

May 14, 1929.

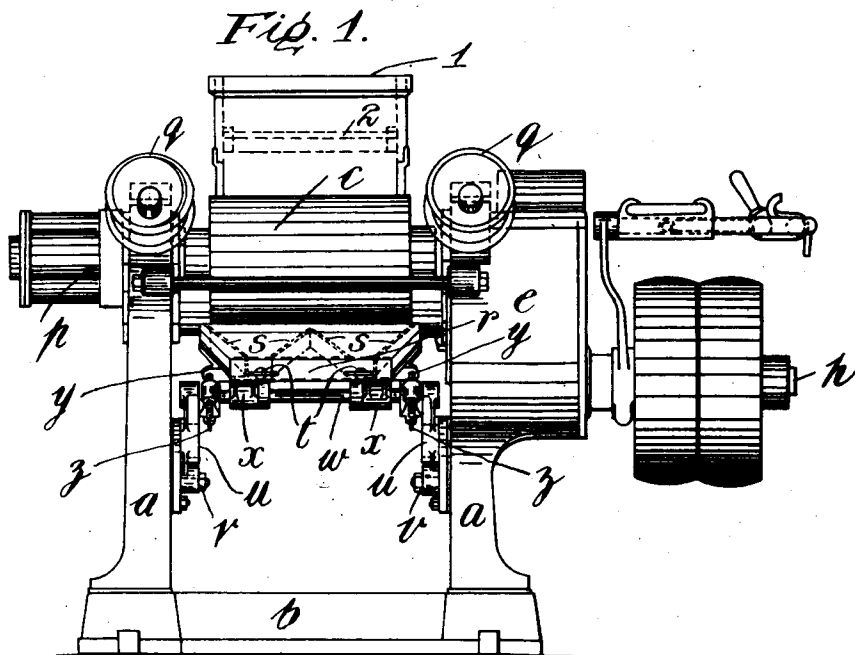
J. R. TORRANCE

1,713,487

MILL FOR FINE GRINDING

Filed Oct. 1, 1923

6 Sheets-Sheet 1



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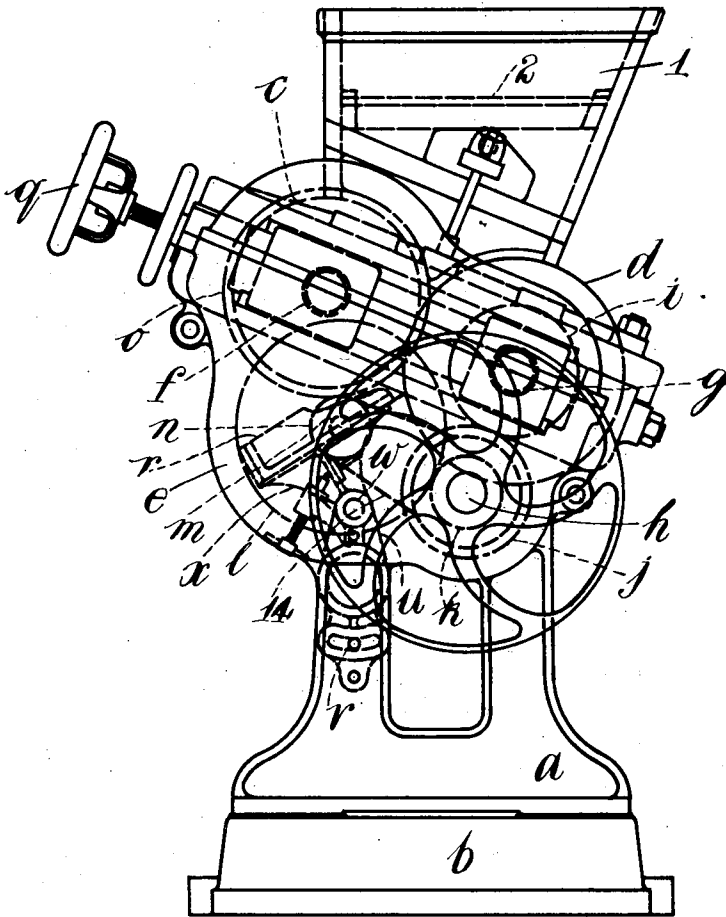
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Fig. 2.



