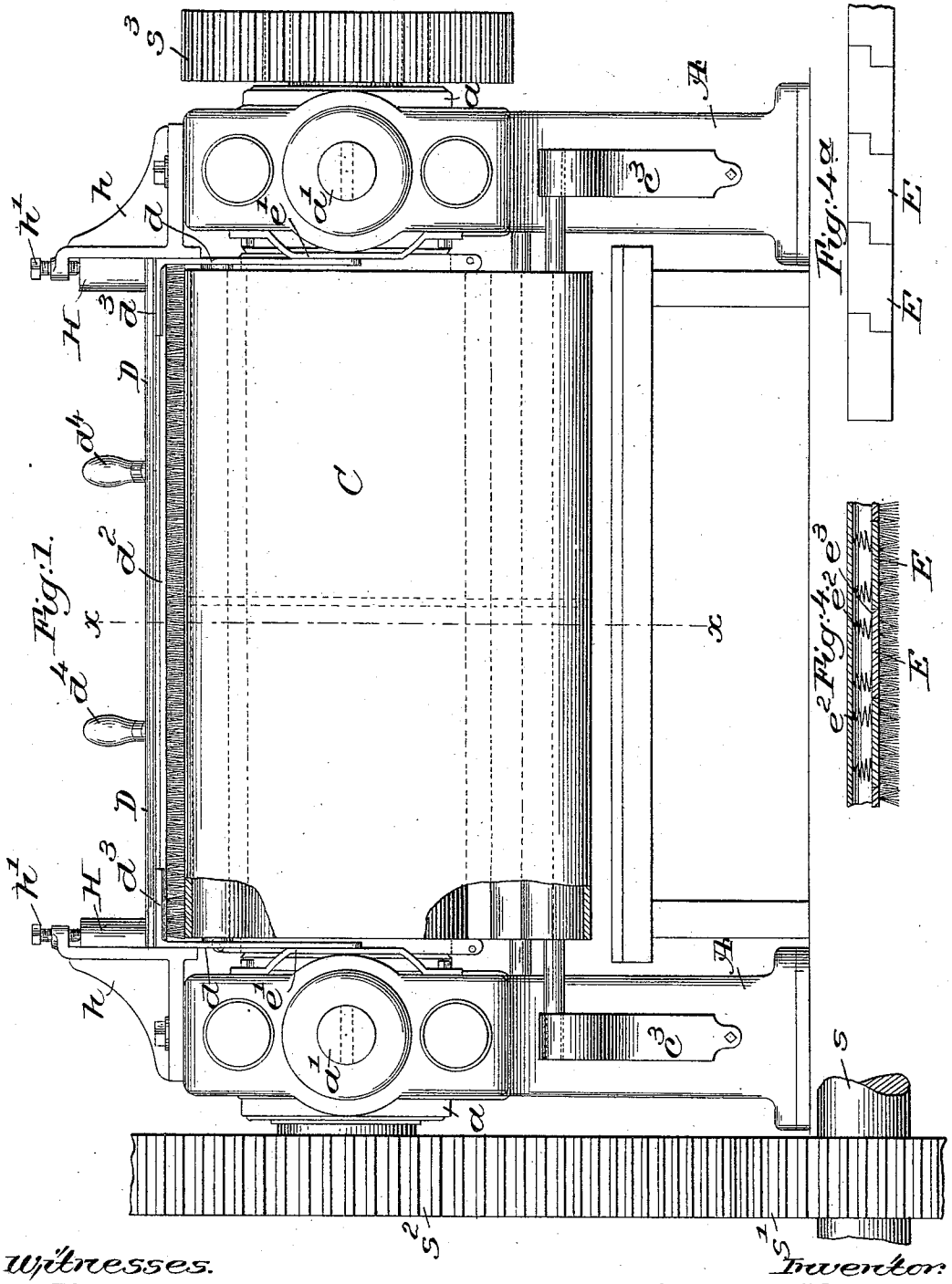
(No Model.) 3 Sheets—Sheet 1.

