April 8, 1952 G. R. LINDEN 2,592,048

HYDRAULIC ROLL POSITIONER

Filed Sept. 27, 1949 2 SHEETS—SHEET 1

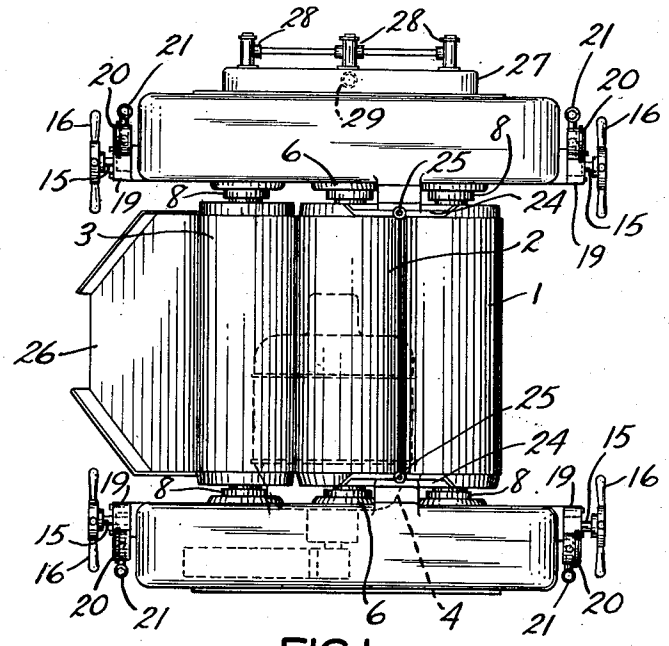


FIG.1.

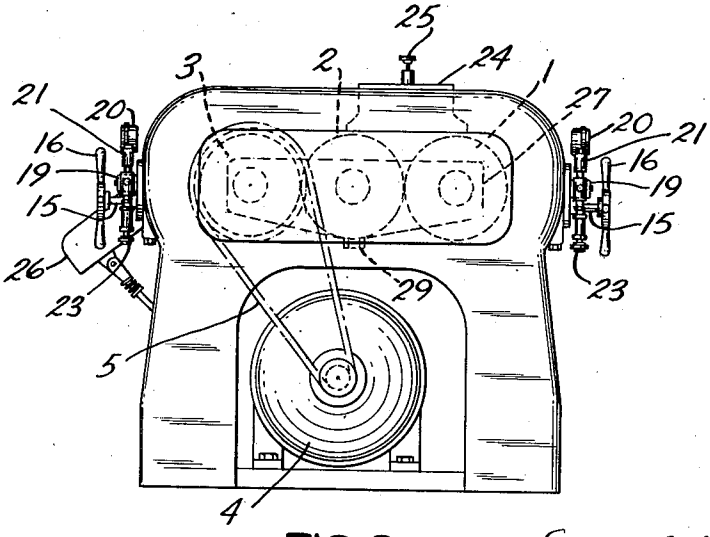


FIG.2.

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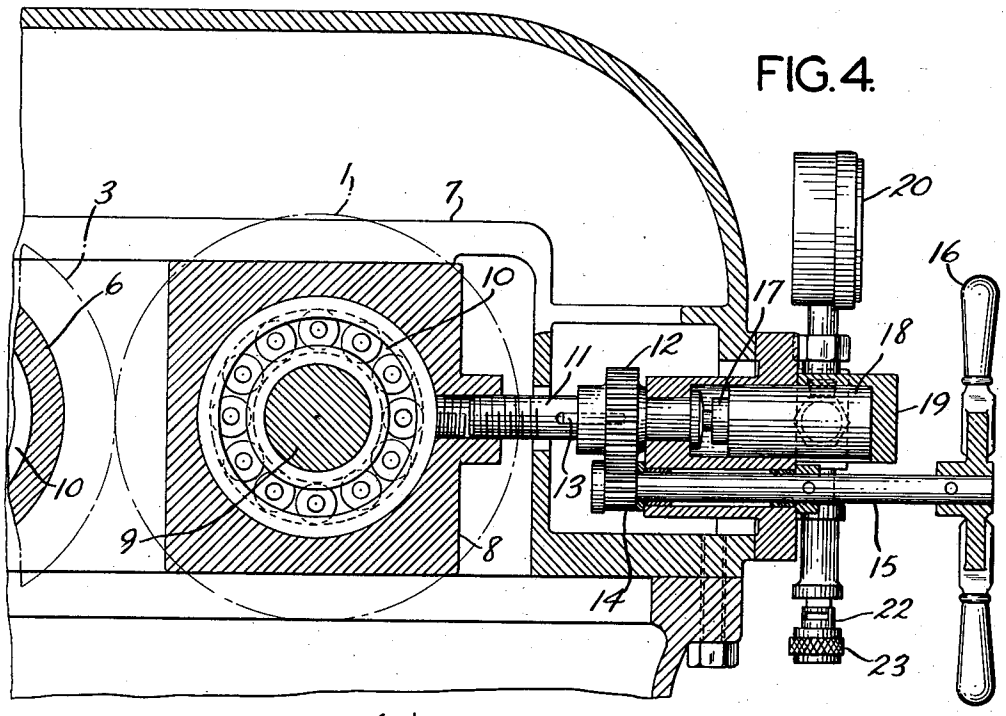
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FIG. 4.



