June 18, 1957 M. P. CHAPLIN 2,796,006

FIBRE DISINTEGRATOR AND SEPARATOR

Filed March 24, 1955 6 Sheets-Sheet 1

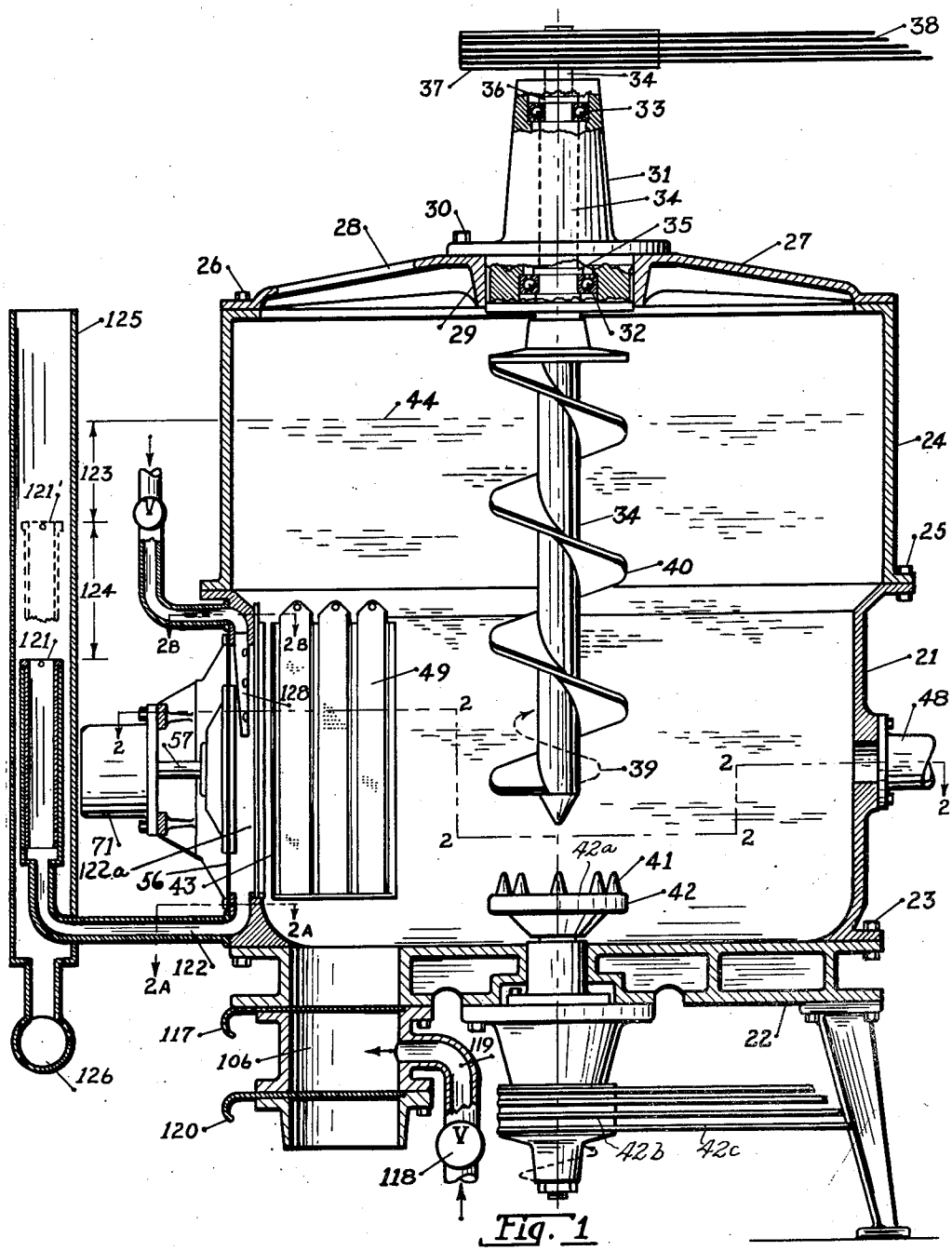


Fig. 1

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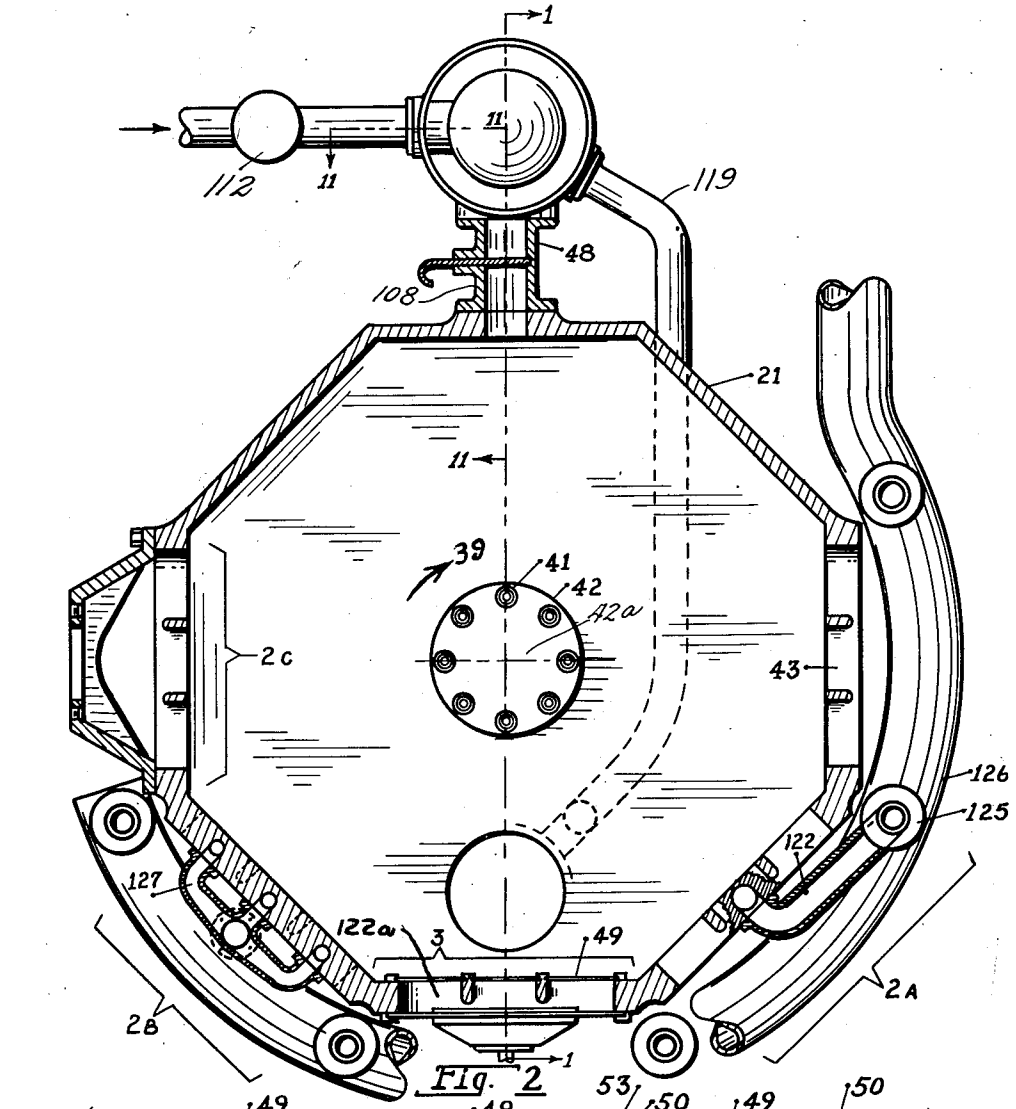


