Sept. 16, 1952 E. H. MILLER 2,610,801

ROLLER MILL

Filed March 12, 1949 2 SHEETS—SHEET 1

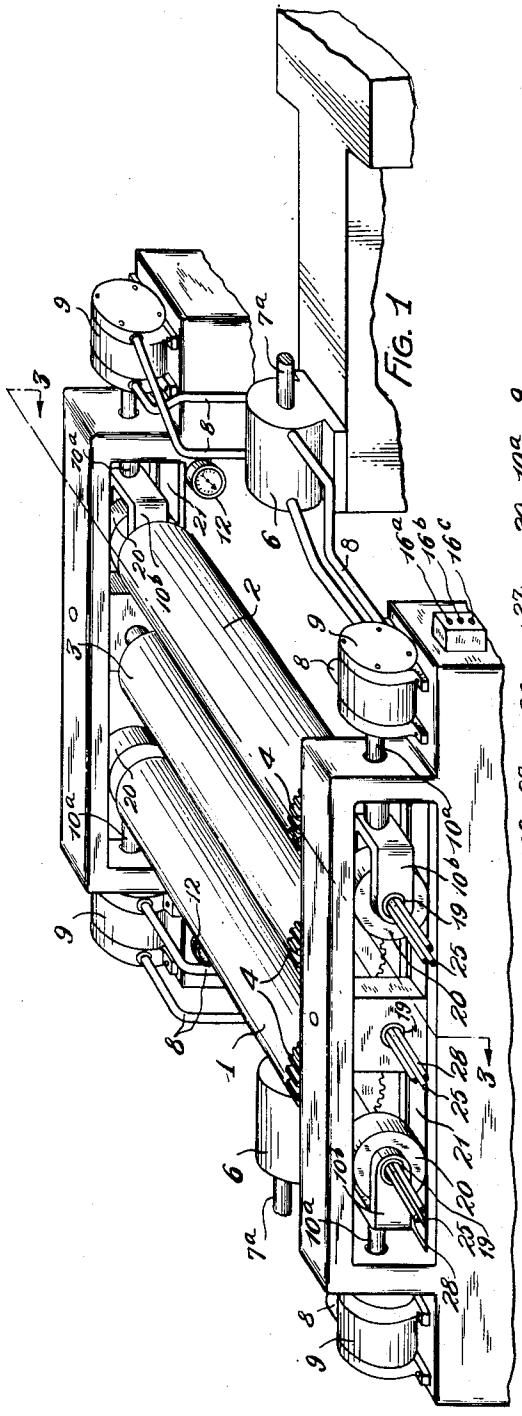


FIG. 1

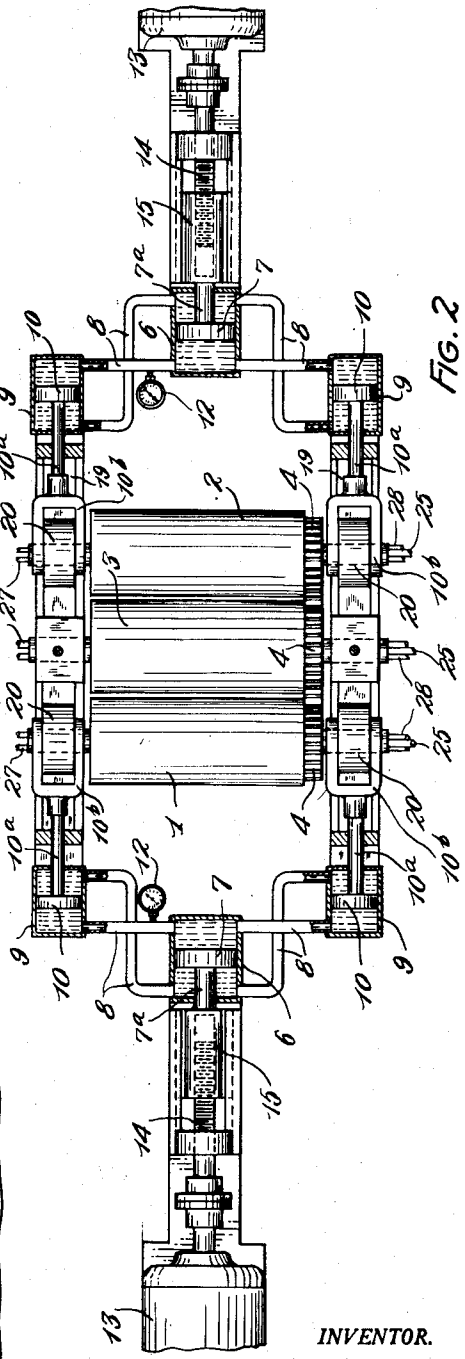


FIG. 2

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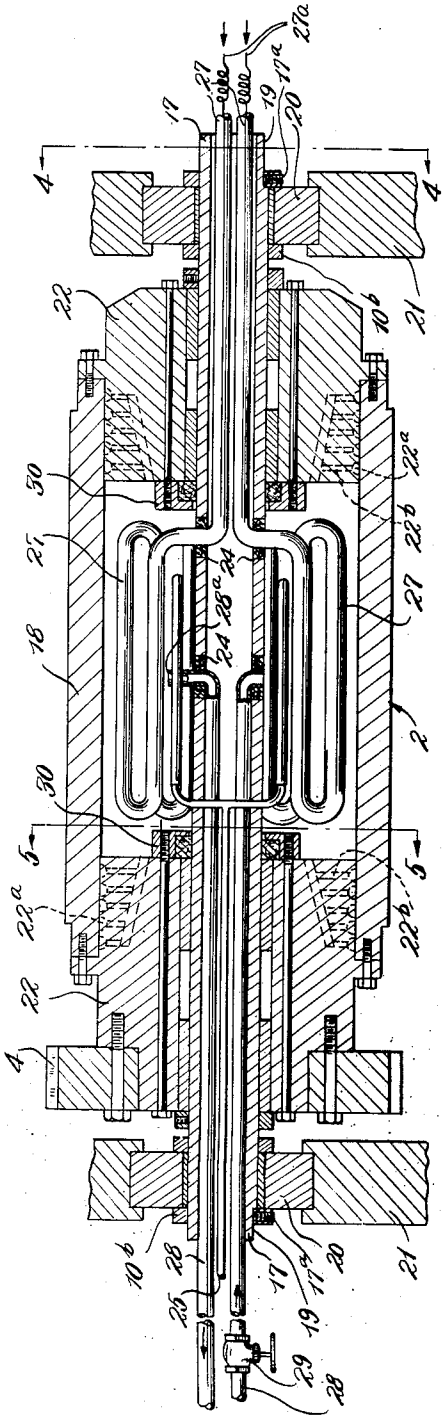


FIG. 3

