May 10, 1966 FRIEDRICH-WALTER HERFELD 3,250,519

MIXER, ESPECIALLY FOR SYNTHETIC MATERIALS

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Fig. 1b

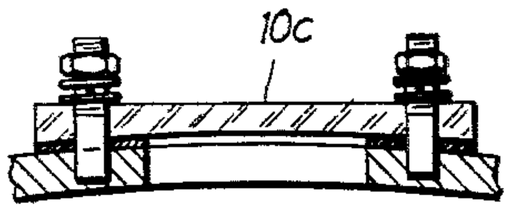

Fig. 1

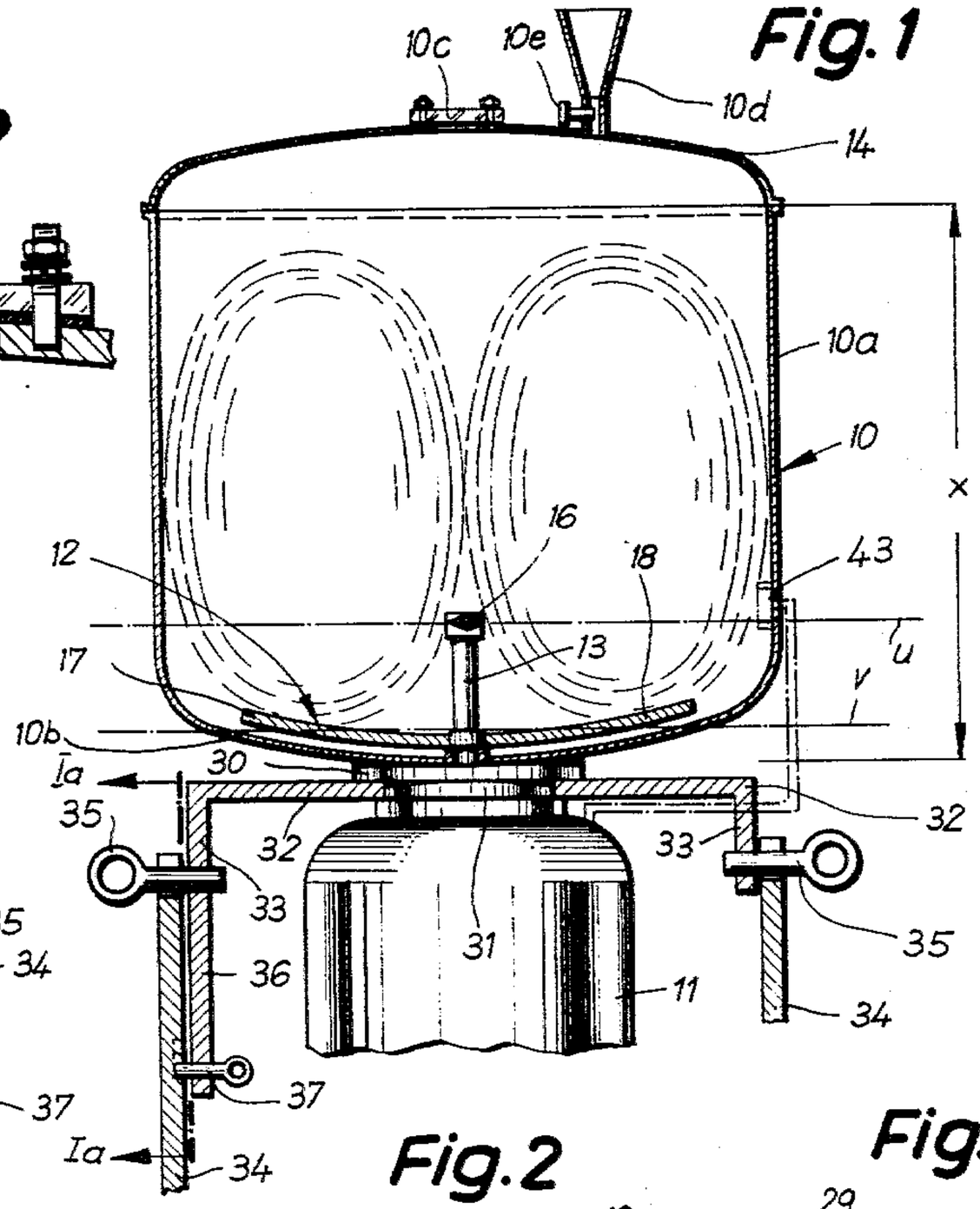

Fig. 1a

