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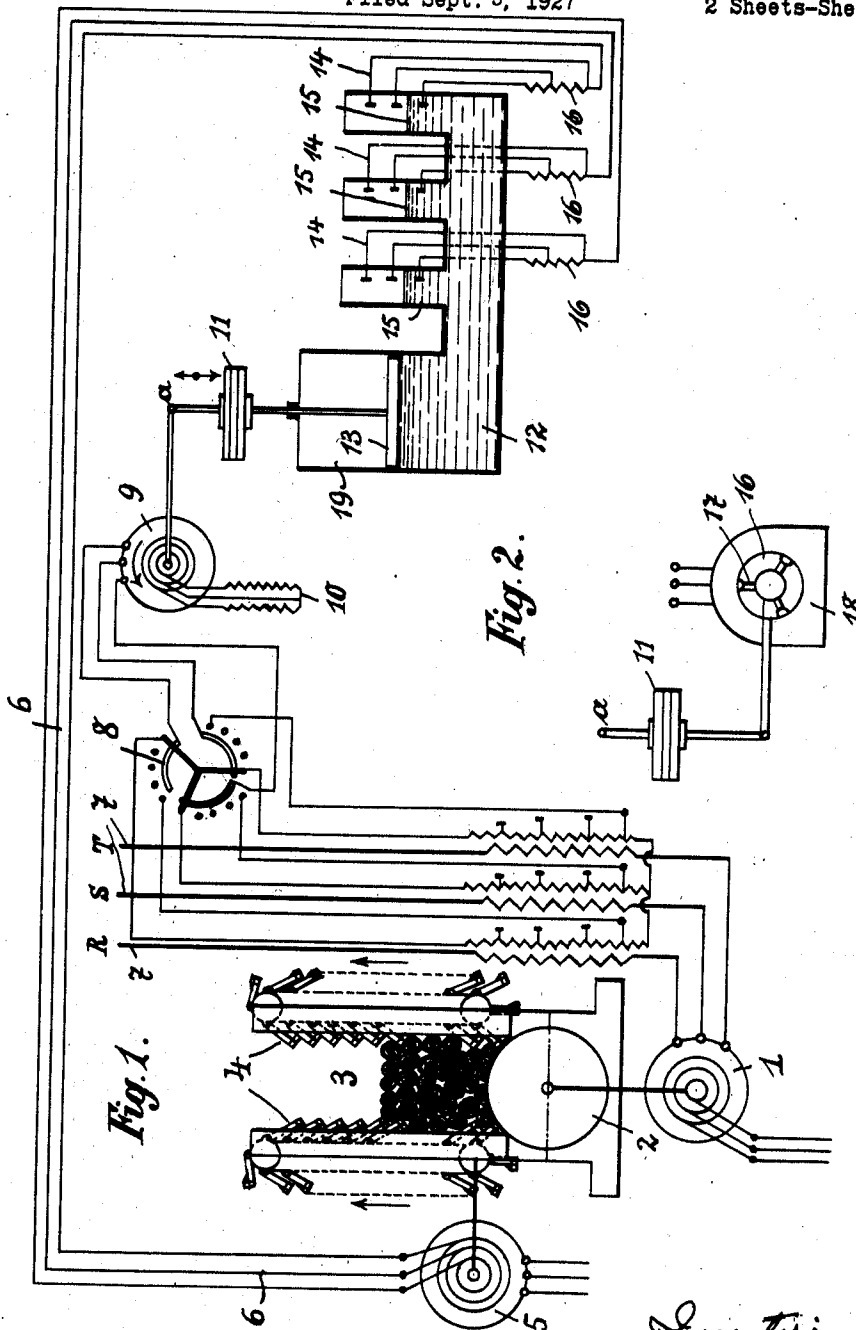
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WOOD GRINDER

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WOOD GRINDER.

