D. R. BOWEN.

RUBBER MIXER OR LIKE MACHINE.

APPLICATION FILED AUG. 27, 1918.

1,369,080. Patented Feb. 22, 1921.

2 SHEETS—SHEET 1.

Fig. 1

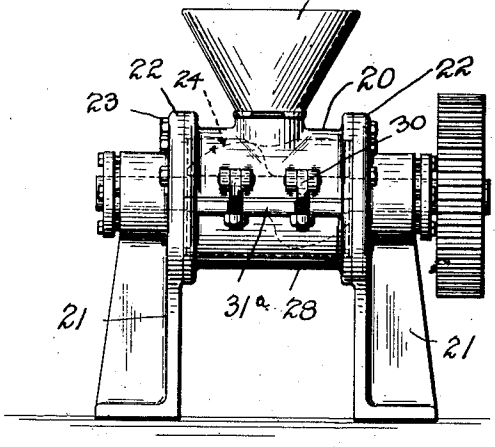


Fig. 3.

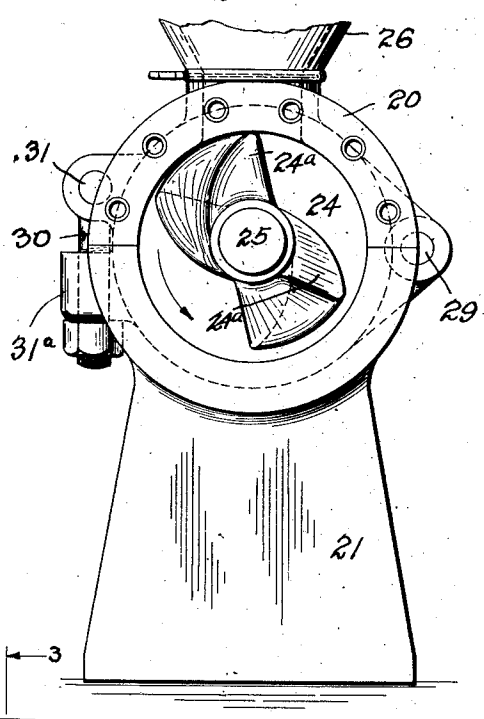
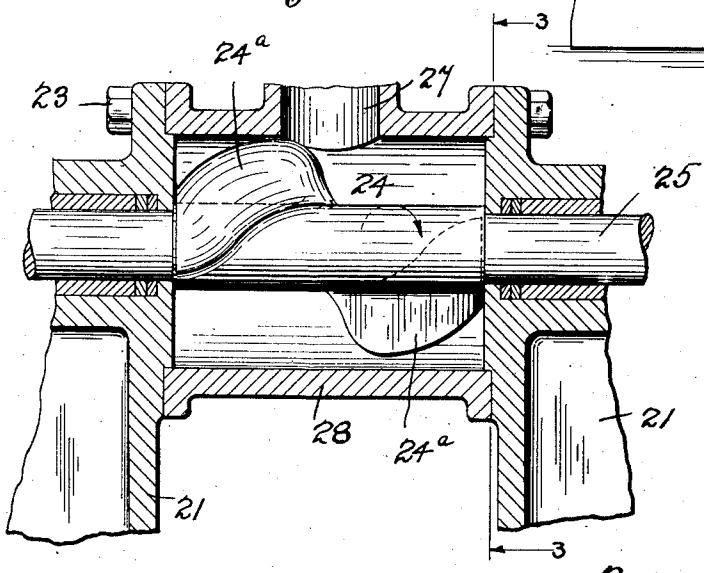


Fig. 2.



Inventor

David R. Bowen

By Kemp & Rothwell

Attorney

D. R. BOWEN.

RUBBER MIXER OR LIKE MACHINE.

APPLICATION FILED AUG. 27, 1918.

1,369,080.

Patented Feb. 22, 1921.

2 SHEETS—SHEET 2.

Fig. 4.