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Fig. 6.

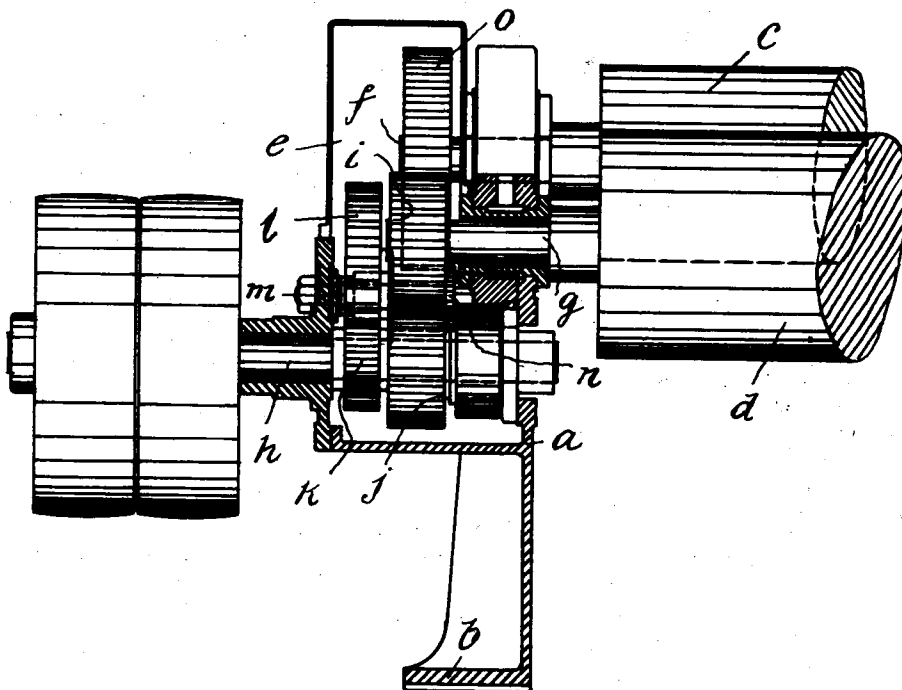
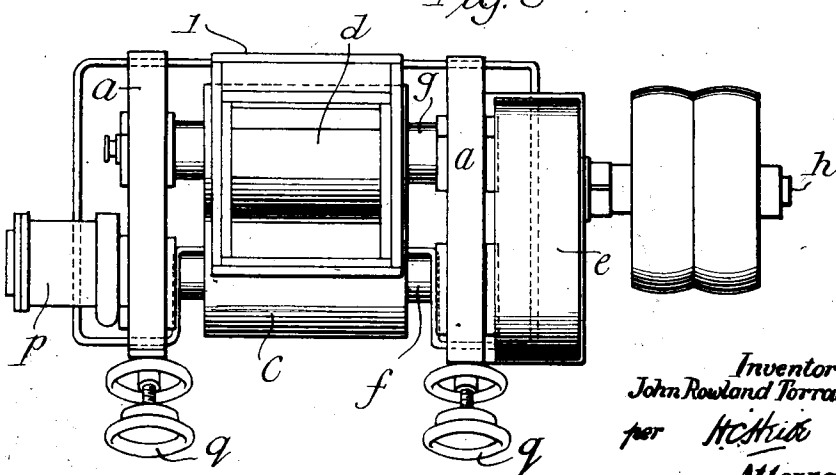


