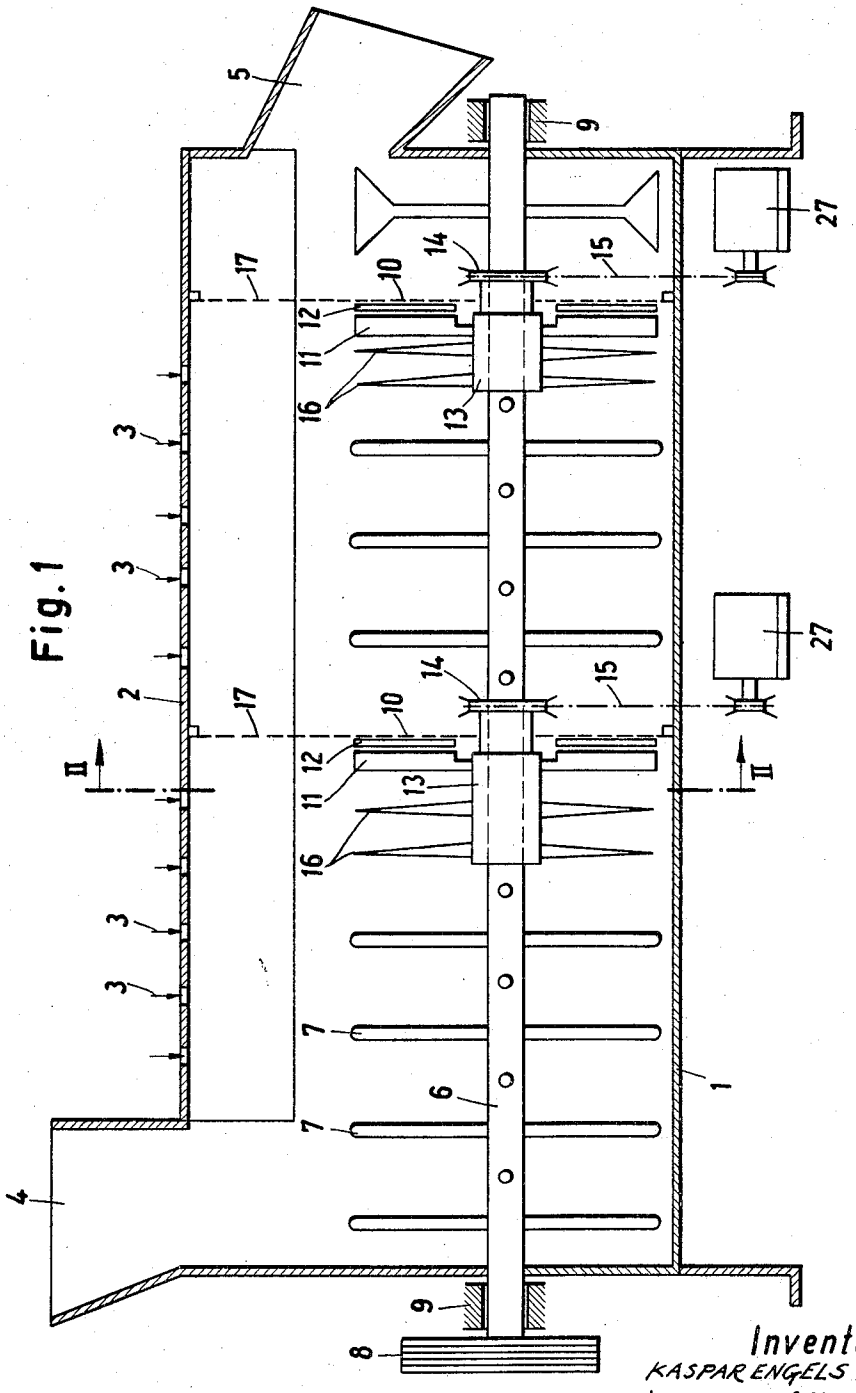
April 14, 1970 K. ENGELS ET AL 3,506,201

