March 20, 1934. S. MILNE 1,951,519

PAPER PULP REFINING ENGINE

Filed Aug. 26, 1933 2 Sheets-Sheet 1

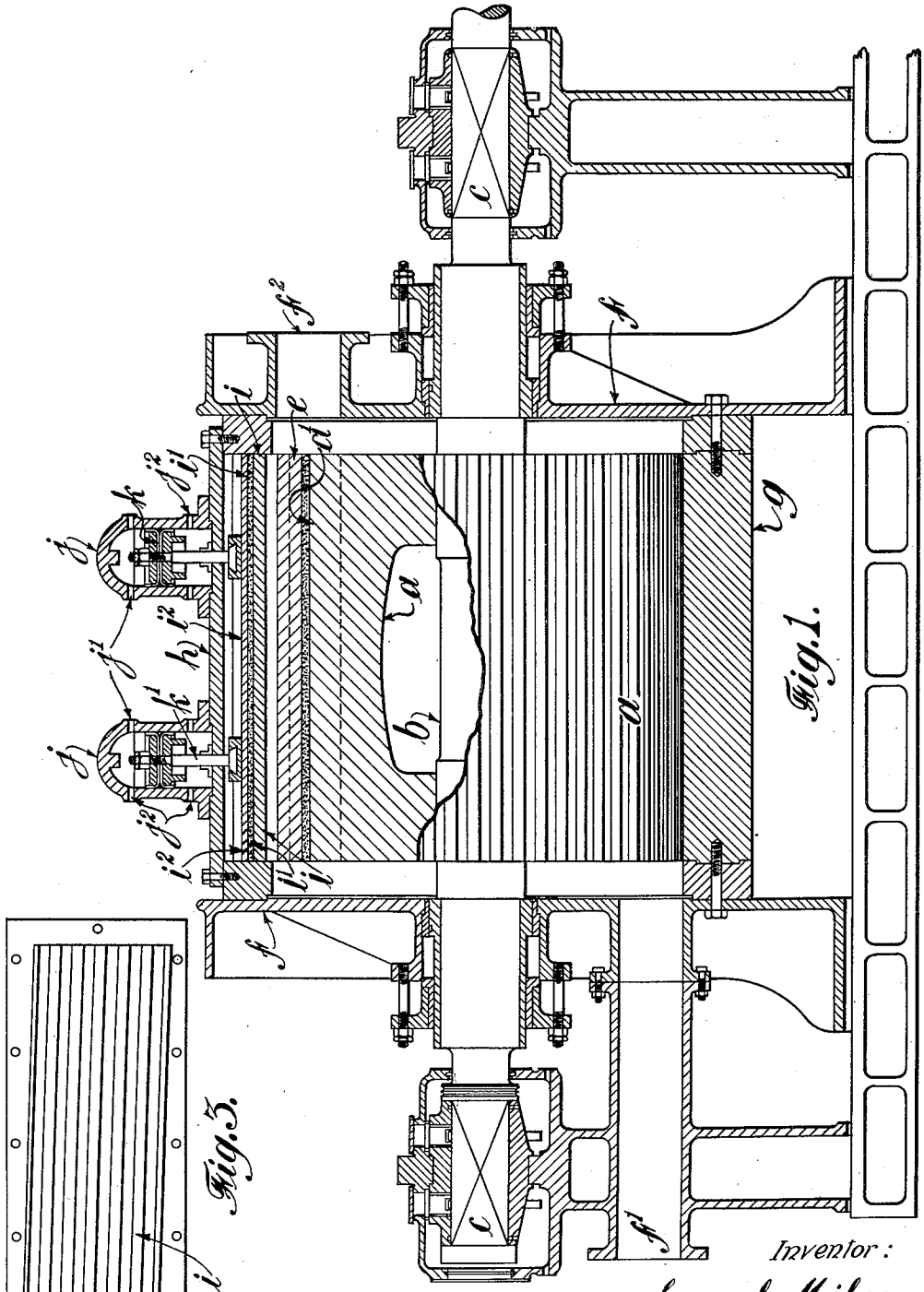


Fig. 1.

Fig. 3.