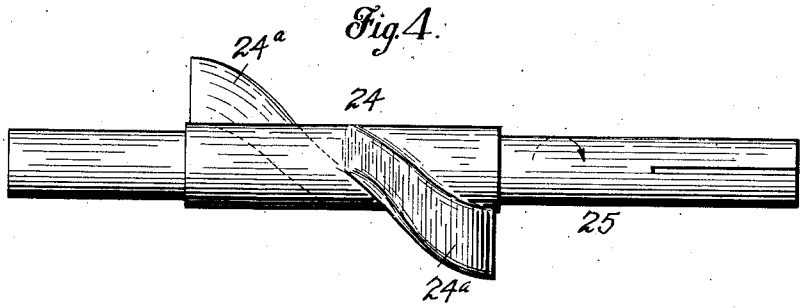


Fig. 5.

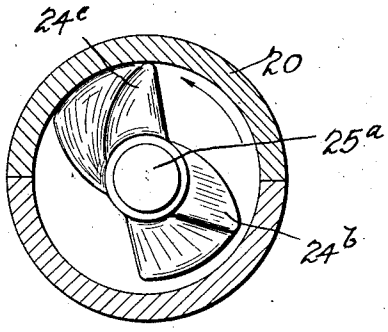


Fig. 7.

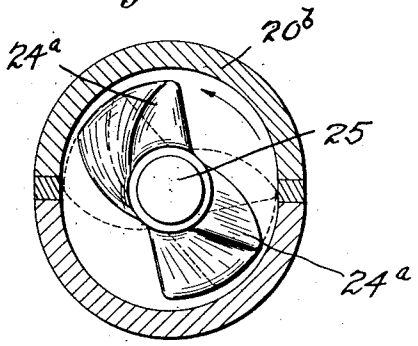
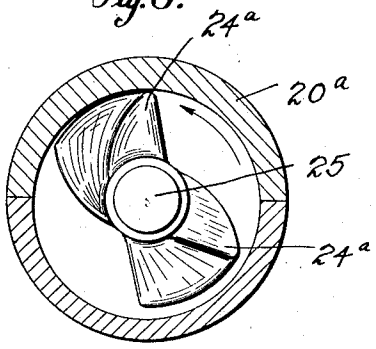


Fig. 6.



Inventor

David R. Bowen,

By Albert G. Wachtel

Attorney

UNITED STATES PATENT OFFICE.

DAVID R. BOWEN, OF ANSONIA, CONNECTICUT, ASSIGNOR TO FARREL FOUNDRY & MACHINE COMPANY, OF ANSONIA, CONNECTICUT, A CORPORATION OF CONNECTICUT.

RUBBER-MIXER OR LIKE MACHINE.

1,369,080. Specification of Letters Patent. Patented Feb. 22, 1921.

Application filed August 27, 1918. Serial No. 251,640.

To all whom it may concern:

Be it known that I, DAVID R. BOWEN, a citizen of the United States, residing in the town of Ansonia, county of New Haven, and State of Connecticut, have invented certain new and useful Improvemnts in Rubber-Mixers or like Machines, of which the following is a full, clear, and exact description.

My invention pertains to machines for mixing rubber and other plastic material, and it has particular application to a machine used in rubber factories for mixing chunks of crude or other rubber with powdered filling or coloring material for the production of various rubber articles. My improvemnts also have special reference to a machine of this nature, comprising a mixing chamber or cylinder into which the material to be treated is introduced, and having therein a rotary, power-driven element for mixing or masticating the mass containing the different ingredients, said chamber being likewise provided with suitable means permitting the discharge of the mass when the mixing operation is completed.

In machines of this general character, considerable difficulty has been encountered as a result of the slippage of the mass on the interior surface of the mixing chamber wall. In many cases, the mass slides freely on the chamber wall and moves around with the rotor without the latter doing any work on it, or at least any effective work. Consequently, the time occupied in mixing is considerable, and in some cases the mixing is unsatisfactory, regardless of the time consumed. The character of the material treated, *i. e.*, the rubber, is such that the tendency to slip is very great, and this is particularly true when the added material is in the form of a fine powder, as is usually the case, inasmuch as such powder when adhering to the rubber chunks further increases the slipperiness of the mass. In order to obtain a satisfactory mixing action, it is necessary for the material to be firmly held against the stationary member, so that the blade or blades of the rotor will mash all portions and produce constantly a thorough redistribution of the particles, which is continuous throughout the operation. This result has not been satisfactorily obtained in prior rubber mixers with which I am familiar.

