Dec. 10, 1940. H. F. WINSLOW 2,224,330

ROLLER GRINDING MILL

Filed July 21, 1937

Fig. 1

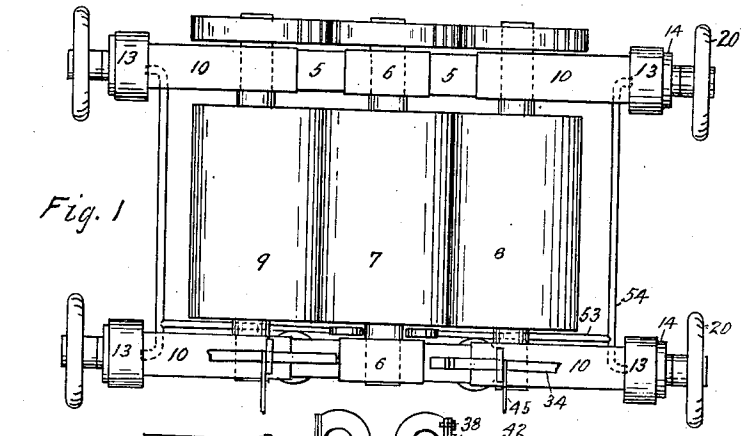


Fig. 2

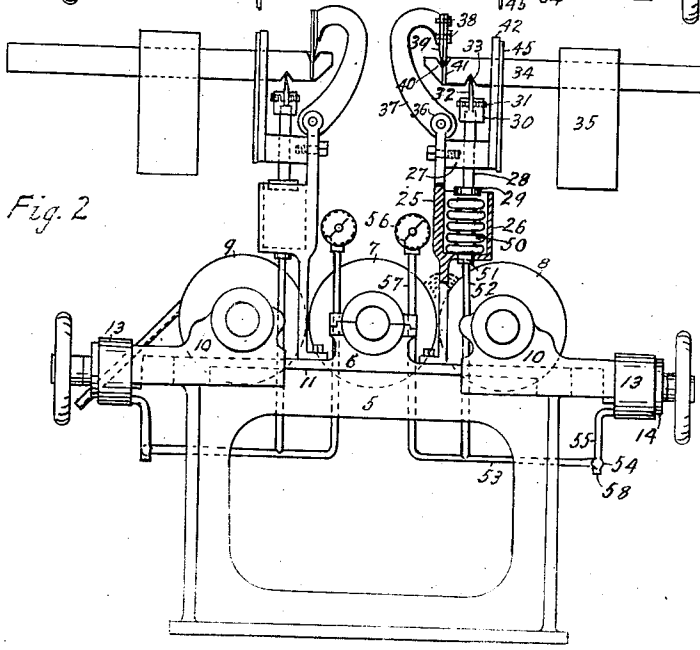


Fig. 4

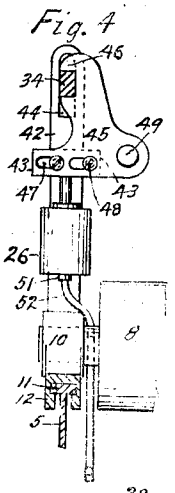
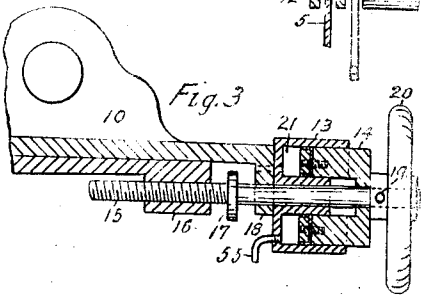


Fig. 3



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ROLLER GRINDING MILL

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2 Claims. (Cl. 83—12)

This invention relates to improvements in roller grinding mills of the general class employed in grinding printing inks and various other kinds of viscous materials.

As ordinarily constructed in mills of this class the grinding rolls are rotatively arranged in multiple pairs, one of each pair being non-adjustably mounted at opposite ends in bearings fixed to the opposite side-frames of the mill, and the opposite rollers of each of said pairs being rotatively supported at their opposite ends in movable bearings slidable lengthwise upon said frames and arranged to effect equal adjustments at the ends of said opposite rolls by means of hand-screw shafts 15 rotatably mounted in said movable bearings and provided at their inner ends with external screw-sections engaging internally threaded portions of said fixed side-frames, see enlarged detail section Fig. 3, the outer ends of said hand-screws being also provided with manually operated driving wheels adapted to urge the pairs of rolls together and effect a uniform grinding action the full length thereof. The grinding of the material produces a heating effect which acts to expand and enlarge the diameters of the rolls, causing an excessive increase of pressure between the rolls and necessitating constant attention and readjustment of the rolls.