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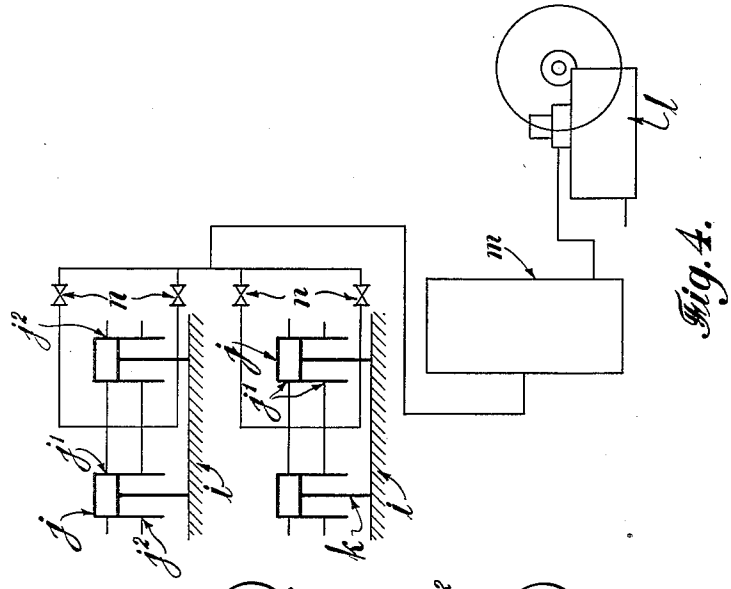


Fig. 4.

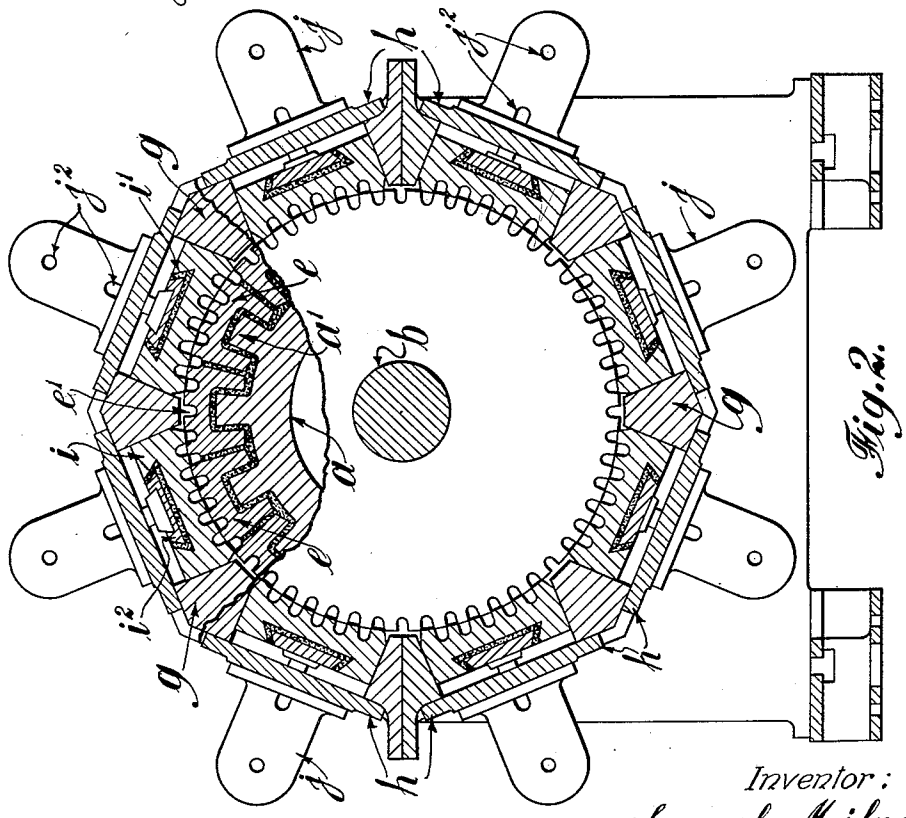


Fig. 2.

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UNITED STATES PATENT OFFICE

1,951,519

PAPER PULP REFINING ENGINE

Samuel Milne, Edinburgh, Scotland

Application August 26, 1933, Serial No. 686,891
In Great Britain June 24, 1932

5 Claims. (Cl. 92—26)

This invention refers to refining engines for the treatment of pulp in the manufacture of paper, the ultimate purpose of which is to "clear" the beaten pulp of knots and clusters; although there is a growing practice of making the refining engine do some of the work of the beating engine.

Hitherto two main types of refining engines have been employed in the art, namely, the conical refiner and the disc refiner. In each type there is a rotor, carrying bars or knives, and a non-rotary, adjustable, casing, surrounding or working against the rotor, and fitted with complemental bars or knives, the pulp being caused to pass between the two sets of bars as they move one over the other. A refining engine has been proposed, however, having a cylindrical rotor and a number of independent bedplates arranged around it, adapted to be forced against the rotor by hydraulic means.

