June 16, 1942. E. H. JOHNSON 2,286,966

METHOD OF REFINING RUBBER

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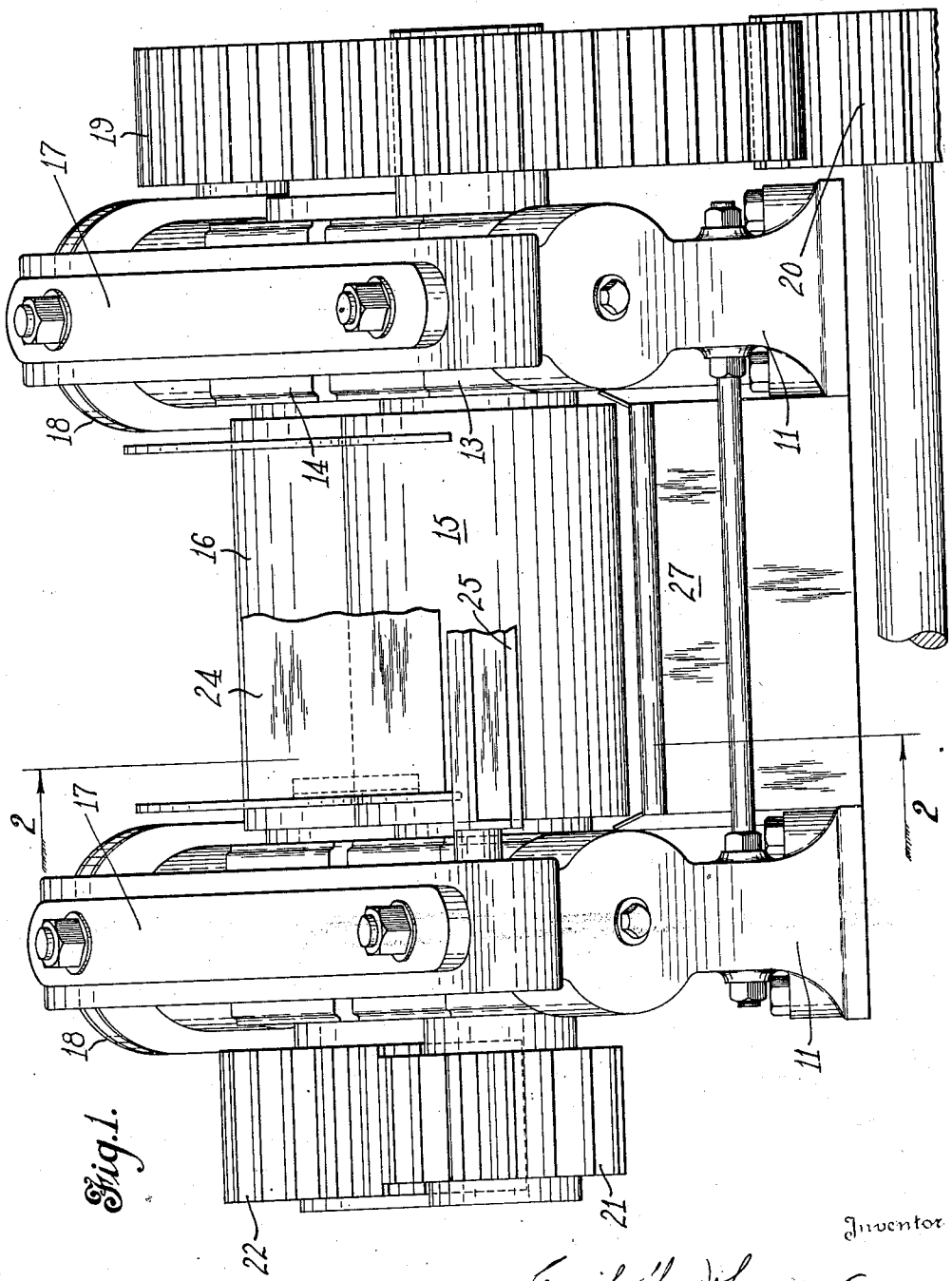


Fig. 1.