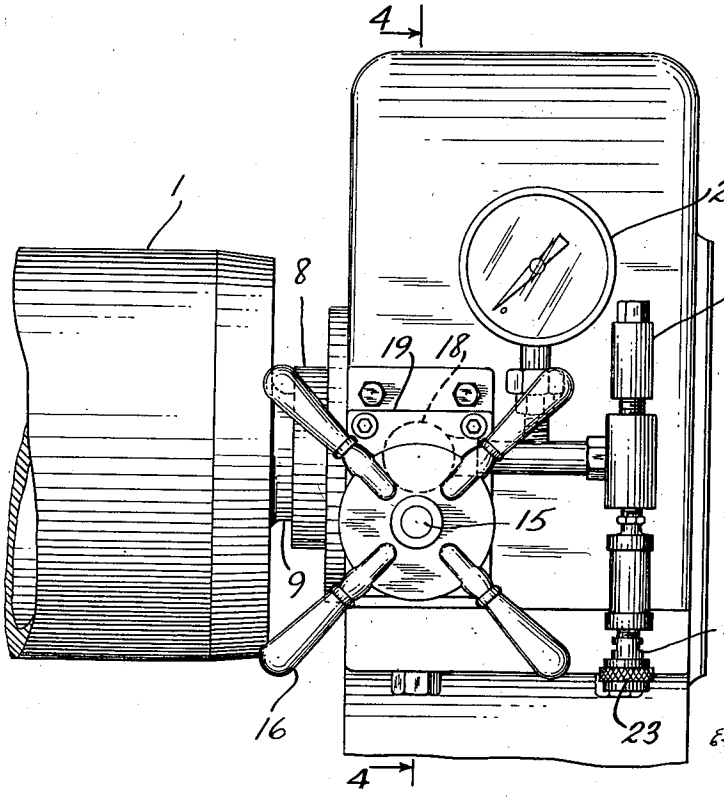


FIG. 3.

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HYDRAULIC ROLL POSITIONER

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Application September 27, 1949, Serial No. 118,057

1 Claim. (Cl. 241—159)

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One of the objects of my invention is to provide a roller grinding mill in which the relative positions of the rollers may be easily, quickly and very accurately adjusted to the precise pressures desired between them, and wherein these adjustments can be made by workmen who have had practically no previous experience in the operation of such mills; another object is to make it possible for the workmen to check these pressures instantly at any moment during an operating period; still another to provide for the instant and automatic relief of any pressure that exceeds a safe limit and to accomplish this without introducing into the mechanism of the mill the customary "weak link" to be broken when the pressure reaches such limit; and, in general, the object of the invention is to improve the construction of this type of mill for simple, efficient and safe operation.

While the invention may be used in a mill having two, three or more rollers, it will be sufficient for the purpose of illustrating and describing the invention, to refer to its embodiment in a 3-roller mill such, for example, as is shown in the accompanying drawings whereof Fig. 1 is a top plan view of the mill; Fig. 2 an end elevation; and Figs. 3 and 4 detail views on a larger scale, Fig. 4 being a section taken on the plane indicated by the line 4—4 of Fig. 3.

The three rollers, denoted by the numerals 1, 2 and 3 respectively, may be driven by a motor 4 (Fig. 2) through a drive chain 5 connecting the motor shaft to a sprocket (not shown) on the end of one of the rollers (here the roller 3), and driving the other two rollers by connecting them to the driven roller by gears (not shown) in the customary manner.