Fig. 2

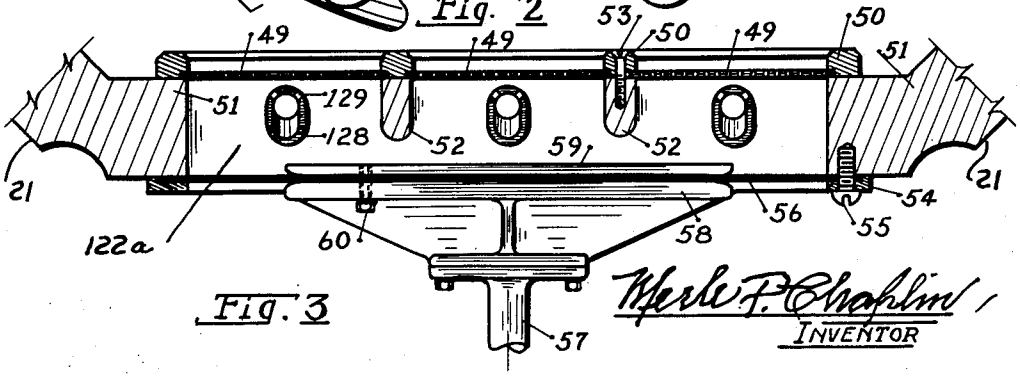


Fig. 3

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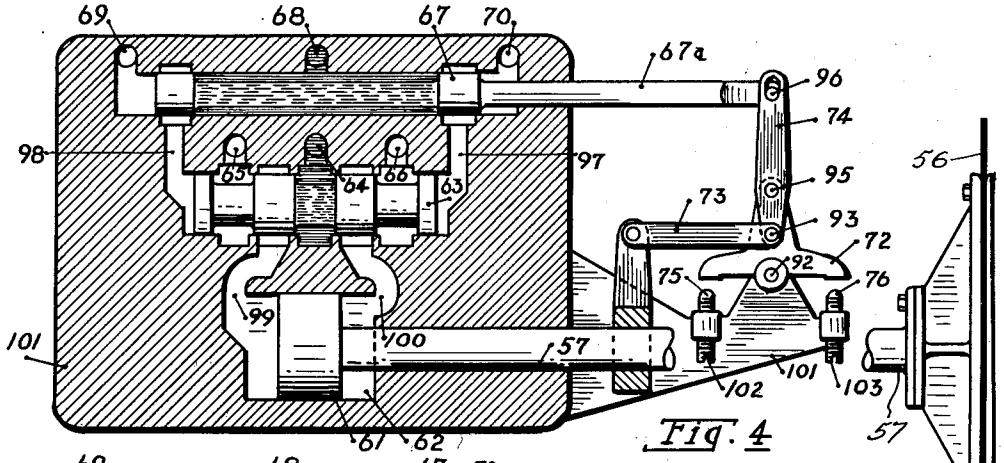