Fig. 3



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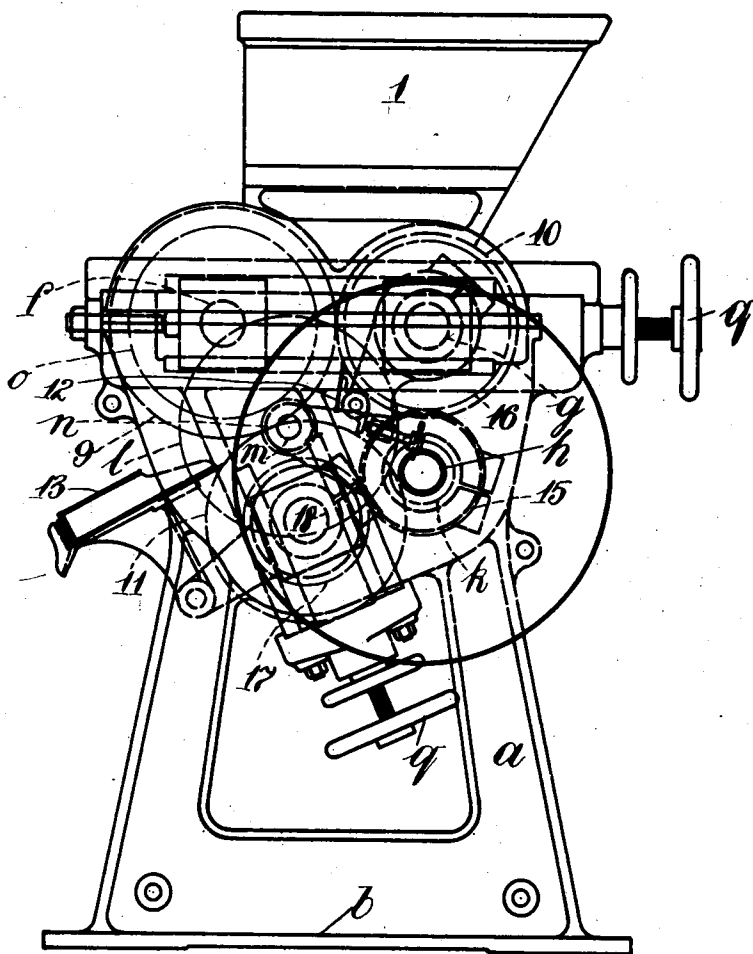
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Fig. 4.



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Fig. 7.

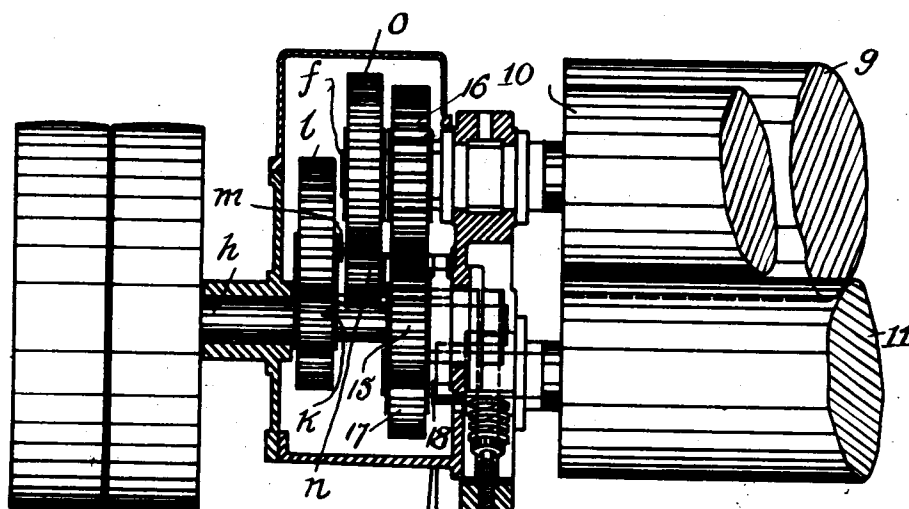
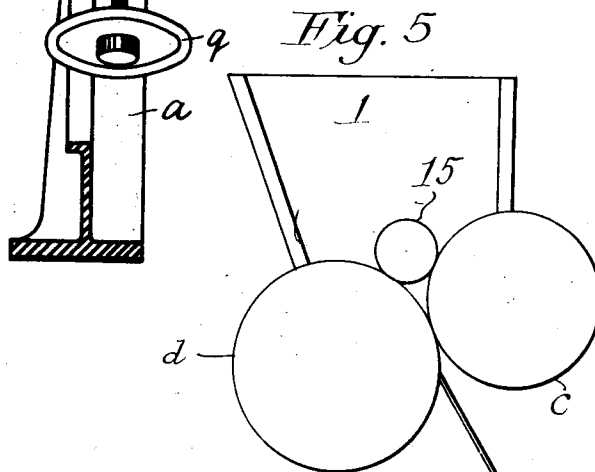