Of the three rollers in the present mill, the middle roller 2 has its ends journaled in stationary bearings 6 and hence may be referred to as the fixed roller, while the other two, which may be called the movable rollers, each have their ends journaled in bearings which are slidable in the mill frame 7 so as to be movable toward and away from the stationary bearings of the middle roller, whereby the positions of the movable rollers 1 and 3 may be adjusted relative to the fixed or middle roller 2. In Fig. 4, which shows one of these sliding bearings supporting the end of the roller 1, the numeral 8 denotes the bearing, 9 one end of the journal of roller 1, and 10 anti-friction members between the journal and the bearing.

To effect the adjustment of each of the bearings 8 relative to the corresponding stationary

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bearings 6 of the fixed roller, each of the bearings 8 has a screw or screw-jack 11 threaded thereto and to which a gear 12 is slidably keyed through a pin and slot connection 13, said gear meshing with a gear 14 fast on a shaft 15 upon the outer end of which an adjusting handle 16 is secured. The rear end of the screw 11 abuts against the thrust-pin of the plunger 17 of a hydraulic ram 18 which is secured in the frame of the mill and the rear end of which rests against a heavy pressure plate 19 of the frame to take the rearward thrust of the screw and thereby transmit the thrust, through the ram, to the frame, a pressure gauge 20 being provided to indicate at all times the pressure within the cylinder of the ram. As many rams with individual pressure gauges attached are provided as there are individual sliding bearings 8, so that there is a separate ram to take the thrust of each said bearing and a separate pressure gauge to indicate the pressure in the cylinder of each ram. The cylinder of each ram does not communicate with the cylinder of any other ram or with any other closed container whatever. Thus, when the rams are filled with liquid, such for example as oil, and one of the handles 16 is moved in a direction to turn the corresponding screw 11 counter-clockwise, the corresponding bearing 8 will be moved toward the adjacent bearing of the fixed roller, since the screw will be prevented from moving rearwardly by the plunger of the corresponding ram. In other words, each of the screws 11 functions as a screw-jack. And in this way, by a similar movement of all of the adjusting handles, the positions of the rollers 1 and 3 relative to the fixed roller 2 may be easily, quickly and very accurately adjusted to provide the precise pressure desired between the rollers 1 and 2 and between the rollers 2 and 3. This is especially true since the adjusting handles act directly upon corresponding screws respectively to effect the adjustment, and not through the hydraulic rams whose sole function is to take the rearward thrust of the screws and in turn transmit it to the frame. And, inasmuch as each individual adjusting means (here comprising the gears 12 and 14 and shaft 15 operated by the handle 16) is off-set from the respective thrust lines of the screws, the thrust of the latter cannot be taken by or transmitted through said adjusting means.

It should be pointed out that, in roller grinding mill operation it is very important that the pressures between adjacent rollers be adjusted to the precise degree required in any given case

in order that the material to be ground will be acted upon by the rollers to produce the result desired in such case; and that in prior roller grinding mills, these roller pressure adjustments generally required the services of highly skilled men who had acquired, by long experience, the ability to adjust the grinding pressures by feel and judgment, or by merely observing the performance of the mechanism. In contrast to this, mills embodying the present invention may not only be operated by unskilled workmen but require fewer operators. The foreman or superintendent who plans the mill operation has only to determine the grinding pressures required for any given case; and then the operator will adjust the jacks until the gauges show these pressures. In addition to the advantage of this preliminary setting or adjustment, the present mill always shows what the grinding pressures are while in operation so that they can be readily checked by the operator to insure continuous operation at the correct pressures. Formerly, this check had to be made by skilled men using the same technique as that used to effect the preliminary adjustment or setting.

It will be understood that by moving the adjusting handles of the present mill in a direction to cause the screws **11** to turn clockwise, the bearings **8** of the movable rollers will be drawn away from the bearings **6** of the fixed roller and thus reduce or entirely release the pressure between the fixed roller and either or both of the movable rollers, or indeed, if desired, separate the rollers entirely.