The object of this invention is to introduce an improved refining engine having advantages over the previously known types, one of which is that the bedplates may be forced away from the rotor, say when some only are in use, and especially those which are so arranged that they tend by gravity to move towards the rotor.

According to the invention, the rotor of the refining engine is of cylindrical or substantially cylindrical form, and is fitted with bars or knives on its circumferential face, whilst the casing in which the rotor is adapted to rotate is provided with a number of independent bed-plates each fitted with bars or knives and some or all of which are adapted to be moved selectively or collectively by hydraulic means towards and away from the rotor.

The bed-plates may be arranged for automatic movement towards or away from the rotor. The machine will include a pump and a pressure regulator for operation of the bed-plates.

The improved machine will, in some cases, be arranged with the axis of the rotor horizontal, and, in some cases, with such axis vertical, and the machine will be driven either by an electric motor direct, or by a belt from any suitable source of power, according to the needs of each particular case.

The hydraulic means for operating the bed-plates will preferably comprise pistons or rams connected to the bed-plates and working in suitable cylinders. When the axis of the rotor is horizontal, those bed-plates above the rotor will need less energy to move them towards the rotor and for this purpose they may have pistons and cylinders of different diameters from those connected to the lower bed-plates. Further, the upper bed-plates will be adapted also to be moved away from the rotor by the hydraulic means, gravitational force assisting the movement in the case of the lower bed-plates.

Another feature of the invention resides in a rotor having a continuous surface of basalt lava, granite, carborundum or like abrasive.

The invention may be further characterized by the constructional embodiments hereinafter described.

One example of the improved refining engine is illustrated in the accompanying drawings, wherein:—

Fig. 1 is a longitudinal sectional elevation, with a part only of the rotor illustrated.

Fig. 2 is a cross-sectional elevation, also with a part only of the rotor illustrated.

Fig. 3 is a plan of one of the bed-plates used in the refiner shown in Figs. 1 and 2.

Fig. 4 is a diagrammatic view illustrating one manner of supplying hydraulic pressure to the bed-plates.

In carrying out the invention according to the example illustrated, having the rotor arranged on a horizontal axis, the rotor consists of a hollow cylinder *a* mounted fixedly on a horizontal shaft *b* carried in suitable bearings *c* and having a pulley (not shown) to receive power from a belt. In this example, the rotor is shown fitted with basalt lava segments *e*, and the bed-plates are shown as made of basalt lava, but the invention equally includes the use of steel or bronze knives in either or both the roll and bed-plates, the knives being held in position by wedges or other means used in the known conical and disc refiners. The rotor *a* has on its periphery, ribs or keys a^1, preferably undercut, over which segments *e* fit and are held by cement. The segments are shaped so that they form a continuous outer surface, as in the beating engine described in my application Serial No. 681,495 filed July 21, 1933. The segments are formed with lifting pockets e^1 which are disposed parallel to the rotor axis. In an alternative form of rotor, the hollow cylinder comprises a flanged annular part forming the carrier for the bars, and two hubs or bosses to which the flanges are connected and by means of which it is keyed to the shaft.

The rotor is mounted to rotate in a stationary casing which consists of a composite octagonal ring and two end covers *f* bolted thereto. The said ring is built up of stout cross bars *g* at the corners, and flat plates *h* mounted thereon, and between the cross bars (which have parallel opposed faces) are slidably mounted bed-plates *i* similar to those of a beating engine, there being eight bed-plates in all, equally spaced around the casing. On each of the said flat plates *h* are mounted two hydraulic cylinders *j*, the pistons *k* of which are connected by piston rods k^1 to the bed-plates *i*. The bed-plates have undercut grooves i^1 in their back face, into which fit un-

dercut bars i^2 connected to projections on the piston rods, the bed-plates being readily removable and interchangeable.

Suitable glands are provided in the end covers f of the casing where the rotor shaft b passes therethrough, and one end cover is provided with an inlet port f^1 for the pulp whilst the other is provided with an outlet port f^2. By disposing the outlet port at the upper part of the casing, the casing is always maintained full. The outlet will be regulated by a valve or sluice in the usual way.

The weight of the rotor and shaft is taken by the bearings c, and not by the end covers, although in small refiners the bearing might be incorporated in the end covers.

