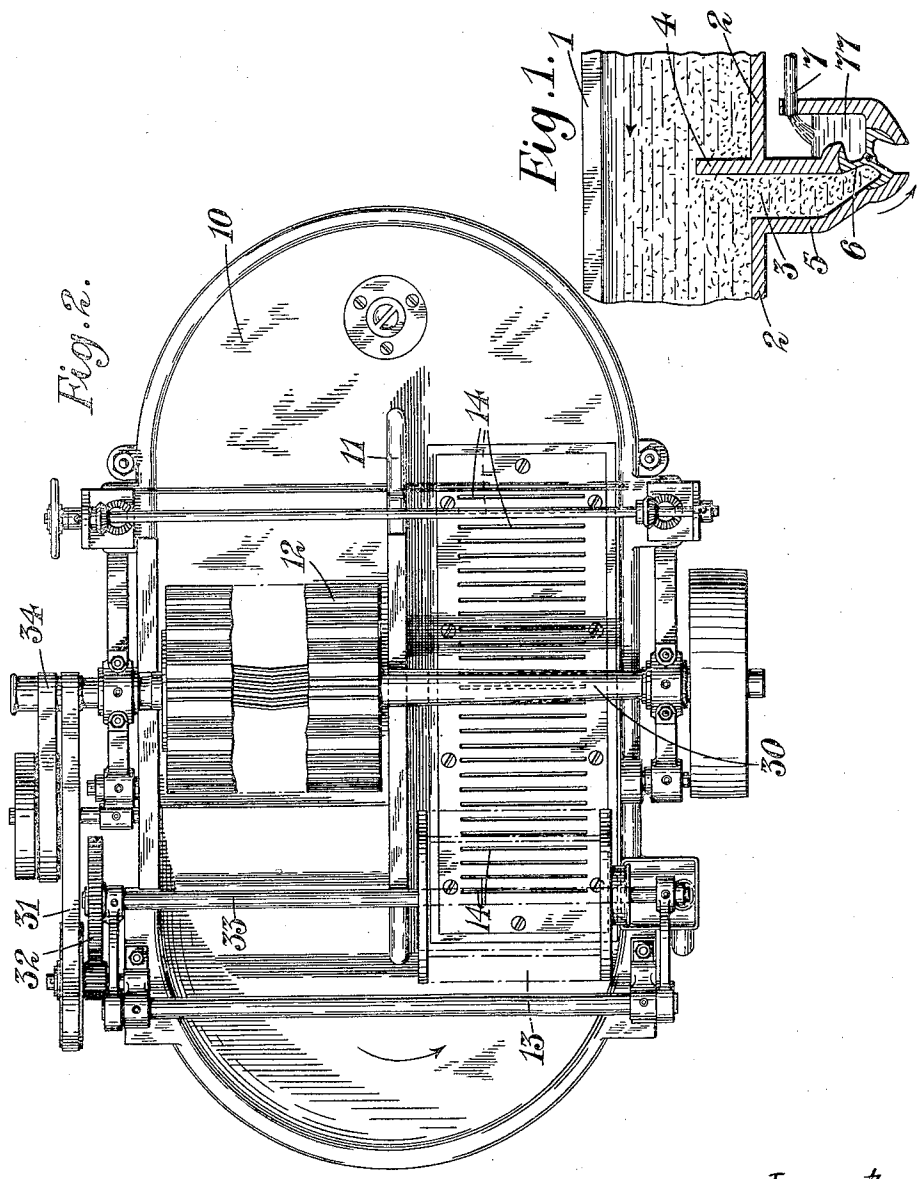


Dec. 23, 1924.

1,520,588

W. A. R. M. McRAE
WASHING APPARATUS SUITABLE FOR THE TREATMENT OF PAPER PULP
AND FOR OTHER PURPOSES
Filed Nov. 10, 1923

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

Fig. 3.