TROUGH MIXER HAVING A DOSING ARRANGEMENT FOR MIXING FIBROUS MATERIALS

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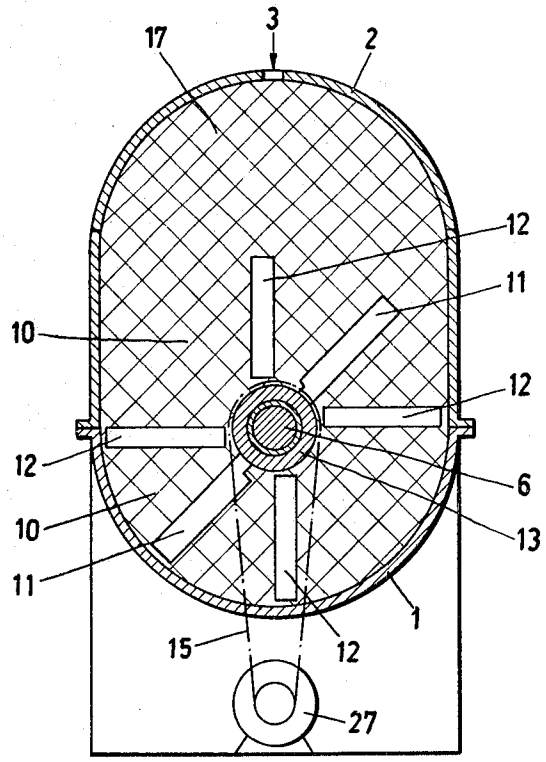
Fig. 1