E. F. BRAGG.

MIXING MILL FOR RUBBER.

No. 530,157. Patented Dec. 4, 1894.



Witnesses.
Fred S. Gunlaf.
Thomas J. Drummond

Inventor.
Edward F. Bragg.
by Crosby & Gregory
Attys.

(No Model.)

3 Sheets—Sheet 2.

E. F. BRAGG.

MIXING MILL FOR RUBBER.

No. 530,157. Patented Dec. 4, 1894.

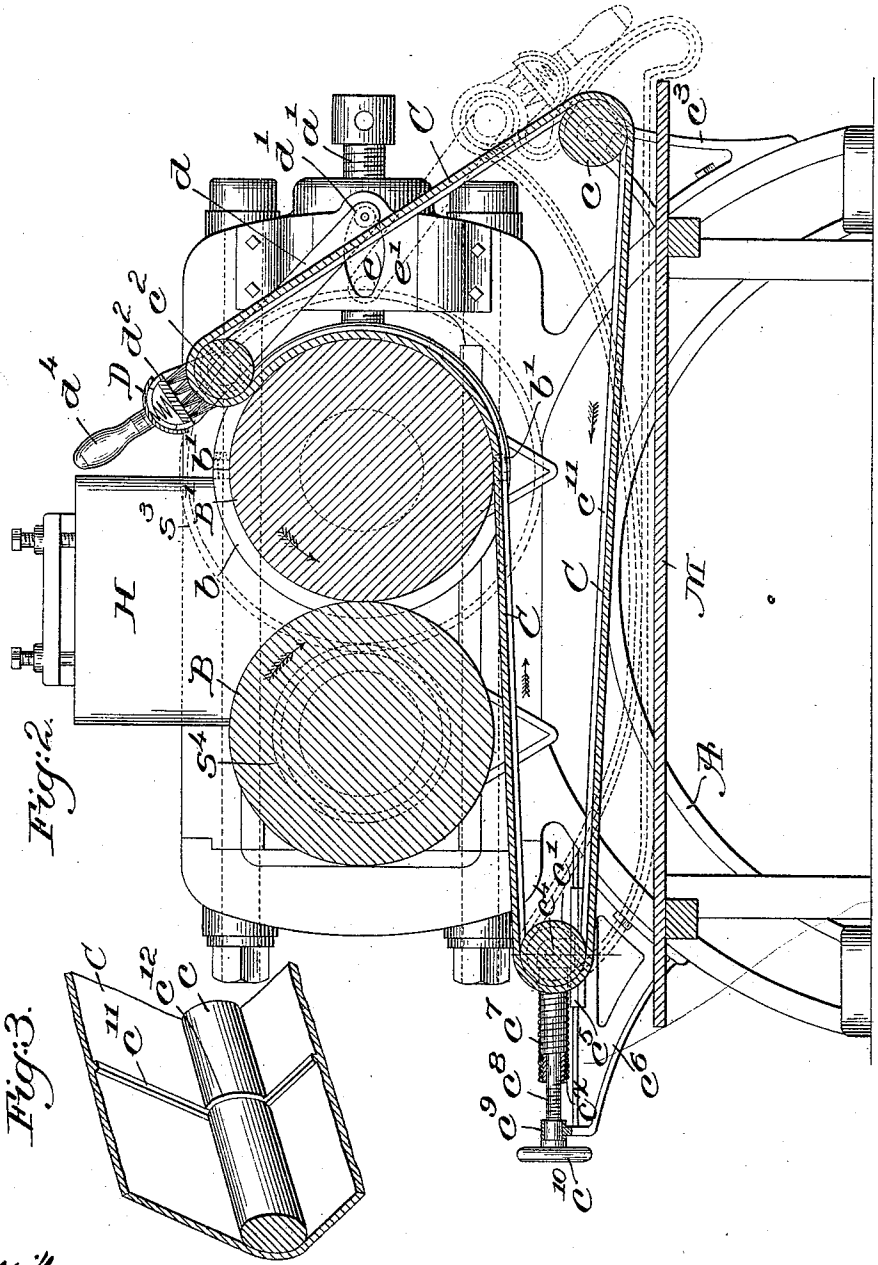


Fig. 2.

