Sept. 11, 1934. W. KROEPFLE 1,973,002

APPARATUS FOR MIXING MATERIALS

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Fig. 1

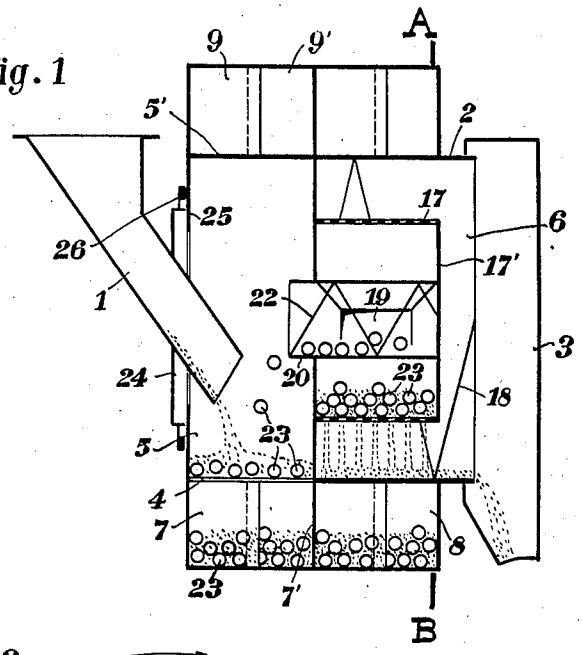


Fig. 2

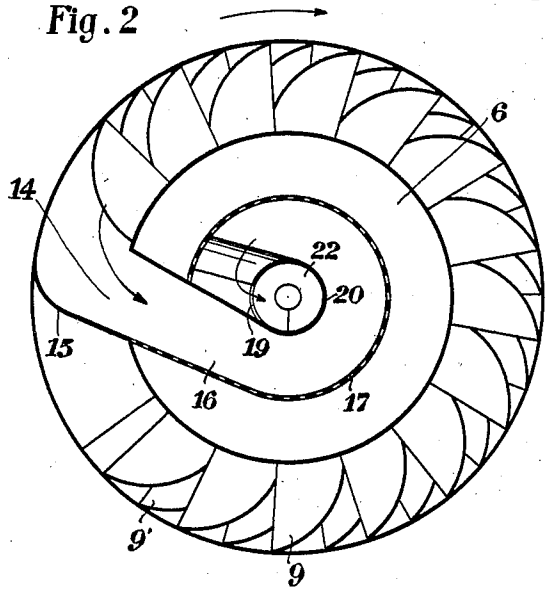
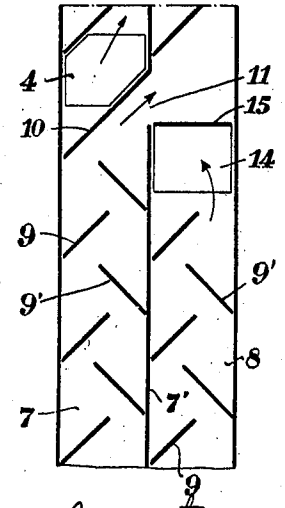


Fig. 3



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APPARATUS FOR MIXING MATERIALS

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In order to obtain the best possible mixture of fine flourlike materials, and especially of those the components of which stick together easily and consequently are mixed only with difficulty, one has provided a number of mixing chambers through which the material passes successively. If this were not possible, one would be obliged to conduct the material repeatedly through the mixing apparatus. This is inconvenient and takes much time and diminishes the efficiency of the mixer. Now in order also to obtain a good mixture of substances sticking together easily when conveying them only once through the mixing apparatus, there are added to the substances to be mixed movable mixing bodies such as punchings, balls and the like which travel through the mixing apparatus together with the substances. By the action of these bodies the particles sticking together are separated, and the mixing operation is made easier and is favorably influenced. The movable mixing bodies having passed the mixing apparatus are separated from the finished mixture and conveyed again to the material to be mixed. A most intimate mixture is obtained with such an apparatus when the material which is fed continuously is at first collected in a preliminary mixing or filling chamber into one charge, whereupon the mixing of this charge is finished in one or more following mixing chambers. Then the charge passes into a collecting chamber from which it is continuously discharged.