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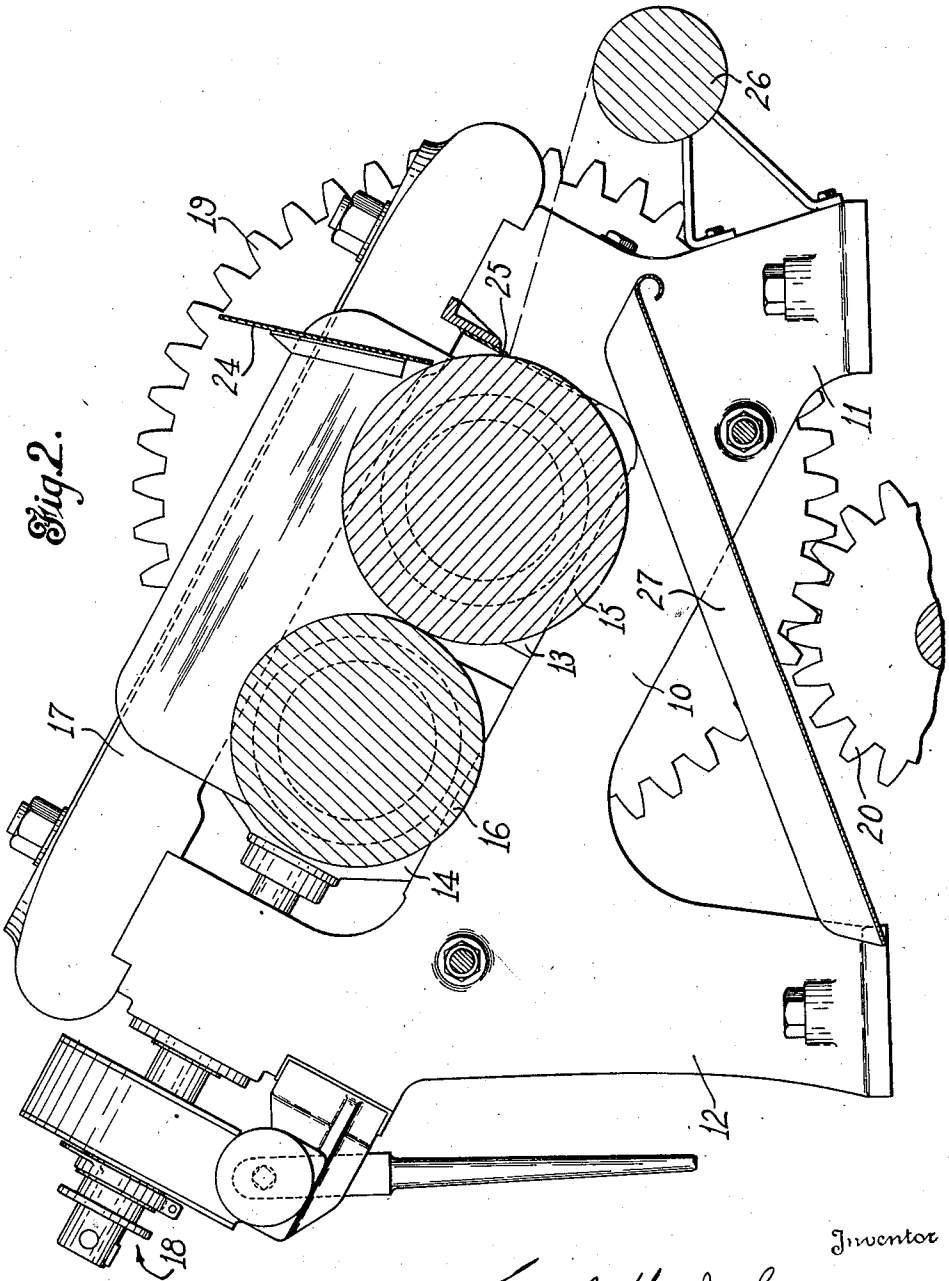
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Fig. 2.



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METHOD OF REFINING RUBBER

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2 Claims. (Cl. 18—48)

This invention relates to so-called rubber refiners, which are machines used in the finishing steps of the process of reclaiming rubber, the refining action being effected by passing the rubber between rolls which may be set close together.

In the process of reclaiming rubber, in order to improve further the consistency and homogeneity of the product, the stock is passed between a pair of rolls set very close together, which removes or breaks up any lumps of tough rubber which thus far may have escaped being plasticized and mixed. After being passed through the refining rolls in a preliminary refining operation, the product is usually strained by forcing it through a screen, and is then again passed through the refining rolls, being delivered therefrom in a thin sheet which is usually wound continuously on a drum until a layer of sufficient thickness is built up, when it is cut off and packaged or baled for the market.