One of the primary objects of my present invention is to overcome in a practical and economical manner these defects and drawbacks of prior machines and to furnish a mixer of such construction that the mixing action is thorough and comparatively rapid. This result is obtained by the provision of means which effectively prevents the slippage of the mass being operated upon in the mixing chamber. The material is so manipulated as to offer substantial resistance to the rotor blade or blades, and such blade or blades do constant and effective work on the mass. The efficiency of the machine is considerably increased as a result of my improvements. The resulting rubber mass has maximum homogeneity and resiliency, and it is produced in a very short time.

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

In the accompanying drawings:

Figure 1 is a front elevation of a rubber mixer embodying my improvements;

Fig. 2 is an enlarged, vertical, central section of the main portion of the machine;

Fig. 3 is a section on line 3—3 of Fig. 2;

Fig. 4 is a detail of the rotor; and

Figs. 5, 6 and 7 are transverse vertical sections showing different modifications.

The machine selected for illustration comprises a horizontal mixing chamber 20 of substantially cylindrical shape, mounted between suitable standards or end frames 21, having heads 22 which close the cylinder at the respective ends. The end frames and the body portion of the cylinder may be conveniently intereconnected by bolts 23. A rotary mixing element 24 is provided within the mixing chamber, having a horizontal shaft 25 with bearings in the respective cylinder heads. That portion of the rotor within the cylinder is provided with one or more blades for mixing or kneading the material, which is charged into the cylinder in any convenient manner; for example, through a charging hopper or funnel 26, the interior of which is in communication with the upper central part of the mixing chamber. The opening at the top of the mixing chamber for the introduction of the material is shown at 27, in Fig. 2. When the material has been

mixed, it is discharged from the lower part of the mixing chamber in any suitable manner; for example, by lowering a hinged section 28 of the chamber wall. In the particular example shown, the discharge section 28 comprises the lower half of the cylinder and is hinged at one side, as shown at 29. At the other side of the cylinder, suitable means are provided for locking the upper and lower sections together. For example, swinging nutted bolts 30 on the upper fixed section, pivoted at 31 and adapted to engage a slotted flange 31ª of the lower section in an obvious manner. In the example shown, the rotor is provided with two blades 24ª, one in each end of the mixing chamber, arranged diametrically with respect to each other, and each pitched to produce movement of the material from the end of the chamber toward the center thereof. The arrangement is such that the blades work the material back and forth in the chamber, one blade picking up the material in one end of the chamber and mashing it against the side wall while simultaneously forcing it toward and past the center of the chamber into the other end, where it is acted upon by the other blade, which forces it back again. In the particular machine shown in the drawings, the mixing action is produced by the mashing or smearing of the material by generally convex working surfaces of the blades against the chamber wall, while the material is being worked back and forth as described.

I have found that in machines of this type where the rotor, which is intended to mash or smear the material against the chamber wall, has a substantially uniform action on the material at practically all different points in the chamber periphery, the slippage on the chamber wall is so great as to prevent proper mixing. It has been proposed to overcome this drawback by grooving or serrating the chamber wall, but, aside from the fact that this is a matter of some inconvenience and expense, the expedient only eliminates a portion of the slippage and the results are unsatisfactory. I have discovered, however, that the desired result can be obtained by having a varying action or what might be termed a differential action of the rotor on the mass, supported by the chamber wall. For example, instead of having the tip of the blade continually at the same distance from the chamber wall, the mixing will be improved and expedited in a remarkable degree if the tip of the blade passes different points in the chamber wall at different distances, having in effect an approaching and receding movement with respect to the chamber wall. This arrangement, which can be produced in many different ways, presents the advantage that the clearance opening between the chamber wall and the working surface of the blade is constantly changing, which expedites considerably the movement of the blade into such firm, biting engagement with the mass that the latter will be effectively held and operated upon. As the blade alternately advances toward and recedes from the chamber wall, its action on the material is constantly changing, thus producing a thorough redistribution of the particles and slippage is prevented because, due to the varying clearance space, the material is enabled to work well over the blade tip into a position in which it will be effectively held by the blade itself against the chamber wall while the blade is doing effective work upon it. Heretofore, one of the main difficulties has been in holding the material in front of the advancing blade so that it would be effectively caught between the blade tip and the opposing surface of the chamber wall. The tendency was for the material to collect in a solid mass in front of the blade without being caught by the blade tip so that, not being effectively held against the chamber wall by the blade itself, it slipped around the wall in front of the blade without having any work done upon it by the latter. This difficulty is overcome by providing a differential action of the blade tip with respect to the chamber wall, as above explained.

