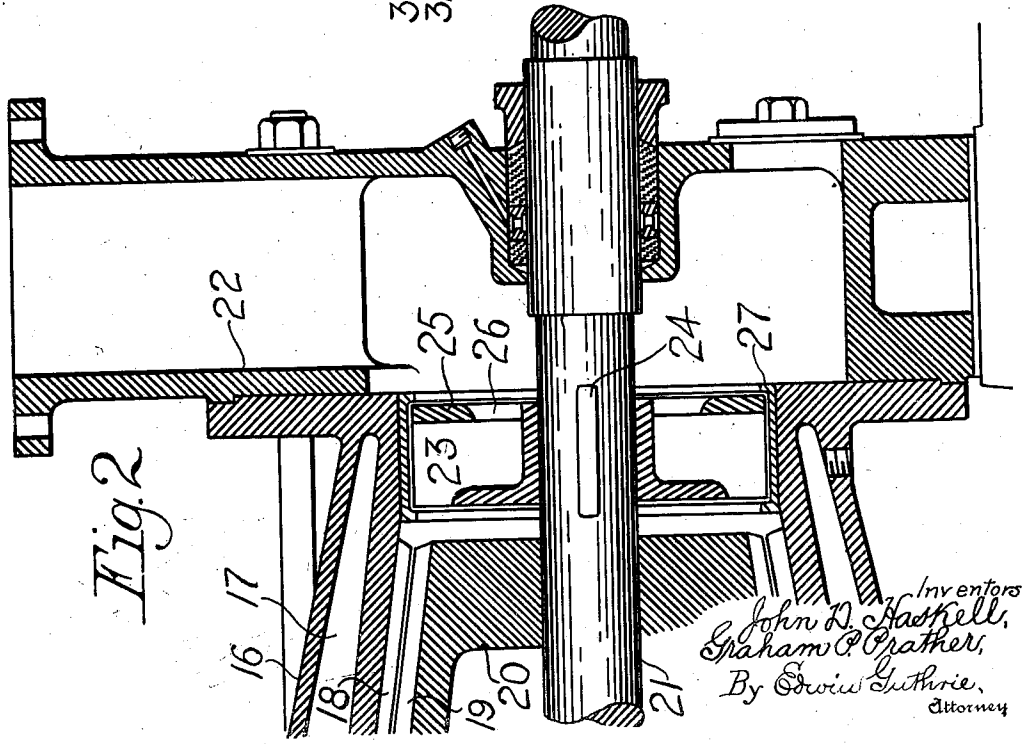


Fig. 2

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Filed May 22, 1933 3 Sheets-Sheet 3