In the accompanying drawing there is shown an example of the mixing apparatus suitable for mixing two substances. In the drawing

Fig. 1 is a longitudinal section of the apparatus,

Fig. 2 is a cross section along the line A—B of the Fig. 1, and

Fig. 3 is a development of a portion of the mixing chamber.

The apparatus consists essentially of a stationary feed device or hopper 1, a rotatable mixing drum 2 and a stationary discharge device 3. The mixing drum 2 in the example shown is divided into two co-axial adjacent compartments, namely the preliminary mixing or filling chamber 5 and the discharge chamber 6. Both chambers 5 and 6 are surrounded concentrically by the main mixing chambers 7 and 8 which are separated from each other by means of a partition 7'. The jacket 5' of the preliminary mixing chamber 5 has a discharge opening 4, see Figures 1 and 3, extending over the whole width of the chamber through which the mixing charge formed in the preliminary mixing chamber 5 is discharged into the mixing chamber 7 after one rotation of the drum 2. There can be provided in the jacket 5' of course several discharge openings so that at one rotation of the drum several mixing lots are formed which are fed one after another to the mixing chamber 7 and are treated there. On the side walls of the mixing chambers 7 and 8 there are alternatively arranged lifting or mixing scoops or shovels 9 and 9'. The scoops or shovels 9 and 9', staggered in relation to each other, cover the whole width of the mixing chambers 7 and 8 and extend over the whole height of the annular space and of the mixing chamber. By this arrangement and execution of the lifting shovels the mixing charge is continually lifted as a whole by the lifting scoops or shovels and an intimate mixture of the particles therein takes place. An oblique guide plate 10, see Figure 3, mounted in the mixing chamber 7 directs the mixed material out of the chamber 7 through the opening 11 of the partition 7' into the chamber 8. In the latter there is provided between the shovel 9 and 9' a curved guide plate 15, see Figure 2, which leads to an opening 14 in the jacket of the discharge chamber 6. The opening 14 is connected with a channel 16 to which the material is fed by means of the guide plate 15. The channel discharges into the sieving drum 17 arranged in the chamber 6. In the chamber 6 there is a discharging screw 18. The drum 17 is closed at the discharge side of the machine by a partition 17'. In the drum 17 a tube 20 is arranged concentrically which discharges into the filling chamber 5. The tube 20 is provided with an inlet opening 19 and a return device 22. 23 indicates movable mixing bodies such as punchings, balls or the like which are added to the material and by the action of which the particles of the material sticking together are separated and the mixing operation is made easier and more effective.

The method of operation of the apparatus is as follows:

When, for example, two separate materials are to be intimately mixed, the inlet 4 is connected to one of the bunkers containing the materials and from which the material is continuously delivered. The materials to be mixed may also be conveyed continuously to the inlet, for example by means of a belt which runs past the separate bunkers. The material accumulated in the filling chamber 5 is preliminarily mixed in the course of one rotation of the drum and then passes as a so-called mixing charge through the opening 4 provided in the jacket of the filling

chamber 5 into the mixing chamber 7. Here the materials are again repeatedly turned over by the lifting or mixing scoops or shovels 9 and 9', staggered in relation to each other, and thus become intimately mixed in a short space of time. From the mixing chamber 7 the material is conducted as a mixture charge by the oblique guide plate 10, see Figure 3, to the opening 11 provided in the partition 7' through which it passes into the second mixing chamber 8 the construction of which is substantially similar to that of the first mixing chamber 7. More than two mixing chambers may also be provided but generally speaking, two mixing chambers will be sufficient to produce a satisfactory mixture. From the chamber 8 the mixture slides upon the shovel-shaped curved guide-plate 15, see Figure 2, to the opening 14 and passes through it and the channel 16 into the sieving drum 17 arranged in the discharge chamber 6. The size of the sieve holes are such as to allow the mixed material to pass through them into the chamber 6 wherefrom it is continuously discharged by the screw 18. The movable mixing bodies previously added to the material are retained in the drum 17 and pass through the opening 19 into the tube 20. Therefrom they are conveyed by the return device 22 into the filling chamber 5 where they are added again to the material.