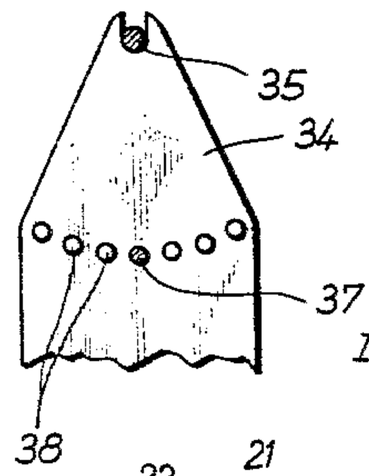

Fig. 2

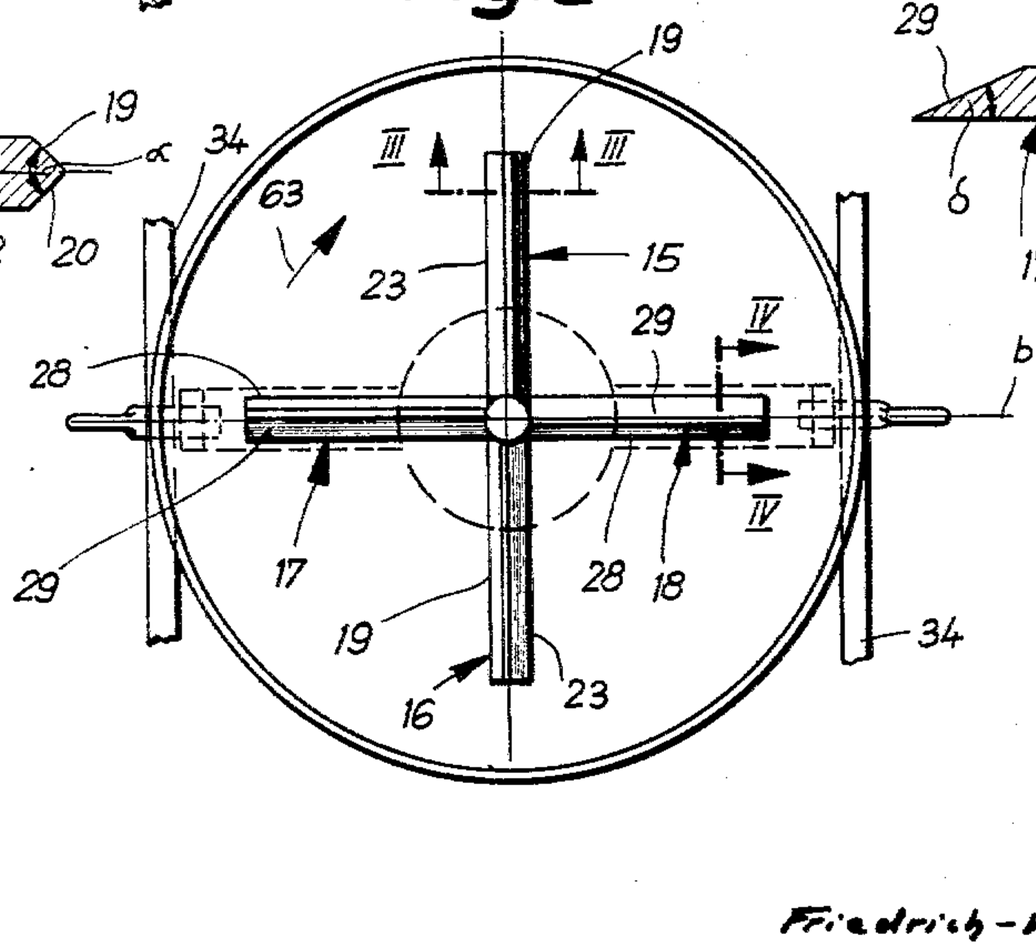

Fig. 3

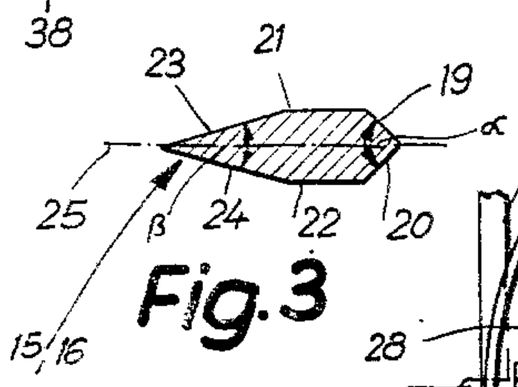

Fig. 4

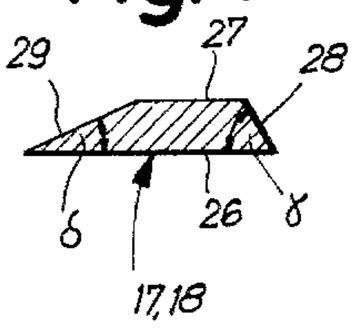

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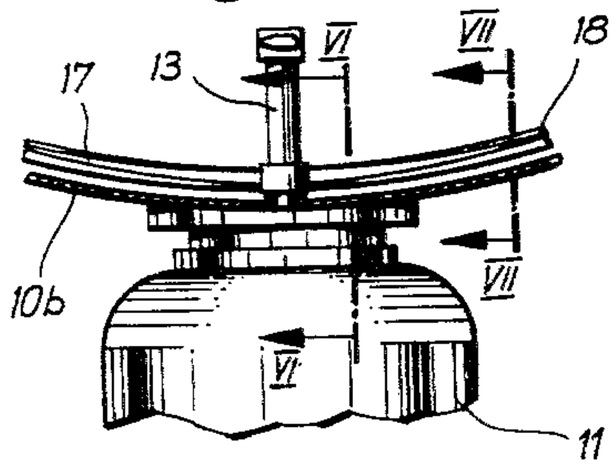
Fig. 5