In the final refining operation, the rolls may be set so close together that they will deliver a rubber sheet from one-and-a-half to two-thousandths of an inch in thickness. In preliminary refining operations, the rolls may be set slightly farther apart, the distance between them varying up to six or even eight or more thousandths of an inch. It will be appreciated that when the rolls are set so close together, the stock offers considerable resistance to the passage into the roll bite.

In machines of this character, the two rolls are usually disposed with their axes in the same horizontal plane, one being in front of the other. The front roll is usually larger than the back roll, and driven at a higher rate of speed. It is usually the drive roll, and the back roll normally is adjustable to vary the roll bite. The front roll is kept cooler than the back roll, so that the stock tends to stick to this roll and be carried around by it, so that it may be scraped off and either dropped on a pan or hopper, or, in case of the final refining operation, wound up upon a drum at the front portion of the machine.

In order that there will be a continuous sheet delivered from the rolls, it is, of course, necessary to keep a supply of stock in the roll bite, so that fresh quantities are fed to the rolls from time to time. As stated, this stock tends to cling to the colder roll, and the motion of this colder forward roll carries the stock toward the rear roll, where the surplus which does not pass into the roll bite tends to ride up over the rear roll, moving against the direction in which the roll is rotated. When the two rolls are horizontally arranged, as is usually the case, this stock has a tendency to pass over the top of the rear roll, and a hopper plate is usually provided to prevent it passing over this roll. This causes the stock to build up above the surface of the slow roll against the hopper plate. When a sufficient mass has been built up, it falls backward toward the roll bite to some extent, but still will be kept largely over the surface of the hotter rear roll, and not be fed back into the roll bite or mixed with the new and colder stock being fed to the rolls. There is, moreover, relatively little agitation in this mass of stock which builds up over the hotter roll, so that it is kept at a relatively high temperature, a condition which prevents an efficient refining action, and as it is not positively fed back into the roll bite, the machine must be operated at a relatively slow speed in order that a continuous and homogeneous sheet is delivered therefrom.

In the present invention the front drive roll is set at a lower level than the driven roll, instead of in the same horizontal plane therewith. This causes the rubber stock to be acted upon by gravity in the direction of the front or colder roll. The surplus stock will be forced over the surface of the slower or rear roll to some extent, but tends under the action of gravity constantly to fall back toward the roll bite. The effect is to produce a boiling action of the stock which continually is carried up upon the slow roll and caused by the action of gravity to roll back toward the roll bite, whereby it is kept boiling or in motion, and therefore kept cooler due to its constant exposure to the air, so that there is no temperature differential occurring in the bank of stock which would interfere with a high rate of feed between the rolls.

This cooler rubber offers more resistance to passage through the roll bite, and therefore increases the refining action, as the cooler the rubber stock the greater will be the refining action, resulting in a higher tensile product. As a better feed through the rolls is secured, the stock does not remain upon the rolls so long, and owing to this fact and to the cooler and higher tensile character of the stock, the rolls may be run at a considerably higher speed than in the usual refiner, thus increasing materially the rate of production from the machine.

One object of the present invention is the provision of a rubber refiner having a novel arrangement of the refining rolls, such that the machine may be operated at a relatively high speed.

A further object of the invention is the provision of a rubber refiner having a pair of cooperating rolls operated at different speeds, and having the faster roll set at a lower horizontal level than the slower roll, whereby the stock tends to be kept by gravity in contact with this roll.

A still further object of the invention is the provision of a rubber refiner having a pair of cooperating rolls, one of which is set at a lower level than the other, the lower roll acting as the feed roll, whereby the action of gravity will tend

to maintain the stock in contact with the feed roll to assist in the feeding of the stock into the roll bite.

A still further object of the invention is the provision of a novel method for refining rubber, whereby a better feed of the stock through the rolls of the refiner is secured, thus making it possible to operate the refiner at a relatively high speed and materially increase the rate of production.

To these and other ends the invention consists in the novel features and combinations of parts to be hereinafter described and claimed.

In the drawings:

Fig. 1 is a front elevational view of a rubber refiner embodying my invention; and

Fig. 2 is a sectional view of the same on line 2—2 of Fig. 1.