A three roller mill is herein shown consisting of a non-adjustable central grinding roll mounted at opposite ends in bearings fixed to the opposite side frames of the mill, and on opposite sides of the central roll cooperating rollers are disposed and adjustably mounted with respect thereto in movable bearings to form double grinding surfaces, between which the material to be ground is caused to flow.

The objects of the present invention also include means containing hydraulic chambers manually actuated by hand-screws disposed in the several movable bearings and arranged at the opposite ends of each of the adjustable rolls and adapted to inwardly force the latter toward said laterally fixed or non-adjustable roller.

Also means actuated by the hand-screws for moving the adjustable grinding rolls in opposite directions.

Also means including an auxiliary hydraulic device leading to the hydraulic chambers of the adjustable grinding roller of a pair of rolls, and provided with adjustably weighted means adapted to automatically maintain a predetermined pressure between the grinding rolls.

Also the provision of a pressure gauge connected to the hydraulic pipe-line for visibly indicating pressure variation.

For further comprehension of the invention, and of the objects and advantages thereof, reference is had to the following description and accompanying drawing, and to the appended claims in which the various features of the invention are more particularly pointed out.

In the drawing,

Figure 1 is a ground plan showing a three-roller grinding mill provided with the roll-adjusting means embodied in the present invention.

Figure 2 is an elevational view showing the ends of the rollers and the hydraulic connections for the automatic pressure regulation.

Figure 3 is an enlarged detail view of a screw actuated hydraulic pressure chamber for grinding roll adjustments, shown partially in section.

Figure 4 is a side elevational view showing an assembly of parts relating to the hydraulic pressure regulating device, taken at right angles to Fig. 2.

In the drawing numeral 5 indicates the opposite side-frames of the mill, having the fixed bearings 6 in which are rotatably mounted the journal ends of the central grinding roller 7, adapted for adjustable engagement on opposite sides by the rolls 8 and 9, the two last mentioned rolls being journaled at their opposite ends in the elongated bearings 10, slidably mounted on the upper flanges 11 of the frames 5, the bearings being retained in movable position lengthwise of frames as indicated by the side gibs 12, shown in Fig. 4, which slidingly engage the lower surfaces of the frame flanges 11.

As shown in Figs. 1, 2 and 3, the outer ends of the several movable bearings 10 are each provided with a cylindrical hydraulic pressure cylinder 13, fixedly secured thereto in any approved manner, see enlarged detail section Fig. 3, the same being internally fitted with a piston 14 having the usual hydraulic packing ring and provided with a central operating hand-screw shaft 15 the inner end thereof being threaded and engaging a correspondingly screw-threaded lug 16 formed in the opposite outer ends of the fixed side frames of the mill. Intermediate its ends the hand-screw is formed with a fixed collar 17 and is rotatively supported exteriorly of its threaded portion by the vertical end flange 18 of the bearing 10 and by the bearings formed by the hub of the hydraulic cylinder 13 and the piston 14, the outer end of the hand-screw being fitted with a hand-wheel 20 secured thereon by a pin 19 extending through the hub of the wheel

and the screw-shaft. By means of the hand-wheel the screw may be rotated within the fixed threaded lug 16 and inwardly forced together with the hydraulic piston 14, the latter acting in opposition to the fluid contained within the hydraulic pressure space 21 to inwardly urge the movable bearing 10 together with its adjustable grinding roller into the desired operative positions. By rotating the hand-wheel 20 in its opposite or releasing direction, the respective spacing between the collar 17 and flange 18 will serve to space the pairs of grinding rolls for cleaning or dismantling purposes.

Cooperating with the hydraulic pressure cylinders 13 shown in detail in Fig. 3, are a pair of pressure regulators or bellows 50 similar to each other and adapted for connection to the two pairs of grinding rollers 7 and 8 and 7 and 9, both mounted on a single side-frame of the mill. Each regulator or bellows includes an upright 25 mounted upon the upper flange 11 of the frame, and formed with said upright between its ends is an internally cylindrical casing 26 provided with a closed bottom and open top. Adjacent the upper end of the upright 25 a guide-block 27 is detachably secured and arranged to slidingly support for vertical movement a presser bar 28 having at its lower end a head 29 and at its upper end a knife-blade holder 30 provided with set-screws 31, to secure the knife-blade 32, for engaging the V-slot 33 disposed in the lower edge of the scale-beam 34 for the support of the latter together with the counterbalance weight 35, slidable along said beam, and adjustably fixed thereon in conventional manner to permit the vibrating action thereof.

