United States Patent

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[54] **MIXING MACHINE**
13 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **259/43**
[51] **Int. Cl.** **B01f 15/02**
[50] **Field of Search** 259/7, 8, 43, 44, 95, 107, 108, 23, 24, 66, 67, 96, 103, 102

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ABSTRACT: A mixing machine for a flowable material is provided with a mixing vessel from the horizontal bottom wall of which extends downwardly a hollow cylindrical guide provided with a lateral discharge nipple. A tubular housing extends slidably through the guide and extends with its upper end into the mixing vessel and is covered at this upper end by an annular funnel-shaped member and below the same has radial discharge apertures. A motor driven rotor in the upper part of the annular housing discharges the material fed into the funnel through the radial discharge apertures which in one adjusted position of the housing communicate with the interior of the mixing vessel while in another adjusted position of the housing communicate with the discharge nipple on the hollow cylindrical guide.

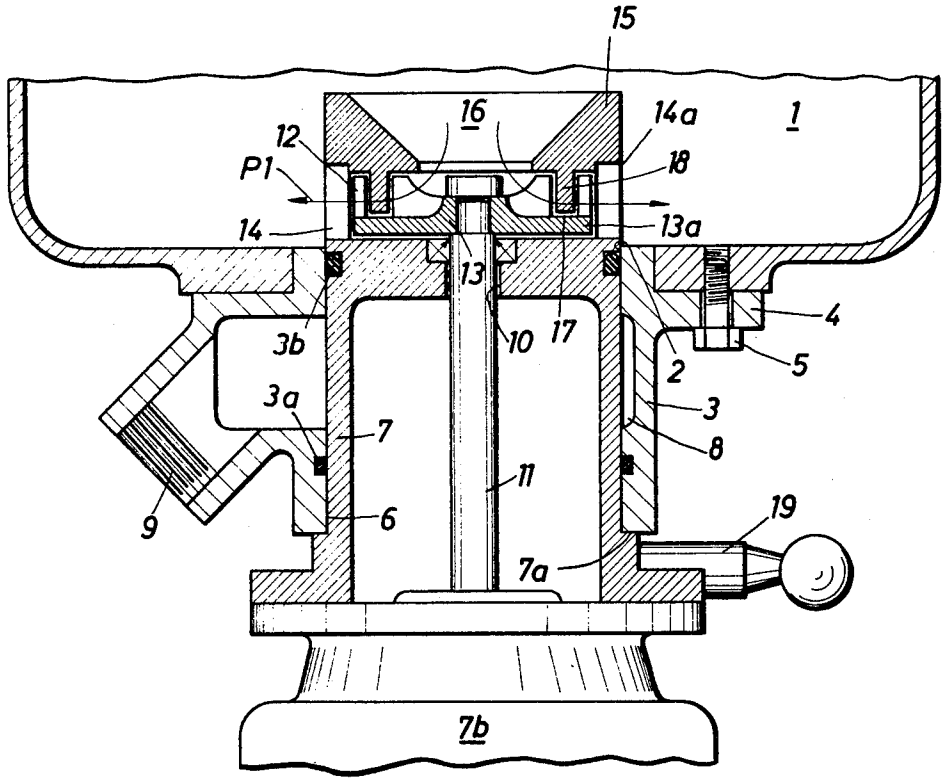

Fig. 1

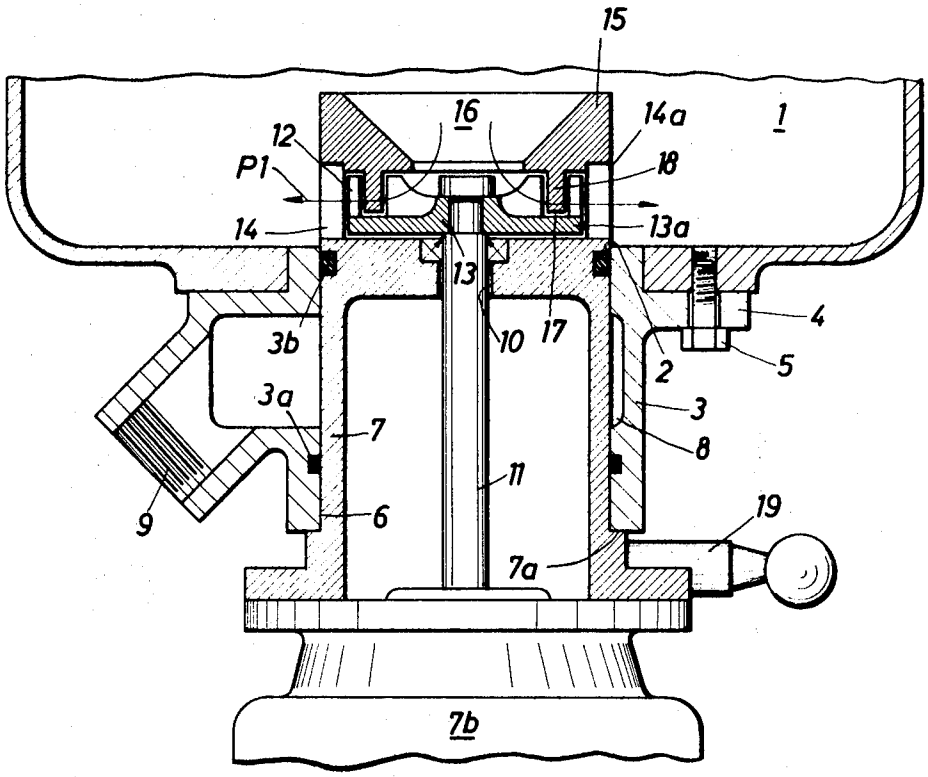

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Fig. 2

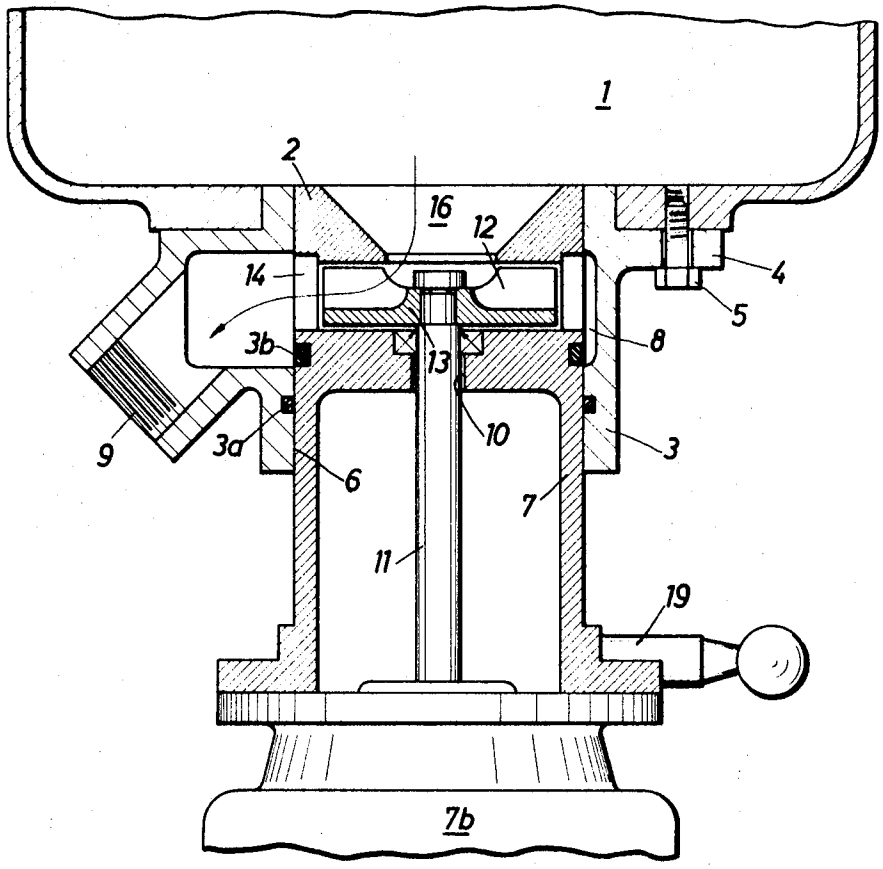

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Fig. 3

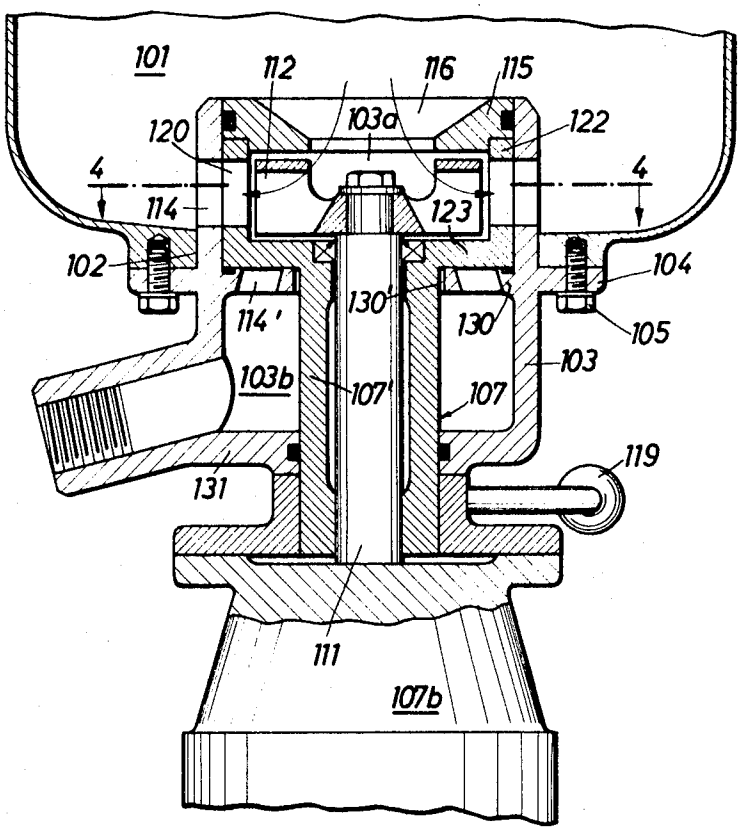

Fig. 4

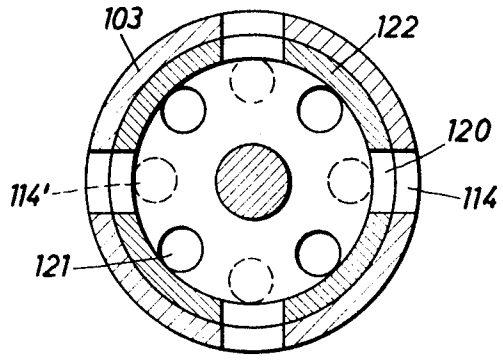

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Fig.5

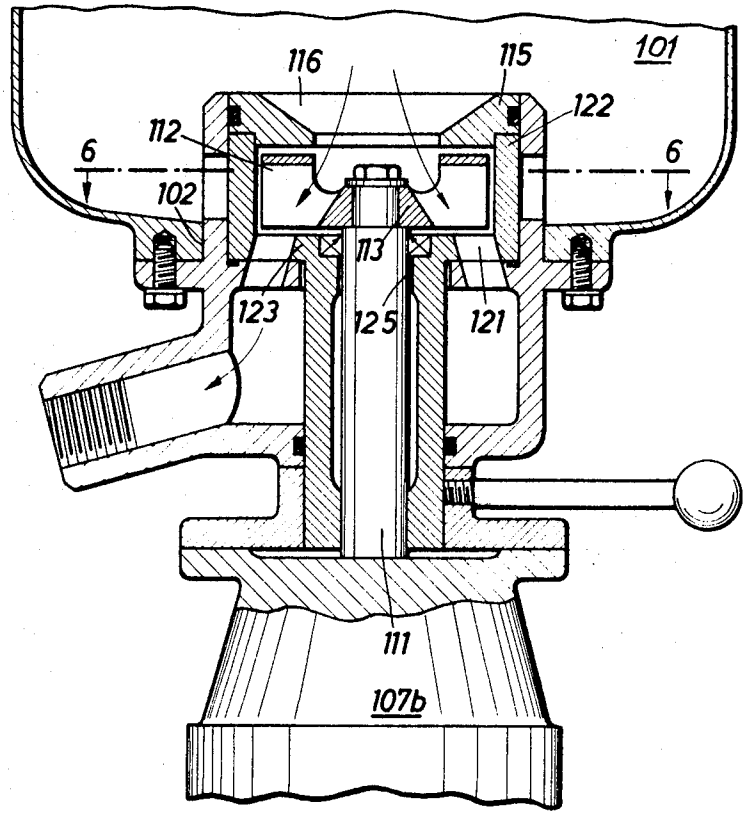
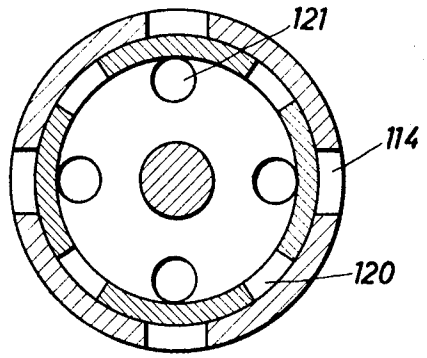


Fig.6



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MIXING MACHINE

In one embodiment of the invention the housing with its funnel-shaped feed member and the motor-driven rotor is axially adjustable as a unit relatively to the hollow cylindrical guide.

In another embodiment of the invention the housing with its associated parts, namely the feed member and rotor is rotatably adjustable relatively to the hollow cylindrical guide.