Fig. 3.

Witnesses.
Fred S. Gruenbaf.
Thomas J. Drummond.

Inventor:
Edward F. Bragg.
by Crosby & Gregory
attys.

(No Model.)

3 Sheets—Sheet 3.

E. F. BRAGG.

MIXING MILL FOR RUBBER.

No. 530,157. Patented Dec. 4, 1894.

Fig: 6.

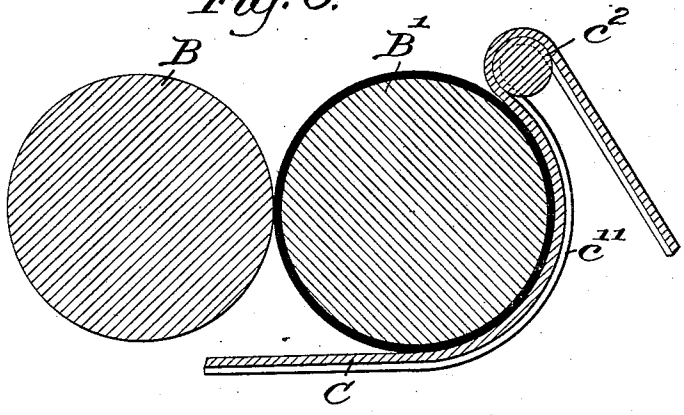


Fig: 7.

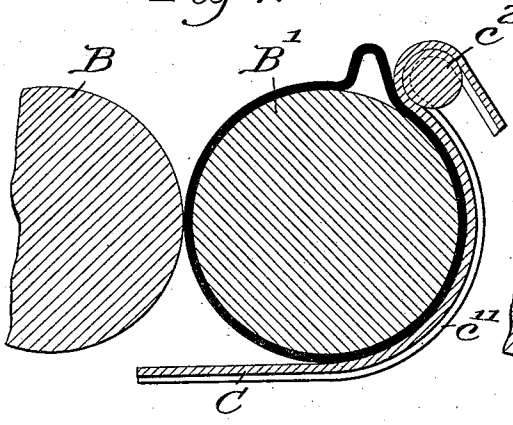


Fig: 8.

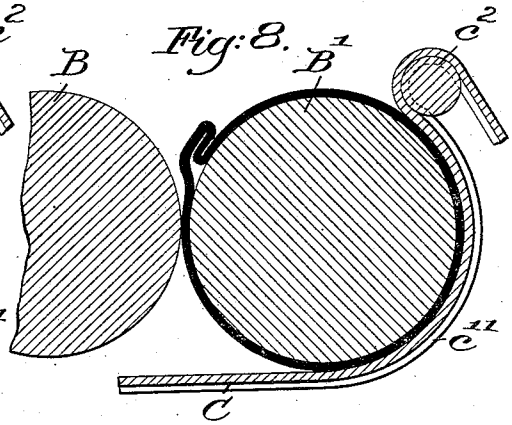


Fig: 9.

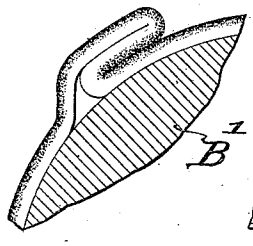


Fig: 5a.