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This invention refers broadly to regulating means in connection with means of preparing mechanical wood pulp by the forcing of blocks of wood against a revolving grindstone, and it is intended to devise means of overcoming the drawbacks resulting from irregularities of pressure of the wood against the grindstone, and to insure a practically uniform grinding operation. With these and other objects in view the invention comprises electrically operated regulating means, adapted to affect and control both the operation of the means for the feeding of the wood and for the holding thereof against the grinder, as well as the operating means for the grinder itself. Devices of the kind herein referred to adapted to produce a continuous, uninterrupted and substantially uniform grinding action generally comprise a grindstone with a superimposed tubular vertical shaft for the reception and the feeding of the wood to the grinder and means in connection therewith to press the wood with a certain pressure against the grindstone, means being provided to regulate the pressure of the wood within substantially wide limits in accordance with the varying condition of the wood, the character of the pulp produced and the amount and rate of driving power at disposal for the operation of the motor engine or the like. In accordance therewith the feeding, propelling and pressing means for the wood which are generally provided at the sides of the feeding conduit, such as chains, worm wheels, cellular feeding wheels and the like are operated by regulatable means which are dependent in their operation on the efficiency of the main driving means for the grindstone, so that by varying the rate of propulsion of the wood and the frictional pressure of the wood the output and efficiency of the operating means will be kept constant. Now my invention broadly considered resides in the fact that the adjustment of the regulating means of the wood-feeding devices is effected by means of an electric relay or the like which is controlled by the current of the main engine operating the grindstone, the regulating means comprising a liquid operated switch, a mercury switch for instance, which is so arranged and constructed that it is under the influence of the induction relay operated by the circuit of the main engine and depending upon the load in such circuit. The regulating device

is preferably adapted to provide a wide range of regulation with but a comparatively small displacement of the relay. As compared with the prior art the invention among other important objects is advantageously distinguished by the fact that the change of revolutions of the feeding motor engine for the wood in view of its direct dependence upon the load in the main operating engine takes place very rapidly. Any undesirable excessive or too rapid regulation may easily be avoided by the combination with damping means, a damping pump for instance. Then there is the advantage that the consumption of power of the electric motor employed for the feeding of the wood is relatively low, amounting to only a fraction of the power required for the oil-motor-engines heretofore usually employed.

The invention is shown on the accompanying drawings in several forms of embodiment by way of exemplification in diagrammatic representation in Figures 1 to 4.

In the drawings 1 is a suitable motor engine, for instance an electric alternating current three-phase motor which is operatively connected to the grindstone 2. Above the grindstone is a tubular shaft or conduit 3 for the reception and the feeding of the logs of wood against the grindstone 2 by means of chains or chain-operated pushers 4. These feeding means 4 are operated by the feeding and propelling motor 5 on the circuit of the electric conduits 6 which are regulated by the relay device according to this invention. 7 indicates the feeding conduits for the main motor engine 1 referred to. These feeding conduits by means of induction coils or the like are connected with a current reversing switch or a stepped switch 8 which in its turn is electrically connected to the rotating or reversing magnet 9 which is provided with a fixed resistance 10, and is in operative connection with a weight 11, suitably connected to the shaft of the magnet 9. The weight is arranged to oppose the rotation of the magnet in a certain direction. To the weight a regulating resistance or the brush-bridge 16 (Figure 2) may be connected in accordance with the use of either an asynchronous motor or a polyphase-collector-motor (Fig. 2) 18 being employed for the feeding and propulsion of the wood.

Upon starting the main driving motor-engine 1 only the idle not operating current

will flow in the stepped transformer 7, 8. The weight 13 overcomes the pulling force of the rotatable magnet 9, the regulating resistance of the feeding-motor 5 is short-circuited, or in the case of the polyphase-motor Figure 2 there is a corresponding adjustment of the brushes for the maximum number of revolutions. The feeding motor 5 will therefore be rotated at its highest speed and will impart a corresponding high velocity to the wood-feeding means 4. The logs of wood are thereby forced with increasing force against the grindstone, and the main driving-motor 1 is under an increasing load, so that the induced current in the stepped transformer is increased, and a pulling force corresponding thereto is imparted to the rotary magnet 9. In consequence thereof the weight 11 is raised and the regulating resistance 16 which is included in the circuit 6 of the feeding and propelling motor 5 or the brush-bridge 16 in the case of the polyphase motor of Fig. 2 is correspondingly displaced and re-adjusted. The regulating resistance 16 is connected to a series of contacts 14 which in the embodiment of Figure 1 are arranged at different levels within the relatively narrow tubes 15 of the mercury tank 12 of a mercury switching device constituted by a system of communicating tubes and comprising a broad tube 19 and a plurality of relatively narrow tubes 15, three for instance. A plunger 13 which works in the broad tube 19 is connected to the weight 11, so that by the reciprocation of the weight 11 the mercury in the leg 19 and in the tank 12 will be correspondingly depressed and respectively raised in the narrow legs 15 where it will reach the different contacts connected respectively to the regulating resistance 16, and it is obvious that by this means the operation of the feeding and propelling motor 5 can be readily regulated and controlled in accordance with the working load on the prime or main motor 1. Thus, inasmuch as the pulling force of the rotating magnet 9 depends directly on the efficiency of the said prime motor and is adapted to act directly upon the regulating resistance or to adjust the brushes in accordance with the embodiment of Fig. 2, a very rapid adjustment of the required speed of feeding movement is obtained, and on the other hand the fluctuations of the efficiency and of the working load of the prime motor 1 are thereby overcome and eliminated, the motor assuming its regular rate of movement. Then, there is the additional advantage that only relatively low operating forces are required for the rotary relay magnet 9 and notwithstanding the comparatively short paths of movement of the relay and of the plunger 13 a very delicate adjustment and great sensibility of the regulating device is obtained.