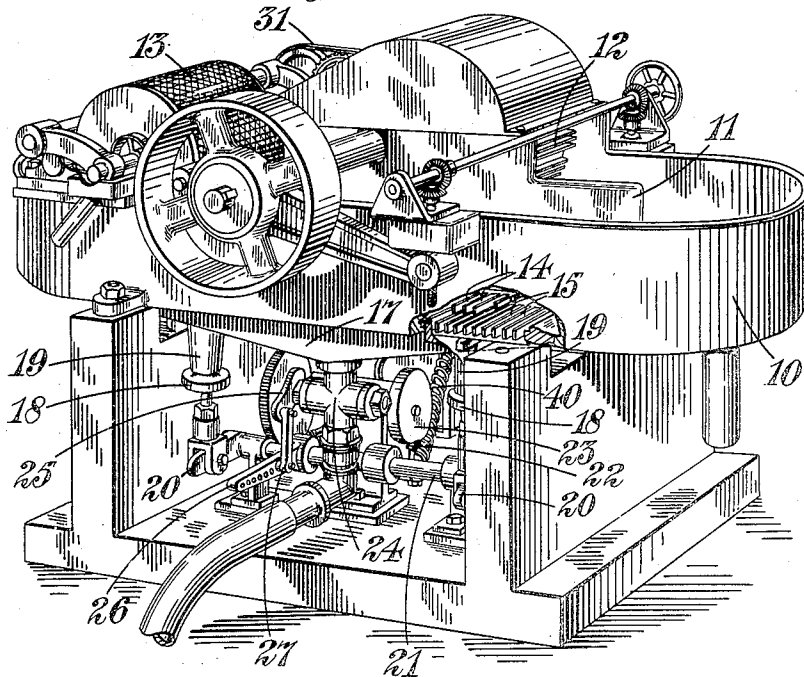
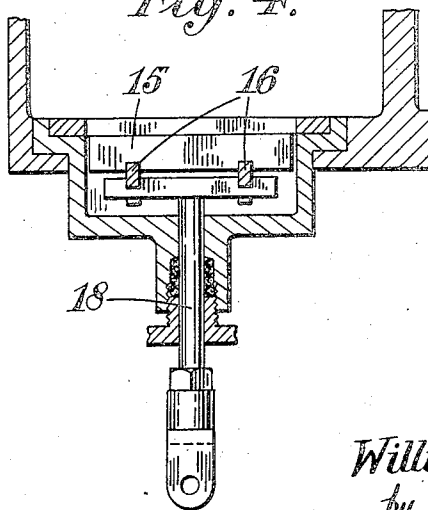


Fig. 4.