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Fig. 2



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Fig. 3

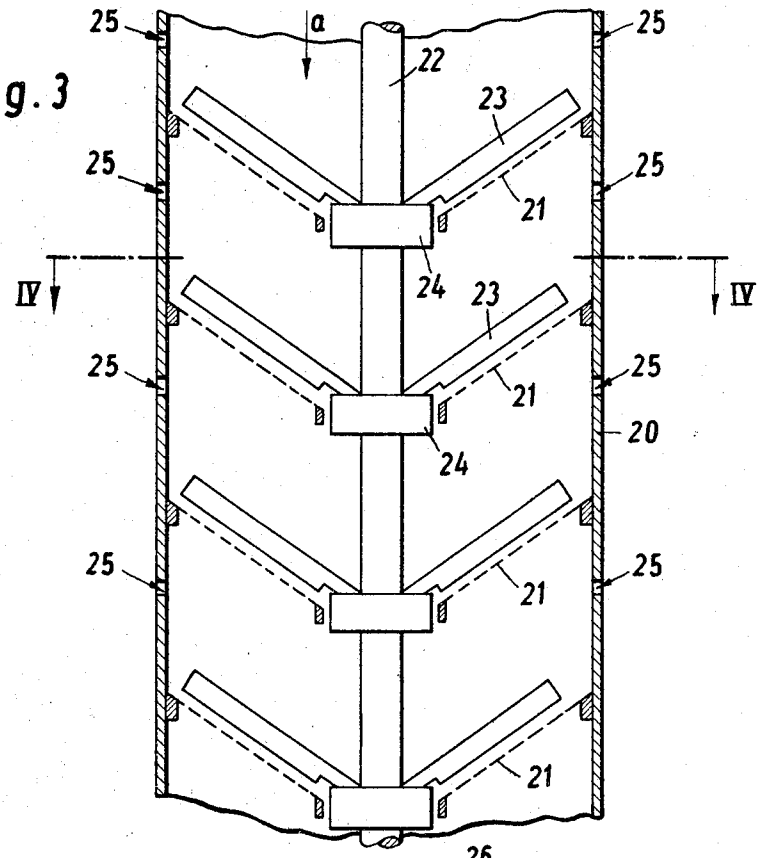
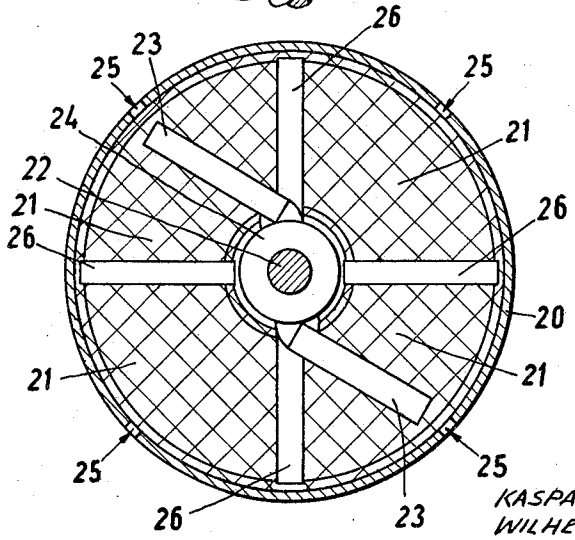
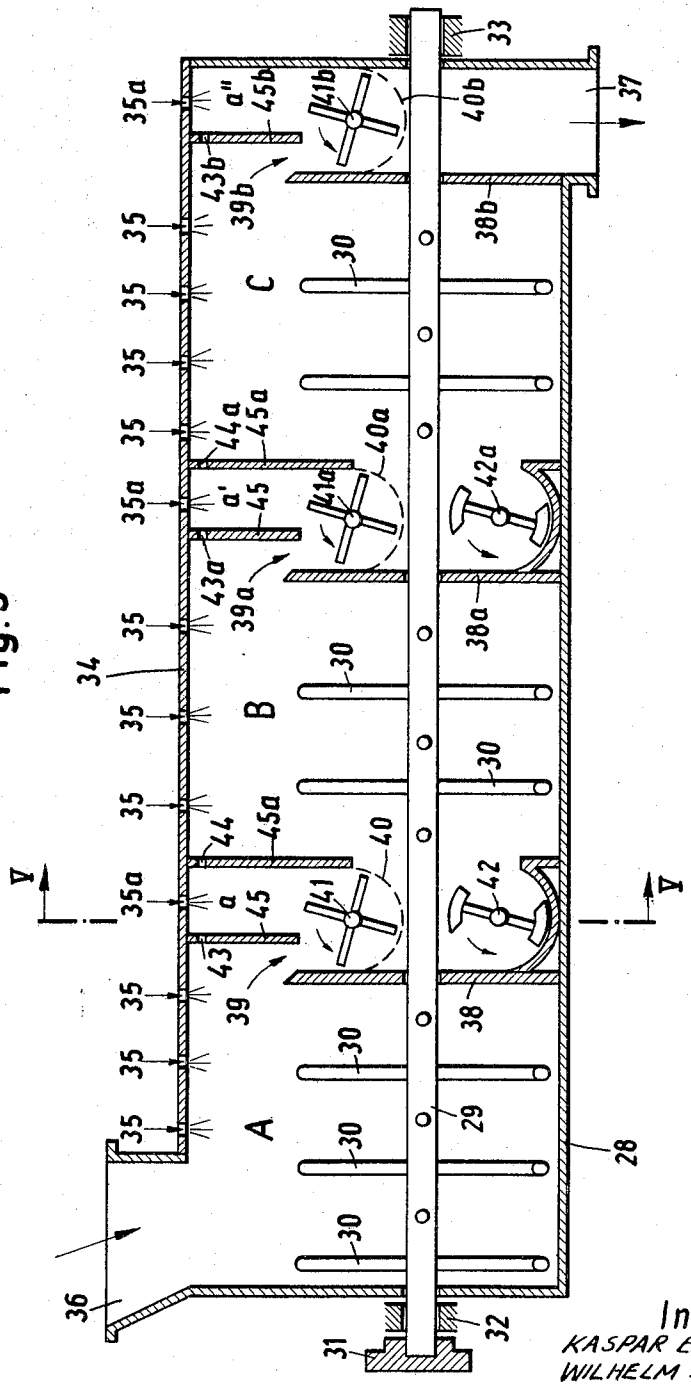