Fig. 5



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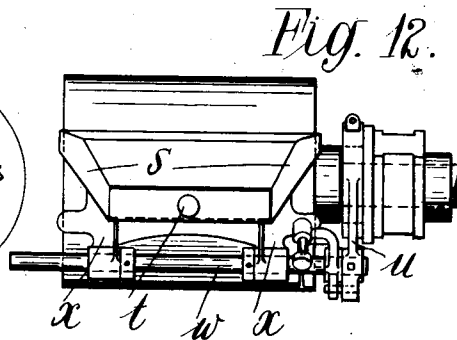
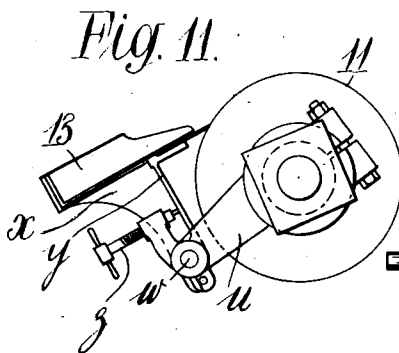
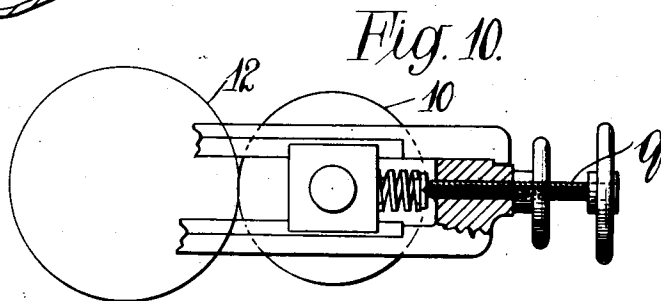
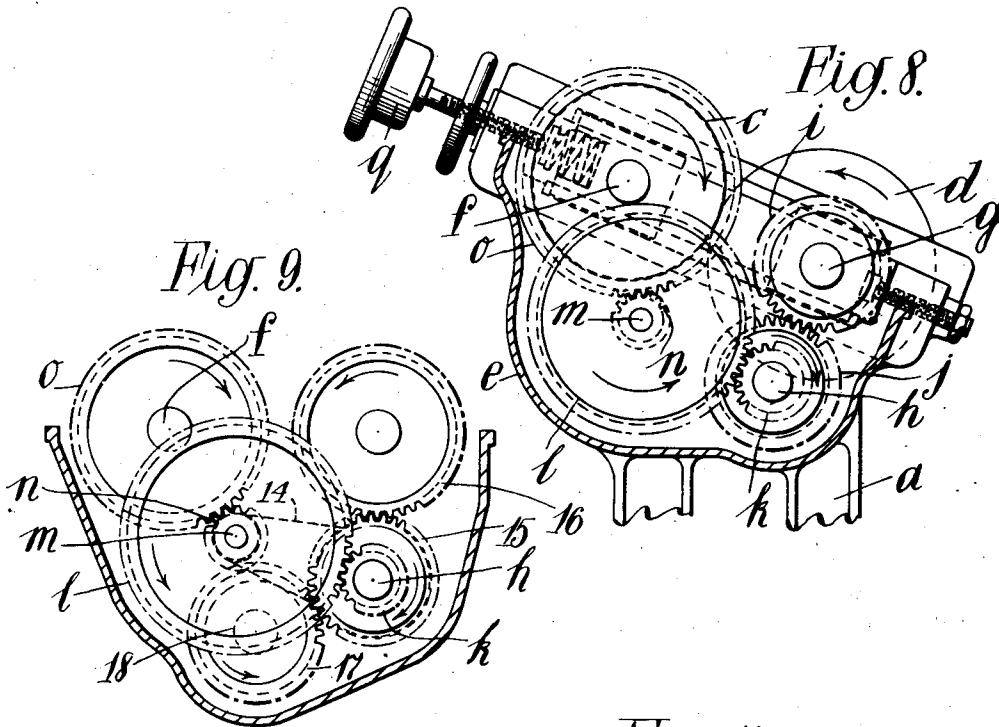
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MILL FOR FINE GRINDING

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6 Sheets-Sheet 6



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UNITED STATES PATENT OFFICE.