Fig. 4

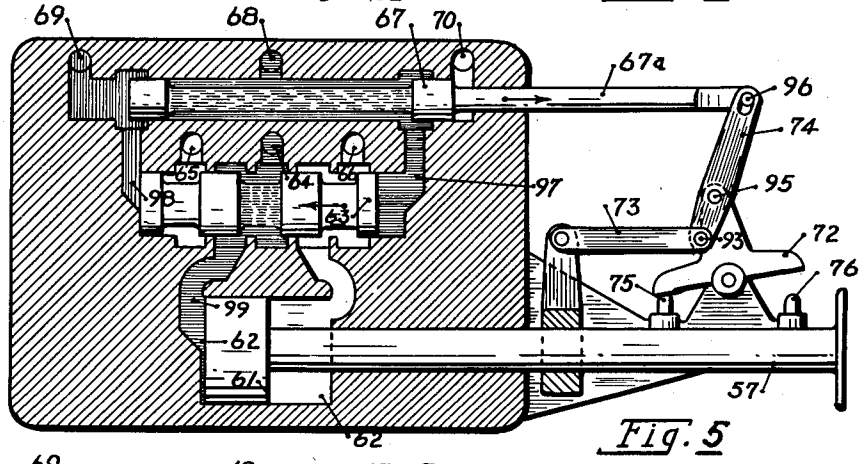


Fig. 5

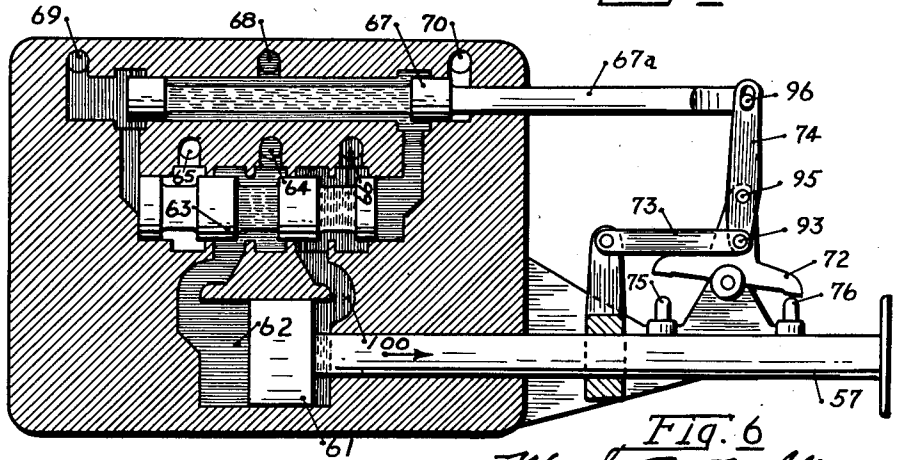


Fig. 6

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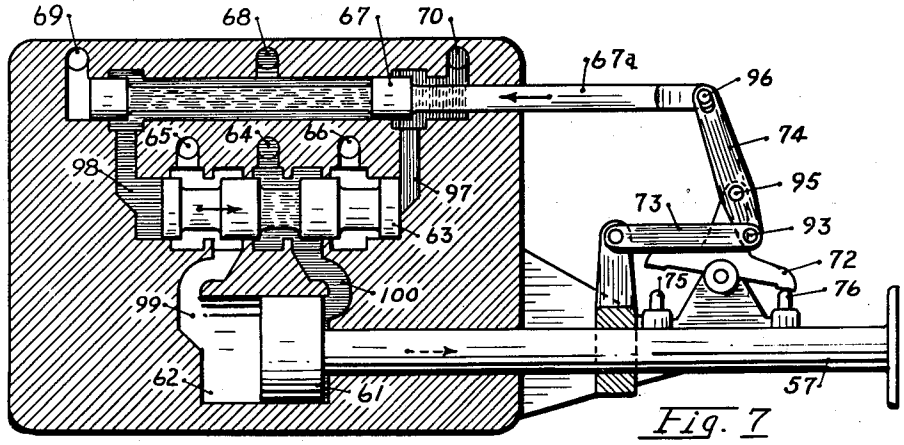


Fig. 7

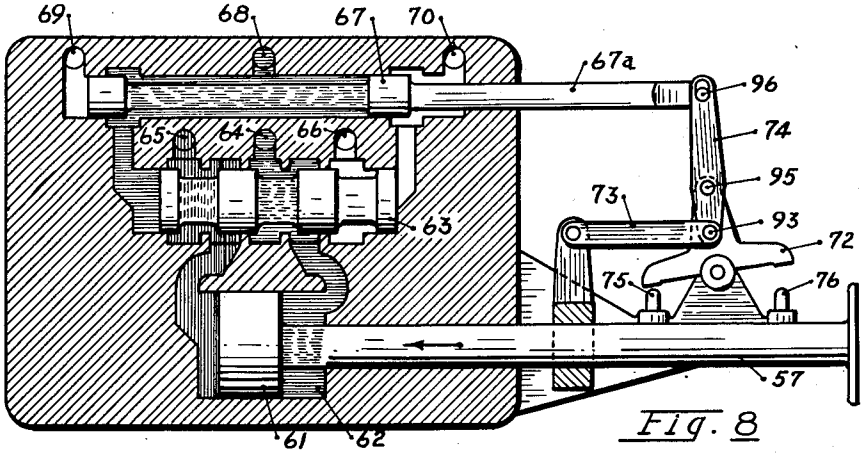


Fig. 8

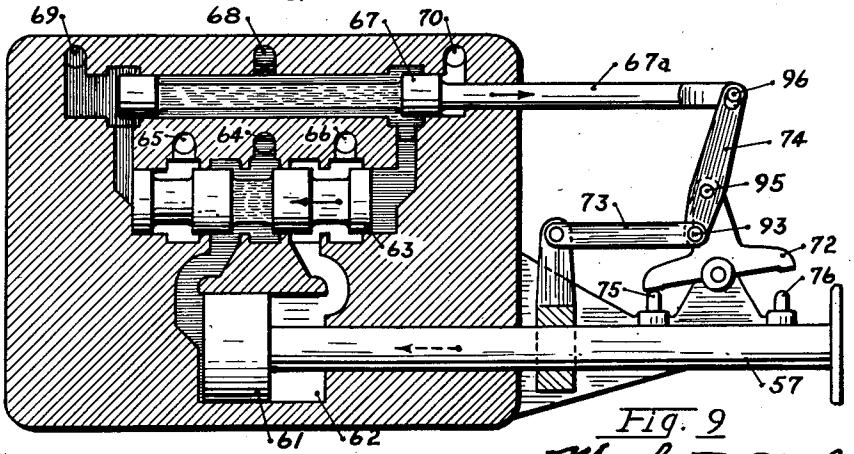


Fig. 9

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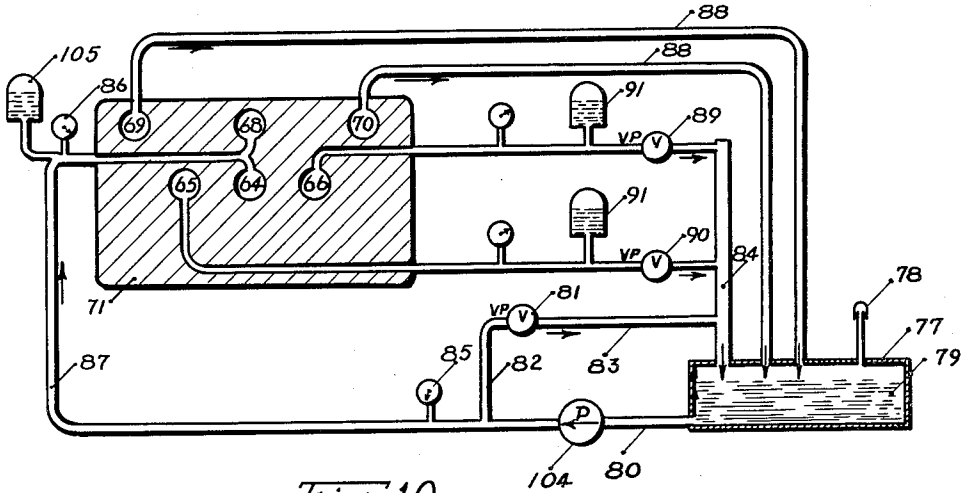