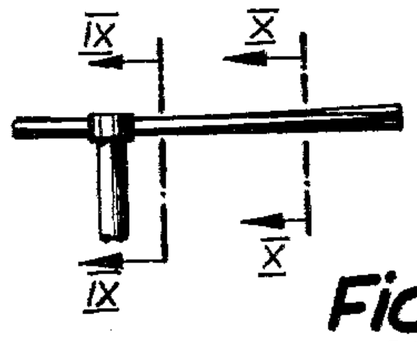


Fig. 8

Fig. 9

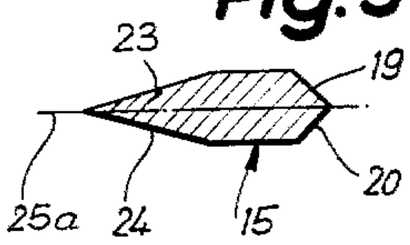


Fig. 6

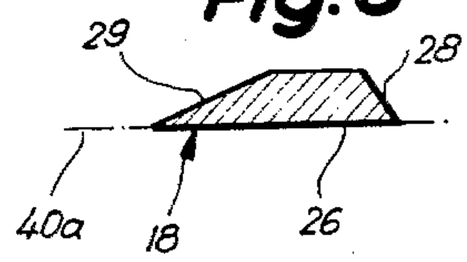


Fig. 10

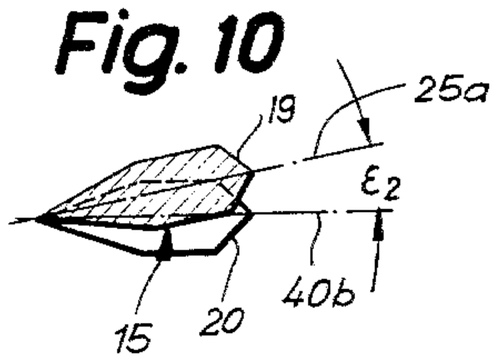


Fig. 7

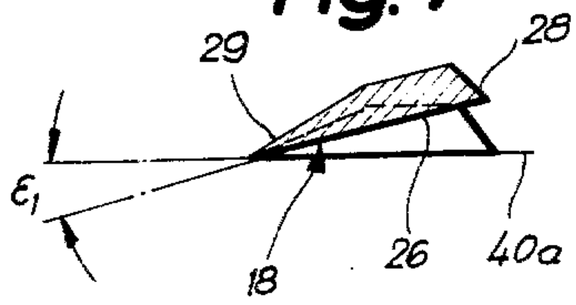


Fig. 11

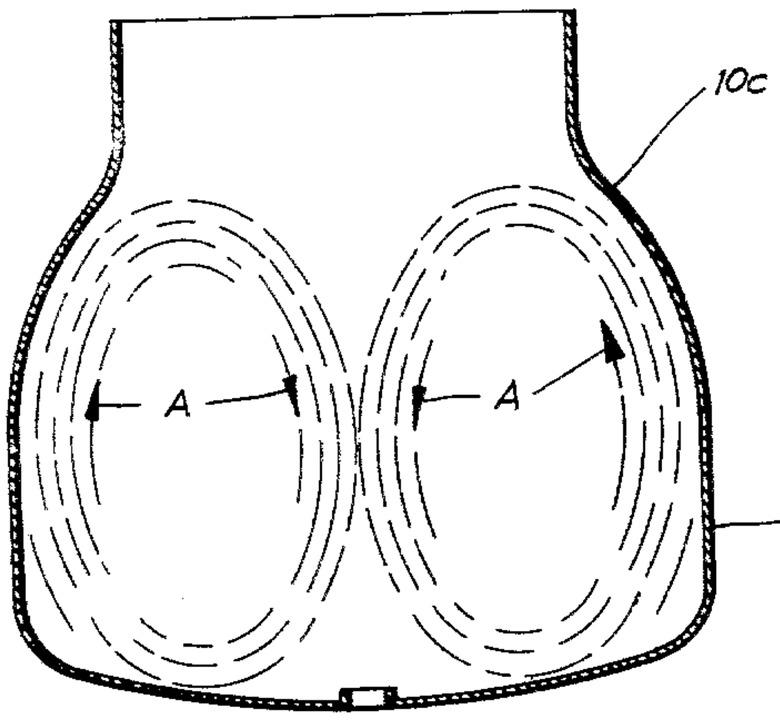


Fig. 12

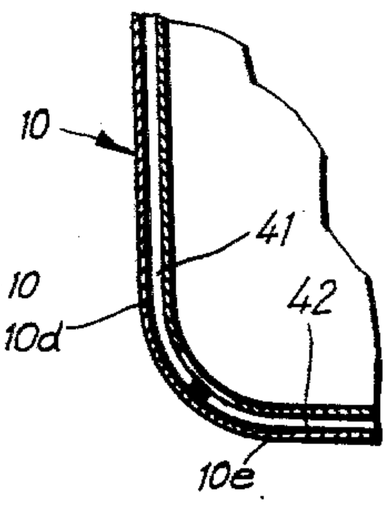


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Fig. 13