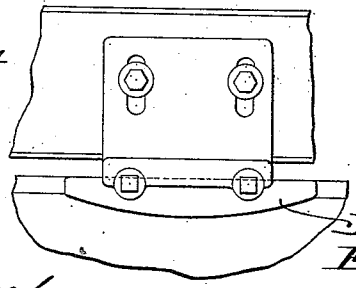
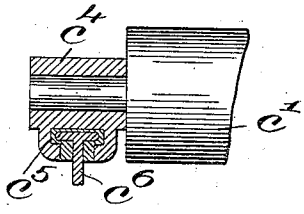


Fig: 5.



Witnesses.

Fred S. Gunnhaf.

Thomas J. Drummond.

Inventor.

Edward F. Bragg.

by Crosby & Gregory

attys.

UNITED STATES PATENT OFFICE.

EDWARD F. BRAGG, OF BOSTON, MASSACHUSETTS.

MIXING-MILL FOR RUBBER.

SPECIFICATION forming part of Letters Patent No. 530,157, dated December 4, 1894.

Application filed November 15, 1893. Serial No. 490,974. (No model.)

To all whom it may concern:

Be it known that I, EDWARD F. BRAGG, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Mixing-Mills for Rubber, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

Mixing mills for rubber, and like material, as commonly constructed, contain two cylindrical rolls driven in opposite directions, one at a speed considerably in excess of the other, said rolls being rotated usually at speeds respectively of about eight and fifteen rotations per minute. The crude rubber is passed between these rolls, it clinging to the slow one, the foreign substance or compound with which the rubber is to be mixed being deposited between the rolls or upon the rubber clinging to the slow roll and thereby thoroughly worked into and mixed with the rubber.

It is impossible for all of the compound to be taken up at once, and it is therefore customary to provide an endless traveling apron to catch such portion or portions of the compound as may escape unmixed from between the rolls and return the same again to the top of the mill to be again passed one or more times between the rolls, this operation being repeated until all of the compound is thoroughly worked into or mixed with the rubber.

The endless carrier or apron which catches and returns the compound, as described, usually travels upon three rollers, two of which are stationary while the third is carried by a yoke pivoted in the frame of the machine, and held by hooks, cords or other inflexible fastening devices in proper position to cause the apron to hug one of the rolls, the fastening devices being released when necessary to permit the said yoke and movable roller to be thrown down away from the rolls in order that the rubber thereon may be removed. Again, it has been customary to so mount this endless carrier or apron that it runs in contact with the faster of the two rolls, the rubber and compound as before stated clinging to the slower roll.

This invention has for its object to improve mills of the class above described, whereby the capacity of the mill and the thoroughness of the mixture of the compound with the pure rubber are increased, and the operation and control of the mill made more convenient and simple.

My invention therefore consists, first, in supporting the endless apron so that it runs in contact and co-operation with the slow roll instead of the fast one, to thereby obtain a more thorough mixture of the compound as will be hereinafter described.

My invention also consists in pivoting the roller carrier by which the endless apron is thrown against the roll in such manner that when in its position against said roll, it stands at one side its dead center, whereby the tension alone of the apron is sufficient to automatically retain the said carrier in such position. One of the other rollers, about which the said apron passes, is made to yield by means of suitable springs, to enable the said carrier and its roller to be moved from one to another of its positions past the intermediate dead center and to exert the proper tension upon the apron to retain the carrier in its position against the roll as described; also to permit the apron to adjust itself to the increasing diameter of the layer of rubber or material upon the roll as the said layer thickens by introduction of the foreign substance or compound.

My invention also comprehends various details of construction to be more fully hereinafter described and set forth in the claims, one of which consists in providing brushes to sweep or brush the compound from the endless apron upon the mixing roll, and another in providing the apron with a rib running in suitable annular grooves in the rollers, to prevent the apron creeping laterally in either direction.