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4 Sheets-Sheet 3

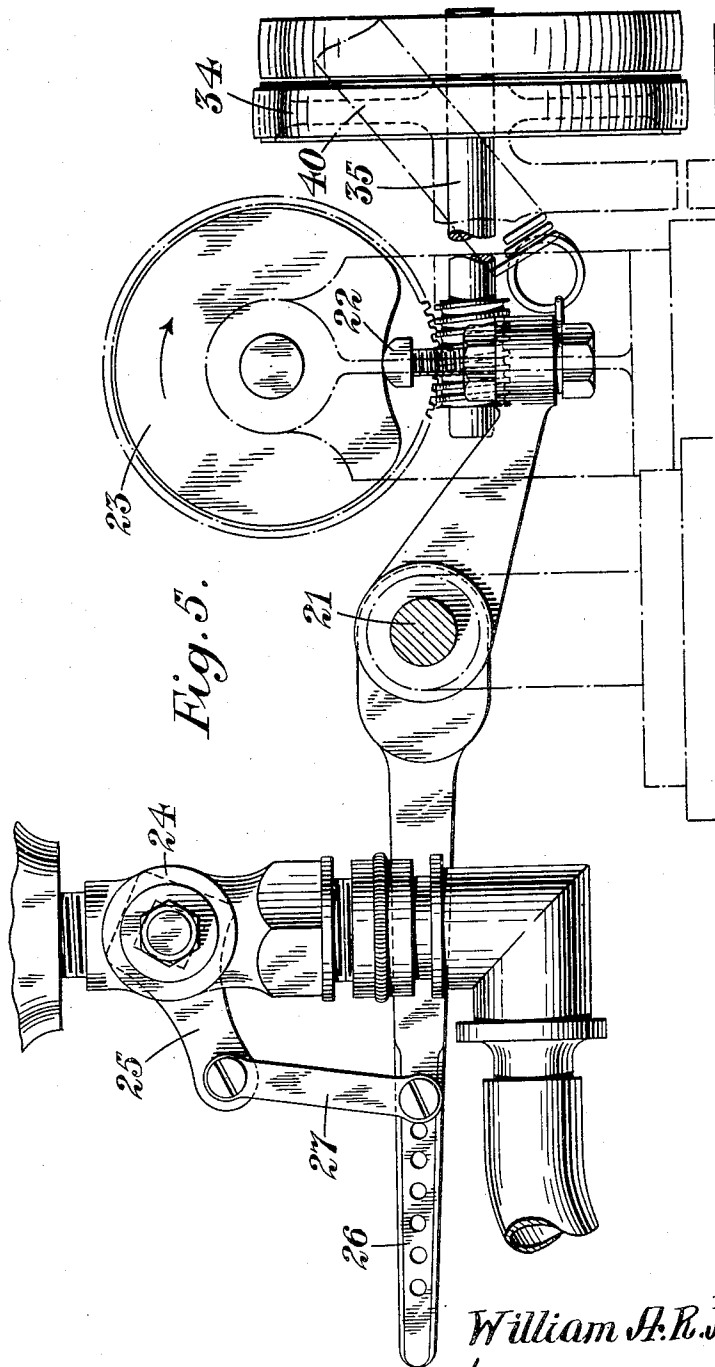


Fig. 5.

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4 Sheets-Sheet 4

Fig. 1.

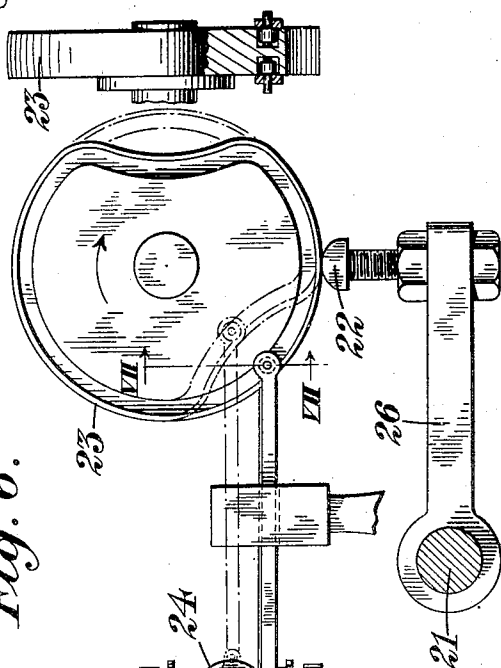
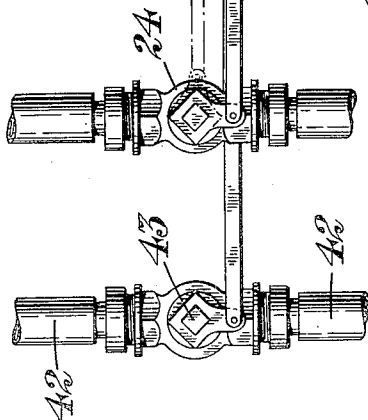


Fig. 6.



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UNITED STATES PATENT OFFICE.

WILLIAM ARTHUR RANKEN MICHAEL McRAE, OF LONDON, ENGLAND.