The invention relates to a mixing machine for flowable material to be mixed and is provided with a mixing vessel and a mixing device which performs a revolving of the material to be mixed in the vessel by means of a rotor and is provided with a housing surrounding the rotor in such a manner as to form at least one intake or suction aperture, and one or more discharge apertures.

In such mixing machines, the mixing devices are customarily arranged in a predetermined position in a mixing vessel and withdrawn in a manner similar to that of a rotary pump, the mixed material from the vessel and expel it through a discharge aperture in the surrounding housing and back into the vessel, so that a revolving current for enhancing the mixing of the material is created, whereby, depending upon the construction of the rotor and the housing, a more or less thorough crushing or disintegration of the solid parts of the material to be mixed and an emulsifying action may take place. In these known devices in which for the preparation of salves, cremes and emulsions the disintegration is often required of the ingredients of the material to be mixed, which devices may also be required to perform an emulsifying action, it is not at all assured that the entire material in the mixing vessel takes part in the revolving movement. Therefore, it has been proposed heretofore to arrange the mixing device in the vessel in such a manner that it may be moved upwardly and downwardly depending on whether the height adjustment of the device communicates with higher or lower disposed ranges of the material to be mixed in the vessel. Also in this type of construction there is no assurance that the entire material to be mixed passes through the mixing device.

The principal object of the invention is now a mixing device which performs an intensive revolution of a flowable material to be mixed in a vessel which also serves as a discharge device for emptying the mixing vessel, whereby the withdrawn or discharged material, if desired, is returned to the mixing vessel, if this is necessary for a particularly intensive mixing of the material being mixed.