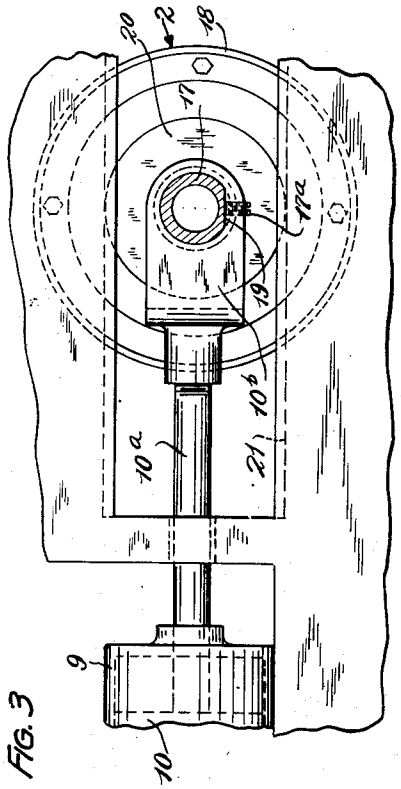


FIG. 4

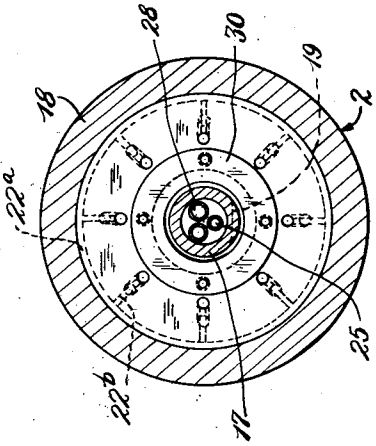


FIG. 5

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UNITED STATES PATENT OFFICE

2,610,801

ROLLER MILL

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Application March 12, 1949, Serial No. 81,041