Fig. 4



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Fig.5



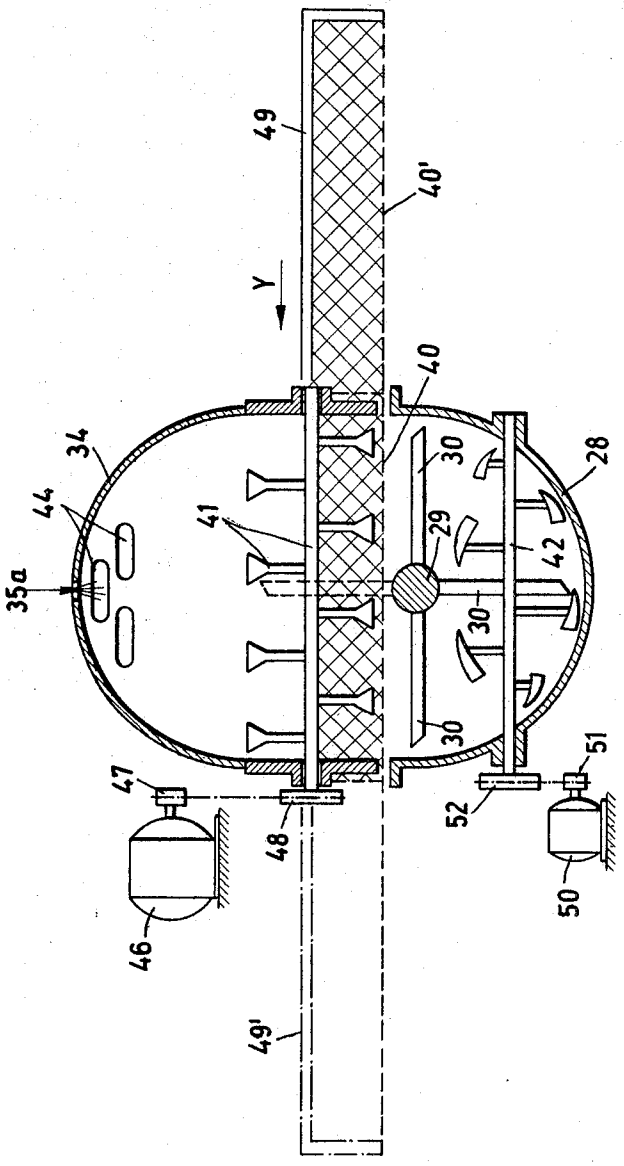
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Fig. 6



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United States Patent Office 3,506,201
Patented Apr. 14, 1970

3,506,201

TROUGH MIXER HAVING A DOSING ARRANGEMENT FOR MIXING FIBROUS MATERIALS

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Filed Dec. 16, 1966, Ser. No. 602,295
Claims priority, application Germany, Dec. 17, 1965, D 48,939
Int. Cl. B02c 13/10
U.S. Cl. 241—42 6 Claims

ABSTRACT OF THE DISCLOSURE

A trough mixer separated by transverse screens into mixing chambers having a shaft extending through the trough and carrying mixing and cutting tools with nozzles for each chamber to blow glue and additives onto fibrous material being mixed with the glue, where the tools adjacent the screens and the screens cooperate to disentangle lumps and balls in the material being mixed and apertures are provided between the chambers to balance the air pressure.

BACKGROUND OF THE INVENTION

The present invention relates to mixing apparatus for mixing materials, such as fibrous materials with different binding agents and/or dye stuffs, hardening agents and other additives.

More in particular, the invention concerns a trough mixer with a nozzle arrangement where fibrous or chip-like substances, such as wood, paper, coco, hemp, cloth and the like are mixed with liquid or powdery binding agents, with components of liquid or dry coloring or dye substances, water, a hardening agent and other additives in order to produce from such a mixture the desired end products, for example, by pressing as into the form of plates.