This object of the invention is obtained by adjusting the housing or a portion of the same in a guide member which is provided with a discharge nipple and has the mixing vessel attached thereto, said adjustment taking place relatively with respect to the mixing vessel in such manner that the material to be mixed in one position of the housing is revolved within the mixing vessel and in another position of the housing is discharged from the mixing vessel into the discharge nipple connected to a discharge pipe, and that for the adjustment of the housing an adjusting device is provided.

In one embodiment of the invention the rotor of the mixing device together with the nonrotatably mounted housing surrounding the rotor is slidably displaced along the rotor axis in such manner that in the mixing position of the rotor a number of discharge apertures in the housing which communicate at least partly with the mixing vessel are movable into a discharge position in which these apertures with their entire cross section or parts thereof communicate with the discharge nipple.

In another embodiment of the invention the housing surrounding the rotor is rotatable about the rotor axis in the guide element, which latter is provided with a number of first discharge apertures communicating with the mixing vessel, while a number of second discharge apertures communicate with the discharge nipple. The housing is provided with first and second passages corresponding to said first and second discharge apertures, whereby the first and second passages in the mixing position of the housing are in alignment with said first discharge apertures and in the discharge position of the

housing are at least in part in alignment with said second discharge apertures.

In both embodiments of the invention, the material or a part thereof is mixed in the vessel by the mixing device which also is used for emptying the vessel. The entire material in the vessel is subjected to an additional mixing operation during its discharge from the vessel, whereby when during the emptying of the vessel the discharge apertures leading to the discharge nipple are only partly open, it is possible to increase the homogenizing, emulsifying and/or disintegrating action.

A substantial advantage of the device of the invention is that all of the operation and results are obtained at costs which are substantially lower than the costs of devices which employ separate discharge pumps for emptying the mixing vessels.

These and other objects of the invention will be further described in the following description with reference to the accompanying drawings which illustrate by way of example two embodiments of the mixing machine of the invention.

In the drawings:

FIG. **1** illustrates a vertical axial section of a mixing machine whose mixing device is adjusted to be in its mixing position.

FIG. **2** illustrates a vertical axial section of a mixing machine similar to FIG. **1**, except that the mixing device is adjusted to be in its discharge position and that the vanes of the mixing device are differently constructed;

FIG. **3** illustrates a vertical axial section of a modified mixing device in its mixing position;

FIG. **4** is a cross-sectional view along line **4–4** of FIG. **3**;

FIG. **5** is an axial sectional view of the mixing device illustrated in FIG. **3** with the mixing device in its discharge position; and

FIG. **6** is a cross-sectional view along the line **6–6** of FIG. **5**.

Referring to the drawing, FIG. **1** illustrates a mixing device with a mixing vessel **1** in the center of the horizontal bottom wall of which is arranged an aperture **2** in which a vertical tubular guide **3** is inserted. This guide **3** has an outwardly extending horizontal circumferential flange **4** which by screw bolts **5** is attached to the bottom wall of the mixing vessel **1**. The bore **6** of the tubular guide **3** has a tubular housing **7** slidably mounted in vertical direction. Between the cylindrical outer wall of the housing **7** and the wall of the bore in the guide **3** is arranged an annular space **8**, which is in communication with a discharge nipple **9** connected to a not illustrated discharge pipe.

In this embodiment of the invention, an annular groove is arranged below the annular space within the bore of the guide **3** in which a sealing element **3***a* is disposed. Another sealing element **3***b* is disposed in an annular groove above the annular space in the outer circumference of the housing **7** and forms a seal between the housing and the guide, so that in the mixing position, the mixed material cannot enter the annular space **8** and the discharge nipple is sealed off.