5 Claims. (Cl. 241—67)

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This invention relates to the art of roller mills which are adapted for the grinding of various materials, as for instance pigments, clays, foods, paper pulp, paper coating, plastics, chemicals, seeds, grain, etc.

It is of course understood that in such a mill it is desirable to vary the space between the adjacent rolls so as to obtain the desired degree of pressure according to the particular character of grinding in any given case; and it is equally desirable to be able to effect such adjustment in a uniform, dependable and convenient manner.

It is therefore the object of my present invention to devise a roller mill with means whereby there may be effected an adjustment of a roll in such manner as to ensure parallel roll relation at all times; in which there may be effected such true adjustment throughout the entire length of an adjustable roll and for all adjustable rolls to any fine degree desired so as to permit the desired character of milling in a uniform manner; in which such predetermined degree of adjustment may be effected in a simple and efficient manner; and in which such variation in the pressure between the rolls may be effected at any time desired, even during actual operation of the mill.

A further object is to devise such a roller mill in which the shaft of each roll is readily separable from the shell of the roll itself so as to permit a damaged shaft to be replaced at any time and with comparatively little cost and loss of time; in which the shaft of the roll is at all times non-rotatable and is so constructed and arranged as to permit temperature-regulating means to be provided upon the interior of the roll body itself for increasing the efficiency of the mill operation, including the end portions of the roll.

Other objects will appear from the following description and claims when considered together with the accompanying drawing.

Fig. 1 is a perspective view of a roller mill embodying my present improvements;

Fig. 2 is a top plan view thereof with parts broken away;

Fig. 3 is an enlarged view taken on line 3—3 of Fig. 1;

Fig. 4 is a view corresponding to line 4—4 of Fig. 3; and

Fig. 5 is a view taken on line 5—5 of Fig. 3.

It is to be understood that the present form of disclosure is merely for the purpose of illustration and that there might be devised various modifications thereof without departing from the spirit of my invention as herein set forth and claimed.

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In the present illustration I have indicated a three-roll mill in which the two outer rolls 1 and 2 are adjustable towards and from the middle roll 3 which is not adjustable. These rolls are all arranged in parallel relation to each other and are adapted to be rotated through gears 4 from an electric motor.

As a means for adjusting the rolls 1 and 2, each one is provided with the double-acting hydraulic master cylinder 6 and plunger 7 with pipe line connections 8 to the double-acting hydraulic auxiliary cylinder 9 and plunger 10 at each end of each adjustable roll. It is to be noted that the pipes 8 provide communication between both sides of the master plunger 7 and both sides of each of the auxiliary plungers 10. There is a pressure gauge 12 in each of these pipe lines; and the gauge will be set for the desired pressure between the rolls, whereupon the adjustable roll in each case will be moved accordingly. This hydraulic system is entirely closed. Thus the auxiliary hydraulic means may be said to be connected to the master hydraulic means "in parallel" and there is ensured uniform and equalized pressure at all times at both ends of each adjustable roll; and the roll adjustment will be even throughout its entire length and the rolls will be maintained parallel at all times with respect to each other.

The master plunger 7 in each instance is operated by means of the electric motor 13 which rotates the screw 14 which, in turn, has operative engagement with the screw-threaded nut 15 upon the rear end of the rod 7a of the master plunger 7. The motor 13 may be controlled by means of suitably located and readily accessible contact buttons 16a, 16b and 16c. Each adjustable roll will have its individual hydraulic system and electric motor and control means therefor to permit actuation of the master plunger, as above described, so as to permit independent adjustment of each of the rolls 1 and 2 towards and from the middle roll 3.