At the upper end of the upright 25, a vertically slotted hub 36 is provided to receive the upright arm 37, the lower end of which is disposed within the slot of said hub and in pivotal relation thereto; and at its upper end the arm is folded partially over upon itself to form a bearing surface alined with respect to its opposite pivot point. Secured to the latter bearing surface by a pair of screws 38 is a knife-blade 39 that engages a V-slot 40 formed in the upper edge of said scale-beam 34 adjacent an end thereof. The knife-blades 32 and 39 are horizontally spaced lengthwise of the scale-beam a relatively short distance apart and they jointly serve as fulcrum points about which the beam is free to rock without frictional resistance. For laterally guiding the beam adjacent the knife-blade 39, a bifurcated plate 41 is provided, the opposite prongs of which engage the opposite sides of the beam and extend the depth thereof plus its movement, and for its support the plate is held by the screws 38 that sustain the knife-blade 39.

Also for guiding the scale-beam adjacent the knife-blade 32, see Figs. 2 and 4, an upright guide-bar 42, having at its lower end opposite side extensions 43, is secured to the guide-block 27, and provided with a slot 44 of definite length to serve both as a lateral guideway for the scale-beam and for limiting the vertical movement of the same. Detachable locking means is also provided for the scale-beam consisting of a movable plate 45 provided with jaws 46 for enclosing and locking the beam 34 in the position shown, and for detachably securing the same, a pair of alined slots 47 are formed in said plate and secured in sliding position against the upright guide-bar 42 by the headed screws 48 extending loosely through said slots in tapped relation into the extensions 43 of said guide-bar 42. The locking plate is also provided with a finger hole 49 by means of which the lock may readily be opened and closed, and the scale-beam operated for detachable connection, held against vibration, and adapted by means of the balance weight 35 to exert a variable downward pressure through the presser bar 28 and head 29 upon the upper end of the corrugated hydraulic expansion member or bellows 50 disposed within the chamber 26, the member consisting of a hollow closed vessel formed of expansible bellows shaped metal, provided at its lower end with a hub 51 extending through the bottom of said chamber 26, and having an hydraulic pipe-line connection 52 leading through similar pipe connections 53, 54 and 55 from the hydraulic pressure spaces 21 of a pair of cylinders 13 the latter being associated with the adjustable grinding roller 8. For indicating the desired variable pressure between said pair of grinding rollers 7 and 8 a gage 56, graduated in pounds per square inch, is connected by the pipe 57 into the hydraulic line.

In charging the hydraulic pipe-line with liquid fluid, the weighted scale-beam 34 is first locked in a fixed horizontal position by means of the lock-plate 45, the fluid preferably consisting of a light weight oil suitable for the variable pressures required, provision being made in the pipe-line connections for the escape of air during the forced admission of the fluid. In the charging action a sufficient quantity of fluid is forced into the hydraulic passages 21 of the cylinders 13 at opposite ends of the adjustable grinding roller 8 to permit the pistons 14, acting by the manually operated screws 15 to effectively fill the superficial areas of said pistons, and inwardly force the adjustable roller 8 into parallel engagement with its opposite grinding roller 7.

In mills having multiple pairs of grinding rollers in which the material ground passes successively between said pairs, difficulty is ordinarily experienced in maintaining a constant desirable pressure between the rolls of each of said pairs, owing in part to a variable difference with respect to the clearances between the roller journals and their bearings, which, under the extreme pressures required, results in the adjustment of one pair of rollers being disturbed by the adjustment of an opposite pair, as instanced in the rollers shown in Fig. 2, in which the screw adjustment of side roller 8 tends to shift roller 7 in its bearings in one direction and in the opposite direction when an adjustment is made in the opposite side roller 9.

In the present invention this difficulty as well as that of the constant heating effect of the rollers due to the frictional, sliding and grinding actions between their respective working surfaces have been met by providing for each pair of grinding rollers a regulated hydraulic pipe-line 52, the fluid pressure of which extends upwardly and also fills the expansion regulator or bellows 50, the length of the latter respectively increasing and decreasing with the pressure therein. The counterweighted scale-beam having been set at a predetermined gage-point, representing as a factor the number of pounds per square inch of fluid surface effected by the pistons 14 within their cylinders 13, to show the total number of pounds pressure exerted between a pair of rollers, it will be obvious that a variably regulated hydraulic setting may be applied to each of the several pairs

of grinding rollers within a mill, and be adaptable for operation upon a wide variety of products requiring variable degrees of pressure in its grinding actions.