In carrying the invention into practice, I may construct the machine as shown in Figs. 1 to 4 of the drawings. In this example, the varying or differential action of the blade is produced by mounting the rotor shaft 25 eccentrically in the mixing chamber, as shown more particularly in Figs. 2 and 3. In this case, the blades 24ª are of equal width. In the example shown, the shaft bearings are nearer to the top of the cylinder than to the bottom, so that the blades have a very small clearance at the top of the cylinder, and a considerable clearance at the bottom. It is not necessary, however, that the small clearance be at the top and the large clearance at the bottom, as many changes in this and other respects may be made without departing from the principle of my invention.

As will be seen from Fig. 3, the blades have curved working faces adapted to mash the material against the inner surface of the chamber wall, and, throughout the greater portion of the length of each blade, its outer edge or tip is uniformly spaced from the rotor axis, in this example, although such outer edge or tip has an approaching and receding movement with respect to the chamber wall. In the case of the upper blade shown in Fig. 3, it will be seen that, upon rotation in the direction of the arrow, the blade and tip will recede from the chamber wall as the blade moves downward, reaching the maximum distance

from the chamber wall at the lowest part of the chamber, then gradually moving toward the chamber wall until the blade reaches the initial position. When the tip of the blade is at the maximum distance from the chamber wall and the clearance space is comparatively great, the material in front of the blade is enabled to pass readily past the tip so as to be wedged in firmly between the blade tip and the chamber wall. Thus, the material is effectively held against the chamber wall by the blade itself, while the latter is carrying on the mashing or smearing action, and, as this mashing or smearing action is very efficacious, especially as the working conditions at the blade face are constantly changing, the rubber mass is quickly worked up into a homogeneous, plastic body.

In the modification shown in Fig. 5, the rotor shaft 25^a is concentrically located in the cylinder 20, but the rotor is eccentrically bladed, the blade 24^b being of less width than the blade 24^c. The result is that the rotor, as a whole, has an eccentric arrangement with respect to the cylinder. As one blade (24^b) passes a given point in the cylinder wall, the clearance is considerable, but when the other blade (24^c) passes said point, the clearance is very slight. Thus, the rotor, considered as a unit, has a varying action on the material. The action on the material is different at different points in the rotation of the rotor, due to the difference in the clearance space at those points.

In the modification shown in Fig. 6, the rotor shaft 25 has concentric bearings in the mixing chamber and the blades are of equal width, but the chamber 28 is eccentrically bored.

In the modification shown in Fig. 7, the interior of the mixing chamber 20^b is elliptical in shape, the rotor blades 24^a having considerable clearance at both the top and bottom of the chamber and slight clearance at the sides of the chamber. In this case also the blades have a constantly changing action on the material, which eliminates or substantially decreases the slippage, and greatly improves the mixing action.

It will be apparent that the advantageous results obtained by my invention do not necessitate any complication of the machine construction or a material increase in its cost. As the mixing chamber can have a perfectly smooth inner surface, the cost of manufacturing the chamber is comparatively low, for it can be readily cast in sections and machined. The rotor can be readily cast.

I have found that the provisions of a varying tip action of the rotor blades as herein described for reducing or preventing slippage of the material on the interior periphery of the chamber is of peculiar value in a machine where the blades have a mashing or forcing action on the material in cooperation with the chamber wall and are inclined relatively to the shaft axis in such a manner as to work the material at one side of the rotor from one end of the chamber toward the center in one direction and the material at the other side of the rotor from the other end of the chamber toward the center in an approximately reverse direction. This combination of features results in a very thorough and efficient mastication or mixing of the material and is especially desirable in a machine of the single cylinder type such as that shown, although it will be obvious that the improvements herein described are applicable to machines having more than one rotor.