Each auxiliary plunger rod 10a is connected, as for instance by a clevis or yoke 10b, to the corresponding end of the shaft 17 of one of the adjustable rolls 1 and 2. As a still further improvement, the rolls are so formed that the shell 18 of each roll rotates upon its shaft 17 which does not rotate. For instance, the shaft 17 at each end and each clevis 10b may be provided with interengaging flat portions; and furthermore, a set screw 17a may be provided in each clevis for engagement with the corresponding flat portion of the shaft 17, which is indicated by reference numeral 19. The purpose of this arrangement is to

prevent the shaft 17 from rotating. Near the ends of each adjustable roll shaft 17 there are the rollers 20 within which the shaft 17 is mounted with roller bearings, the rollers 20 resting upon the rails 21 for adjustable movement therealong towards and from the roll 3. The hollow shell 18 of each roll is bolted at its ends to the castings 22 which in turn are mounted upon roller bearings about the shaft 17. The outer end of one of the castings 22 has affixed thereto a gear 4 for driving connection from an electric motor, as above explained.

The shaft 17, which is of hollow form, is provided with as many sets of holes 24 as may be desired to accommodate temperature regulating means which may be lead through the same and into the space within the hollow roll shell 18. For instance, part of such temperature regulating means may consist of a suitable form of thermostat 25 for automatically controlling suitable heating or cooling means 27 which will also extend in through the hollow shaft 17, holes 24 and into the hollow shell 18 of the roll. This device may be provided with either heating or cooling means or both such means may be embodied in the same device if so desired; the means 27 here indicated being only illustrative. The holes 24 will be packed so as to close the same about the various temperature regulating means. These several instrumentalities, which constitute the temperature-regulating means, are here indicated in only a general way as the present organization is not limited to any specific form of thermostatic control means or heating or cooling means. The point is that my present structure facilitates the inclusion of all such means as may be desired in any given case; and my present invention is to be understood as embodying all such means as are herein referred to. For instance, an electric resistance 27*a* wire may be lead into the hollow shell 18 through the conduit 27 for heating purposes. Also, water may be supplied to the interior of the shell 18 from the regular water main supply line through the pipes 28 for cooling, the extent of the outlet 28*a* within the shell determining the height or depth of the water within the shell. Instead of providing circulation of water through the shell under the force of the main supply line, it may be retained within the shell by closing the valve 29 after supplying water to the shell. Also, an antifreeze solution may be provided in the water within the shell. The water or liquid within the shell not only will itself serve as a cooling medium but will serve also as a means for conducting the heat or cold radially from the other heating or cooling medium outwardly to the shell 18.

Each of the castings 22 may be provided with annular grooves 22*a* thereabout in the region of the outer end portions of the shell 18, and these grooves have duct connections 22*b* through the inner end of the casting in each instance, there being a plurality of sets of ducts 22*b*, as indicated in Figs. 3 and 5 of the present drawing. Thus, as the roll rotates, the ducts 22*b* will be filled with the liquid in the lower part of the shell and will be carried up with the roll and deposited therefrom by gravity as the roll continues to rotate, this filling and emptying of these ducts and grooves with the liquid being repeated as the roll continues to rotate, thereby producing a cooling effect upon the end portions of the roll.

I have provided a packing gland 30 at each end of the chamber within the hollow roll so as to prevent temperature-conditioning liquid from entering the bearings between the housings 23 and the shaft 17.

In actual use of my present invention, each gauge 12 will be set for the desired pressure for each end roll with respect to the middle roll, the operator will press one of the buttons 16*a* to start the electric motor 13 which will be permitted to run until there is obtained the pressure for which the gauge has been set; whereupon the operator will press stop button 16*b* for stopping the motor 13. The same procedure will be followed for the other roll by means of its electric motor and the control buttons therefor. Whenever it is desired to move roll 1 or 2 away from roll 3, the operator will first set the gauge for the desired pressure, then press the button 16*c* for reverse operation of the motor 13; and, when the desired pressure is obtained according to the gauge, the stop button 16*c* will be pressed to stop motor 13.