When employing asynchronous motors as feeding and propelling devices the movability of the mercury with proper adjustment allows

of an acceleration of the start by suitable over-regulation, so as to further increase the sensibility of the regulator.

In the exemplification of Figure 2 a polyphase-collector-motor is employed as a feeding means for the logs of wood. In this figure 18 is the motor, 17 are the brushes and 16 the brush-bridges. By suitable connection with the weight 11, diagrammatically indicated in this figure the respective relative position of the parts 16 and 17 may be adjusted.

In case direct current is at disposal aside from the use of alternating current for the prime or main motor 1, the feeding and propelling motor 5 may also be in the form of a direct current motor. The field of this feeding motor which should be built as a shunt-direct current motor is produced by the direct current voltage and the regulation of the number of revolutions is effected by the variation of a regulating resistance included in the armature circuit in the same manner, as set forth with reference to a polyphase-asynchronous motor.

In the exemplification shown by the diagram according to Figures 3 and 4 the relay comprises substantially a solenoid 20 which is included in the secondary circuit of a transformer or the like 21. By means of a shunt resistance 30 with regulatably disposed controlling contacts the strength of the current in the solenoid 20 or in an equivalent electromagnetic operating device and the lifting and pulling force thereof may be adjusted to different values. The core of the solenoid may be connected to a plunger 13, as shown in the exemplification above described, or the core may be connected to an ordinary controlling valve to regulate the flow of an operating fluid or liquid. The controlling valve in the embodiment shown in Figure 3 is preferably constructed as a balanced valve which works in the controlling cylinder 31. In the embodiment shown this cylinder is provided with four ports or connecting conduits for the admission and discharge of the pressure fluid or liquid. 28 is the mercury container which is provided with the communicating narrower and somewhat higher leg 32 in which the regulating resistances 29 are disposed which are included in the circuit of the feeding and log-propelling motor 5. The conduit 25 is assumed to connect the upper part of the wider leg of the mercury switch with the cylinder 31, and is continued by the oppositely arranged discharge conduit 24. The conduit 26 at the bottom part of the controlling cylinder 31 may be employed for instance as feeding conduit for the pressure fluid and is continued by the communicating conduit 27 which leads into the mercury container 28, terminating above the level of the mercury in the position of rest. In this position the mercury in the narrower leg 32 is

preferably slightly below the lower end of the resistance 29 which in the exemplification shown comprises three spirals for instance which are connected to the rotor-resistance of the asynchronous feeding motor for the wood. The number of rotations and the torque of this motor are, of course, variable within wide limits. If, on account of insufficient contact of the wood against the grindstone the current of the main or prime motor 1 is decreased below the predetermined value, the steering and controlling valve 22 on account of the correspondingly reduced strength of the field of the solenoid or the like descends, as shown at A in Figure 3 of the drawing, so as to open communication for the pressure fluid or liquid with the interior of the container 28. Thus the pressure fluid will depress the level of the mercury in the broader leg and raises it in the narrower leg containing the resistances 29, and in accordance with the degree of pressure produced a correspondingly larger or smaller amount of the resistance 29 will dip into the mercury, so that in consequence of this short-circuiting action the feeding motor 5 will increase its number of revolutions and will force the wood with greater force against the grindstone, until the load on the main motor 1 has reached the desired value.

If, on the other hand, the load on the main motor 1 on account of excessive frictional contact of the wood against the grindstone becomes too high, the field strength of the solenoid or the like will be correspondingly increased, so that the controlling valve 22, 23 will be raised into the position B of Figure 4. This causes the throttling or interruption of the admission of pressure fluid or liquid, while the return and discharge conduits 25, 25 are opened. As a result thereof the mercury in the broader leg 28 ascends and the mercury in the narrower leg 32 descends and the short-circuit of the regulating resistance is broken, and in view of the resulting increase of rotor-resistance the feeding or propelling motor 5 will now run with decreased speed or will be stopped, until the desired value of the current strength for the main motor has been obtained. Thus, the controlling and regulating valve 22, 23 will oscillate, so as to respectively open and close one of the communicating passages, and thereby regulates the rate of rotation of the feeding motor and insures the desired load on the prime motor.