WASHING APPARATUS SUITABLE FOR THE TREATMENT OF PAPER PULP AND FOR OTHER PURPOSES.

Application filed November 10, 1923. Serial No. 673,979.

To all whom it may concern:

Be it known that I, WILLIAM ARTHUR RANKEN MICHAEL McRAE, a subject of the King of England, residing in London, England, have invented certain new and useful Improvements in Washing Apparatus Suitable for the Treatment of Paper Pulp and for Other Purposes, of which the following is a specification.

This invention consists, in general, in improvements in or relating to washers for treating a stream of liquid, which is flowing in or through a vessel and which contains materials in suspension, for the isolation and removal of certain materials substantially without removing another or others of them. In a particular application of the invention the present improvements are applied to machines commonly known, amongst other terms, as rag-engines, potchers or breakers such as are used for breaking-in or beating paper-making materials for the production of paper-pulp or half-stuff or for bleaching or otherwise treating such materials.

According to the present invention a washer of the type and for the purpose above described, is characterized by one or more riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof, of material which will deposit by gravity, and an opening in the base of the washer so disposed in relation to each riffle or rib that the material which has so collected, or would so collect, will fall there-through. Conveniently there is a sump beneath the said opening or openings in the base of the washer, so constructed that it may constitute an extension beneath the washer to be filled with liquid so that material falling through the opening or openings aforesaid will settle down into the sump in still water.

Preferably the riffles or ribs are removable at will from their upstanding positions and are combined with means to move them into and out from that position.

The invention includes a method of operating the washer above described, which consists in maintaining the aforesaid sump full of liquid during such times as the mate-

rial is passing thereinto through the opening or openings aforesaid.

A particular form of the invention, as applied to a rag-engine or the like having the usual knife-roll or agitating-vanes and drum-washer, is characterized by the combination of a drain grid in the base of the engine in "rear" of the drum-washer and movable vanes so formed and of such dimensions as, in one extreme position, to extend between the grid spaces and project above the grid, whereby they substantially close the grid spaces and constitute riffles above the surface of the grid and, in the other extreme position, to be withdrawn below the grid to leave the surface of the latter unobstructed and the grid spaces open.

The grid is in "rear" of the drum-washer in the direction of travel of the material round the base or container of the engine.

According to a feature of the invention, there is provided, in addition, a sump beneath the grid and a discharge cock controlling the outlet from the said sump, means for moving the vanes into and out from their positions between the grid bars, and means operatively connecting said vanes with said cock so that the latter is not opened until the vanes close the grid, and vice versa. Conveniently means may be provided for admitting water to the sump to replace the bulk of water and solid matter withdrawn. This admission may take place either simultaneously with, or subsequently to, the withdrawal of the water and solids from the sump.

The invention will now be described, with the aid of the accompanying drawings, which are given as examples only of the application of the invention and in which—

Figure 1 is a diagrammatic illustration of the general application of the invention;

Figure 2 is a plan of a rag-engine or the like constructed according to the present invention;

Figure 3 is a perspective view of the apparatus shown in plan in Figure 2;

Figure 4 is an enlarged view, in section, of a detail of the apparatus;

Figure 5 is a detail of parts of the driv-

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ing connection looking from the right of Figure 3 so as to show those parts in their relative positions;

Figure 6 is a diagrammatic illustration of modified means for operating inlet and outlet cocks for the sump in addition to means for operating the movable vanes; and

Figure 7 is a section on the line VII—VII of Figure 6.

Like reference numerals indicate like parts throughout the drawings.

In Figure 1 the base of a channel 1 is represented at 2 as being formed with an opening 3 in front of which, considered in the direction of the flow of the fluid stream indicated by the arrow, is an upstanding rib or riffle 4. Beneath the opening 3 is a sump 5 having an outlet at the base through which material deposited in the sump is removed, for example by a continuously rotating pocket-wheel or pocketed cylinder 6. A conduit 7 is provided for supplying liquid to replace the bulk of liquid and solid material removed by the wheel or cylinder 6 and at the same rate as such liquid and solid is withdrawn so as to prevent any appreciable down-current of liquid into the sump 5. The supply of liquid through the conduit 7 passes into a trough or other receptacle 77 and thence is picked up by a pocket in the member 6 as the latter rotates and is carried into the sump 5.