The stout rods forming the corner pieces of the stationary casing are arranged at an angle to the end covers slightly out of perpendicular, the bed-plates being in consequence of rhomboidal shape in plan as shown in Fig. 3. This allows of the bars or pockets being at an angle to those in the rotor, whilst utilizing the whole area of the bed-plate, the bars or pockets being parallel to the sides of the bed-plate.

A hydraulic pump is provided to give the necessary pressure, connected by pipes to all the hydraulic cylinders so that pressure may be applied to all the bed-plates simultaneously. Alternatively, the pairs of opposite bed-plates may be coupled together by the piping, or the bed-plates may be controllable singly. In any arrangement the idea is to vary the power of the refining engine by varying the number of bed-plates to which pressure is applied, and/or by varying the pressure on any or all the bed-plates.

Some or all the hydraulic cylinders, and especially those arranged above the horizontal rotor, will have further pipe connections below the pistons so that the bed-plates may be lifted away from the rotor by hydraulic power. As shown, all the bed-plates have double acting pistons in the cylinders j, each cylinder having two inlets j^1 and two outlets j^2.

One method of coupling the fluid pressure supply is illustrated schematically in Fig. 4, two only of the bed-plates being depicted. From a pump l water or oil is fed to an accumulator m, and from thence to the respective inlet ports of the cylinders j. Each set of inlet ports, that is each set for the "on" pressure and each set for the "off" pressure, of each bed-plate, is controlled by a valve n, whereby the pressure may be adjusted as required. Any other combination or arrangement of pipe connections and valves may be adopted to give the required variation and/or choice of pressure on any or all the bed-plates.

To counteract centrifugal force when steel or bronze knives are employed, and to hold the knives of the rotor in their correct positions, they are clamped between filling pieces projecting from longitudinal grooves in the rotor, and wooden wedges, the filling pieces having lateral projections such as pins or studs which lie in holes or undercut slots in the bar.

The invention is not limited to any special arrangement or combination of knives. The bars in the bed-plates may be of the same kind as those in the rotor, or of a different kind. For instance, one element may have steel or bronze knives and the other have basalt lava or like bars.

In some cases the rotor may be of cast iron, with bars cast on it, and would be replaced when the bars are worn down.

Whilst the preferred form of the invention comprises a cylindrical rotor, the rotor may be tapered slightly from one end to the other.

The term hydraulic is intended to include the use of water, oil or other liquid. Also, compressed air, or steam may be employed.

The rotor, instead of being made hollow as above described may be solid, or if hollow may be of one piece or may be built up. Further the number of bed-plates provided, and consequently the shape of the stationary ring, may vary, as also may their size and distance apart. In large machines there may be ten or twelve bed-plates, in a ten-sided or twelve-sided ring, and in small machines there may be four or six bed-plates only in a square or hexagonal ring.

What I claim is:—

1. A refining engine for paper pulp, comprising a casing with inlet and outlet ports, a rotor mounted to rotate in the casing and having its working face on its outer periphery, independent bed-plates in the casing slidable towards and away from the working face of the rotor, hydraulic means cooperating between the casing and the bedplates to feed the bedplates towards and away from the rotor, and valve mechanism to control said hydraulic means to vary the effective pressure of each bedplate against the rotor.

2. A refining engine for paper pulp, comprising a base, a cylindrical casing with inlet and outlet ports mounted horizontally on the base, and comprising end covers, corner rods and peripheral plates; bearing pedestals on the base carrying a horizontal shaft; the shaft passing through and co-axial with the casing; stuffing boxes in the casing, end covers where the shaft passes therethrough; a cylindrical rotor on the shaft within the casing; independent bed-plates slidably mounted between the corner rods of the casing; hydraulic cylinders on the peripheral walls of the casing; double-acting pistons in the cylinders and connected to the bed-plates; a hydraulic pump; and pipe and valve connections whereby the bed-plates may be selectively and collectively forced towards and away from the rotor.

3. A refining engine as claimed in claim 2 wherein those pistons and cylinders above the rotor are of smaller diameter than those below the rotor.

4. A refining engine for paper pulp as claimed in claim 1, wherein the hydraulic means comprises cylinders closed at one end, connected to the casing, double acting pistons therein and piston rods with enlarged undercut ends fitting undercut recesses extending longitudinally of the bedplates in their rear or outer face.

5. In a refining engine as claimed in claim 2, a rotor having its outer, pulp-treating part composed of abutting sections, the outer surface of said rotor being provided with a multiplicity of similarly shaped substantially uniformly spaced longitudinal grooves, said grooves being arranged substantially parallel to the axis of said rotor.

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