SUMMARY OF THE INVENTION

Different types of trough mixers are known for applying glue to wood fibers or chips or the like. Thus there are continuously and interruptedly operating trough mixers in which one or more stirring devices initiate movement of the fibrous or chip-like material in more or less fluffed condition and where the binders and additives in liquid or powder form are sprayed onto the fluffed mass or introduced in any other different manner. Embodiments have also been proposed where more rapidly running mixing tools force the wood chips to follow correspondingly greater paths of projection. Machines of this type require additional equipment to return the chips to the casting or throwing tools.

Machines of this type for applying glue to wood chips, particularly for applying glue to and moistening fibrous substances are subject to the shortcoming that the fibrous substances to be coated or moistened tend to mat. Immediately after or during the addition of the binders, resins or the like the chip-like or fibrous substances mat to form lumps which have different proportions of binder material from the core outwardly and which do not dissolve or break up as a result of the spreading or pressing that follows the mixing operation. Therefore, the end products are not consistent as to quality and appearance.

It is therefore an object of the invention to prevent the clumping or balling of the mix in the mixing trough as much as possible or to break up clumps which form in the mixing trough.

The problem is solved by providing a trough mixer

having a blow nozzle arrangement for mixing fibrous substances preferably with liquid binding agents, if desired also with dye substances and other additives, comprising a mixing trough through which the fibrous or chip-like material is passed by means of rotating mixing, overturning and casting elements, or by inclining the mixing trough, while continuously absorbing the additives, which trough, in accordance with the invention is subdivided by screening devices holding back the clumps, and balls that form during the mixing and where cutting wings or arms for breaking up the clumps and balls of mix are disposed ahead of the screens. It is advantageous in this connection to operate the trough mixer continuously and to subdivide it into a plurality of chambers by means of a plurality of screening devices having cutting arms or wings located ahead of them. The screening devices serve the purpose of holding back the lumps or balls of mix formed in the individual chambers from the flow of the remaining material until they are broken up or dissolved by the rotating cutters.

The cutting arms or beaters in accordance with the invention may be disposed on the shaft means for the mixing, over-turning and casting members and like the screening devices they may be mounted in mixing troughs of conventional construction. In order to achieve more rapid comminution of the clumps or balls of mix, it is particularly advantageous to drive the cutting arms at a high number of revolutions. For this purpose the cutting arms may be mounted on separate shafts, hubs or the like. In a particularly advantageous manner the cutting arms may simultaneously serve as mixing arms. If the mixing trough is subdivided into a plurality of separated chambers by the screening devices, it is necessary to provide supply nozzles for the binding agents for each chamber, and mixing, turning and casting arms or members adapted to the prevailing degree or condition of the mix in the individual chambers.

In accordance with a further feature in accordance with the invention the rotating cutting wings cooperate with stationary counter cutters disposed immediately before the screens. This makes it possible to obtain an increase in the passage or production of mix material. In order to avoid balling or clumping of the mix material to a considerable extent, and to impart precomminution to the lumps being formed, a further feature of the invention provides for the arrangement of cutters ahead of the screens alongside the cutting arms, which rotate at the same velocity as the cutting arms.

In a modified embodiment where the mix material is passed through by inclination of the trough, the invention provides for the arrangement of screening devices in the form of funnel shaped screens having their points downwardly directed in the inclined or vertically disposed mixing trough and for cutting arms mounted on a shaft at a fixed distance ahead of the screens and parallel thereto.

In a particularly advantageous manner the screens are arranged in the mixing trough in such a way that they may be displaced to permit adjustment of the cutting gap.

However, a further embodiment in accordance with the invention is particularly advantageous, where the mixing trough is subdivided by cylindrical screens with separating walls disposed with their axes perpendicularly to the mixing trough, which hold back the balls and lump formed during mixing and in which these retained products are broken up by beating and/or cutting tools. For this purpose the arrangement may be such that evading spaces are provided above the shaft of the cutters or beaters, the borders of which are defined by stationary walls arranged in the mixing trough. It is advisable to

select the width of these evading spaces smaller than the diameter of the cylinder screen associated therewith.