If, for example, material such as crushed or opened-up bamboo is being washed with agitation in the vessel, diagrammatically represented by 1, it is found that certain of the non-fibrous material, such as the parenchyma or pith, together with the material of the knots or nodes, if present, and cuticular substances, will become deposited in rear of the rib 4 and will settle or fall into and down through the still water contained in the sump 5, while the fibre which comprises pecto-ligno-cellulose will be held in suspension in the flowing stream and will not settle or deposit into the sump.

With this construction there is no suction effect in the sump which, if it were present, would tend not only to withdraw the material described above as settling quietly therein, but would also tend to withdraw some of the fibrous material. Such a suction effect would be present if the liquid and the deposited material were allowed to flow freely continuously or intermittently through an outlet-conduit from the sump.

In the particular application of the invention as illustrated in Figures 2-4, a rag-engine is illustrated of known construction in the form of a comparatively shallow and more or less oval vessel 10 having a mid-feather 11 disposed longitudinally therein, a knife-roll 12 and a drum-washer 13, the knife-roll and drum-washer being on opposite sides of the mid-feather 11. The de-

vice illustrated in Figure 1 is not employed in its exact form in the construction illustrated in Figures 2 to 4. The corresponding parts, described in detail below, operate, however, to the same or an equivalent effect. In the base of the vessel 10, immediately in rear of the drum-washer, is a grid formed with a series of parallel rectangular slots 14 extending transversely to the direction of the current of the fluid passing round within the vessel 10, the direction of flow being indicated by the arrow on the left of Figure 2.

As will be seen more clearly from Figures 3 and 4, a series of vanes 15 is provided, one for each grid-space, and of such dimensions that each will slide freely within its appropriate grid-space and when within it will substantially fill and close it. The vanes 15 are carried on a supporting frame, indicated generally at 16, common to them all, and the frame 16 is located within a sump 17 disposed beneath the grid and adapted to receive the material discharged therethrough as in the case of the sump 5 of Figure 1.

The frame 16 is carried on vertical reciprocating plungers 18 which pass through packed glands 19 extending downwardly from the base of the sump, there being one such plunger for each end of the frame. The lower ends of the plungers are connected by crank-arms 20 to a rock-shaft 21 and are conveniently spring-controlled so as normally to be pressed towards their lowermost positions. Such a spring has been illustrated at 40 in Figures 3 and 5 as pulling on a lever extending from the rock-shaft 21, but this is only to be taken as indicative of the nature of the spring control required but not necessarily as the form to be adopted in practice. In their lowermost position the vanes will be removed beneath the grid, leaving the grid-spaces open. The rock-shaft 21 has a rocking lever extending rearwardly in Figure 3 and terminating at its outer end in an abutment 22 to be engaged by a snail-cam or the like 23 which is operated by any convenient connection from the main driving-gear. By the action of the cam 23 the plungers are periodically reciprocated so as to raise the vanes between the grid-spaces, then to hold them there for a certain period of time, and thereafter to lower them to the position beneath the grid illustrated in Figure 4.

A drain-cock 24 controls the outlet from the sump 17, the plug of the cock being connected through the levers 25 and 26 and link 27 to the rock-shaft 21. The connection of the cock-plug is such that the drain-cock is not opened until the vanes 15 are raised into a position in which they close or substantially close the grid-spaces.