Fig. 10

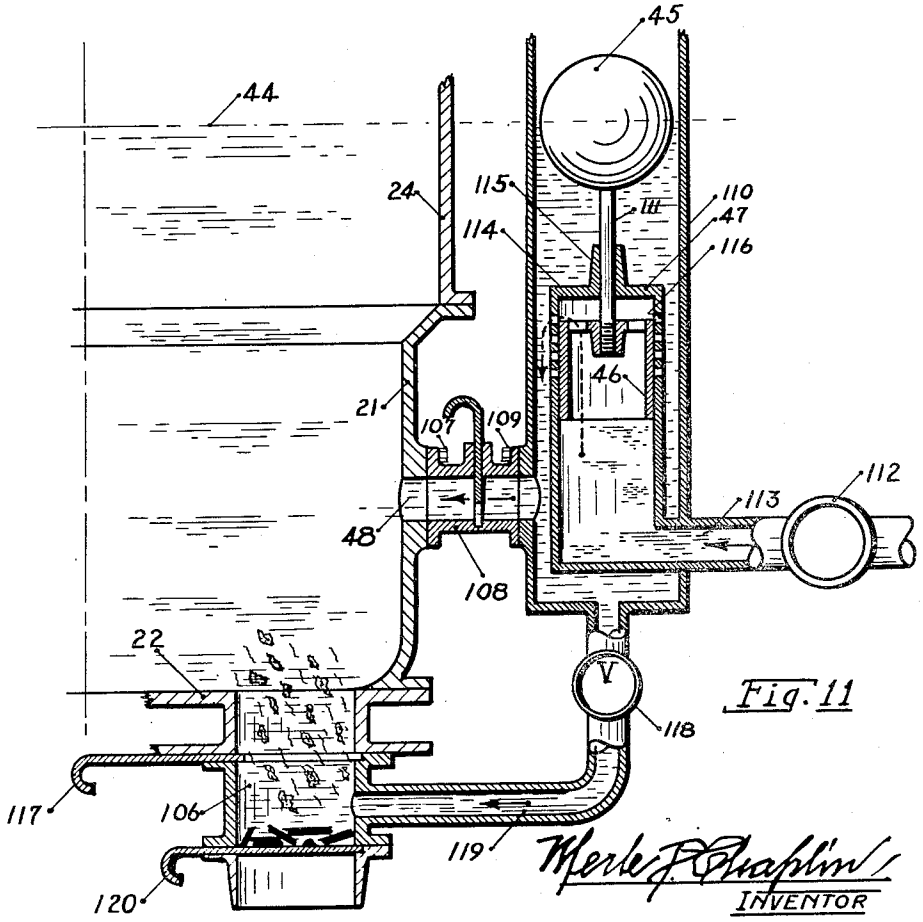


Fig. 11

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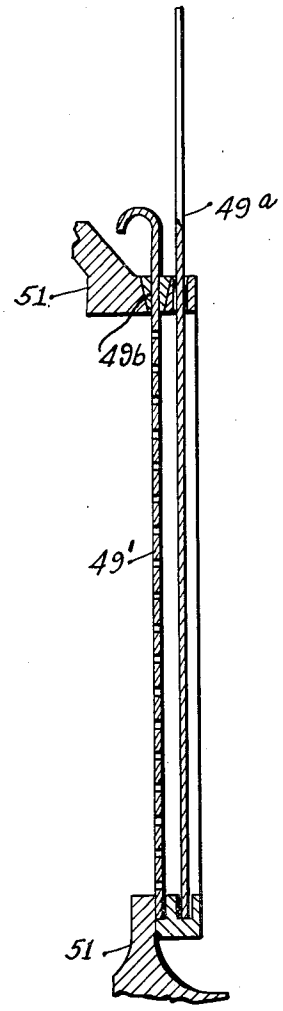


Fig. 12

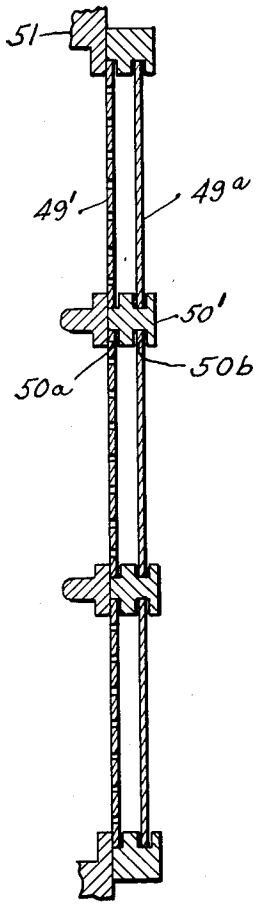


Fig. 13

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United States Patent Office 2,796,006
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2,796,006

FIBRE DISINTEGRATOR AND SEPARATOR

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Application March 24, 1955, Serial No. 496,496

6 Claims. (Cl. 92—23)

This invention relates to apparatus useful in the disintegration of intially dry fibrous materials in a liquid fibre mixture and the removal of the individual fibres from a disintegrating area as fast as they are reduced to a predetermined size.

One of the many uses for such an apparatus is the reduction of paper and paperboard materials to as near as possible the same state and form as they were in when the original paper or paperboard was made, so far as the individual fibrous materials are concerned. To do this, the fibres must be separated one from the other with a minimum of rupture or damage to the fibres themselves.

It had been common practice to effect partial separation by violent agitation of a mixture of fibres and water whereby the sheets of paper or paperboard were broken up into pieces of various sizes, after which they were treated by some form of attrition apparatus such as a Jordan engine or similar machine, wherein the material was abraded between metal bars, thereby to effect a separation of the fibres one from the other. Such action however, produced an unwanted cutting and damaging action on the fibres themselves.

In my Patent No. 2,648,261, I have shown an improved fibre disintegrator and separator which embodies a tank adapted to contain a pool of water. Near the bottom of the tank and rotating at relatively high speed about a vertical axis, is an "impactor" comprising a relatively small disk preferably provided with impactor knobs near its outer periphery. To insure that all material introduced into the tank in immediately and continuously acted upon by the "impactor," it is fed downwardly by a spiral or other feeding device rotating at a relatively slow speed and in a direction opposite to the rotation of the impactor. The stock thus fed to the impactor passes radially outwardly over the impactor with a swirling motion contra to the rotation of the impactor and is thus subjected to sharp impact by the knobs and is disintegrated thereby. The rotation of the impactor, coupled with the operations of the spiral feeder, effect a continuous circulation of the water-fibre mixture in the tank so that the stock is repeatedly acted upon in the manner stated. The wall of the tank is provided in the path of such circulation with one or more screens through which individual fibres, which have been separated from the rest of the mass by impact and which are suitable for use, pass from the tank and the mixture as it flows past the screen. A vibrating diaphragm mechanism is employed to move these individual fibres suspended in the water through said screen into a chamber, and the mixture is then piped to storage tanks for use.

Although such fibre disintegrator and separator of the above patent has proved to be useful in the preparation of pulp from waste paper stock, further study thereof has shown that its operation may be improved to fulfill more completely the full range of requirements of the pulp and paper industry for such purposes.

Accordingly, it is an object of the present invention to

provide a greatly improved fibre disintegrator and separator both from the standpoint of structure and function. In this apparatus, the fibrous materials are at no time confined between metal or other abrading or rubbing materials, but on the contrary, are always cushioned by a liquid on one side of the fibrous mass while the disintegrating action is taking place on the other side. In operation, they are first subjected to a rapid series of impacts, these being more effective as the undisintegrated pieces are larger as there is then more tendency for the liquid in which they are held to resist their being suddenly displaced from their floating position by encountering a rapidly moving impactor element. These impacts tend to loosen the bond or adhesion between the several fibres and continued impacts effect a practically complete separation of one fibre from another. So long as there are bundles or groups of fibres which have not been separated from each other, this impact separation effect continues. However, little or no violent action is present when the individual fibres are present, as they readily flow around the impacting surface and are not materially affected thereby.