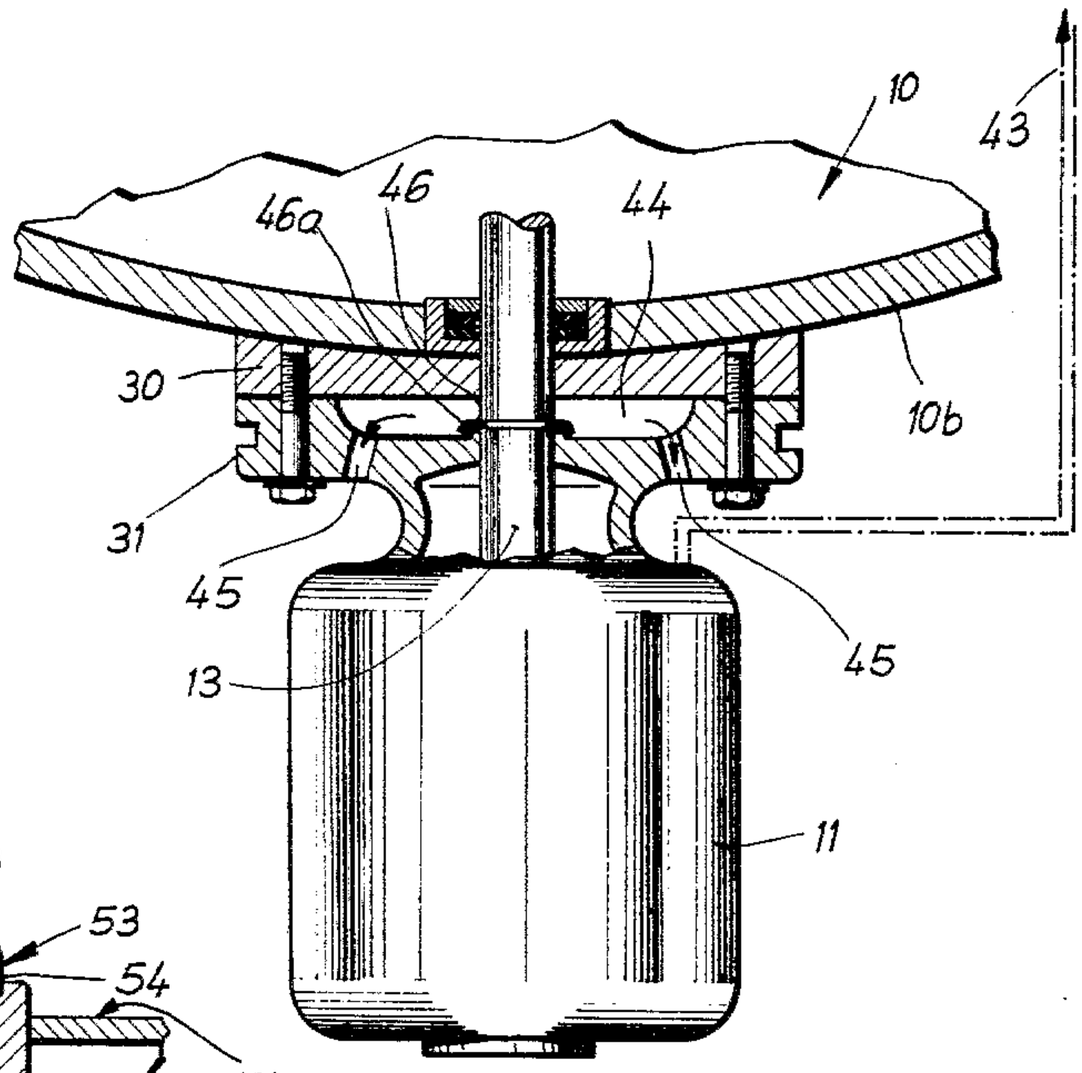


Fig. 15

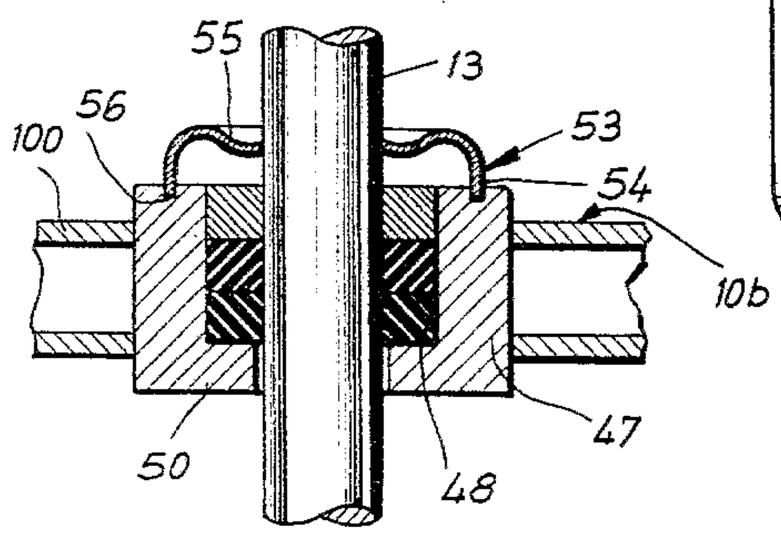


Fig. 14

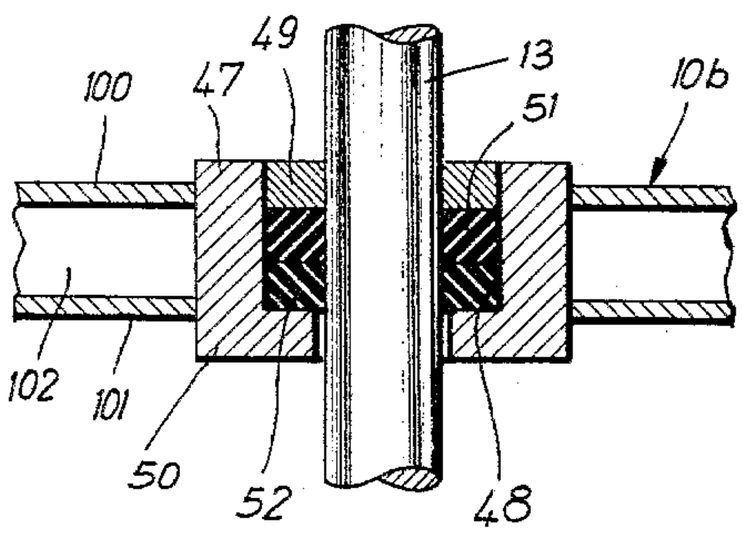


Fig. 15a

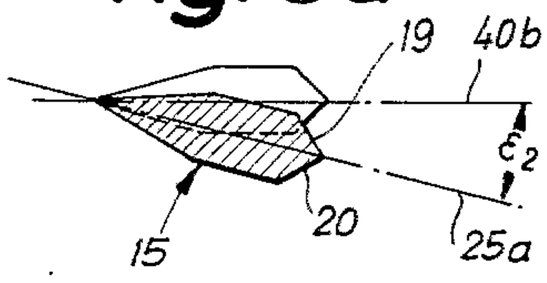
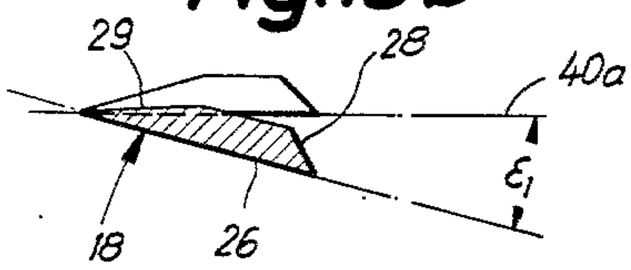


Fig. 15b



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MIXER, ESPECIALLY FOR SYNTHETIC MATERIALS

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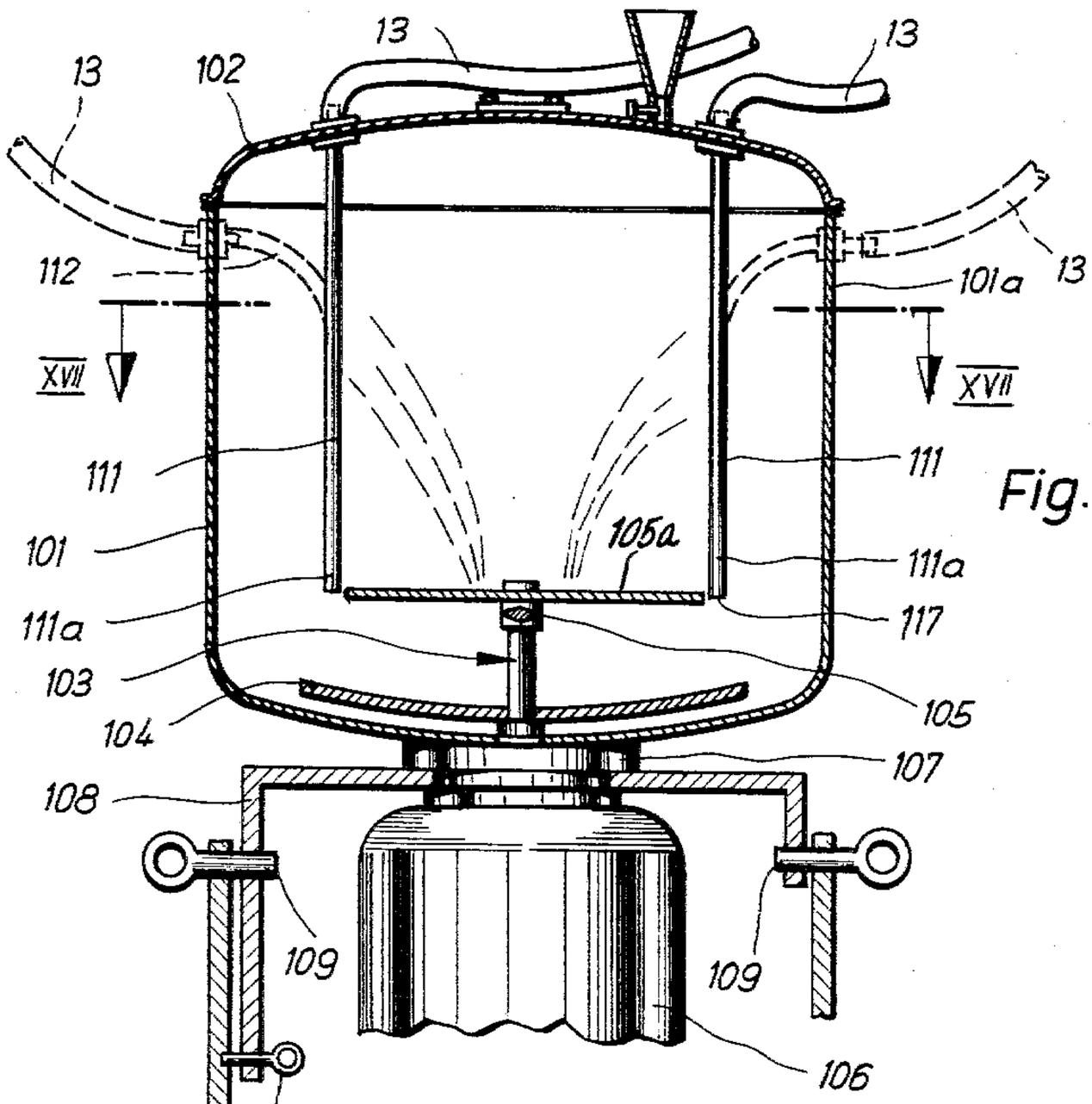