As shown in Figures 3 and 5, the drain-

cock 24 is shown as moving with the rock-shaft 21 so that it is opened during such period as the vanes are in their raised position. Provided the vanes substantially close the grid-spaces no appreciable suction effect will be experienced in the vessel 10. Conveniently an inlet-conduit, not shown in the drawings, is provided for supplying water to the sump to replace the water and solid material removed therefrom through the drain-cock.

Figures 6 and 7 diagrammatically illustrate a modified means for controlling the inlet and outlet cocks from the sump directly from the cam 23. In the diagram the cam 23 is shown as having cam-grooves parallel with its cam-surface and in the cam-grooves are received two rollers one at the end of an operating-arm for the drain-cock 24 and the other at the end of the operating-arm for the inlet-cock 43 controlling an inlet-conduit 42 which supplies liquid to the sump. It will be now seen that the cam 23 operates the inlet and outlet cocks similarly to, but lagging in phase behind, the operation of the rock-shaft 21. This lag is such that the cocks are not opened until the vanes have reached positions in which they close the grid-spaces but they are only opened for a comparatively short time sufficient, however, to permit removal of the liquids and solids from the sump 17. Conveniently the parts are so adjusted that the drain-cock opens as soon as the vanes have moved to a position in which they commence effectively to close the grid-spaces by entering them and remains open until the vanes have reached their highest position. Shortly after this position is reached the cocks are closed. Water is admitted through the inlet-cock at a sufficient rate to the upper end of the sump so as at all times to maintain the sump full of water.

The driving connections comprise a main shaft 30 on which is mounted the knife-roll 12 from which a belt-connection 31 effects the drive of gearing 32 for the spindle 33 of the drum-washer 13, and another belt-connection 34 is made to a transverse shaft 35 which is conveniently geared, for example by worm and worm-wheel, to the spindle of the cam 23.

The operation of the apparatus is as follows and will be described in its application to the preliminary treatment of bamboo-fibres for the extraction of the parenchyma or pith and any foreign matter which may be present, from the pecto-ligno-cellulose fibres.

The vessel 10 is furnished with the crushed or opened-up bamboo and water and the knife-roll and drum-washer are set in operation but the belt 34 is thrown on to the loose pulley so that the shaft 35 is not rotated.

The cam 23 is adjusted so that the upper edges of the vanes 15 are flush with the surface of the grid. The drum-washer removes the dirty scum and if the knife-roll is set to the brush-out position in relation to the bed-plate beneath it, it will be found that at the end of from 15-20 minutes the parenchyma or pith will have become separated and reduced to small particles. The shaft 35 is then thrown into gear and the vanes 15 are raised so as to project above the surface of the grid and in their highest position extend thereabove approximately 1 inch but this height will vary according to circumstances and to material under treatment. Meanwhile the sump is full of water or is filled with water and it is found that the material, in passing round the container 10, becomes balled up (so far as the fibres are concerned) and the ball-like masses roll, partly held in suspension, over the surface of the projecting ribs or riffles constituted by the vanes 15. In so doing the masses receive a certain amount of shaking and this tends to deposit or precipitate the parenchyma or pith together with the material of the knots or nodes, if present, and cuticular substances which settle and collect in rear of the vanes 15. Taking a complete cycle of movement of the vanes, they are held for approximately four-fifths of the cycle in their raised position, then the cam 23 operates to lower them rapidly during approximately one-twentieth of the cycle, to their extreme depressed position, in which they are removed below the grid-spaces to open the latter. At the same time, or preferably immediately the vanes had reached their highest position, as with the arrangement shown in Figure 5, the cock 24 is closed and the parenchyma or pith particles fall through the grid-spaces and settle in still water to the bottom of the sump 5. The period for which it is found necessary to retain the vanes in their lowermost position is approximately one-tenth of the period of the cycle, after which they ascend again rapidly during a period equal approximately to one-twentieth of the cycle period. These figures are approximate only and are used to illustrate the nature of the movement to be imparted to the vanes.