Various other changes may be made in the details of the construction without departing from the scope of my invention as defined in the claims.

If desirable or necessary, means may be provided for closing the charging opening during the mixing operation to prevent escape of the material, or other provision may be made for that purpose, with which my present invention is not concerned.

I do not claim, broadly, herein features concerned with the charging of a mixing chamber having a feed hopper in the upper wall of the casing, as claimed in the copending application of myself and Carl F. Schnuck, Serial No. 420,390, filed October 29, 1920, nor do I claim, broadly herein a chamber having end walls which are provided by forming extensions upon the supporting pedestals of the chamber, or other features of construction, claimed in the copending application of myself and Carl F. Schnuck, Serial No. 423,365, filed November 11, 1920.

What I claim is:

1. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, and a rotor in said chamber having blades inclined relatively to the longitudinal chamber axis to work the material at one side of the rotor from one end of the chamber toward the center and the material at the other side of the rotor from the other end of the chamber toward the center in an approximately reverse direction, said blades having a varying action on the material, substantially as described.

2. In a rubber mixer or like machine, a mixing chamber, and a bladed rotor in said chamber for working the material forcibly against the interior periphery of the chamber and simultaneously moving it from the chamber end toward the center, said rotor having a variable clearance at the periphery of the chamber, substantially as described.

3. In a rubber mixer or like machine, a

mixing chamber having a plain inner surface, and a bladed rotor in said chamber having blades for working the material on the inner periphery of the chamber wall and moving it from the ends of the chamber toward the center, said chamber and rotor constructed and arranged to reduce slippage on the chamber wall.

4. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, and a rotor therein having blades for mashing the material against the chamber wall and simultaneously working it from the ends of the chamber toward the center, at least one of said blades having a different action on the material at one point in its rotation from that at another point.

5. In a rubber mixer or like machine, a mixing cylinder, and a rotor in said cylinder having blades to mash the material against the interior periphery of the cylinder and simultaneously working it from the ends of the chamber toward the center, said rotor having an axis permanently fixed relatively to the cylinder and at least one of the rotor blades having different clearances relatively to the cylinder wall at different points in the rotation of said blade.

6. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, and a rotor in said chamber having blades for working the material against the inner periphery of the chamber and simultaneously moving it from the ends of the chamber toward the center, said rotor blades being arranged relatively to the chamber periphery in such a manner as to reduce slippage of the material on the latter.

7. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, and a rotor in said chamber having blades for working the material from the ends toward the center of the chamber at each of the respective sides of the rotor and for mashing the material against the chamber wall, said rotor so mounted relatively to the chamber wall as to prevent slippage of the material.

8. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, a rotor in said chamber having blades for mashing the material against the chamber wall and simultaneously working it toward the center of the chamber, and means providing for a variable action of the rotor on the material at different points in its rotation.

9. In a rubber mixer or like machine, a mixing chamber, a rotor therein having a blade with a generally convex face adapted to mash the material against the chamber wall, and means mounting the rotor so that the clearance between it and the chamber wall is different at different points in the rotation of the rotor, whereby the material is permitted to pass over the blade tip so as to be gripped thereby.

10. In a rubber mixer or like machine, a mixing chamber, and a rotor in said chamber having a blade with a generally convex working face having an approaching and receding movement relatively to the chamber wall.

11. In a rubber mixer or like machine, a mixing chamber, and a rotor therein provided with a blade having an approaching and receding movement relatively to the inner periphery of the chamber, constructed and arranged to press the material forcibly against such periphery while moving it away from the end of the chamber toward the center thereof.

12. In a rubber mixer or like machine, a mixing chamber having a plain inner surface, and a mixing blade in said chamber having an eccentric movement with respect to the chamber wall.

13. In a rubber mixer or like machine, a mixing cylinder, and a plurality of mixing blades in said cylinder mounted for bodily advancing and receding movements with respect to the chamber wall.