The housing **7** has centrally arranged sealed passage **10** for a vertical shaft **11** at the upper free end of which is mounted a rotor **13** provided with radial vanes **12**. The vanes **12** are arranged on the upper face of a rotor disc **13***a*. The disc **13***a* is covered by a circular intake member **15** arranged above the disc in axial alignment therewith and connected with the housing **7** by vertical bars **14**. The intake member **15** has a centrally disposed intake funnel **16** which is conically reduced toward the rotor **13**. The spaces between the bars **14** form discharge apertures **14***a*.

In the embodiment of the invention illustrated in FIG. **1**, all of the vanes **12** have recesses **17** into which projects an annular rib **18** provided on the lower face of the intake member **15**. This annular rib **18** has a number of interruptions. The vanes and the annular rib cooperate to cause a fragmentation of the material to be mixed passing through these parts.

The radial vanes may also have the shape shown in FIG. **2** in which the vanes have no recesses. The vanes, indeed, may have any other desired form.

The lower end of the tubular housing **7** has an outwardly extending flange to which a corresponding flange on a motor **7***b*

is secured which rotates the shaft 11 and therewith the rotor 13.

A diagrammatically illustrated adjusting device 19 serves the purpose of performing a vertical sliding movement of the tubular housing together with the rotor between an upper mixing position and a lower discharge position and in any desired position between these upper end lower positions. This adjusting device which supports the mixing device and can lock the mixing device in any desired position between its upper and lower end positions is not disclosed in all its details, because the operation of the same is known to every expert in the art, and may have various constructions.

When the device is operated in its mixing position, i.e. when the discharge apertures are in communication with the interior of the mixing vessel, then the material to be mixed enters the intake funnel 16 and is conveyed by the rotor 13 through the discharge apertures back into the mixing vessel, so that a revolving and mixing of the material takes place, as indicated by the arrow P 1.

In the embodiment illustrated in FIG. 1 the upward movement of the rotor of the housing and the intake member 15 connected with said housing is limited by an outwardly extending annular shoulder 7*a* at the lower end of the housing 7.

There is, however, also an arrangement possible and contemplated in which the rotor with its associated parts is moved beyond the position shown in FIG. 1 into the mixing vessel, so that particularly difficult to mix components may be grasped by the rotor and revolved at different levels within the mixing vessel.

The adjusting device 19 may continuously move the rotor 13 together with the associated parts also in a position below that shown in FIG. 1 until the discharge position shown in FIG. 2 is reached. In the intermediate positions between the upper mixing position and the lower discharge position, the discharge apertures are partially covered up, so that the passage of the material during revolving and also during the discharging operation is throttled. This results in a stronger effect of the vanes on the material being mixed and contributes to a controlled crushing or fragmentation of the lumps which may be in the material. In the discharge position of the device, the throttling effects also a change of the stream of material in the discharge pipe which is independent of the speed of rotation of the rotor. Therefore the device may function as a valve arranged in the discharge pipe.

Furthermore, intermediate positions of the rotor are possible in which the discharge apertures are still partially in communication with the mixing vessel, while they in other respects already partially communicate with the discharge pipe.

The motor 7*b* may for instance consist of a pole-changing electric motor.

The FIGS. 3 to 6 illustrate an embodiment of a mixing device in accordance with the invention in which a guide 103 is inserted in a central aperture 102 in the bottom wall of the mixing vessel 101. The guide 103 has an outwardly extending flange 104 which is attached with bolts 105 to the bottom wall of the mixing vessel 101. The guide 103 has a substantially hollow cylindrical form and by a horizontal partition 130 is divided into an inner hollow section 103*a* and a lower hollow section 103*b* provided with a discharge nipple 109. A hollow cylindrical housing section 107′ extends through the lower cylindrical section 103*b* and is rotatable in an aperture 130′ of the partition 130 and in an oppositely arranged wall 131 of the section 103*b*. A sealing element 132 is arranged between the wall 131 and the housing section 107′.