During the upward movement of the vanes the cock 24 is opened as soon as the grid-spaces are closed or substantially closed and the collected parenchyma or pith escapes from the sump. Provision is made, for example the conduit 42 diagrammatically shown in Figures 6 and 7, for running fresh water into the sump either simultaneously with the removal of the water and pith therefrom or, if desired, subsequently thereto, by altering the position of the cam-engaging wheel of the inlet-cock operating-lever. The object of this is to refill the

sump or to maintain the sump constantly full so that when the vanes are again depressed the parenchyma or pith will settle down in still water in the sump. Thus, suction effect at the grid in the vessel 10 is eliminated during the time that the parenchyma or pith particles and other materials previously referred to are passing from the vessel through the grid-spaces into the sump.

The apparatus can obviously be employed for treating other liquids containing materials held in suspension whereof some of the materials will settle more rapidly or more readily than will some of the others, the settlement being assisted, as is well understood, by the presence of the ribs or riffles constituted by the vanes such as 15.

It is obvious that in place of vertically reciprocating flat vanes, curved or segmental vanes could be employed operating from a rock-shaft or a series of rock-shafts. As a further alternative the grid spaces could be made comparatively wide and vaned wheels could be carried on spindles parallel with the slots. The vanes would be of such length and width that in certain positions of the wheels they serve to close the slots. The vaned wheels would take the place of the reciprocating vanes described in detail above, and it will be understood that as they are rotated they serve to discharge the matter collected within the grid spaces or on the grid above the spaces in a manner similar to the discharge which is effected by the reciprocating vanes. Further rotation of the vanes would again serve to close the slots or grid spaces until it was again desired to discharge them. The vaned wheels could be either rotated always in one direction or they could be reciprocated.

In a modified form of the invention each grid-space may be partitioned off by narrow transverse strengthening ties and the vane slotted to pass the ties.

Whether flat or curved vanes are employed, it is preferred that their upper surfaces should be chamfered so that they slope upwardly in the direction of travel of the material past them. Similarly, the rear edges of the grid-bars could also be chamfered so as to be parallel with the chamber of the edges of the vanes. This will materially assist in the quick discharge of the material which has collected behind the vanes. Alternatively, the lateral edges of the grid-bars could be oppositely chamfered or they could be parallel-sided and the upper edges of the vanes can be flat-topped or wedge-shaped.

It will be understood that the apparatus described and claimed herein can be employed in processes for removing the pith, cuticular and other non-fibrous material

after boiling for example in a mild alkali solution.

What I claim as my invention and desire to secure by Letters Patent is:—

1. A washer of the type and for the purpose described characterized by one or more riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof of material which will deposit by gravity, and an opening in the base of the washer so disposed in relation to each riffle or rib that the material which has so collected or would so collect will fall there-through.

2. A washer of the kind described having one or more movable riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof of material which will deposit by gravity, and an opening in the base of the washer so disposed in relation to each riffle or rib that the material which has so collected or will so collect will fall therethrough and means to move the riffles or ribs at will into and out from their upstanding position.

3. A washer of the kind described having one or more riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof of material which will deposit by gravity, an opening in the base of the washer so disposed in relation to each riffle or rib that the material which has collected or will so collect will fall therethrough, and a vessel beneath said opening or openings so constructed that it may be filled with liquid and thereby provide a column of still liquid extending from the opening or openings into the vessel from or from near the base of the washer for the purpose described.

4. A washer of the kind described having one or more movable riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof of material which will deposit by gravity, and an opening in the base of the washer so disposed in relation to each riffle or rib that the material which has so collected or will so collect will fall therethrough, means to move the riffles or ribs at will into and out from their upstanding position, and a vessel beneath said opening or openings so constructed that it may be filled with liquid and thereby provide a column of still liquid extending from the opening or openings into the vessel from or from near the base of the washer, for the purpose described.