It is a feature of this invention that a novel hydraulically actuated vibrating diaphragm mechanism is provided, which mechanism may be readily adjusted for optimum separation of the particular fibrous material to be disintegrated.

It is another object of this invention to provide a novel liquid level control mechanism cooperating with the other means of the invention to provide improved control of removal of prepared fibres by the screening or separating mechanism.

It is still another object of this invention to provide means whereby the screens may be cleaned without first shutting down the machine.

Still further objects and features of the invention will become apparent from the following description of a preferred embodiment thereof, together with the accompanying drawings, in which:

Fig. 1 is a side elevational sectional view of the machine of the invention taken along the line 1—1 of Fig. 2;

Fig. 2 is a sectional plan view of the machine of Fig. 1 taken along the line 2—2—2—2—2—2 of Fig. 1;

Fig. 3 is an enlarged sectional view as at 3 of Fig. 2 showing the screen portions thereof;

Figs. 4, 5, 6, 7, 8 and 9 are diagrammatic sectional views of the hydraulically-actuated diaphragm mechanism of the invention showing six stages of an operating cycle therof;

Fig. 10 is a diagrammatic view of the external hydraulic system of the mechanism of Figs. 4 through 9;

Fig. 11 is a sectional view of the machine of Fig. 1 taken along line 11—11—11 of Fig. 2 and showing the liquid level control mechanism of the invention, and

Figs. 12 and 13 are detail cross-sectional side and plan views respectively of a modification of a portion of the machine of Figs. 1 through 11.

Referring now to Fig 1, the machine of this invention has a main tank 21 with a liquid inlet 48, said tank being mounted upon and secured to machine frame 22 by means of suitable bolts 23. Surmounting said tank 21 is an upper tank portion 24 extending upward from said tank 21 and being secured thereto by means of bolts 25. A tank cover 27 provided with a plurality of access openings such as opening 28 for loading and observation purposes is secured to upper tank portion 24 by suitable bolts 26.

The tank cover 27 is provided with a bore 29 generally centrally thereof to receive an upper bearing housing 31 secured by screws 30 to said tank cover. The upper bearing housing 31 is counterbored at both top

and bottom to receive and align main bearing 32 and outboard bearing 33 of shaft 34, which bearings are secured to said shaft by means of locknuts and lockwashers 35 and 36. Shaft 34 is driven by pulley 37 mounted at the outboard end thereof through V-belts 38 by any suitable means (not shown) at a predetermined speed in the direction of indicating arrow 39.

Shaft 34 is fitted at its lower free end with a cantilever helical vane section 40 of left-hand spiral arranged to force the pulp stock in the tanks 21—24 downward against the rotating upper surface 42*a* of the impactor disintegrator head 42 and knobs 41, said head having a lower driving pulley 42*b* driven through V belts 42*c* by any suitable means (not shown). Such impactor, as well as its mounting and driving means, as shown in my said Patent 2,648,261, will not herein be further described. By means of such novel outboard bearing mounting of the shaft 34 providing a cantilever feed device spaced from the upper surface of disk 41, I am enabled to provide a much larger useful disk area and with no increase whatsoever in disk diameter over that heretofore used. A further advantage is secured by the elimination of a bearing at the bottom of the tank with its attendant maintenance problems due to its operation beneath the surface of the liquid-fibre mixture, as well as the advantage of installation or ready removal of the entire feed screw assembly through the opening 29 in cover 27 for inspection or repair. Preferably, a trash removal means is provided at the bottom of tank 21, said means including a pipe 106 having upper and lower sliding gate members 117 and 120, respectively, as well as a valve 118 connected by pipe 119 to said pipe 106 for providing a flushing liquid to said pipe between said members 117 and 120.

In Fig. 2 is shown in horizontal section taken along line 2—2—2—2—2—2 of Fig. 1, the lower tank 21, preferably octagonal in form, with its hydraulic screen assemblies 43, one of which is detailed as in Fig. 3. Said screen assemblies each include a plurality of vertical screens 49 retained in place at their vertical edges and the bottom edges by rabbeted guides 50 secured to the screen frame portion 51 of tank 21, by clamp screws 53. I somewhat prefer, however, to use the modified structure as shown in Figs. 12 and 13, wherein rabbeted guides 50′ are provided with two slots 50*a* and 50*b*, screens 49′ being retained in the outer of said slots 50*a*. When it is desired to remove a screen, an imperforate plate 49*a* is positioned in the inner slot 50*b* to prevent free flow of the mixture when the screen is removed. To aid in removing the screens, they may be provided with a wedge shaped guide 49*b* at their upper end, which guide fits within a corresponding recess on guide 50′. Such structure permits ready removal and replacement of the screens 49′ by sliding them upwardly until they are free of said guides.

A rubber or other flexible diaphragm 56 is secured by means of a retainer strip 54 and screws 55 to screen frame portion 51. This diaphragm 56 is caused to vibrate or pulsate toward and away from the screen surfaces 49 by means of a hydraulically actuated mechanism generally designated 71 (Fig. 1) and hereinafter more fully described, said mechanism having its piston rod 57 connected to rubber diaphragm 56 by plates 58 and 59 (Fig. 3) secured to said diaphragm by screws 60. The chamber 122*a* formed between a diaphragm 56 and its screens 49 is provided with an outlet manifold 122 (Fig. 1 at section 2A), said manifold having a vertically adjustable portion 121 within standpipe 125 for controlling the mixture discharge level from chamber 122*a* to manifold 126. Flushing nozzles 128 having openings 129 are provided within said chamber 122*a* for diluting the mixture in chamber 122*a*, water being supplied to said nozzles by a manifold 127 (Fig. 1 at section 2B).

An important feature of this invention resides in the hydraulically-actuated mechanism for vibrating or pulsating the rubber diaphragm 56. By so moving said diaphragm, it acts to clear agglomerate accumulations from the openings in screen 49 by alternately forcing water and dilute stock through them into the lower tank 21 and then immediately drawing most or all of such water back with such entrained pulp fibres as will pass through the openings in screen 49.

My novel mechanism for pulsating the rubber diaphragm 56 provides, by its ready adjustability, a number of substantial advantages over heretofore known mechanisms. For example, total diaphragm movement is readily adjustable while the mechanism is in use and such movement will thereafter be maintained. Also, the rate of the movement of the diaphragm in either direction may be adjusted as desired. Furthermore, means are provided for adjusting the force or pressure applied to move the diaphragm in either direction, and consequently, the force or pressure applied to the screen openings either to draw the disintegrated fibres through said openings, or to expel the larger fibrous masses, which have not been properly disintegrated, from said openings and from said screen surface periodically or on each pulsation of the diaphragm itself.