In order to illustrate a preferred embodiment of my invention, I have shown a rubber refiner comprising a bed or frame 10 supported upon legs or standards 11 and 12. It will be noted that the leg 12 is considerably longer than the leg 11, thus supporting the bed 10 in an inclined position, sloping downwardly toward the front of the device. A similar frame will be provided at both sides of the device, and upon the beds 10 are supported bearing boxes 13 and 14 in which are rotatably mounted the refiner rolls 15 and 16. The bearing boxes are held in place by caps 17. One of the rolls, in this case the roll 16, is adjustable, so that the spacing of the rolls from each other may be varied to some extent, and at one end of the machine is arranged adjusting mechanism 18, which may be of any approved construction.

It will be noted that the roll 15 is slightly larger than the roll 16, and also that it serves as the drive roll, having mounted at one end thereof the drive gear 19, which is driven from a pinion 20 operated from any suitable source of power. Upon the end of the roll 15 opposite the drive gear 19 is mounted a pinion 21 which meshes with a pinion 22 provided upon the driven roll 16. The pinion 22 is larger than the pinion 21, so that the roll 16 is driven at a slower speed than the roll 15, the differential in the surface feeds of the two rolls being due in part to the difference in the size of the gears 21 and 22, and in part to the larger diameter of the roll 15.

A hopper plate 24 may be arranged adjacent the forward portion of the front roll 15 to prevent the bank of stock falling downwardly out of contact with the roll surface, and at the front of the roll 15 is a scraper 25 adapted to scrape the rubber sheet from the roll.

This rubber sheet removed from the roll by the scraper 25 may, if desired, be wound up upon the drum 26, particularly if it is the final refining operation. It may, if desired, however, be permitted to drop upon the pan 27 provided below the rolls, from which pan it may be removed for a future operation, such, for example, as being passed through a strainer.

The operator stands in front of the machine, which is at the right-hand end as shown in Fig. 2, and feeds the stock into the roll bite over the plate 24, or in some cases over the rear roll 16. As has already been indicated, the rolls 15 and 16 are set very close together, so as to discharge the refined rubber in a thin sheet. The mass of stock, particularly when cooled, offers considerable resistance to passage through the roll bite, and while a part of it will pass through the rolls, a part will tend to be forced up over the surface of the roll 16 in a direction opposite to the surface movement of this roll. Due to the fact that the front roll is set at a lower horizontal level than the rear roll, the force of gravity will tend to cause the stock to fall back toward the faster-moving feed roll, so that it tends to be kept constantly over the roll bite. The continued movement of the mass of stock over the surface of the roll 16 and back toward the roll bite, causes the stock to be kept in a completely agitated condition, with no dead or negative spots. This continual agitation tends to prevent any temperature differential in different parts of the stock, and also by continually exposing all parts of it to the air, tends to keep it at a relatively low temperature, which increases the refining action, as well as securing a better feeding of the stock through the rolls. As a result, the rolls may be run at a relatively high speed, thus increasing materially the rate of production of the machine.

As shown, the roll axes are disposed in a plane making an angle of approximately 30° with the horizontal. It has been found that such an arrangement produces very advantageous results, and enables operation of the machine at a speed much greater than refiners in which the rolls are disposed at the same level. It will, of course, be understood that the invention is not limited to this particular angularity of the plane of the roll axes, as this may be varied to a considerable extent, and the advantages of the principles involved retained.

It will be understood that the lower and higher-speed roll 15 is normally in the operation of the device kept at a lower temperature than the adjustable slower roll 16. This causes the rubber to tend to adhere to the front or lower roll, where the operator may superintend the operation of the device more conveniently.

While I have shown and described a preferred embodiment of my invention, it will be understood that it is not to be limited to all of the details shown, but is capable of modification and variation within the spirit of the invention and within the scope of the appended claims.

What I claim is:

1. The method of refining rubber which comprises passing the rubber stock through a pair of closely set cooperating rolls, one of which is set forwardly of, and at a higher level than, the other, and maintaining the lower of said rolls at a lower temperature than that of the higher roll, and feeding the rubber to the roll bite over the lower of said rolls whereby the stock adjacent the surface of the higher roll will be kept freely in agitation and urged by gravity toward the roll bite.

2. The method of refining rubber which comprises passing the rubber stock through a pair of closely set cooperating rolls, one of which is set forwardly of, and at a higher level than, the other, driving the lower of such rolls at a greater surface speed than that of its mate, and maintaining the mass of rubber stock in free agitation adjacent the surface of the higher roll before the passage of such stock through the roll bite.

EMIL H. JOHNSON.