Air balancing apertures are advantageous in these walls in order to obtain a balance of pressure in the individual mixing spaces.

This manner of installing cylinder screens disposed at right angles relative to the axis of the mixing trough makes it possible to provide in a simple manner for displacing or moving the screens like chests.

Finally, it is possible to provide additional mixing devices below the cylinder screens transversely of the axis of the trough, thereby preventing dead spaces in these locations.

BRIEF DESCRIPTION OF THE DRAWINGS

Further details, features and advantages of the invention will become apparent from the following description with reference to the accompanying drawings which illustrate different embodiments of a trough mixer equipped with the screens and comminuting tools according to the invention, and in which,

FIG. 1 shows a sectional view of continuously operating trough mixer in horizontal position,

FIG. 2 is a sectional view taken along line II—II in FIG. 1,

FIG. 3 is a sectional view of a mixer in accordance with the invention arranged vertically,

FIG. 4 is a sectional view taken along line IV—IV in FIG. 3,

FIG. 5 is a longitudinal sectional view of a further embodiment of a trough mixer, and

FIG. 6 is a sectional view taken along line V—V in FIG. 5.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The continuously operating trough mixer for applying agglutinant and other substances to fibers illustrated in FIG. 1 comprises a trough **1** and a hood **2** which is provided with nozzles **3**. The fibrous material is introduced through a funnel **4** and leaves the mixer through a discharge aperture **5**. A mixing assembly is arranged in the mixing trough which consists of a shaft **6** equipped with mixing arms **7**. The mixing shaft **6** is driven by way of a disk **8** and is journalled in bearings **9**. In accordance with the invention the trough of the mixer **1** is subdivided by screening devices such as screen walls **10**. In front of these screen walls **10** cutting tools **11** are arranged which rotate at high speed and are also adapted for mixing which cooperate with stationary counter cutters **12**. The cutting arms **11** are advantageously mounted for adjustment on a hub **13** which is driven by a motor **27** by way of a belt pulley **14** and a belt **15**.

Additional freely rotating cutting arms **16** may be arranged on the hub **13**. The surfaces of the screen walls **10** may be extended into the area of the hood **2** by means of screen **17** in a manner that the mixing trough defined by the trough mantle **1** and the hood **2** is subdivided into chambers. The mixing arms **7** are advantageously so arranged that a small thrust is applied to the clumps or balls of mix in the direction of the screens **10**.

FIG. 2 is a cross section of trough **1** with the hood **2** and nozzles **3**. A hub or sleeve **13** is journalled on the mixing shaft **6** which carries the cutting arms **11** and is driven by means of a V-belt by the motor **27** at a higher number of revolutions than the shaft of the mixing assembly. The cutting arms **11** cooperate with the stationary cutters **12** mounted closely to the screen **10**. The screen **17** closes the free space underneath the hood **2**.

In contrast to the embodiment in accordance with FIGS. 1 and 2 which illustrate a horizontal trough mixer where besides the cutters a mixing means of conventional construction operates at a low number of revolutions, FIGS. 3 and 4 illustrate a particularly advantageous embodiment of a vertical trough mixer. Screens **21** which are preferably funnel shaped are fixedly mounted in the trough **20**. The screens may, however, be also arranged horizontally or cylindrically in the trough **20**. With the cylindrical embodiment special feed back means for the fibrous material would then be needed. A shaft means such as a mixing shaft **22**, axially disposed in the trough, carries cutting devices or arms **23** which are secured to the shaft **22** by means of a hub **24**. The cutting arms **23** are preferably mounted parallel to the screens **21** and scan them at a relatively small distance. It is furthermore possible to arrange additional counter cutters **26** between the cutting arms and the screens. The shaft with the cutting arms **23** rotates at a relatively high number of revolutions, for example at 600 r.p.m. with a trough diameter of 700 mm. Especially with the vertical trough arrangement the cutting arms **23** serve simultaneously as mixing arms for the mass of fiber mix present at any particular time between two screens **21**, which as indicated by the arrow runs into the trough mixer from the top and upon passing through the individual screens leaves through the bottom. It is, of course, also possible to feed the fiber mass into the second or third chamber of the trough mixer, depending on the finess of the material. In a particularly advantageous manner the screens **21** may be arranged for adjustment of height on the wall **20** of the trough by means of screws or the like (not shown) to permit of adjusting the cutting gap that is most suitable for the fiber mass supplied at any particular time. The nozzles **25** are so arranged that they spray in through the wall of the trough **20** laterally into the spaces between two screens. The conical arrangement of the screens also provides the advantage that the centrifugal forces resulting from the effect of the cutting arms favorably influence the draft on the balls of fiber material and binder and that thereby the output or efficiency of the screen is essentially increased. Beyond that, the inclined arrangement of the screens assures of pure overturning of the fibrous material between two screens without development of a closed ring formation.