Fig. 16

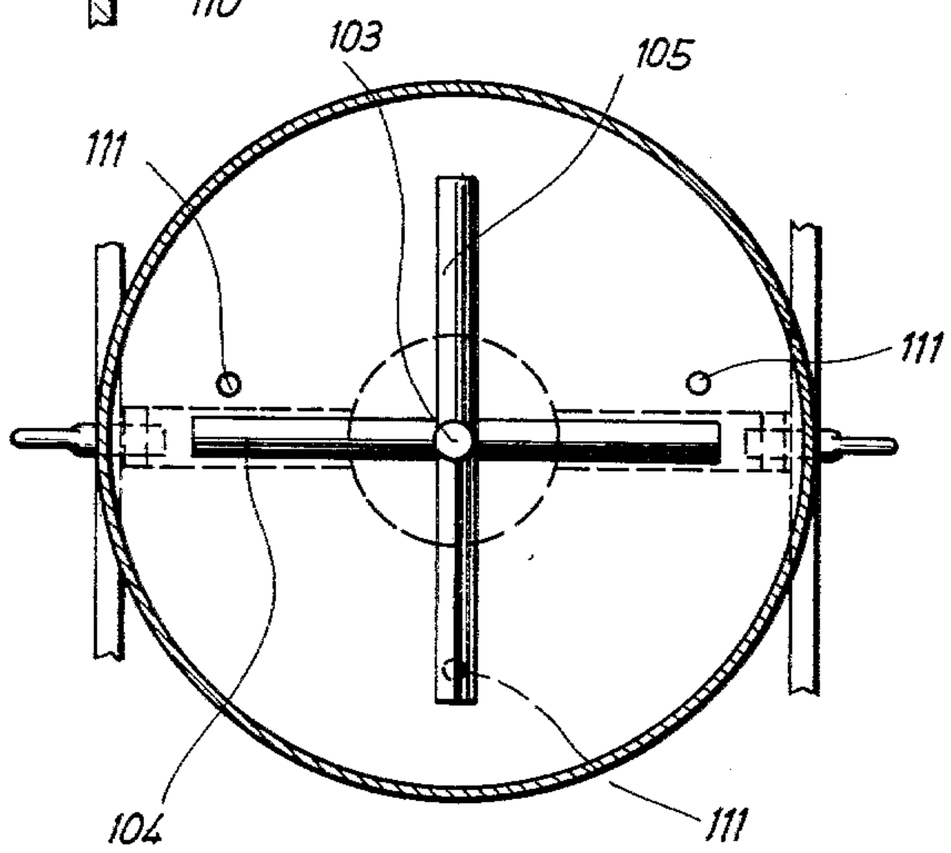

Fig. 17

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Fig. 18

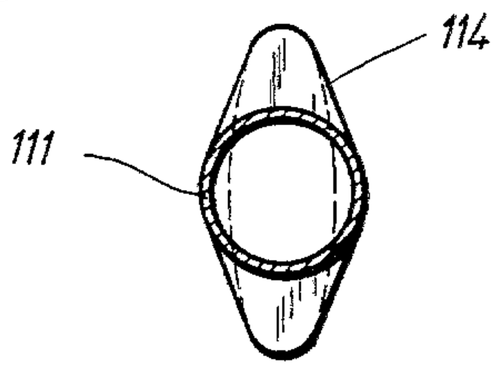


Fig. 19

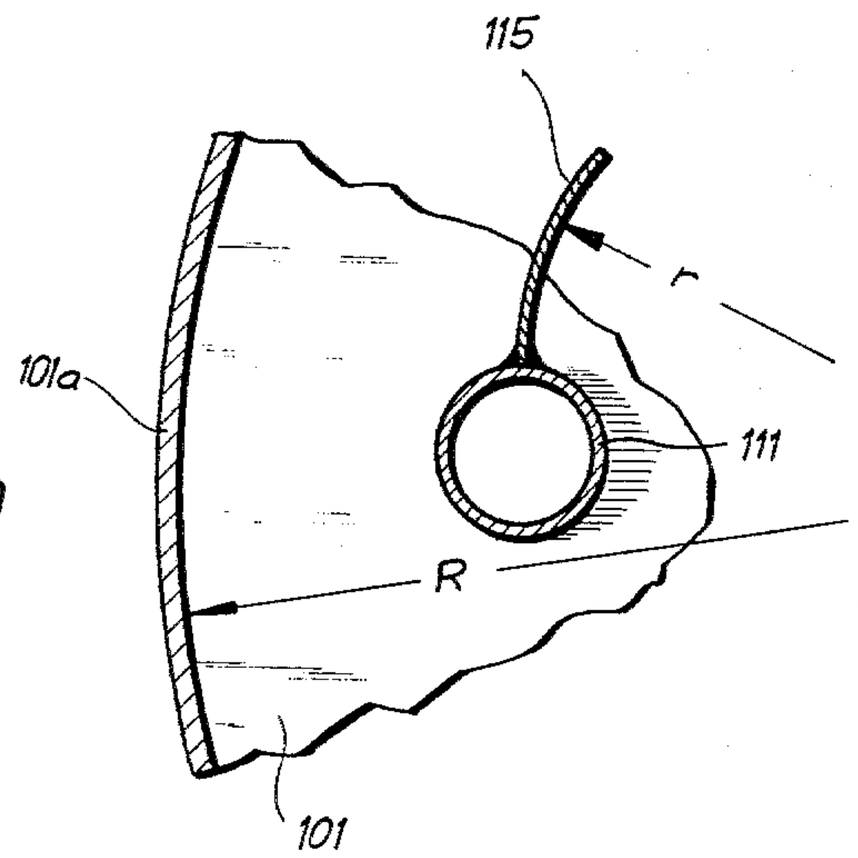
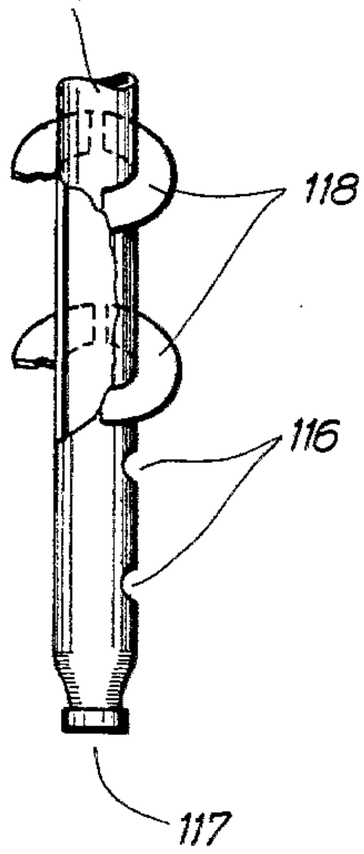


Fig. 20



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United States Patent Office

3,250,519

Patented May 10, 1966

3,250,519

MIXER, ESPECIALLY FOR SYNTHETIC MATERIALS

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Filed July 6, 1962, Ser. No. 208,028
Claims priority, application Germany, Apr. 13, 1962, V 22,339
3 Claims. (Cl. 261—93)

The present invention relates to a mixer, especially for synthetic materials and also for the chemical, pharmaceutical, and food industry, and in particular concerns a mixer comprising a mixing container with a motor driven mixing cross.

Mixers for synthetic material are known which comprise a mixing container having a pivot mounted along a circular line on the bottom of the container, while the motor driven mixing tool is provided with correspondingly arranged studs cooperating with the stationary pivot on the bottom of the container.

Furthermore, mixers are known the mixing cross arms of which work in one direction only with the cutting edge.

Also mixing devices have been suggested which employ a mixing tool having mixing arms in groups of four arranged in a plurality of horizontal planes.

In addition thereto, mixers for synthetic material have become known in which the mixing member rotating at high speed heats up the material to be mixed inasmuch as a portion of the mixing energy is transformed into heat energy. For reducing the heating period of the mixture of synthetic material and of the mixing container, a heating jacket has been employed for mixing containers which is employed either by itself or in combination with the high-speed rotating mixing member. For purposes of cooling the mixed material, a cooling medium may be passed through the jacket.

For purposes of cooling the mixed material in a mixer for synethetic material, a device has heretofore been employed which, by means of a conduit, continuously withdraws the mixed material at the lower end of the mixing container or of a separate container and passes the withdrawn material through a cyclone separator in which the mixed material is separated from air and then is again passed into the starting container into which also cooling air may be introduced. This known cooling device is rather expensive and comprises too many parts.

It is an object of the present invention to provide a mixer of the above mentioned general type in which the introduction of heat through a heating jacket will not be necessary and in which the friction between the mixing cross and the material to be mixed will furnish the required heat.

It is another object of this invention to provide a mixer as set forth in the preceding paragraph, which is relatively simple in construction and highly efficient and economical.

It is also an object of this invention to provide a mixer as set forth above which makes it possible in a relatively short time to cool the mixing material subsequent to the heating process.