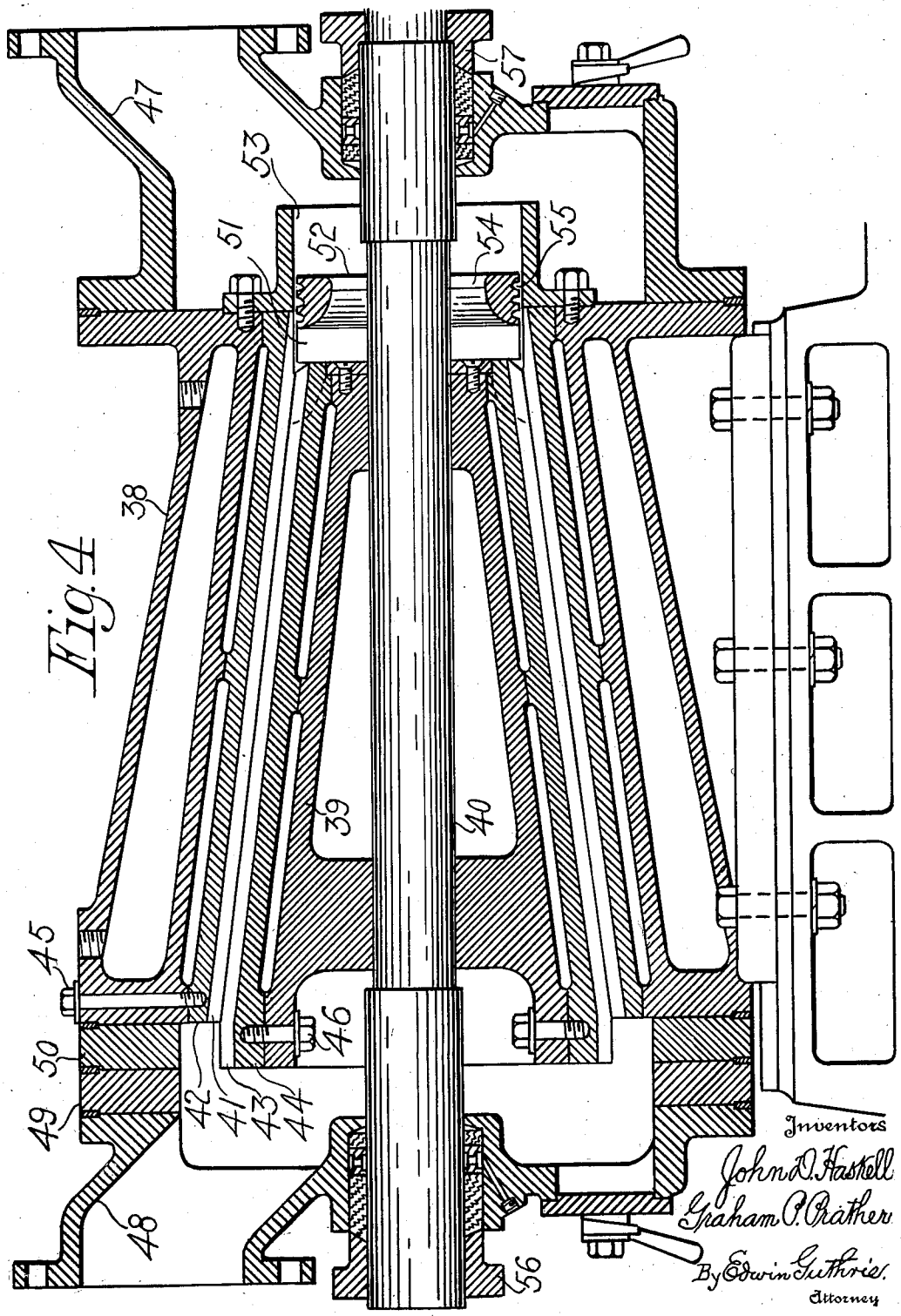


Fig. 4

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UNITED STATES PATENT OFFICE

1,985,569

REFINING ENGINE

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Application May 22, 1933, Serial No. 672,310

13 Claims. (Cl. 92—27)

This invention relates to refining engines customarily employed in the reduction of paper pulp, but usable in the like treatment of any other material in apparatus to which the construction herein set forth may be applied.

In a machine built in accordance with the patent of the United States Number 1,873,199 issued to one of the applicants herein small fins at the lesser end of the plug are utilized to force the stock through the knives. It was found that as the plug wears those fins cause agitation and loss of efficiency. It is the object of this invention to overcome such disadvantage by the introduction of a special orifice element or plate which these applicants have worked out and placed on the smaller end of the plug or similar inlet end of the machine, and which has greatly augmented its efficiency. In preliminary tests and trials of this present invention the effectiveness of the impeller blades or fins seems to increase as the parts wear, due to the fact that the space between the orifice plate and the impeller blades, in one form of the invention, is reduced as the plug wears and is adjusted endwise, so that there is less slippage of the stock at these points.

In the accompanying drawings the preferred construction of this invention, and certain valuable modifications thereof are illustrated.

Fig. 1 represents a vertical section lengthwise of a machine provided with this invention, and shows all parts assembled.

Fig. 2 is a vertical section lengthwise of the smaller ends of the shell and plug, showing a modified form of this invention with the impeller and orifice plate together and arranged to rotate in a guide frame.

Fig. 3 is a vertical section lengthwise of the smaller ends of the shell and plug, with the orifice plate of this invention carried by the impeller. This figure also illustrates a modification of the construction disclosed in Fig. 1.

Fig. 4 sets forth a vertical section lengthwise of apparatus of this character showing all parts assembled and having this invention applied thereto in another and special modified form.

Throughout the drawings and description the same number is used to refer to the same part.

Considering the drawings, Fig. 1, while the interior of the shell 1 and the plug therein are of frusto-conical form, it is not intended to limit the invention thereto. The shell may or may not have the cooling chamber 2. The shell is provided with the inlet pipe connection and chamber 3 at the smaller end, and a like outlet 4 at the other end. At the left hand or larger end of the shell are shown removable spacer rings 5 and 6 whereby the shell may be adjusted to compensate for the usual wear in such machines. The blades 7 of the shell coact with like blades 8 of the plug 9. The coacting surfaces or lines of the shell and plug may obviously be grinding surfaces of any selected nature. At the small end of the plug will be noted the recesses 10 formed in a circular series, of suitable size and shape, to aid in the delivery of the stock to the knives. As best shown in Fig. 1, the recesses 10 are formed in the body of the plug below the ends of the blades. A key 11 or the like secures the plug to the shaft 12. The impeller 13, is attached to the smaller end of the plug. The form of impeller illustrated is not intended to limit this invention, as there are in use many different shapes of this element. Adjacent to the impeller and supported by the shell in the form of this invention disclosed in Fig. 1, is the plate 14, having the orifice 15 for the passage of the stock and through which the drive shaft 12 also extends.