In the drawings, Figure 1 represents, in end view, partially broken away, one form of rubber mixing mill embodying my invention; Fig. 2, a vertical section of the same taken on the dotted line *x*—*x*, Fig. 1; Fig. 3, a perspective detail showing the rib upon the apron; Figs. 4 and 4ª, sectional detail and partial top views respectively, showing the preferred construction of the brushes for cleaning the apron; Fig. 5, a cross section detail showing one of the boxes for the yielding

roller; Fig. 5ª, a detail showing top of one of the guides H, and Figs. 6, 7, 8 and 9, diagrams illustrating the action of the apron running on the slow roll, to be referred to.

Referring to the drawings, in the embodiment of my invention there shown, A, A, represent two end frames of the mill, which may be of suitable shape and construction to sustain the working parts. The frames A, A, are provided with suitable horizontal guideways to receive the boxes a, a, for the journals of the main rolls B and B′, cylindrical in shape and of any suitable or desired construction, they being provided with suitable means for cooling, which, not constituting an essential part of this invention, is neither shown nor described.

The journal boxes for the roll B are shown as stationary, while the boxes for the roll B′ are made to slide in the horizontal guideways referred to and maintained in adjusted position, by the usual set screws a', a'.

In Fig. 1 s represents a main driving shaft provided with a spur wheel s' in mesh with and driving the larger spur wheel s^2, shown as fast upon one of the end journals of the roll B, the two rolls being geared together at the opposite end of the machine by spur wheels s^3 and s^4, shown in dotted lines Fig. 2, and of such relative diameters that the speed of rotation of the roll B shall be preferably about double that of the roll B′, the relative speeds of the two rolls in usual practice being fifteen rotations per minute for the roll B and eight for the roll B′. It is evident, however, that the relative speed of rotation of the two rolls may be varied to meet the various requirements, and that any suitable driving mechanism other than that herein shown may, so far as this invention is concerned, be employed.

In accordance with one part of this present invention, I provide an endless apron C, the same being passed about three rollers c, c', and c^2, the roller c being mounted in suitable fixed bearings c^3 on the front of the frame, as shown. The roller c', as herein shown, is mounted in suitable journal boxes c^4, shown in dotted lines Fig. 2, the said boxes being fitted to slide on suitable guide ribs c^5, see Fig. 5, formed upon brackets c^6 bolted or otherwise secured to the rear of the end frames, said boxes being drawn rearwardly by means of suitable springs, shown as close-coiled springs c^7 connected at one of their ends to the said boxes, and at their opposite ends to the blocks $c^\times$ threaded to receive the screws c^8 loosely mounted in suitable bearings c^9 on the said brackets and provided with proper means for adjustment shown as hand wheels c^{10}. The roller c^2 is journaled at its opposite ends in the side arms d of a yoke D, said side arms as herein shown being provided at their lower ends with roller or other suitable studs d' shown in dotted lines Fig. 2, which enter and are adapted to move in the elliptical or cam-shaped openings e in the cam plates e', at either end of the machine and bolted or otherwise secured to the inner adjacent faces of the end frames.

The top bar d^2 of the yoke D is shown as a substantially semi-cylindrical member, bolted or otherwise secured at its ends to the inturned upper ends d^3 of the side arms d, said top bar being provided with conveniently located handles d^4 shown as arranged comparatively near each other, in practice about eighteen inches apart, instead of being arranged at the extreme ends of the yoke as is the usual practice.

In the full line position Fig. 2, it will be seen that the movable roller c^2 is thrown to the left past the dead center line drawn vertically through the fulcrum d', the tension of the apron created by the springs c^7 at the rear of the machine acting to retain the said roller c^2 and its yoke in the position shown with the apron in close contact with the roll B′ without the use of any fastening devices to retain said yoke in such position. When, however, it is necessary to throw the yoke down and away from the roll B′ for any purpose, the operator grasps the handles d^4 and draws the yoke to the right Fig. 2 about d' as a fulcrum, the said fulcrum at the same time sliding along in the cam openings e into its dotted position, to enable the said roller c^2 to more readily pass the dead center point, the tension upon the apron and gravity thereafter operating to throw the said roller and its yoke away from the roll B′ and down into its dotted position Fig. 2. The springs c^7 which permit the yielding roller c' to slide bodily toward the front of the machine, enable the apron to also move toward the front of the machine in order that the roller c^2 may rise and pass the dead center line, which would be impossible if both rollers c and c' were fixed, without straining the apron.