As experiments have shown, it has been found advantageous in mixing apparatus of this kind to make adjustable the mixing shovels provided in the mixing chambers in order to accommodate their position to the flowing capacity of the substances to be mixed, the mixing work being in this way accelerated and favourably influenced. If chemical or physical processes are to be performed in the mixing apparatus, gases or vapours may be conducted through it. The continual loosening of the material produced by the action of the movable mixing bodies permits the gases or vapours to come into intimate contact with all the particles of the material whereby the reaction is accelerated.

The cover 24 closing the inlet opening of the filling chamber 5 will be provided in this case with a joint 26 which fits air-tight the front wall 25 of the chamber 5.

The mixing machine according to the invention permits, due to its construction, the direct removal of the finished mixed material to the point where it is to be used, so that no deterioration of the mixed material can result either in its composition or in its nature.

What I claim is:

1. In an apparatus for mixing substances, a rotatable drum having a preliminary mixing chamber, a discharge chamber co-axial with said preliminary mixing chamber, at least one main mixing chamber surrounding said first-mentioned chambers, a plurality of stationary alternately directed scoop members in said main mixing chamber for guiding and mixing materials therein, means for feeding materials to be mixed into said preliminary chamber, movable mixing bodies adapted to pass through said mixing chambers together with said materials and to cooperate with said scoop members in said main mixing chamber, means for withdrawing the mixed materials from said discharge chamber, and means for reconducting the movable mixing bodies to the preliminary mixing chamber for operation upon newly fed materials.

2. In an apparatus for mixing substances, a rotatable drum having a preliminary mixing chamber, feeding means associated with said chamber adapted to feed continuously therein materials designed to be mixed, a discharge chamber co-axial with said preliminary mixing chamber, a plurality of main mixing chambers surrounding said first-mentioned chambers, a plurality of stationary alternately directed scoop members in said last-mentioned chambers for guiding and mixing the materials therein, movable mixing bodies adapted to pass through said chambers together with said materials and to cooperate with said scoop members, means for intermittently charging one of said main mixing chambers with materials and mixing bodies from said preliminary mixing chamber, means in said discharge chamber for separating the mixed materials from said movable mixing bodies, conveying means in said discharge chamber for withdrawing the mixed materials therefrom, and means for reconducting the separated movable mixing bodies into said preliminary mixing chamber.

3. In an apparatus for mixing substances, a rotatable drum having a preliminary mixing chamber, a discharge chamber co-axial with said preliminary mixing chamber, at least one main mixing chamber surrounding said first-mentioned chambers, a plurality of stationary alternately directed scoop members in said main mixing chamber for guiding and mixing the materials therein, means for feeding materials to be mixed into said preliminary chamber, movable mixing bodies adapted to pass through said chambers together with said materials and to cooperate with said scoop members in said mixing chamber, a sieving drum in said discharge chamber for separating the mixed materials from said movable mixing bodies, an opening for said movable mixing bodies, and conveying means for reconducting said mixing bodies from said opening to said preliminary mixing chamber.

4. In an apparatus for mixing substances, a rotatable drum having a preliminary mixing chamber, feeding means associated with said chamber adapted to feed continuously therein materials designed to be mixed, a discharge chamber co-axial with said preliminary mixing chamber, a plurality of main mixing chambers surrounding said first-mentioned chambers, a plurality of stationary alternately directed scoop members in said last-mentioned chambers for guiding and mixing the materials therein, movable mixing bodies adapted to pass through said chambers together with said materials and to cooperate with said scoop members, at least one opening between said preliminary mixing chamber and one of said main mixing chambers for charging intermittently said last-mentioned chamber with materials and mixing bodies, an opening between adjacent main mixing chambers, a sieving drum in said discharge chamber for separating the mixed materials from said movable mixing bodies, means for guiding the material and mixing bodies from the last one of said main mixing chambers to said sieving drum, and a tube within said sieving drum having an opening for receiving the movable mixing bodies to return said bodies to said preliminary mixing chamber.

WILHELM KROEPFLE.