Considering the modification shown in Fig. 2, the shell 16 has the cooling chamber 17. The blades 18 carried interiorly by the shell coact with blades 19 borne by the plug 20, which is rotated by the drive shaft 21. The inlet connection and chamber 22 admit the stock to the impeller 23 which by means of its engagement with the feather key 24 is revolved by the shaft. The center or hub of the impeller is in engagement with the key. The orifice plate 25 is carried by or fashioned integrally with the impeller, and the stock passes through the orifice 26 in the plate. The impeller and plate are arranged in the guide ring 27. In this construction the whole impeller "floats" on the feather key and is held within limits by means of the guide ring.

Considering the modification illustrated in Fig. 3, the shell 28 has the enclosing cooling chamber 29. The blades 30 of the shell coact with the blades 31 of the plug 32. The drive shaft 33 carries the plug. Inlet pipe connection and chamber 34 admit the stock to the impeller 35 to which is directly attached the plate 36 having the orifice 37.

Fig. 4 represents in section another and for many uses a special and valuable modification of this invention. The shell 38 has therein the plug 39 revolved by the longitudinally adjustable shaft 40. In this construction the shell has interiorly the usual knives or blades 41 on a removable liner 42. The plug has like blades 43 on a removable liner 44. The liners of the shell are secured to the shell by suitable machine screws 45, and the

plug liners are similarly held by screws 46. An important feature in this construction is the use of the liners carrying the knives on the plug and shell, so that when these knives are worn out it is not necessary to discard the entire plug and outer shell, but the liners with the worn knives may be readily removed and new liners introduced. The shell and plug may, therefore, last indefinitely with corresponding economy in practice.

In Fig. 4 the apparatus has the inlet pipe connection and chamber 47 at the smaller ends of shell and plug, and a like outlet 48 at the left. As previously described, the shell may be equipped with the spacer rings 49 and 50 to permit of the adjustment of the shell lengthwise for wear.

At the smaller end of the plug is attached the impeller 51, of which it will be noted that the impeller ring 52 is made much heavier due to the fact that these applicants have found excessive wear of those parts. Auxiliary to the orifice plate such as disclosed in the previous figures herein, the applicants have fashioned a hollow cylindrical extension or tube 53, that is removably attached to the end of the shell as shown. It will be observed that the endwise adjustment of the plug can be made to its extreme right hand position and still have the necessary close clearance within the cylinder and in revoluble relation thereto. This construction permits the maximum adjustment of the plug for wear. The stock passes from the inlet chamber by way of the cylinder 53 and is directed through the orifice 54 in the impeller ring. Encircling the ring are the labyrinth grooves 55. These small grooves are designed to break down the velocity of such stock and water as tends to be thrown back toward the inlet opening of the cylinder or tube 53, by the action of the impeller. The applicants make the clearance between the impeller blades and the interior of the tube 53 very close, usually about one-sixty-fourth of an inch, yet even with such small clearance there is a tendency for leakage or slippage at this point, and the customary form of labyrinth grooves is introduced to break down this slippage and velocity and minimize the leakage due thereto. It will be understood that water thrown at high velocity at the periphery of the impeller blades tends to back into the space between the impeller ring and the hollow cylinder or tube 53, but upon reaching the first groove 55 it loses some of its velocity, and the same effect takes place additionally in subsequent grooves. If a sufficient number are used these grooves will effect a substantially tight seal against slippage. Where the drive shaft enters and leaves the shell, suitable stuffing boxes are provided, such as the boxes 56 and 57 illustrated in Fig. 4. The operation of this invention is the same in principle as that of any similar reducing beater, shredder or grinder, but the service of the stock to the coacting devices of the shell and plug, and the efficiency of the machine as a whole are found to be greatly augmented by the provision and arrangement of the orifice plate herein described and illustrated, and particularly by the employment of the cylindrical extension or tube within which the impeller revolves and may be adjusted for wear as explained.