It is a further object of this invention to provide a mixer for synethetic material which has a boiler-like mixing container and a mixing member arranged above the bottom of the mixing container, in which the heating as well as the cooling of the mixed material may be carried out in a minimum of time and at low costs.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 is a section through a mixer according to the present invention.

FIGURE 1*a* represents a section along the line 1*a*—1*a* of FIGURE 1.

FIGURE 1*b* is a section through the sight glass in the lid of the mixer drawn at enlarged scale.

FIG. 2 shows a top view of the mixer of FIG. 1 with the lid of the latter removed.

FIG. 3 is a section taken along the line III—III of FIG. 2, but on a larger scale than that of FIG. 2.

FIG. 4 is a section along the line IV—IV of FIG. 2, but likewise on an enlarged scale.

FIG. 5 illustrates the setting of the mixing arms.

FIG. 6 is a section along the line VI—VI of FIG. 5, but on an enlarged scale.

FIG. 7 is a section along the line VII—VII of FIG. 5, likewise on an enlarged scale.

FIG. 8 illustrates the setting of the upper mixing arms.

FIG. 9 is a section along the line IX—IX of FIG. 8, also on an enlarged scale.

FIG. 10 is a section along the line X—X of FIG. 8, but on an enlarged scale.

FIG. 11 shows a modified container with tapering edge.

FIG. 12 illustrates partly in section the cooling of the bottom and the side wall of the container.

FIG. 13 illustrates a modification of the lower portion of the container and the flanged-on motor, the seal of the shaft for the mixing cross relative to the motor housing likewise being shown.

FIG. 14 shows a modification of the seal for the shaft of the mixing cross in the container bottom.

FIG. 15 represents a still further modification of the seal for the shaft of the mixing cross.

FIGS. 15*a* and 15*b* illustrate modifications in the twisting of the mixing arms.

FIG. 16 represents a vertical section through a modified mixing container.

FIG. 17 is a section taken along the line XVII—XVII of FIG. 16.

FIG. 18 is a section through a tube employed in connection with the apparatus according to the invention.

FIG. 19 likewise represents a section through a tube with a guiding surface and shows the arrangement of the tube with regard to the container wall.

FIG. 20 illustrates a further modification of an air tube.

General arrangement

The present invention concerns a mixer construction especially for synthetic materials, which has a motor driven mixing cross and is characterized primarily in that each two mixing arms located opposite to each other with regard to the shaft for the mixing cross are located at respectively different levels, while one pair of mixing arms is provided with end faces located in a gable-like manner with regard to each other, said end faces defining an angle greater than the likewise gable-shaped back surfaces of the respective arm. The distance between the two horizontal planes in which the mixing arms are arranged may amount to from $\frac{1}{10}$ to $\frac{1}{2}$ of the height of the container. The mixing arms located in one plane are offset by 90° in the direction of rotation thereof with regard to the mixing arms in the second plane.

According to the present invention, two oppositely located mixing arms, i.e., the two upper mixing arms operate in the main working direction—mixing and heating process—with blunt, gable-like end faces, whereas in the opposite direction—cooling operation—they operate with relatively sharp back edges. The front and back surfaces

of the upper mixing arms are located symmetrically with regard to a central plane.

Furthermore, the other mixing arms which are located opposite to each other with regard to the shaft for the mixing cross, i.e., the lower mixing arms, are provided with a flat bottom side while the inclined top front surfaces form a greater angle with this bottom side than do the back top surfaces.

According to a further feature of the invention, the arms are twisted about their longitudinal axes.

The driving motor for the shaft carrying the mixing cross is directly adjacent the bottom of the mixing container so that expensive transmission means between motor and shaft for the mixing cross will be avoided. The mixing container is furthermore tiltable about a horizontal axis and may be arrested at random in its tilted position. Preferably, the motor is so arranged on the container bottom that a considerable balance of the weight between the container with contents and the motor will be obtained in tilted position of the container so that the tilting can be carried out with a minimum of force. As a result thereof, it is also possible to carry out the mixing operation at any desired inclined position of the mixing cross while the engagement with the mixing material and thereby temperature increase caused by friction will be varied. It may be added here that the heating up in the present invention may be effected and controlled by the selection of the corresponding speed of rotation of the mixing cross and/or by controlling the container jacket cooling. The mixing process as well as the temperature control can in this way easily be effected. Moreover, when reaching a desired temperature of the mixing material, the direction of the driving motor for the mixing tool may be reversed, i.e., may be rotated in opposite direction for the cooling process or for specific mixing problems.

The mixing container has a wall cooling system and bottom cooling system which, if so desired, may be controlled in unison or independently for efficient operation. For purposes of sealing the shaft of the mixing cross with regard to the motor, said shaft is provided with a centrifugal disc fixedly connected to said shaft and arranged in an intermediate chamber between the container base and the motor flange which latter is equipped with lateral outlets. For purposes of further sealing the container bottom relative to the mixing cross shaft at the level of the container bottom, the mixing cross shaft is surrounded by two metallic rings or flanges between which one or more elastic seals are provided, for instance seals of synthetic material such as polyvinyl chloride, asbestos and the like. If desired, a slide ring seal of any known type may be employed.

A particularly advantageous arrangement for heating and cooling the mixed material in a minimum of time and at low cost will be obtained when, with a mixer of the above mentioned type, at least one tube is provided which is arranged in the mixing chamber and the lower edge of which extends directly above or below the mixing member and is adapted to convey warm or cold air into or below the material to be mixed. Preferably, but not necessarily, the invention is employed where a heating-up of the material to be mixed is already effected due to the design of the mixing member and/or in view of the speed of rotation thereof.

In connection with the rotary movement of the mixing member, care is to be taken that the warm or cold air will intimately contact the material to be mixed. This arrangement is advantageous inasmuch as the drying of the mixed material may favorably be influenced by the fact that the introduced warm air has a low humidity content.

It is furthermore of great importance that the introduced air forms an air cushion below the material to be mixed. This cushion may be so designed that it takes up the space of the mixing member more or less completely. At peaks of energy requirement for the mixing member, namely when the mixer starts and at a certain stage of the load, as for instance when the material is being plasticized, addition of liquids, and the like, it is, therefore, possible to introduce into the mixing chamber such a quantity of air that the mixing member will operate in the air cushion in which, however, also a certain quantity of material to be mixed is present. The resistance due to the smaller quantity of material to be mixed will then permit the mixing member to operate at low energy requirement which may be less than 50% of the heretofore necessary energy requirement.

Another important factor is seen in that the mixing material when moving around the longitudinal axis of the container will continuously contact the tube or the tubes. When employing a plurality of tubes, the same may be arranged symmetrically with regard to the axis of rotation of the mixing member. The tubes may be connected to the container lid or they may be mounted on a tubular elbow connected to the container wall. The design of the tubes may be so selected that their lower end has a flat mouth. In order to obtain a radial change in direction or to influence the movements of the material being mixed with regard to the tubes or the mixing member, the tubes may be provided with guiding surfaces and/or with attached guiding plates. Furthermore, the tubes may be rotatable about their longitudinal axes.