The cylinder of each ram is provided with an individual relief valve **21** which may be set to operate automatically at a given pressure so as to relieve the pressure within any ram, due to over-load, when the pressure has reached that degree for which the valve has been set. In many former designs of roller grinding mills, over-load protection has been provided by building into the mill a "weak link," such for example as a shear pin which will break the moment the pressure thereon has become too excessive. With over-load protection of that nature, accuracy of roller adjustment is not practicable since fatigue of materials very substantially affects the shear values. And since materials of construction are sometimes not duplicated and often are not homogeneous, such factors definitely influence the shear values associated with such parts. In addition to these factors, conditions that apply the shearing force to the breaking pin generally vary with the age of the mill. The present invention, embodying as it does relief valves for the hydraulic rams which receive the thrusts of the jack-screws, obviates the disadvantages just alluded to as inherent in former mechanisms for providing over-load protection. Moreover, the pressures at which the relief valves operate can be accurately adjusted and, once adjusted, remain constant regardless of the age of the mill whereby the accuracy thus built into the mill will still be apparent after many years of operation. Once over-loaded the present mill can be put back into proper operating condition very easily and quickly without requiring any skill on the part of the operator. In former mills this could properly be done only by a skilled mechanic since the necessary replacement of parts often involved substantial difficulty.

The precise construction of the screw-jacks **11** as shown and described in the present case is immaterial to the invention, but they must be so

organized into the mill that the rearward thrust of each in adjusting a movable roller toward a fixed roller is taken by a ram and by it transferred directly to the mill frame. Moreover, in accordance with this invention, the oil or other liquid space associated with each ram is definite and fixed in volume; and a portion of this liquid is disposed in the path of the thrust so as to register the degree of the thrust pressure upon the corresponding gauge; and if, in adjusting one roller to another the pressure becomes too excessive, the corresponding relief valve or valves will operate to reduce the pressure to a safe limit. The over-load necessitating this relief may be due to various reasons such as too tight an adjustment or the passing between the rollers of a piece of material that is too hard and too large to permit the rollers to remain in their adjusted position, thus causing them to separate. The relief valves permit this separating movement by releasing the exact amount of liquid from the rams to permit the thrust receiving plungers to alter their positions in the cylinders of the rams by the same amount the rollers had to move and still keep the same pressure between the rollers. Thus, for example, if the rollers have been separated by a large hard object passing between them so that, by the operation of the relief valves, the volume of oil contained in the rams is decreased, the position of the rollers may be readjusted to the proper operating pressure in order to continue the operation. This may be done in either of two ways: one, by further manual operation of the screw-jacks in which case there will now be an excessive amount of play or free movement of the jacks between their push and pull operations; while the other and preferred way is to replace the liquid discharged from the rams so that the liquid spaces therein will be completely filled again.

To fill the rams with oil or other liquid, either in the first instance or when one or more of the relief valves have operated to decrease the oil in the system, each ram is provided with a filling plug **22** having a cap **23** threaded thereto and upon the removal of which the nozzle of a liquid supply pump may be fitted to the mouth of the plug. Thus, in the first instance as well as when liquid has been discharged from any ram by the operation of its relief valve, liquid may be easily and quickly introduced into the cylinder of the ram to keep it filled.

In operating the mill shown in the drawings, the material to be ground is delivered into the space between the rollers **1** and **2** just above the line of contact between these two rollers, a thin metallic retaining strip **24** of brass or other suitable metal (Fig. 2) being snugly held against these rollers at each end by an adjusting screw **25**. As these rollers revolve, the material which passes between them adheres to the surface thereof and continually passes from the surface of roller **2** to that of roller **3** from which it is scraped off by a knife (not shown) on the inner edge of a receiving pan or discharge chute **26** into which the scraped off material drops. This feature of the mill constitutes no part of the present invention nor does the water cooling system for the rollers, a part of which is indicated by a water header **27**, inlet and distributing pipes **28** and discharge orifice **29** (Figs. 1 and 2).

I claim as my invention:

In a roller grinding mill having three rollers arranged in horizontal train with the center roller mounted in fixed bearings and the flanking

rollers mounted in sliding bearings and adjustable toward and away from the center roller, the improvement which comprises, in combination, externally threaded screw jacks respectively engaging internally threaded apertures in each of the bearings of the adjustable flanking rollers, an hydraulic ram for each of the screw jacks respectively the plunger of each ram being arranged to abut the outer end of each screw jack to take the thrust of its associated screw jack, and the cylinder of each ram being fixed relative to the frame of the mill and being free from communication with any other cylinder and with any other closed container, a relief valve and a pressure gauge attached to each cylinder of each ram respectively, and an independently operable turn shaft carrying a spur gear which meshes with a spur gear which is pin and slot connected to each of the jacks respectively in such manner that the axis of each turn shaft is parallel to but offset from the axis of each associated jack, each said relief valve being adjustable to maintain constant the volume of the fluid space within the

corresponding cylinder so that once the pressure on any bearing has been adjusted by the turn shafts and jacks to the amount desired, the said volume will remain unchanged until the corresponding relief valve opens.

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