Such adjustability is extremely important in a practical fibre disintegrator and separator and effects a decided improvement in the utility of the machine for a wide variety of purposes as for disintegrating a wide variety of fibrous materials. For example, under certain conditions, and with certain materials, a strong suction pressure is desirable to draw the disintegrated fibres through the screen openings and from the pulper to the discharge side of the screen at chamber 122*a*. In addition, such action materially increases the capacity of the apparatus. Under certain other conditions, and with other materials, such suction may not only result in no increase whatsoever in fibres being drawn through the screen openings, but may actually plug or obstruct the openings by trying to draw fibres through them too forcibly. Under still other conditions, it may be desirable to expel fibre bunches of undisintegrated material with greater force from the screen openings and from the screen surface adjacent to the pulper tank than at other times. Thus, my provision of ready means of adjustability, as hereinafter explained in detail, greatly increases the overall utility of the machine by enabling its use under a wide variety of operating conditions.

Referring now to Fig. 4, the piston rod 57 provided for moving the flexible diaphragm 56 extends into a chamber 62 in the mechanism base 101 and has a piston 61 mounted thereon within said chamber. In order to move said piston back and forth within said chamber, an intermediate valve 63 is arranged for reciprocatory movement within a bore in said base 101, said valve being moved as hereinafter described, to alternately connect a source of fluid pressure at inlet port 64 positioned in said base generally centrally of said valve through passages 99 or 100 to one side or the other of said piston 61. Simultaneously, the other side of said piston 61 is connected through one of said passages to one of two exhaust ports 65 and 66 positioned in said base 101 near the ends of said valve 63.

The intermediate valve member 63 is reciprocated by application of fluid pressure to one of its ends by means of a pilot valve 67 also arranged for reciprocatory movement within a second bore in said base 101. The pilot valve, when moved, alternately connects its inlet port 68 through passages 97 and 98 to one of the ends of intermediate valve 63, and the other of said ends to one of its exhaust ports 69 or 70, said inlet port being positioned generally centrally of said valve and said outlet ports at the ends thereof.

For moving pilot valve 67, I have provided at one end thereof a compound lever mechanism actuated by the movement of piston rod 57. Such mechanism includes a T shaped rocking lever 72 mounted for pivotal

movement about a fixed pivot pin **92** on base **101**, the extent of rocking movement of said lever **72** being determined by contact of its two lower arms **75** and **76**, respectively, with a pair of adjusting screws **102** and **103** mounted on base **101**. At the free end of said rocking lever **72** is mounted a double acting lever **74** for pivotal movement about a pivot pin **95** on said rocking lever, the pivot point of said double acting lever being positioned between the ends thereof. The double acting lever **74** is connected by a pivot pin **96** to the extension **67***a* of a pilot valve **67**. The other end of the double acting lever **74** is connected to piston rod **57** by a link **73**.

The object of the above mechanism is to provide for a controlled movement of the flexible diaphragm. This control includes the distance which the diaphragm is moved by the piston, the rate of pulsation of the number of movements in a given period of time, the force applied to the diaphragm in either direction, and the relative time of movement in either direction.

In the operation of the above-described mechanism, the reciprocation of intermediate valve **63** is controlled by pilot valve **67** as it is moved back and forth by means of the compound lever mechanism alternately to supply pressurized fluid at inlet port **68** to one end of the intermediate valve, exhausting from the other end thereof through discharge ports **69** or **70**. The reciprocatory movement of pilot valve **67** is reversed in direction from that of piston rod **57** with its piston **61** by reason of the action of the compound lever mechanism. The extent of movement of pilot valve **67** is controlled by adjustable stops **75** and **76**, said stops being positioned at an adjustable, predetermined distance from the arms of rocking lever **72** so that a predetermined amount of motion of the piston rod **57** with diaphragm **56** (Fig. 3) takes place before an arm of the rocking lever **72** contacts a stop. Such contact so actuates the compound lever mechanism that the movement of pilot valve **67** is immediately reversed. Since the stops **75** and **76** are readily adjustable by means of threaded adjusting stop screws **102**—**103** while the mechanism is in operation, ready adjustment of the motion and position of the diaphragm **56** is provided. The main piston **61** and the flexible diaphragm **56** thus move a predetermined distance in each direction before the floating lever mechanism effects a movement of the pilot valve. It is most important that the flexible diaphragm be moved its entire predetermined distance by the force applied to it by means of fluid pressure acting on the piston without being influenced by any velocity or acceleration moment at any part of its movement.

In Fig. 10 the hydraulic system of the above-described mechanism is shown, wherein inlet ports **64** and **68** are connected to a suitable source of fluid under pressure and exhaust ports **65**, **66**, **69**, and **70** are arranged to return fluid to the fluid source. More specifically, an oil reservoir **77** is provided for containing a supply of oil or other hydraulic fluid **79**, said reservoir preferably being vented to the atmosphere as at **78**. A pipe **80** is provided to supply said fluid to a pressure pump **104** having a pressure regulating valve **81** connected thereto by pipe **82**. Relief return manifold **84** is provided to return relief oil flow to reservoir **77** through pipe **83**. A pressure gauge **85** is arranged on the discharge side of the pump **104** for indicating output pressure. Pump **104** thus supplies fluid under suitable pressure to inlet ports **64** and **68** through pipe **87**. Preferably, an accumulator **105** is connected to pipe **87**, and a further pressure gauge **86** is provided adjacent said ports to eliminate line pressure drop as a factor in relative readings of pressure. Thus inlet ports **64** and **68** are supplied with oil at constant but adjustable pressure.

Exhaust ports **69** and **70** associated with pilot valve **67** are directly connected to reservoir **77** through pipes **88** to return discharged oil from said pilot valve to reservoir **77**. However, exhaust ports **65** and **66** of intermediate valve **63** are independently connected to relief return header **84** through variable pressure regulating valves **89** and **90** respectively, each of said valves preferably being equipped with accumulators **91**. Thus, regulating valves **89** and **90** permit adjusting the pressure differential across the piston **61** (Fig. 4) to provide variations in resultant force on the piston rod **57** driving the diaphragm **56** (Fig. 3). The oil or other hydraulic medium is hence supplied to the entire mechanism under a controlled pressure which can be readily adjusted within wide limits, and which in effect, determines the amount of fluid force in the main operating chamber **62** (Fig. 4) and, consequently, on the rubber diaphragm **56** (Fig. 3) which actuates and controls the screening operation.