The movement of the apron bodily toward the front of the machine and the sliding movement of the roller c' is reduced to a minimum by providing the sliding fulcrum d' for the yoke D, for were the said fulcrum fixed, said yoke in swinging about said fulcrum from one to another side of its dead center line would take up and require a much greater length of apron.

The apron C is preferably of a width equal to the length of the rolls B, B′, and is provided in the present instance, with a single longitudinal rib c^{11}, which runs in grooves c^{12} in the rollers c, c' and c^2, which prevent the apron creeping in either direction, although more than one rib may be employed if desired.

To brush any compound from the apron and to keep the latter always clean, I have provided the top bar d^2 of the yoke D with one or more, preferably a series of, independent brushes as E, see Fig. 4, which bear upon the apron as the latter moves through the yoke, said brushes E being acted upon and pressed against the apron by means of suit-

able springs as e^2, I having herein shown two such springs for each brush, the ends of adjacent brushes being overlapped as at e^3 Fig. 4ª to thereby break joints and present as it were a single continuous brush.

H, H, represent lateral guide plates shaped to enter between the rolls at the top of the mill to prevent the rubber working out at the ends of the machine.

As herein shown and preferably, the guides H, H, are each fitted to and adapted to slide vertically in suitable brackets *h*, *h*, bolted or otherwise secured to the end frames, said brackets being provided with adjusting screws *h'*, by which to effect vertical adjustment of said guides.

To prevent the compound working off the ends of the roll B', I have provided said roll with end collars *b*, said collars, as herein shown, being formed in segments preferably two in number bolted together by bolts *b'* shown in dotted lines Fig. 2, embracing the end of the roll.

M represents a table arranged beneath the machine to catch and support the endless apron when the latter is slackened by throwing back of the yoke.

The operation of the mill is as follows:—The screws *a'* are first slackened, to permit the rolls B and B' to separate sufficiently to draw in the crude rubber deposited in lumps or large pieces in the space between the rolls from the top, said rubber being drawn between the rolls and worked into a sleeve or layer surrounding and hugging the slow roll B', as shown by the heavy black line Fig 6. During this time the yoke D is maintained in its dotted position Fig. 2 with the apron removed from the roll. After the rubber has been rolled into a proper layer about the roll B', and the rolls pressed together by means of the screws *a'* until the said layer or sleeve of rubber is of suitable thickness, the operator throws the yoke into its full line position Fig. 2, in which position it is automatically held, without fastening devices, by the springs c^7, with the endless apron C in contact with the rubber layer or sleeve surrounding the rotating roll B', the said apron being thereby caused to travel in the same direction as said roll. See arrows Fig. 2. The compound or foreign substance or material with which the rubber is to be mixed is then thrown in between the oppositely rotating rolls and is more or less worked into the rubber at the pinch between the rolls, the excess of compound which cannot be taken up at once, working or dropping through upon the traveling apron C beneath, which carries it around in contact with the layer of rubber upon the roll, and again deposits it upon the top of the said roll to be passed once more between the rolls and worked into the rubber, this operation being repeated until all of the compound is thoroughly worked into the rubber. The brushes E act to brush all the compound carried up by the endless apron off onto the rubber coated roll. As the compound is worked into the rubber, the space between the rolls remaining fixed, the coating or sleeve surrounding the roll B' is necessarily lengthened, owing to the additional material incorporated with it during the mixing operation, the said sleeve so lengthened tending to droop or sag away from the roll at the under side. The traveling apron however being in contact with the sagging sleeve of rubber takes the sag or slack along with it to the upper side of the roll as in Fig. 7, when it is lapped over upon itself as shown in Fig. 8, so that it passes through the pinch between the rolls in three thicknesses instead of one as in machines as now constructed, the three thicknesses being thoroughly worked together into a single thickness. This folding and doubling operation takes place at each two or three rotations of the roll B', according to the quantity of compound worked into the rubber and the rapidity with which it is incorporated therewith, dependent more or less upon the separation of the rolls, said folding or doubling operation, due solely to running the endless apron on the slow roll B' to which the rubber adheres, being of the utmost importance as it enables the compound to be worked into the rubber in much less time than has hitherto been possible. This is for the reason that when the compound is rolled upon the rubber it mixes with the latter at first only for a short depth in from the outer face of the rubber, that portion of the rubber next the roll receiving at first little or none of the compound. As the outer surface of the rubber layer becomes more or less filled with the compound at the very first, decreasing its richness, its ability to take compound correspondingly lessens, rendering it more difficult for the rolls to force the compound thereafter through to the inner and richer portions of the said layer; but by folding over or doubling the layer every few rotations of the roll, as in the present invention, the richer outer portions of the rubber layer which receive at first little or none of the compound, are interposed between and worked into adjacent faces of the layer which have at first received the compound, the latter being thereby introduced at different lines in the thickness of the layer and more thoroughly and quickly incorporated therewith. This is illustrated in Fig. 9 where the heavily shaded portions of the rubber layer represent the portions which have received the compound, the lighter shaded portions representing the pure or rich rubber which has yet to receive the compound. It will be seen from this figure that by the folding operation described the rich portions are interposed between portions which have already received compound, thereby making it possible to more thoroughly distribute the compound through the entire thickness of the layer.