In order to improve the effect of blowing air below the material to be mixed, it is advantageous to employ a disc which is preferably round and is so mounted on the mixing member that it will carry out the same revolutions as the mixing member and parallel to the plane of movement thereof. A disc of this type preferably has a diameter of approximately 50% of the inner diameter of the mixing container. However, the disc must not cover up the opening of the blowing tube inasmuch as this would affect the entire effect. In view of the high speed of rotation of the mixing member of the mixer for synthetic material, the vertical rotation of the material to be mixed is effected by the fact that, due to the centrifugal force, said material is driven toward the wall of the mixing container. As a result thereof, a central free space in the container is obtained through which the air may escape from below the material to be mixed into the space above said material. This, however, is prevented by the above mentioned disc according to the invention.

In particular, with relatively heavy material to be mixed, and at low filling of the container, the above mentioned disc has proved highly advantageous in bringing about the above mentioned effect of the air cushion.

In addition thereto, the said disc is adapted to relieve the mixing member when mixing material is involved which is difficult to mix, is plastic or paste-like. It will be appreciated that in this instance the disc helps in carrying the material to be mixed.

Strtuctural arrangement

Referring now to the drawings in detail and FIG. 1 thereof in particular, the mixer shown therein comprises a container **10** below which there is arranged a motor **11** for driving the mixing cross **12** in said container **10**. The container **10** has vertical side walls **10***a* and a nearly horizontal bottom **10***b* through whhich shaft **13** extends which is drivingly connected to said motor **11** and which carries the mixing cross **12**. The container **10** is adapted to be closed by a lid **14** which latter is equipped with a sight glass **10***c* which, in a manner known per se, may also be designed as a relief valve. The lid **14** is furthermore provided with a funnel **10***d* having an adjusting screw **10***e* for adding a softener by drops. As softener in this connection may be used softeners well known to all those skilled in the art.

The motor may be directly connected to the container **10** or to the base **30** thereof. The motor **11** is provided with a groove **31** engaged by lateral arms **32** having their ends bent at a right angle so as to form arms **33**. These arms **33** are by means of bolts **35** journalled in walls **34**.

One of the arms has an extension **36** and carries a pivot **37** adapted to have its free end engage bores **38** in a wall **34** in conformity with the tilted position of container **10**. In this connection, it may be mentioned that the container **10** is tiltable about pivots **35**. Container **10** is located above the pivots **35** while at least the major portion of motor **11** is located at a level substantially below said pivots.

The mixing cross **12** has two upper arms **15, 16** located in the same vertical plane (see FIG. 2) and also in the same horizontal plane *u* (see FIG. 1). In addition thereto, the mixing cross **12** has two lower arms **17, 18** (FIGS. 1 and 2) which are located in a second vertical plane *b* perpendicular to the said vertical plane of arms **15** and **16**. The two lower arms are also located generally in a second horizontal plane *v* below horizontal plane *u*. The upper arms **15, 16** are vertically spaced from the lower arms **17, 18** by a distance which amounts to approximately one-tenth to one-half of the container height. The mixing arms **15, 16** have a cross section of a contour shown in FIG. 3. As will be seen therefrom, the front side of said mixing arms **15, 16**, i.e., that side which, during the mixing operation is located in the direction of rotation, is formed by two end faces **19, 20** which are gable-shaped. The mixing arms are furthermore provided with two substantially parallel surfaces **21, 22**, whereas the back side of arms **15, 16** is formed by surfaces **23, 24** tapering with regard to each other in outward direction. As will be evident from the drawings, the surfaces **19, 20** include therebetween an angle α which is greater than the angle β confined by the surfaces **23, 24**. The surfaces **19, 20** and **23, 24** are located symmetrically with regard to a common central plane **25**.

The lower mixing cross arms **17, 18** have a flat bottom side (FIG. 4) and an intermediate surface **27** parallel thereto. The end face **28**, which during normal rotation of the mixing cross is located in front, forms with the bottom side **26** an angle γ. The angle γ is greater than the angle α formed by the inclined back side **29** with the bottom side **26**.

The arms **17, 18** are twisted from their inner end, i.e. from that end facing the mixing cross shaft **13**, and this twist extends about the longitudinal axis of said arms to the outer end thereof. While at the level of line VI—VI in FIG. 5 the mixing arm **18**, for instance, has the position shown in FIG. 6 with regard to a horizontal **40***a*, it will be seen from the drawing that the same arm at the level of line VII—VII of FIG. 5 has a position as it is illustrated in FIG. 7. The bottom side **26** forms an angle ϵ_1 with the horizontal **40***a*. The arms **15, 16** may be twisted in a similar manner. At the level of the line IX—IX in FIG. 8, the central plane **25***a* (FIG. 9) of arm **15** is horizontal and with regard to the surfaces **19, 20** and **23, 24** is substantially symmetrical. At the level of line X—X in FIG. 8, arm **15** has a twist (FIG. 10) at which the central plane **25***a* forms an angle ϵ_2 with the horizontal **40***b*.

FIG. 11 shows an advantageous embodiment of a container according to the invention in which the upper marginal section **10***c* tapers inwardly whereby the mixing material circulating in the direction of the arrows A does not permit the formation of dead zones where residues could settle.

FIG. 12 shows a section of a container wall **10***d* and also shows a section of a bottom **10***e*. These walls confine therebetween the cooling chambers **41, 42** which may selectively be put into operation.

Container **10** is provided with a device **43** (FIG. 1) which is a kind of thermostat adapted in response to a certain temperature of the mixing material having been reached, to automatically reverse the direction of rotation of the drive motor **11** for the mixing cross **12**. Simultaneously, there may be provided a speed control and a signalling device for the cooling water control or an automatic cooling water control. The motor is sealed with regard to the mixing container. To this end, according to the embodiment of FIG. 13, the base **30** has connected thereto the flange **31** of motor **11** while an intermediate chamber **44** is formed. This intermediate chamber has discharge passages **45** provided in the flange **31**. Shaft **13** of the mixing cross has at the level of the intermediate space **44** a plate **46**, the rim of which is preferably downwardly bent at **46***a* where it extends around an elevation of the flange. If the mixing material should escape from container **10** and pass along shaft **13**, it will be caught by the dish-shaped plate **46** tightly keyed to shaft **13** and will be thrown outwardly to pass through discharge openings **45** from the intermediate chamber **44**. By providing a corresponding pan below passage **45**, the leak-out substance may be caught. The dish-shaped plate **46** may, if desired, also have a conical shape.

For purposes of sealing the container **10**, the embodiment shown in FIG. 14 has proved advantageous. According to this embodiment, at the level of the mixing cross shaft **13** there is provided in the bottom **10***b* a sleeve **47** having an inner bore **48**. Said bottom **10***b* is formed by the two wall portions **100'**, **101'** and the intermediate cooling chamber **102'**. A metal ring **49** which is softer than shaft **13** is inserted into bore **48**. Between said ring **49** and flange **50** of the sleeve there are inserted two elastic seals **51, 52**. These seals may consist of any suitable synthetic material such as polyvinyl chloride or asbestos or the like.