As an example, if it is desired to reduce the amount of force effective to actuate the rubber diaphragm **56**, back pressure may be applied to the discharge side of the chamber **62** (Fig. 4) through adjustment of relief valves **89** and **90** (Fig. 10). Not infrequently, it is desirable to have different forces or actuating pressures on the rubber diaphragm **56** (Fig. 3) in opposite directions of movement. In such a case, the main pressure valve **81** (Fig. 10) is adjusted to maintain the optimum pressure for the highest force in one direction of piston movement and the relief valves **89** and **90** (Fig. 10) then adjusted to effect a difference between such pressure and the relief valve pressure to give a reduced force in the opposite direction of piston movement. More specifically, if the main operating pressure valve **81** (Fig. 10) is set to provide 100 p. s. i., and the back pressure valve **89** operating against one side of the piston **61** (Fig. 4) at 50 p. s. i., the resultant fluid pressures will then have twice as much effect on the piston and diaphragm in one direction of its movement as in the other.

Also, such an arrangement makes it possible to compensate for the different effective areas of the sides of the piston **61** (Fig. 4), there being a substantial difference in effective pressure areas as between the two sides of the piston, since its rod projects outside of base **101** on one side thereof.

Referring now to Figs. 4 through 9, wherein is shown the various stages in an operating cycle of the hydraulically-actuated mechanism for vibrating the diaphragm, the state of the oil therein, i. e. pressurized or non-pressurized, is indicated by hatching those passages containing oil at rest and performing no function (although at times under pressure but trapped) being indicated in clear view as at ports **69** and **70** (Fig. 4), those passages containing oil being discharged, either under pressure at greater than atmospheric pressure or simply at atmospheric pressure, indicated as hatched with vertical lines, and those passages containing oil under pressure and not being discharged being indicated as hatched with horizontal lines.

Now in Fig. 4 is shown the mechanism in a neutral position, considered simply as illustrative but not as a point of normal rest in actual use. Thus, inlet port **68** is delivering oil under pressure to the cylindrical section in the bore of pilot valve **67**, such fluid being indicated as hatched with horizontal lines. Likewise, inlet port **64** is supplying oil under pressure to the similarly hatched area indicated in the bore of intermediate valve **63**.

In Fig. 5, the piston rod **57** being in a predetermined retracted position of travel, the double-acting lever **74** has by means of link **73** caused the rocking lever **72** to rock to the left until its left-hand arm contacts adjustable stop **75**. This halts the rocking motion of said lever **72** and causes the remaining motion of link **73** to be transmitted through lever **74** to pilot valve rod **67***a*, thus moving pilot valve **67** to the position shown in Fig. 5. Oil under pressure at inlet port **68** is released by such valve movement into connecting passage **97** and is admitted to the end of the intermediate valve **63**, causing said valve to move to the left end of its bore. Oil displaced by this movement is discharged through passage **98** as

hatched with vertical lines into the left end of the bore of pilot valve 67 and exhausted through port 69.

The movement of intermediate valve 63 to the position shown in Fig. 5 permits oil under pressure from inlet port 64 to flow into the chamber 62 through passage 99 and forces the piston 61 to the position shown in Fig. 6. Oil displaced by such piston movement is discharged through passage 100 into the bore of intermediate valve 63 and is exhausted through port 66 to pressure regulating valve 89 (Fig. 10). The resulting motion of the compound lever mechanism causes rocking lever 72 to reverse its movement, thereby rocking the right hand leg of said lever toward its stop 76.

At the point of travel of piston 61 shown in Fig. 6, the motion of link 73 has been absorbed by the free movement of rocking lever 72 so that the travel of piston 61 is accomplished under full pressure of the oil supply. The final portion of the travel of piston 61, as in Fig. 7, moves lever 74 to the left and through pivot 96 to reverse the position of pilot valve 67 to its left-hand position.

Thus, in Fig. 7, oil flows under pressure from inlet port 68 through passage 98 to force a reversal of the intermediate valve 63. Its movement releases oil under pressure to the right hand end of piston 61 through passage 100 and forces piston 61 to the left as shown in Fig. 8. This rocks rocking lever 72 toward stop 75, so that the final movement of piston 61 to the left brings the left leg of said lever into contact with stop 75 (Fig. 8). This reverses the direction of movement of lever 74, and the cycle of operation described above then repeats.

In view of the foregoing, it will be appreciated that adjustment of stops 75 and 76 will result in any desired amount of piston and diaphragm travel, and that the force of such movements may be controlled and adjusted by variation of pressure differentials across input ports 64 and 68 and exhaust ports 65 and 66.

In the operation of the machine of this invention, it is further important that a constant liquid level be maintained in the tank (21—24 Fig. 1) and also that means be provided to vary the head differential between the inside of the tank and the discharge side of the screen assemblies. Therefore in Fig. 11 is shown in section an enlarged view taken along the line 11—11 of Fig. 2 in which view is also shown the trash removal structure of Fig. 1. Thus, input pipe 48 provided for tank 21, has attached thereto by means of bolts 107, a shutoff pipe 108. A float tower 110 is mounted on said gate by means of bolts 109, said float tower in effect providing a measuring chamber having a constricted liquid passage through inlet pipe 48 and valve 108 to the tank. The level of liquid in said float tower (when gate 108 is open), is normally the same as the liquid level in the tank 24 as at 44 without the turbulence existing in tank 24 due to the disintegration and pulsating screen actions therein. Therefore, within this float tower 110 a control or liquid level sensing float 45 is provided, said float having a float stem 111 attached to the inner portion 46 of a sleeve valve. Said portion 46 has a cooperating fixed outer portion 47 mounted within float tower 110 and arranged to permit vertical passage of liquid through the inner portion 46 to the area thereabove surrounding the stem 111. The sleeve valve outer portion at its lower end is supplied with feed water from valve 112 through passage 113, said outer valve portion 47 being capped as at 114 and having a valve guide 115 to centralize and guide float stem 111 and inner valve portion 46. The upper end of outer valve portion 47 is drilled with a plurality of holes 116 so arranged that with the liquid level 44 at its normal level, the water feed rate to the float tower 110 from passage 113 out through holes 116 (as shown by the dotted arrow) is equal to the rate of pulp removal at the discharge side of the screen assemblies 43. As the liquid level 44 lowers, more holes 116 are exposed to water flow by the lowering of float 45. This causes the feed rate through the float tower to increase. With a rising liquid level 44 an effective shut-off of flow at holes 116 takes place due to the rising of float 45.