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MILL FOR FINE GRINDING.

Application filed October 1, 1923, Serial No. 665,895, and in Great Britain October 17, 1922.

This invention relates to improvements in mills of the roller and roller and breast type for reducing paints, colours and pigments, and the like.

5 In practice it has been found with roller mills of the standard type having two, three or more rollers with a velocity ratio therebetween that a limitation of the periphery speed of the rollers is necessary for practical
10 working, as when the top or fast speed roller has more than a medium periphery speed the material is thrown off the roll in all directions by centrifugal action. For example
15 15" diameter rollers in a triple roller mill is respectively 20, 45 and 120 revolutions per minute, and if the periphery speed of the top speed roller is increased to a high speed, centrifugal action of the material brings
20 about the throwing off above referred to and a practical working of the mill is destroyed.

Roller mills have been proposed in which the grinding takes place between rolls having different periphery speeds but due to the haphazard throwing off above referred to,
25 the peripheral speed of the relatively high speed roll has been limited to a speed below that at which a haphazard throw off takes place.

30 Now an object of the present invention is to provide an improved mill of the kind in which the grinding takes place between rolls having different periphery speeds, wherein the differentiation in periphery speeds between the rolls is considerable while at the same time the practical working of the mill is maintained as the haphazard throw off of the material by centrifugal action is counteracted or checked by a direction controlled
40 removal of the material from the high speed roller as soon as the material has passed the grinding station.

The differentiation in the periphery speeds of the two rolls is in all cases considerable
45 but in relation to different materials both the differentiation and the maximum periphery speeds are widely variable.

In relation to grinding fluids such as paints, a known water cooled roll of fourteen inches
50 diameter driven at two hundred revolutions per minute co-operating under a close but non-contacting setting between peripheries of $\frac{1}{1000}$ th inch or thereabouts with a known
55 water cooled roll of twelve inches diameter

driven at twenty revolutions per minute works well.

An effect of the considerable differentiation in the periphery speeds of the two rolls is a very effective mixing agitation of the
60 material in the feeding hopper applied to the V between the rollers, this agitation having an emulsifying effect tending to greater homogeneity and smoother finish particularly of paints, and like materials. Further by
65 such agitation all foreign matter and filth that is in the material in suspension is kept from passing the rolls until all the good material has gone through, so that the delivered material may not require the usual straining
70 but is ready for the market as it leaves the machine.

It is difficult to lay down precise variations of differentiation in periphery speeds and of
75 maximum periphery speeds of the two rolls in relation to different materials as so much depends upon the nature of the materials to be treated but in view of the disclosure hereinabove given, both the peripheral ratio or the maximum speeds for any given material
80 suited for the treatment are readily determinable by the craftsman. In general for ordinary cases a range of differentiation in periphery speed of the two rolls of from
85 six to one up to thirty to one and ranges of maximum periphery speeds of twenty to one hundred feet per minute of the slow roll and of four hundred to eighteen hundred feet per minute of the fast roll will serve.

The slow roller may be arranged common
90 to a series of fast rollers so as to provide a number of grinding contacts or stations. Or pairs of rollers one roller being a fast roller and the other roller a slow roller may be arranged in battery or tandem form superimposed feeding one to the next.

The following are examples of lay out of paint mills for example under the present invention, it being understood that these only
100 indicate the general arrangement and that details of construction will be embodied in the finished mill so as to make each mill a practical machine in a paint making plant.

One form of mill comprises a slow roller forming a live breast and a fast grinding
105 roller with a scraper device so located as to remove the material under a directional control permitting the material to leave the grinding region with a strong centrifugal action or tendency. As an example of the
110

periphery speeds of the two rollers it may be mentioned that satisfactory working on paint was accomplished with a slow roller having a diameter of 12" driven at from 16 to 20 R. P. M., and a fast roller having a diameter of 14" driven at from 200 to 250 R. P. M.

Any suitable form of drive may be used.

Various materials require different settings of the rolls and while in general a finely controlled non-contacting setting is preferred, a working mill is possible with contacting rolls but in such cases lower output and quality must generally be tolerated.