A further seal of the container **10** may be effected by the embodiment of FIG. 15 according to which the mixing cross shaft **13** carries an annular disc **53** which has its outer marginal portion **54** bent downwardly. While the section **55** is resiliently bent near shaft **13** and presses said marginal portion against sleeve **47**, the edge **56** of the outer marginal portion grinds itself into the sleeve whereby a good seal will be obtained.

While for purposes of mixing and simultaneously heating the mixing material, the mixing cross **12** is rotated in the direction of the arrow **63** (FIG. 2) so that the respective steeper end faces **19, 20** and **28** of the mixing arms will be located in front in the direction of rotation, and the less steeply inclined surfaces **24, 25** and **29** will form the back sides when looking in the direction of rotation. It is possible for purposes of cooling, to reduce the speed of rotation of the mixing cross and to reverse the direction of rotation of said mixing cross. In this way, the less inclined surfaces will form the front surfaces of the mixing arms when looking in the direction of rotation. As indicated above, the container **10** may be tilted.

If necessary, the twisting of the mixing arms may be effected in a different direction than is illustrated in FIGS. 5 and 10 so that the angles ϵ_1 and ϵ_2 in FIGS. 7 and 10 will be located below the horizontal **40***a*, **40***b* (see FIGS. 15*a* and 15*b*).

Referring now to the modification illustrated in FIGS. 16 and 17, it will be noted that the mixing member generally designated **103** is arranged in the boiler-shaped mixing container **101** which is adapted to be closed by a lid **102**. The said mixing member **103** comprises a mixing blade **104** arranged above the container botom, and a further or second mixing blade **105** which is located at a somewhat higher level. The mixing member **103** is driven by a motor **106** and is adapted in view of its high speed of rotation to heat up the material to be mixed. The container **101** rests in a manner known per se on a base **107** which is mounted on a rotatable frame **108**. Frame **108** is tiltable about bolts **109** and can be arrested in its respective position by bolt **110**. In FIG. 16 disc **105***a* is positioned above the upper blade **105**.

One or a plurality of tubes **111** adapted to convey warm or cold air extend into the mixing contaainer **101**. The said tubes **111** may either be connected to the lid **102** or may be connected to an elbow member **112** which is mounted in the wall **101***a* of the container. Selectively

hot air or cold air may through conduits **113** be introduced into the tubes while the discharge of the air will be effected in a manner described further below. As will be seen from the drawings, the free ends **111***a* of the tubes extend downwardly directly above the mixing member, i.e. above the mixing blade **105**. A plurality of tubes **111** are advantageously arranged symmetrically with regard to the axis of rotation of the mixing member as indicated in FIG. 17 according to which the tubes are arranged so as to form the corners of a triangle. However, also any other arrangement may be suitable.

Preferably, the tubes **111** have over the major portion of their length an annular flattened or elliptical cross section and at their lower end end in a flattened mouth **114** as shown in FIG. 18.

The tubes **111** may also have a cross sectional restriction at their lower end in order to thereby accelerate the air being discharged. The tubes **111** may furthermore be provided with a guiding surface or an attached guiding blade **115** which may be of curved shape. In view of this design of the tube **111**, a change in the direction of the material to be mixed radially of the container is obtained in such a way that the said material will be conveyed toward the central axis of the container or in opposite direction. Particularly when the tubes are rigid and are connected to the lid (FIG. 16), the tubes may be rotatable about a longitudinal axis, by means not shown, so that the extent and the direction of the change in the movement in the said radial direction of the material to be mixed will be adjustable. To this end the tubes may have spiral rib means **118** theron. If desired, tubes may also be provided with smaller discharge openings **116** as illustrated in FIG. 20, said openings being provided laterally in the tubes. Thus, in addition to the lower discharge openings **117**, there are provided openings through which the air jet may be discharged also in radial direction of the tube in order to heat up the material to be mixed or to cool the same. In view of the discharge of the warm or cold air through the openings **117** at the lower end and in axial direction of the tubes, it is possible to create a more or less strong air cushion at the level of the mixing member **103**. It is in this air cushion that the mixing member may rotate at low energy requirement when the material to be mixed due to warming up, plasticizing or during the starting of the machine has reached a condition which would necessitate a high power requirement.

For purposes of improving the effect, the disc **105***a* is mounted directly on the mixing member and screwed together with the latter to the driving shaft **103**. Air from below of the material to be mixed will be prevented to a greater extent from escaping when said material during the operation of the machine is driven against the wall of the container. Furthermore, this disc may aid in supporting the material to be mixed and thereby relieve the mixing member.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings, but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In a mixer, especially for mixing synthetic materials, a container for receiving the material to be mixed, a reversible motor beneath said container, a shaft drivingly connected to said motor and extending upwardly through the bottom portion of said container, a first pair of mixing arms in said container connected to and respectively located on opposite sides of said shaft, a second pair of mixing arms in said container connected to and respectively located on opposite sides of said shaft but vertically spaced from said first pair of mixing arms, the longitudinal edges of the arms of one of said pairs of mixing arms being tapered in such a way that the angle on the front edge of each of the arms when looking in the normal direction of rotation of said last mentioned pair of arms is greater than the angle on the rear edge of each of the respective arms, and thermostatic means arranged in said container and adapted for being operatively connected to said motor for reversing the direction of rotation of said motor and thereby of said shaft in response to a certain temperature within said container.

2. A mixer, especially for mixing synthetic materials, which comprises: a container for receiving the material to be mixed, a rotatable shaft extending through the bottom of said container, mixing arms mounted on said shaft within said container, a disc mounted on said shaft above said mixing arms, a plurality of tubular means respectively having an inlet and an outlet, at least the major portion of said tubular means being arranged within said container and having their outlets extending to points directly above said disc, the outer diameter of said disc being less than the distance between the discharge ends of said tubular means, means to connect the inlets of said tubular means with air of a desired condition for selectively heating up and cooling the material to be mixed in said container, said tubular means being arranged symmetrically with regard to the axis of rotation of said shaft and the center of said disc.

3. A mixer according to claim **2** in which each said tubular means includes means operable to divert material radially of the container in response to movement of the material over said tubular means in the circumferential direction of the container.

References Cited by the Examiner

UNITED STATES PATENTS

117,446	7/1871	Mulholland	259—134
1,409,112	3/1922	Jones	259—134
1,521,873	1/1925	Dunham	259—107
1,737,624	12/1929	Thomson	261—93
1,760,058	5/1930	Hennebutte et al.	261—93
2,187,746	1/1940	Lefevre	261—87
2,193,934	3/1940	Moores	261—87 X
2,246,560	6/1941	Weinig et al.	261—93
2,513,254	6/1950	Savage	259—107
2,646,237	7/1953	Hinesman	248—13
2,757,909	8/1956	Wayne	259—107
2,801,083	7/1957	Balassa	261—93 X
2,836,589	5/1958	Allen et al.	261—93 X
2,926,002	2/1960	Spielvogel	259—108
2,945,634	7/1960	Beck et al.	259—107
3,024,010	3/1962	Sperling	259—134
3,046,584	7/1962	Wepfer	15—22
3,064,950	11/1962	De Laria	259—108
3,133,976	5/1964	Gross	261—93 *X*
3,139,917	7/1964	Elmore	259—107 X

FOREIGN PATENTS

1,060,317 11/1953 France.

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