Certain types and kinds of waste paper materials which may be utilized, may contain foreign materials of metal or other non-fibrous substances, which it is desirable to have removed from the pulper tank before their accumulation becomes sufficient to interfere with the pulping operation. These materials are normally sufficiently heavy so that they will settle on the bottom of the tank and eventually find their way into an opening above the upper trash gate member 117. This trash gate member 117 is normally open which permits this foreign metallic or other material to settle into the chamber of pipe 106 coming to rest above the lower trash gate 120.

Periodically, and depending on the amount of foreign material which the operator may feel has been fed to the pulper with the waste paper materials, the pipe 106 above gate 120 is flushed with water by opening valve 118 which expels such pulp or fibrous materials as may be contained in this pipe 106, leaving the heavy foreign material resting on gate 120.

Valve 118 is then closed as is also the upper trash gate member 117. Opening of the lower trash gate 120 enables foreign material trapped in pipe 106 to be removed from the machine without interruption of normal production. The lower trash gate 120 is then closed and gate 117 opened, enabling the removal of non-fibrous materials from the pulper tank to continue as before by the accumulation of these materials in the pipe 106.

It is sometimes desirable continually to introduce some water through pipe 119 into pipe 106 by means of valve 118 to prevent the accumulation of too great a quantity of unpulped materials in the pipe 106, which materials would be expelled by the introduction of water, the heavy metallic and other non-fibrous materials remaining at the bottom of the pipe 106 on gate 120. Such water as may be added to the pulper tank 21, through valve 118 simply means that less water is introduced into the pulper tank 21 through pipe 103 which is under the control of a float valve 46 which serves to maintain in a predetermined level 44 in the pulper tank itself.

To maintain a predetermined, but ready adjustable hydrostatic pressure head on the screen members 49 two means of adjustment are provided. One is that illustrated in Fig. 11 whereby the level of liquid in the pulper tank can be adjusted to a predetermined position and maintained at this position through the float mechanism illustrated and previously described. Also, the discharge level or head can be regulated by a telescopically vertically adjustable overflow tube 121, over which the effluent or screened material is discharged and flows away from the machine through pipe 126. The standpipe 125 completely encloses the adjustable overflow tube 121, and there is illustrated in Fig. 1 the two possible positions of this overflow gate and consequently, a variation of effective pressure head on the screen member 49 which pressure urges the fibrous materials to pass through the openings in this screen member.

By raising the member 121 above the level 44 in the pulper tank, the flow of screened material can be completely cut off, which in turn steps the flow of fibrous materials through the openings in screen members 49. Under these conditions it is possible to remove one or more of the screen members 49 without unpulped materials flowing through pipe 122 and over the telescopically adjustable member 121. Under these conditions an excess of clear water can be introduced through nozzle 123 to eliminate any large unpulped fibrous materials from the space behind the screen plates 49 and after plates have been removed for the purpose of examination, cleaning or changing opening size and are returned to position, the adjustable telescopic member 121 can be returned to its previous position and screening resumed.

As it is usually desirable to pulp materials at a consistency or fibre content relative to that of water above

which said materials will pass through the screen openings readily and freely, it is usually desirable to introduce dilution water through manifold 127 and distributing nozzle 128 with its holes 129, which water effects a dilution of the screened material in the rear of the screen plates 49, and on each pulsation of the rubber diaphragm 56, a portion of this dilution of screened materials effects a momentary dilution of the materials being on the inside of the screen plates 49 which assists in the removal of the materials which have been sufficiently defiberized to pass through the screen openings on the return or outward movement of the rubber diaphragm 56. The amount of water which may be introduced through the nozzle 128 varies under different conditions, and also it is possible to complete the flush at the rear of the screens by adding an excess of water through this nozzle 128 over and above that which is desirable or necessary for ordinary screening operation.

It will thus be seen that I have provided an improved fibre disintegrator and separator useful in the preparation of completely defiberized materials in liquid form from waste paper or other dry fibrous materials. It will be apparent to those skilled in the art that various modifications may be made therein within the spirit of my invention and the scope of the appended claims.

I claim:

1. A pulper comprising a tank adapted to contain a mixture of liquid and fibrous material, said tank being provided therein with means for circulating said mixture past the side walls of said tank, said sirculating means including means for disintegrating the fibrous material in said circulating mixture, a screen positioned in the side wall of the tank, an activator chamber disposed externally of the screen, one wall of which embodies a vibratory diaphragm, said activator chamber having a discharge outlet for the mixture contained therein, and hydraulically-actuated means controlled by movement of said diaphragm for vibrating the diaphragm to propel liquid from the activator chamber through the screen to free the internal surface of the screen from agglomerate accumulations thereon when the diaphragm moves in one direction and to withdraw liquid through the screen with entrained separate fibres when the diaphragm moves in the opposite direction, said latter means including a chamber having therein a piston mounted on said diaphragm for moving said diaphragm, valve means for admitting fluid to either side of said piston, and means connected to said diaphragm actuated by movement of said piston and said diaphragm for actuating said valve means in response to movement of said diaphragm.

2. A pulper as claimed in claim 1 wherein said means actuated by movement of said piston includes compound linkage means having a first pivot in fixed relation to said chamber and a second pivot in fixed relation to said piston.

3. A pulper as claimed in claim 1 wherein said valve means includes a first slide valve for admitting fluid to the sides of said piston and means for sliding said first slide valve, said latter means including a second slide valve for hydraulically moving said first slide means, and wherein said means actuated by movement of said piston is effective to slide said second slide valve.

4. A pulper comprising a tank adapted to contain a mixture of liquid and fibrous material said tank being provided therein with means for circulating said mixture upwardly past the side walls of said tank, said circulating means including means for disintegrating the fibrous material in said circulating mixture, an upright screen positioned in the side wall of the tank, an activator chamber disposed externally of the screen, one wall of which embodies a vibratory diaphragm, said activator chamber having a vertically adjustable discharge outlet for the mixture contained therein, automatic feeding means for maintaining a predetermined liquid level in said tank higher than said discharge outlet to establish a head on said screen, said head being adjustable by adjusting the vertical height of said discharge outlet relative to said liquid level in said tank established by said automatic feeding means, said automatic feeding means including a measuring chamber having a constricted passage to said tank and liquid level sensing means in said chamber, and means for vibrating the diaphragm to propel liquid from the activator chamber through the screen to free the internal surface of the screen from agglomerate accumulations thereon when the diaphragm moves in one direction, and to withdraw liquid through the screen with entrained separated fibres when the diaphragm moves in the opposite direction, said liquid with entrained separated fibers being discharged through said discharge outlet by said head.

5. A pulper as claimed in claim 4 in which said automatic feeding means further includes valve means actuated by said liquid level sensing means for feeding liquid to said tank.

6. A pulper as claimed in claim 5 in which said liquid level sensing means includes a float connected to said valve means.

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