Any suitable form of adjustment device for preserving gear pitch circles may be incorporated for example a quadrant gear may be used.

The scraper or equivalent collecting device may be suitably mounted in relation to the grinding roller and have provision for setting, etc. A position of the scraper or equivalent which serves well is one in which the scraper is contactingly related edgewise to the fast roll below the grinding region and above the lowest peripheral point of the fast roll, preferably nearer to the grinding region than to the aforesaid lowest peripheral point, preferably as close as possible to the grinding station on the fast roll. For fluids and the like use may be made of a covered collector having two or more valve controlled outlets, treacle taps for example.

In an example of battery form the material may be delivered from the scraper of the first pair of rollers to a second pair of rollers so as to effect, in this example, a double grinding. It has been found that a suitable speed for the second pair of rollers is 20 R. P. M. for a slow roller of 12" diameter and 250 R. P. M. for a fast roller of 14" diameter. The finished material is delivered by a scraper from the second pair of rollers into a receptacle placed beneath to receive it.

The periphery speed of the fast rollers may be considerably increased, especially so when these are water cooled.

In another lay out of mill two or more fast rollers may be arranged so that the slow roller is common to all the fast rollers. For example two fast rollers may co-operate for grinding with one slow roller, the slow roller having a diameter of 15" running at 15 R. P. M., the first fast roller having a diameter of 12" running at 200 R. P. M., and the second fast roller having a diameter of 12" running at 250 R. P. M. The material would be delivered from the first fast roller to the second fast roller by a scraper positioned so as to place the material under a directional controlled removal from the first fast roller to the second fast roller.

From experimental tests it is believed that the features which make the mill under the present invention notable for efficiency include (1) the high periphery speed of the

grinding roller against the slow roller, the increase in the differentiation of periphery speeds being very marked to that of present-day standard practice, and (2) the direction controlled removal of the material so that this is permitted to be carried away from the grinding region with a strong centrifugal action or tendency.

In order that the present invention may be the more clearly understood reference is made to the accompanying sheet of drawings, in which:—

Fig. 1 is a front elevation.

Fig. 2 is a side elevation.

Fig. 3 a plan.

Fig. 4 a diagrammatic side elevation of a mill with two fast rolls.

Fig. 5 a diagrammatic side elevation with an intermediate small roller for assisting the material to be carried into the grinding region.

Fig. 6 is an end view of Fig. 2, and Fig. 7 an end view of Fig. 4.

Fig. 8 is a transverse section of the gear box shown in Figs. 2 and 6 showing the gears in full lines. Fig. 9 is a transverse section of the box shown in Figs. 4 and 7 showing the gears in full lines. Fig. 10 shows the known roll adjusting means as applied to a fast roll 10 hereinafter referred to. Figs. 11 and 12 are side and front views of the scraper and the adjusting means therefor.

Referring to Figs. 1 to 3 and 6 of the accompanying drawings in the upper portions of side frames *a*, *a* on a base plate *b* is rotatably mounted a pair of rolls *c*, *d*, the setting of the roll centres being inclined with respect to the horizontal and the front higher roll *c* being made the slow roll and the rear lower roll *d* being made the fast roll.

The right aspect frame *a*, Fig. 1, expands laterally into a gear box *e* into which the corresponding ends of the roll spindles *f*, *g* project, and in which a main driving shaft *h* is mounted, this driving shaft *h* being belt driven as shewn, or otherwise driven from any available source of power, for example, the shaft *h* may be driven by an electric motor through a speed reducing gearing, for example a driving pinion driving a spur wheel of shaft *h*.

In the depicted example and referring to Fig. 8, the fast roll *d* is driven from the shaft *h* by equal size spur wheels *i*, *j*, and the slow roll *c* is driven by a speed decreasing wheel train consisting of a driving pinion *k* driving a spur wheel *l* alongside which on the countershaft *m* is a second driving pinion *n* for a spur wheel *o* on the spindle *f* of the slow roll *c*.

One of the rolls may be given an axial reciprocatory movement in any suitable manner. As preferred *p* designates a housing for an ever-varying lateral gear of known type which may be fitted either to the slow roll *c* as shewn, or to the fast roll, to impart

an axial reciprocatory movement to one of the rolls. Such a lateral gear causes the axial movement to take place at varying angles of revolution of the roller so as to distribute the wear over the whole roller. This gear is known and no claim per se is made herein to such a gear.