The practical advantages of my present mill are quite numerous and will be mentioned only briefly in view of the above explanation. With my form and arrangement of the means for adjusting the rolls and thereby always maintaining parallel relation between the rolls at exactly the pressure desired, it is possible to produce more efficient results, in fact results that have heretofore been impossible in a commercial mill. The adjustment of the rolls in my mill is sensitive, true and dependable; and the "touch and feel" of the highly skilled artisan is no longer necessary in order to obtain the proper set-up. Furthermore, the danger of human error is reduced to practically nil and there is also experienced a decided saving in time in establishing any desired set-up or in adjusting the rolls at any time. With my present arrangement, the rolls may be adjusted at any time, even during actual operation of the mill; and the rolls may be depended upon to stay in the position to which adjusted at any time, this by virtue of the combined arrangement of the double-acting hydraulic means for effecting the adjustment of the rolls, and its adjusting means.

My present improved mill makes it possible to process many more materials of different characters than has been heretofore possible and the milling operation can be performed at a more sensitive degree of pressure by virtue of the uniform pressure throughout the entire extent of any given roll and also for all rolls in the mill and by virtue also of the provision for temperature regulation within the rolls. This means also the elimination of the loss of material that has heretofore been experienced in the grinding of certain commodities, as for instance in the case of certain classes of foods. My present mill makes it possible to chart the milling operation of any given material and to reproduce the same result for the same material in accordance with the chart data in a scientific manner.

Furthermore, as above indicated, the provision of temperature regulation makes it possible to mill at more effective pressures and temperatures and accordingly permits finer milling without any danger of damage to the material being milled. There may be obtained any desired operating condition with respect to both pressure and temperature at any time either before or during a given milling operation.

Thus, with my present improved mill, there is eliminated the familiar and objectionable "tooth line" on a roll as well as other objectionable features of the old mills. Also, with the increased efficiency in the results produced by virtue of my complete regulation of both pressure

and temperature, there are no longer any "throw-backs" of unsatisfactory milled products, as heretofore experienced. Furthermore, the means for effecting operation and control of my present machine is extremely simple.

The hydraulic system in my present mill is completely closed and hence there may be obtained uniform and equalized pressure at all times at both ends of each adjustable roll and each roll will be dependably held in such adjusted position by virtue of the means for effecting such adjustment, as above described, which includes the screw and nut combination for operating the master plunger.

It is believed that further advantages, resulting from my present invention, will readily suggest themselves to those who are familiar with the art to which this invention relates.

What I claim is:

1. In a device of the class described, a plurality of parallel companion rotatable rolls, one of said rolls being adjustable towards and from another of said rolls, rollers on the two ends of the shaft of said adjustable roll for supporting the same and facilitating adjustable movement thereof, said adjustable roll comprising a hollow shaft and a hollow roll body rotatable upon its shaft, means for holding said hollow shaft against rotation, means extending through said hollow shaft and into said hollow roll body for controlling the temperature within said roll, double-acting hydraulic master cylinder and plunger, double-acting hydraulic auxiliary cylinders and plungers at the two ends of said adjustable roll, said auxiliary plungers having operative connection with the ends of the shaft of said adjustable roll, hydraulic operative connections so arranged between both sides of said master plunger and both sides of each of said auxiliary plungers so as to have the master and auxiliary cylinders connected in parallel and being otherwise closed so as to permit simultaneous and equalized hydraulic pressure of the auxiliary plungers at both ends of said adjustable roll and corresponding adjustment of the two ends of said adjustable roll, means for operating said master plunger, and means for rotating said rolls.

2. In a device of the class described, a plurality of parallel companion rolls adapted for rotation, one of said rolls being adjustable towards and from another of said rolls, said adjustable roll comprising a hollow shaft and a hollow roll body rotatable upon its shaft, means for holding said hollow shaft against rotation, means extending through said hollow shaft and into said hollow roll body for controlling the temperature within said roll and including means for conditioning the temperature of the end portions of each of said rolls, double-acting hydraulic master cylinder and plunger, double-acting hydraulic auxiliary cylinders and plungers at the two ends of said adjustable roll, said auxiliary plungers having operative connection with the ends of the shaft of said adjustable roll, hydraulic operative connections so arranged between both sides of said master plunger and both sides of each of said auxiliary plungers so as to have the master and auxiliary cylinders connected in parallel and being otherwise closed so as to permit simultaneous and equalized hydraulic pressure of the auxiliary plungers at both ends of said adjustable roll and corresponding adjustment of the two ends of said adjustable roll, means for operating said master plunger, and means for rotating said rolls.