14. In a rubber mixer or like machine, a mixing cylinder, and blades in the respective end portions of the cylinder for mashing material against the cylinder wall and simultaneously working it toward the center of the cylinder, said blades being mounted so that one is in close proximity to the chamber wall and the other is farther away from said wall.

15. In a rubber mixer or like machine, a mixing cylinder, a pair of blades in the respective ends of the cylinder for mashing the material against the cylinder wall, and means for mounting said blades so that they alternately approach toward and recede from the cylinder wall.

16. In a rubber mixer or like machine, a material-receiving chamber in combination with an interior rotary mixing or masticating blade having a convex face and mounted for approaching and receding movements relatively to the chamber periphery during the rotation of said blade.

17. In a rubber mixer or like machine, a material-receiving chamber and a rotary blade therein having a convex working face for mashing the material against the inner chamber periphery as the blade is rotated, said blade rotatable about an axis permanently fixed with respect to the chamber, but being inclined relatively to such axis to move the material from the end of the chamber toward the center thereof, and said blade having an approaching and receding movement toward and from the chamber periphery.

18. In a rubber mixer or like machine, a material-receiving chamber, a rotary shaft therein, blades on said shaft in the respective end portions of the chamber inclined

relatively to the shaft axis so as to work the material from the ends of the chamber toward the center, said blades provided with convex working faces for pressing the material forcibly against the interior periphery of the chamber, both of said blades having an approaching and receding movement toward and from the inner chamber periphery during the rotation of said blades.

19. In a rubber mixer, a working chamber, a blade in said chamber having a curved face for mashing the material against the chamber wall, the outer edge of said blade being at a uniform distance from the blade axis at different points in the length of the blade, and means for mounting said blade in said chamber so that the outer blade edge advances toward and recedes from the chamber wall as the blade rotates.

20. In a rubber mixer or like machine, a mixing cylinder, mixing blades therein diametrically arranged, and a shaft for said blades eccentrically located with respect to the cylinder so that the blades advance toward and recede from the chamber wall as they are rotated.

21. In a rubber mixer, a mixing cylinder, a pair of blades in said cylinder, one at each end, each blade having a curved surface to mash the material against the chamber wall, and being pitched to move the material toward the center of the chamber, and means for mounting said blades in said cylinder so that the clearance between the blade tip and the cylinder wall varies at different points in the periphery of the cylinder.

22. In a rubber mixer, a mixing cylinder, a pair of blades in said cylinder, one at each end, each blade having a curved surface to mash the material against the chamber wall, and being pitched to move the material toward the center of the chamber, and a shaft on which said blades are mounted for alternate advancing and receding movement with respect to the chamber wall, whereby the blade clearance is enlarged to catch the material over the blade tip and then decreased to mash the caught material.

23. In a rubber mixer, a mixing chamber, and a rotary mixing blade therein having a generally convex working face with a clearance which is enlarged during the rotation of the blade to catch the material over the blade tip and then decreased to mash the caught material against the inner periphery of the chamber with minimum slippage.

24. In a rubber mixer, a mixing chamber, and a rotary mixing element therein which, at one point in its rotation catches a relatively thick mass of material between it and the inner surface of the chamber wall and then moves toward that portion of the wall where said mass is located, to mash the mass, said mixing element constructed and arranged to work the material from the ends toward the center of the chamber.

25. In a rubber mixer, a mixing chamber, and a bladed rotor in said chamber having a varying gripping and mashing action on the material at different points in the periphery of the chamber.

26. In a rubber mixer, a smooth-surfaced chamber, and a rotary, bladed mixing element in said chamber having a varying action on the material to grip it between the tip of the blade and the opposing surface of the chamber wall.

27. In a rubber mixer or like machine, a mixing chamber, a bladed rotor eccentrically mounted therein, the clearance between the blades of the rotor and the chamber wall being varied at different points in the rotation of said rotor.

28. In a rubber mixer or like machine, a mixing chamber, a bladed rotor eccentrically mounted therein, the rotor blades having a greater clearance at one side of said chamber than at the other side thereof.

In witness whereof, I have hereunto set my hand this 24th day of August, 1918.

DAVID R. BOWEN.