5. A washer of the kind described having one or more riffles or ribs extending upwardly from the base of the washer to effect collection in rear thereof of material which will deposit by gravity, an opening in the base of the washer so disposed in relation to each riffle or rib that the material which

has collected or will so collect will fall there-
through, a vessel beneath said opening or
openings so constructed that it may be filled
with liquid and thereby provide a column
5 of still liquid extending from the opening
or openings into the vessel from or from
near the base of the washer, means to main-
tain the vessel full of still liquid during such
time as the material is passing thereinto
10 through the said opening or openings.

6. A washer of the kind described having
one or more movable riffles or ribs extending
upwardly from the base of the washer to
effect collection in rear thereof of material
15 which will deposit by gravity, and an open-
ing in the base of the washer so disposed in
relation to each riffle or rib that the ma-
terial which has so collected or will so collect
will fall therethrough, means to move the
20 riffles or ribs at will into and out from their
upstanding position, a vessel beneath said
opening or openings so constructed that it
may be filled with liquid and thereby pro-
vide a column of still liquid extending from
25 the opening or openings into the vessel from
or from near the base of the washer and
means to maintain the vessel full of still
liquid during such time as the material is
passing thereinto through the said opening
30 or openings.

7. A rag-engine or potcher having the
usual disintegrating knives or agitating
vanes and drum-washer, characterized by
the combination of a drain-grid in the base
35 of the engine in "rear" of the drum-washer,
and movable vanes so formed and of such di-
mensions as, in one extreme position, to ex-
tend between and to project above the grid
whereby they substantially close the grid-
40 spaces and constitute riffles above the sur-
face of the grid and, in the other extreme
position, to be withdrawn below the grid to
leave the surface of the latter unobstructed
and the grid-spaces open.

8. A rag-engine or potcher according to
claim 5 characterized in addition by a sump
beneath the grid, a discharge-cock control-
ling an outlet from said sump, means for
moving the vanes into and out from their
50 positions between the grid-bars and means
operatively connecting said vanes with said
cock so that the latter is not opened until
the vanes close or substantially close the

grid-spaces and vice versa, with or without
a water-inlet for the sump and an inlet-cock 55
controlled simultaneously, or substantially
so, with the outlet-cock.

9. A rag engine or potcher having the
usual disintegrating knives or agitating
vanes and drum washer in combination with 60
a drain-grid in the base of the engine in
"rear" of the drum washer, movable vanes
so formed, and of such dimensions as, in one
extreme position, to extend between the grid
spaces and to project above the grid whereby 65
they substantially close the grid spaces and
constitute riffles above the surface of the grid
and, in the other extreme position, be with-
drawn below the grid to leave the surface of
the latter unobstructed and the grid spaces 70
open, a sump beneath the grid, a discharge
cock controlling an outlet from said sump,
means for moving the vanes into and out
from their positions between the grid bars
and means operatively connecting said vanes 75
with said cock so that the latter is not opened
until the vanes close or substantially close the
grid spaces and vice versa.

10. A rag engine or potcher having the
usual disintegrating knives or agitating 80
vanes and drum washer in combination with
a drain-grid in the base of the engine in
"rear" of the drum washer, movable vanes
so formed and of such dimensions as, in one
extreme position to extend between the grid 85
spaces and to project above the grid where-
by they substantially close the grid spaces
and constitute riffles above the surface of the
grid, and in the other extreme position, be
withdrawn below the grid to leave the sur- 90
face of the latter unobstructed and the grid
spaces open, a sump beneath the grid, a dis-
charge cock controlling an outlet from said
sump, means for moving the vanes into and
out from their positions between the grid 95
bars, means operatively connecting said
vanes with said cock so that the latter is not
opened until the vanes close or substantially
close the grid spaces and vice versa, and a
water inlet for the sump and an inlet cock 100
with means to control it simultaneously or
substantially simultaneously with the outlet
cock.

In testimony whereof I affix my signature.

WILLIAM ARTHUR RANKEN MICHAEL McRAE.