3. In a device of the class described, a plurality of parallel companion rolls, one of said rolls being adjustable towards and from another of said rolls, said adjustable roll comprising a hollow shaft and a hollow roll body rotatable upon its shaft, means for holding said hollow shaft against rotation, means for supplying a cooling medium through said hollow shaft and into said hollow roll body, means provided in the ends of said roll body for communicating the cooling medium to the end portions thereof, said last-named means being actuated by the rotation of said roll body, double-acting hydraulic master cylinder and plunger, double-acting hydraulic auxiliary cylinders and plungers at the two ends of said adjustable roll, said auxiliary plungers having operative connection with the ends of the shaft of said adjustable roll, hydraulic operative connections so arranged between both sides of said master plunger and both sides of each of said auxiliary plungers so as to have the master and auxiliary cylinders connected in parallel and being otherwise closed so as to permit simultaneous and equalized hydraulic pressure of said auxiliary plungers at both ends of said adjustable roll and corresponding adjustment of the two ends of said adjustable roll, means for operating said master plunger, and means for rotating said rolls.

4. In a device of the class described, a plurality of parallel companion rolls, one of said rolls being adjustable towards and from another of said rolls, said adjustable roll comprising a hollow shaft and a hollow roll body rotatable upon its shaft, means for holding said shaft against rotation, means for supplying and maintaining a cooling liquid within said hollow roll and to a partial depth thereof, means provided in the ends of said hollow roll and opening to the interior thereof and communicating to the outer end portions of said roll, said last-named means being inclined so as to be actuated by the rotation of said roll in filling and emptying the same, double-acting hydraulic master cylinder and plunger, double-acting hydraulic auxiliary cylinders and plungers at the two ends of said adjustable roll, said auxiliary plungers having operative connection with the ends of the shaft of said adjustable roll, hydraulic operative connections so arranged between both sides of said master plunger and both sides of each of said auxiliary plungers as to have the master and auxiliary cylinders connected in parallel and being otherwise closed so as to permit simultaneous and equalized hydraulic pressure of said auxiliary plungers at both ends of said adjustable roll and corresponding adjustment of the two ends of said adjustable roll, means for operating said master plunger, and means for rotating said rolls.

5. In a device of the class described, a plurality of relatively adjustable companion rotatable rolls with parallel longitudinal axes, means for varying the distance between said rolls, said means including a single master double-acting hydraulic cylinder and a single plunger therein, a pair of equal sized auxiliary double-acting hydraulic cylinders and single plungers therein, each latter cylinder located at an end of at least one of said rolls and oriented perpendicularly to the roll axis, operative connections between the plungers of said auxiliary hydraulic cylinders and each adjustable roll, hydraulic operative connections so arranged between both sides of the plunger of said master hydraulic cylinder and both sides of each of the plungers of said auxiliary hydraulic cylinders so as to have each side of said master and a single side of said auxiliary hydraulic cyl-

inders connected in parallel, the two parallel hydraulic systems thus arranged being otherwise closed so as to transmit simultaneous and equalized pressures upon the operative connection of the auxiliary means and corresponding equal adjustment of the two ends of the adjustable roll, means for operating the plunger in said master hydraulic cylinder as the sole means for actuating and directing the hydraulic medium, and means for rotating said rolls in all positions of adjustment.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,671,356	Diederichs	May 29, 1928
2,068,779	Tunley et al.	Jan. 26, 1937
2,274,821	Bloxsom	Mar. 3, 1942

FOREIGN PATENTS

Number	Country	Date
250,321	Great Britain	Apr. 9, 1926
410,967	Great Britain	May 31, 1934
360,354	Italy	Mar. 2, 1938