In the automatic action of the device to control the pressure between a pair of grinding rollers, in which an increase of pressure over a setting occurs, as will be indicated by the action of the hydraulic fluid that completely fills the several pipe-lines and regulator or bellows 50 for upwardly expanding the latter, which in turn raises the balanced scale-beam 34 by means of the intermediate connections 28, 29, 30 and 32, the beam being free for vertical movements about their pivotal knife-blades. It thus appears that the movements have caused a quantity of the fluid to be transferred from the pipe-line to the expansible regulator or bellows, in which condition the scale-beam will be retained in its raised position and the gage held to the desired setting. In like manner should the pressure between the grinding rollers fall below the setting, the regulator or bellows and scale-beam would be depressed under the influence of the weighted beam and cause a portion of the regulator or bellows fluid to be returned to the pipe-line, while the gage would maintain its originally desired setting position, it being understood that by reason of the non-compressible nature of the fluid, the quantity thereof used in the transfer would be relatively small. Also, as shown, the regulator or bellows and associated balanced scale-beam acts as an automatic measuring valve ready instantly to transfer the necessary fluid in either direction to maintain said balance and insure a regulated pressure at all times between a pair of grinding rollers throughout their operation.

In cases of accidental entrance of foreign matter into the grinding run, as nails from supply packages, or other more bulky matter, the scale-beam will be caused to yield and pass the nails between the grinding rollers with no objectionable operative result, and if the obstacle within the run is beyond the yielding capacity of the beam, the general safety of the mill is insured by the provision of safety-pins 19 disposed within the hubs of the handwheels 20 which operate the hand-screws 15, the pins being designed to be sheared for the release of the handwheels from their screw-shafts by the obstacle acting to separate the rollers blocked thereby that lead through the movable bearings to said pins.

It is to be understood that the present automatic pressure device may, with comparatively small expense, be applied to existing mills of similar general character in which the pressure adjustments consist of hand-screws either with or without hydraulic connections. In either of these latter types of mills the pressure adjustments between the grinding rollers cannot be held for any definite length of time owing to the constantly changing temperature condition, common in all mills. In ordinary mills of the above types the operator is called upon to be practically in constant attention to the pressure adjustments of the grinding rollers if the regularity of quantity and quality of output is called for; if the pressure between the rollers is allowed to become reduced and irregular, the quality of the material ground will be coarser and the quantity delivered greater, while if the pressure is maintained by close adjustment the quality of the material will be improved by being more finely ground and the quantity of output reduced accordingly.

On the other hand, if automatic pressure valves are applied to the ordinary roller mills having one or more pairs of grinding rollers set to a suitable grinding pressure, the operator may give his attention to a plurality of mills, or other matters and be assured that the mills thus automatically operated will hold such pressure, or other desired ones throughout a required period, and produce a maximum output in conformity with the quality thereof.

It is clear that the grinding action of the rollers causes them to heat and expand and more closely space the roller surfaces and give a finer grinding movement. The only time the rollers are cold is when the mill stops work.

On setting the mill to the desired pressure, the scale-beam is temporarily locked in horizontal position and the hand-screws operated in accordance with the pressure gage.

The beam is then unlocked and as the rollers begin to grind and grow warm the pressure therebetween will gradually increase and lift the scale-beam against the action of its weight by the upward expansion of the regulator which in its movement absorbs a small amount of the hydraulic fluid from the pipe-line sufficiently to reduce the pressure therein, and thus maintain the desired pressure, as shown by the gage.

I claim:

1. In a mill, a pair of grinding rollers, one thereof being journaled in bearings fixed to the frame of the mill, the opposite roller being journaled in bearings slidable on said frame for adjustment toward and from the roller carried by the fixed bearings, hydraulic cylinders fixed to the outer ends of said slidable bearings, pistons slidable within said cylinders to form hydraulic chambers, a hand-screw shaft rotatively mounted within the cylinder and piston of one of said slidable bearings, the threaded portion of said screw-shaft engaging a corresponding threaded section in a fixed portion of said frame, a hand-wheel having a hub mounted rigidly on said screw-shaft exteriorly of the piston, said hub having an abutting relationship with said piston, whereby rotation of said hand wheel will urge said piston inwardly to decrease the volume of said hydraulic chamber, or permit said piston to move outwardly to enlarge said hydraulic chamber.

2. In a roller grinding mill, a frame, a pair of grinding rollers rotatable thereon and subject to expansion and contraction from heat, hydraulic pressure generating means including closed pipe-lines carried by said frame, manually operable screw means carried by said frame to exert through said hydraulic means a desired grinding pressure with respect to said pair of grinding rollers, a pressure regulator or bellows connected to said pipe-lines and adapted for longitudinal expansion and contraction movements, an adjustably weighted scale-beam mounted on said frame to receive the longitudinal movements of said regulator or bellows, and means for horizontally locking said beam including a slidable lock-plate provided with a pair of jaws disposed to engage the upper and lower edges of said beam.

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