FIG. 4 shows a horizontal section of the vertical trough mixer with the trough mantle **20**, the cutting arms **23** and the counter cutters **26** in accordance with FIG. 3. The screen **21** is arranged at a short distance behind the counter cutters. The cutting arms **23** are arranged, preferably adjustably, on a hub **24**. The journalling of the mixing shaft **22** and its driving means is not illustrated in FIG. 4. The cutting arms **23** are set up for pulling cutting as shown in FIG. 4, but other forms of cutting arms may also be employed.

The mixer in accordance with FIGS. 5 and 6 comprises the trough **28** in which the mixing shaft **29** with mixing arms **30** is mounted. The mixing shaft is driven by way of the flange **31** of a pulley by means of drive means which are not illustrated in detail. The mixing shaft is journalled in bearings **32** and **33**. The upper part of the trough **28** is closed by means of a hood **34**, which in turn is provided with nozzles **35** that serve, for example, for supplying a binding agent. The fibrous material is fed into the trough **28** by means of the funnel **36** and leaves the mixer through the outlet opening **37**.

Two separating walls **38**, **38***a* are provided in the trough which subdivide the mixer into three compartments A, B, C. The fibrous material supplied to the mixer through funnel **36** is moved in the trough A by the mixing tools **29**, **30** and is sprayed through the first three nozzles **35**. In accordance with the amount or quantity of fibrous material fed into the funnel **36**, fibrous material partially glue coated by the nozzles **35** moves in the direction of the arrow **39** into the first screening means, cylinder screen **40**, which, as shown in the drawing, is in the form of a semi cylinder. The fibers which enter the screen area at **39** are completely disentangled here by the beating and cutting device **41**. This means that objectionable lump formations are destroyed in the cylinder screens **40**. Differences in the supply of lumps not completely dissolved

in the passing material are given an opportunity to move upwardly into the escaping space *a* so that they can be seized repeatedly by the beating tools **41**.

The disentangled fibers, i.e. the destroyed lump formations then pass through the screen **40** and reach the chamber or space B.

Since no mixing arms which are disposed radially with respect to the mixing shaft **29** can be located below the screen **40**, care must be taken that the fibers which leave the screen **40**, are again supplied to the mixing arms **30** by means of a special transversely disposed mixing assembly **42** so that they may be moved in chamber B in a similar manner and sprayed further with glue by additional nozzles **35**.

The cutter or beater mechanism **41** running at high speed circulates air in a large volume which without special measures would be forced through the screen **40** in the direction of chamber B and would thus be driven in the direction of the outlet of the mixing trough. Arrangements are therefore made that the spaces *a*, *a'* are provided at their upper ends in walls **45** and **45***a* with air balancing apertures **43** toward space A and **44** toward space B.