The resistances 29 should be made of high-grade material and are preferably cooled by any suitable means. Cooling by air may be used as the simplest means of cooling, or water-cooling may be resorted to in which case the slight conductivity of the water does not substantially interfere with the operation of the resistances 29.

With this kind of relay and manner of regulation a practically unlimited adaptability of the device is produce as compared with the

other exemplification shown in which the regulation is depending upon the number of contacts 14 employed. Instead of a solenoid I may employ other equivalent devices, such as a speed controller or the like, so that the feeding controlling means according to this invention may also be employed in connection with wood-grinders which are driven by water turbines, steam-turbines or the like, and the device also does away with the rather unreliable feeding means operated by oil-fed working engines and the like.

It should of course be understood that the invention is not limited to the particular exemplifications herein shown merely by way of illustrating the principles of the invention which is susceptible of modifications and changes in accordance with varying conditions of application, and the convenience of the user and within the scope and spirit of the invention, as defined in the appended claims.

I claim:—

1. In a wood-grinder the combination with a rotating grindstone, driving means for the stone and electrically operated wood-feeding means cooperating therewith, of a liquid-operated switch, adapted for operative connection with the wood-feeding means, an electric relay, operatively associated with the stone-driving means, and actuating means for the switch connected to the relay.
2. In a wood-grinder the combination with a rotating grindstone, driving means for the stone and electrically operated wood-feeding means cooperating therewith, of a liquid-operated stepped electric switch-regulator, an electric relay intermediate the regulator and the stone-driving means and adapted for operation thereby, means connected to said relay and influencing the liquid of the switch-regulator and connection between said regulator and the wood-feeding means.
3. In a wood-grinder the combination with a rotating grindstone, driving means for the stone, and electrically operated wood-feeding means cooperating therewith, of a liquid-operated stepped electric switch-regulator, an electric relay intermediate the regulator and the stone-driving means, and adapted to be operated thereby, a liquid-container on said relay, and pressure producing means in said container and connected to the relay, and connection between said regulator and the wood-feeding means.
4. In a wood-grinder the combination with a rotating grindstone, driving means for the stone, and electrically operated wood-feeding means cooperating therewith, of a substantially U-shaped liquid container, comprising unequally dimensioned legs, a supply of liquid in said container and electric regulating and switching means on said container adapted to be bridged by the movement of the liquid, connections of said regulating

and switching means with the wood-feeding means, means in said container, producing liquid-pressure, an electric relay connected to the pressure-producing means and adapted
5 to be operated by variations of efficiency of the stone-driving means.

5. In a wood-grinder the combination with a rotating grindstone, driving means for the stone, and electrically operating wood-feed-
10 ing means cooperating therewith, of a substantially U-shaped liquid container, comprising unequally dimensioned legs, a supply of mercury in said container, and electric
15 regulating and switching means on said container normally above the level of the mercury and adapted for differently large electric engagement with the mercury, and connected to the wood feeding means, pressure-
20 producing means in said container above the mercury, and an electric relay operatively connected to the pressure-producing means and adapted for operation by variations of the efficiency of the stone-driving means.

6. In a wood-grinder the combination with
25 a rotating grindstone, driving means for the stone, and electrically operated wood-feeding means cooperating therewith, of a liquid-container, a supply of mercury in said container, and electric regulating and switching
30 means on said container above the normal level of the mercury and adapted for differently large electric engagement with the mercury and connected to the wood-feeding means, means to raise the level of the mer-
35 cury, an electric relay, connected to the level-raising means electrically influenced by the stone-driving means and operable by the variations of efficiency thereof.

7. In a wood-grinder the combination with a rotating grindstone, electric driving means
40 for the stone, and electrically operated wood-feeding means cooperating therewith, of a differently movable electric relay, induction-current-influenced operating means for said
45 relay, connected to the stone-driving means, a substantially U-shaped container comprising differently dimensioned legs, current regulating means in one of said legs connected
50 to the wood-feeding means, a supply of mercury in said container, a pressure-fluid conduit communicating with the other leg of the container, and a plunger movable in said conduit and operatively connected to the electric
55 relay, and adapted to produce different pressures on the mercury and changeable engagement thereof with the current regulating means.

8. In a wood-grinder the combination with a rotating grindstone, electric driving means
60 for the stone and electrically operated wood-feeding means cooperating therewith, a stepped rotary magnetic switch, controlling means for said switch, operatively connected
65 to the stone-driving means, a liquid-container, a supply of mercury in said container, means operatively connected to the magnetic switch and operatively associated with the mercury and adapted to change the level
70 thereof, and current regulating and proportioning means on the container and connected to the wood-feeding means and adapted for differently extensive engagement with the mercury of the container.

In testimony whereof I have affixed my signature.

XAVER WINKLER.