In practice I have found that by running the apron on the slow roll, the compound may be incorporated with the rubber in at least one quarter less time than when the apron is run on the fast roll.

The spring c^7 permits the apron to move toward and from the peripheral surface of the roll B′ according as the rubber layer thereon is of greater or less thickness, thereby avoiding injury to the apron usually caused by stretching of the same beyond its normal length.

This invention is not restricted to the particular construction of mill herein used to illustrate this invention, nor is the invention otherwise restricted to the particular construction and arrangement of parts shown, for while I consider the construction shown an excellent one, yet the same may be varied more or less without departing from the spirit and scope of the invention.

Having described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a mixing mill for rubber and like material, two rolls, and means to rotate the same in opposite directions, one at a higher speed than the other whereby the material adheres to the latter, combined with an endless apron moving in contact with and in the same direction as the slow moving roll or the material thereon, to act upon said material, substantially as described.

2. In a mixing mill for rubber and the like, two rolls, and means to rotate the same, combined with an endless apron and movable and yielding rollers over which said apron is passed, the former movable toward and from one of said rolls and the latter yielding to permit such movement, substantially as described.

3. In a mixing mill for rubber and like material, two rolls, and means to rotate the same, combined with an endless apron adapted to travel in contact with one of said rolls or the layer of material thereupon, and two or more rollers over which said apron travels, and springs to retain one of said rollers in normal position whereby said roller may yield to accommodate changes in position of said apron, substantially as described.

4. In a mixing mill for rubber and the like, two rolls and means to rotate the same, combined with an endless apron; a yoke; a cam opening in which the fulcrum thereof is movable; a roller carried by said yoke and over which said apron is passed; and a yielding roller also for said apron whereby the said apron is enabled to change its position to permit said yoke to be moved from one to another side of its dead center line, substantially as described.

5. In a mixing mill for rubber and the like, a frame; two rolls and means to rotate the same, combined with an endless apron; a pivoted yoke; a roller carried thereby, and a roller on said frame, over which said apron is passed; and one or more brushes on and movable with said yoke to sweep said apron, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

EDWARD F. BRAGG.

Witnesses:
FREDERICK L. EMERY,
EMMA J. BENNETT.