The axis of the intermediate gears l, n , may be adjustable concentrically or substantially so round the axis of the driving pinion k such as by a radius arm 14 in order to preserve the gear pitch circles when the rollers are adjusted to a different setting or to take up wear.

q, q (Fig. 3) designate known adjusting screw contacts applied to the opposed spring urged bearings of the slow roll c for effecting a contacting or non-contacting setting of the rolls c, d according to the class of material to be ground. In Fig. 10 a similar adjusting screw contact is shown applied to a fast roll 10 hereinafter referred to.

r is a scraper or collector applied in collecting contact to the fast roll d below and adjacent to the grinding region.

For paints and the like, the scraper r may be conveniently and advantageously covered in and provided with two or more pairs of converging sides s, s , leading to valve controlled outlets t so that the machine attendant may close the outflow while changing a full collector for an empty one. Figs. 11 and 12 show a scraper similar to that shown in Figs. 1 and 2.

Any appropriate mounting of the scraper r may be adopted, that shewn comprising a pair of arms u mounted to turn on a horizontal axis within the limits of a pin and slot control v by which a desired adjustment when made may be locked with the aid of a screw nut, the arms u carrying a rod w on which arms x carrying the scraper r are rotatably mounted, stops y on the arms x stepping in to be acted upon by the two screws z for keeping the scraper in proper collecting contact with the roll.

1 is the feeding hopper which for paints and like fluids is advantageously furnished with a screen 2, especially when a non-contacting non-yielding setting of the rolls is employed, the screen serving in such a case to keep back foreign matter that might enter the V between the rolls and damage the machine.

A screen of $\frac{1}{16}$ " or $\frac{1}{8}$ " mesh serves well for paints and like fluids.

In a paint or like mill a gear ratio of $12\frac{1}{2}$ to 1 for the two rolls c, d has given good re-

sults and in a mill with this ratio and having a 12" diameter slow roll (water-cooled) and a 14" diameter fast roll (water-cooled) with a hopper capacity of 15 gallons, running at a speed of the fast roll of 240 R. P. M., delivers 50 gallons per hour of white enamel (zinc white in varnish).

At or about the speed mentioned the mill yields an output of 30 to 50 gallons per hour according to the nature of the paint or like, thus forming a highly economical unit in any paint, enamel, ink or like or similar plant.

To a certain extent the speed of running the mill is regulated according to the material being treated. For example, the mill would not be run so fast when grinding turps colours as when grinding oil colours.

The mill is applicable to grinding chocolate powder to a paste product. In this case the rolls were steam heated.

The drives from the shaft m are indicated by dot and dash circles.

In the mill, Figs. 4, 5 and 9, with one slow roll 9 and two fast rolls 10, 11, the gearing by way of example may be arranged to drive the slow roll of 15" diameter at 15 R. P. M., fast roll 10 of 12" diameter at 200 R. P. M., and fast roll 11 of 12" diameter at 250 R. P. M., scraper 12 collecting from fast roll 10 and delivering to fast roll 11 whence it is collected by scraper 13 for delivery to a receptacle below.

The rolls 9, 10 and 11 are all driven from the main shaft h , the drive for the fast roll 10 being through gear wheel 15 and gear wheel 16. 15 drives gear wheel 17 on the shaft 18 carrying the roll 11. The second gear wheel k on the main shaft h gears with gear wheel l on the countershaft m , while the second gear wheel n on this countershaft m through gear wheel o on the spindle f drives the slow roll 9.

As tending to assist the material to be carried into the grinding region the expedient may be adopted of placing a relatively small diameter idling roll 15 in the upper V between the grinding rolls, this roll being plain or having grooves or corrugations or a thread extending wholly or partly along its length.

What I claim is:

In a grinding mill of the character described, a high speed roll, a low speed roll, driving means connected to the rolls in a ratio of at least six to one for driving the high speed roll with a peripheral speed at least six times that of the peripheral speed of the low speed roll.

In testimony whereof, I affix my signature.

JOHN ROWLAND TORRANCE.