Having now described this invention and the manner of its use, we claim:—

1. In apparatus of the character described, a shell having a frusto-conical interior, in combination with an inlet connection at the smaller end of the shell interior and an outlet at the larger end, a revoluble frusto-conical member within the shell, means for adjusting said shell and member longitudinally with respect one to the other, said shell and member having coacting devices adapted to reduce material passing between them, an impeller revoluble with said member and located at the smaller end of said member and arranged to direct material from the inlet to said reducing devices, and a unitary, separately removable orifice plate supported near the impeller and between said inlet and the impeller.

2. In apparatus of the character described, a shell, in combination with inlet and outlet connections for the shell, a revoluble member within the shell, said shell and member having coacting devices adapted to reduce material passing between them, an impeller revolving with said member and arranged to direct material from the inlet to said reducing devices, and an orifice plate carried by and revolving with the impeller.

3. In apparatus of the character described, a driving shaft, an impeller carried by the shaft, a guide ring for holding the impeller within limits on the shaft, and an orifice plate carried by the impeller and revoluble therewith.

4. In apparatus of the character described, a drive shaft, an impeller on the shaft, and an orifice plate carried by the impeller.

5. In apparatus of the character described, a drive shaft, an impeller on the shaft, and an orifice plate formed integrally with the impeller.

6. In apparatus of the character described, a drive shaft, an impeller on said shaft, and an orifice plate carried by said impeller and having an orifice for the passage of material and shaft, of greater diameter than the shaft.

7. In apparatus of the character described, a shell, in combination with a drive shaft, a revoluble member in said shell carried by the shaft, said shell and member having coacting blades adapted to reduce material passing between them, said shell having inlet and outlet connections, an impeller on said shaft located at the inlet end of said member, and said member being constructed with a circular series of spaced recesses formed in the body of the said member below the ends of the blades opening towards the impeller and said reducing blades.

8. In apparatus of the character described, the combination with a shell having an inlet and outlet, of a longitudinally adjustable drive shaft, a revoluble member carried by the shaft within the shell, said shell and member having coacting devices adapted to reduce material passing between them, an impeller movable with the shaft, and a unitary hollow cylindrical extension carried by the shell and separately removable therefrom and having an orifice for directing material to the impeller, said impeller being constructed and arranged to revolve near said cylinder whereby the impeller is thus revoluble at any longitudinal adjustment of the shaft.

9. In apparatus of the character described, the combination with a shell having an inlet and outlet, of a longitudinally adjustable drive shaft, a revoluble member carried by the shaft within the shell, said shell and member having coacting devices adapted to reduce material passing between them, an impeller movable with the shaft and having an orifice ring, and a hollow cylindrical extension carried by the shell and directing material to the impeller, said impeller being constructed and arranged to re-

volve within and near said cylinder whereby the impeller is thus revoluble at any longitudinal adjustment of the shaft.

10. In apparatus of the character described, the combination with a frusto-conical shell having an inlet at the smaller end and an outlet at the larger end, a longitudinally adjustable drive shaft, a conical plug carried by the shaft, said shell and plug having coacting devices adapted to reduce material passing between them, an impeller and orifice plate removably carried by the smaller end of the plug, and a hollow cylindrical extension carried by the smaller end of the shell and directing material to the impeller, said impeller and orifice plate being constructed and arranged to revolve within and near said cylindrical extension whereby the impeller is thus revoluble at any longitudinal adjustment of the shaft.

11. In apparatus of the character described, the combination with a shell having an inlet and an outlet, of a longitudinally adjustable drive shaft, a revoluble member carried by the shaft within the shell, said shell and member having coacting devices adapted to reduce material passing between them, an impeller movable with the shaft, said impeller having a thickened ring provided with a plurality of encircling labyrinth grooves to retard back water, said thickened ring having a central orifice, and a hollow cylindrical extension carried by the shell and directing material to the impeller, said impeller being constructed and arranged to revolve within and near the cylindrical extension whereby the impeller is thus revoluble at any longitudinal adjustment of the shaft.

12. In apparatus of the character described, a shell having an inlet and chamber at one end and an outlet at the other end, in combination with a unitary extension secured to the shell in the inlet chamber thereof for directing material into the shell, said extension being independently removable from the shell and having a central orifice.

13. In apparatus of the character described, the combination with a shell, of a cylindrical extension secured to the shell at one end, a drive shaft, and an impeller carried by the shaft and located within the cylindrical extension in revoluble relation thereto, said impeller having a ring portion provided with an orifice.

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