The disentangling operation described above is repeated in this mixing trough at **38***a*, **39***a*, **40***a*, **42***a*. A disentangling mechanism of the same construction and function is also provided at the outlet end of the mixer. An overflow wall **38***a* is provided and the direction of flow of the glue coated fibers into the screen space with the screen **40***b* and the beating mechanism **41***b* rotating therein is indicated at **39***b*. Also there it is possible for excess material or lumps to reach an evading space *a''*, which is separated by the wall **45***b* from the inflow **39***b*. The evading space *a''* in this case is in communication with the mixing space or chamber C only by air balancing apertures **43***b*. The fully, finally and most evenly glue coated fibers which are discharged through the screen **40***b* leave through the outlet opening **37** to be treated further. The evading spaces *a*, *a'*, and *a''* may conveniently be provided with additional nozzles **35***a*, in order to utilize also that area for glue distribution.

It has been found that in the treatment of fibrous material with glue a certain amount of clogging of the screens is unavoidable. The solution of this problem proposed here provides for the effective coating of such fibrous material with glue that the screens are slidable sections as illustrated in FIG. 6 of the drawings. Also here the mixing trough is identified at **28**, the mixing shaft at **29** and the mixing arms at **30**. The mixing trough is covered at the top by the hood **34** where gluing nozzles **35***a* are arranged. Above the shaft **29** the beater shaft **41** is disposed rectangularly relative to the axis of the trough, which sweeps over the cylindrical screen **40**. The beater shaft **41** is driven by the motor **46** by way of pulleys **47** and **48**. The screen **40** is secured to a frame **49** which is twice as wide as the actual mixing trough. This frame is sufficient to accommodate two screen lengths **40**, **40'**. The screen **40** as shown in FIG. 6 is in active position. The screen **40'** can be cleaned in this position or may be exchanged. As soon as the screen **40** indicates clogging, which is normally reflected by the power consumption of the motor **46**, the frame **49** is displaced in the direction of the arrow Y, whereupon the frame moves with the screen **40** to the position indicated in dot and dash line **49'**, while screen **40'** arrives in operating position and the screen **40** is exposed for cleaning or exchanging. Thus the exchanging of the screen can take place without interruption in the operation.

Inside the hood **34** there can also be seen passage apertures **44** for the balancing of the air between chambers A and B, for example.

FIG. 6 also shows in combination with FIG. 5 that one mixing mechanism **42** is disposed below the cylinder screen **40** and that it is driven by the motor **50** by way of pulleys **51** and **52**.

Having now described our invention with reference to the embodiments illustrated in the drawings, but what we desire to protect by letters patent is set forth in the appended claims.

We claim:

1. Trough mixer for mixing fibrous materials, for example wood, paper, coco, hemp, cloth fibers, with binding agents, especially liquid agents or other additives, said mixer comprising, a mixing trough, a nozzle arrangement disposed in spraying relation to said trough, a main mixing shaft extending longitudinally of said trough, arms for mixing, overturning and casting material mounted on said mixing shaft for rotation in said mixing trough, at least one screening device disposed generally transversely of and subdividing said trough, said at least one screening device being in the form of a semi-cylinder, and separating walls extending laterally of said at least one screening device, downwardly before the forward end of the screening device and upwardly adjacent the rearward end thereof, and a working mechanism comprising a shaft with radially extendings arms disposed transversely of said main mixing shaft proximate said at least one screening device, operative to disentangle balls and lumps formed in the material being treated.

2. Trough mixer in accordance with claim **1**, where evading spaces are provided above said working mechanism, said spaces being defined by downwardly extending walls.

3. Trough mixer in accordance with claim **2**, where the width of said evading spaces is smaller than the diameter of said semi-cyclinder screens.

4. Trough mixer in accordance with claim **3**, where apertures for balancing the air pressure in adjacent chambers are provided in said separating and downwardly extending walls.

5. Trough mixer in accordance with claim **4**, where a frame extends transversely across and laterally from said mixer, said frame supporting two similar screens and being slidably movable with said screens to permit movement of one screen out of the mixer for cleaning.

6. Trough mixer in accordance with claim **4** including a further mixing mechanism extending transversely of said mixer below said screening device.

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