The housing section 107′ extends up to the inner section 103*a* and at this point is provided with a substantially circular bottom part 123 which slidably engages the upper face of the partition 130. The outer circumference of the bottom part 123 is formed by a cylindrical wall 122 extending upwardly from the bottom part 123. An inlet body 115 is placed on top of the cylindrical wall 122 whose outer circumferential face is sealed against the inner circumferential face of the guide section 103*a*. The inlet body 115 may be secured to the wall 122 or to the guide 103. In the last case, the inlet body 115 having a conical inlet aperture 116 rotates with the parts 107′, 122 and 123 forming the housing 107.

The aperture 116 of the inlet body 115 forms a feed funnel which conducts the material to be mixed into a chamber formed by the hollow cylindrical wall 122, the bottom wall 123 and the inlet body 115 and in which a rotor 113 with vanes 112 is rotatably mounted. The rotor 113 is secured to the upper end of a vertical shaft 111 extending through the housing section 107′, while the lower end of the shaft is attached to the motor 107*b*.

In the mixing position of the device, as illustrated in FIG. 3, the material to be mixed is conducted by the feed funnel 116 into the motor-driven rotor 113 and is returned to the mixing vessel 101 by the first apertures 120 in the hollow cylindrical wall 122 and the first discharge apertures 114 in the guide 103.

The only schematically illustrated adjusting device 119 may rotatably adjust the housing 107 relatively to the guide 103 about its vertical longitudinal axis, for instance from the mixing position shown in FIGS. 3 and 4 to the discharge position shown in FIGS. 5 and 6, in which latter position the second apertures 121 in the bottom wall 123 come into alignment with the second discharge apertures 114′ in the horizontal partition 130. In the last-mentioned position, the mixed material is directed by the feed funnel 116 through the rotor in the guide section 103*b* into the discharge nipple 109.

Also in the embodiment illustrated in FIGS. 3 and 4, intermediate positions between FIGS. 3 and 4 and FIGS. 5 and 6 are possible, so that discharge positions may be selected in which the discharge stream is more or less throttled and in which the suitably constructed rotor acts more or less effectively on the material to be mixed, so that a controllable disintegration and/or emulsifying action may be performed.

The material in the mixing vessel has to pass the rotor necessarily during the emptying of the vessel so that during the disintegration, emulsification and the like, a highly uniformly mixed material is produced.

In the embodiment illustrated in FIGS. 3 to 6, the motor 107*b* may either be rotatable with the housing 107 or in other manner may be fixedly supported. It is also possible to make the device tubular so that the same with the feed body 115 foremost may be slidably inserted in any desired direction, for instance, from above or from below, more or less into a mixing vessel. The guide section 103*b* would be in communication with a discharge pipe which concentrically surrounds or extends parallel to a possible very long shaft 111.

What I claim is:

1. A mixing machine for flowable material to be mixed and provided with a mixing vessel and a mixing device comprising a rotor for revolving the material in said mixing vessel and a housing surrounding said rotor and rotatably supporting the same, said housing having at least one inlet aperture and one or more discharge apertures, wherein the improvements comprise a hollow guide attached to the mixing vessel, means slidably attaching said guide to said housing, a discharge means on said guide, and means for adjusting said housing relatively to said vessel and said guide attached thereto so that in one end position of said housing the material is revolved in said mixing vessel by said rotor, while in another end position of said housing the mixed material is discharged from said mixing vessel by said rotor through said discharge apertures into said discharge means.

2. A mixing machine according to claim 1, in which said means for adjusting said housing comprising means which adjust said housing and said motor and rotor in axial direction relatively to the axial direction of said mixing vessel and said guide attached thereto, whereby the discharge apertures in said housing are adapted to be selectively brought into communication with the interior of said mixing vessel and with said discharge means on said guide.

3. A mixing machine according to claim 1, in which said housing comprises a tubular member, one end of which ex-

tends into said mixing vessel while the other end of said housing has a motor attached thereto for driving said rotor.

4. A mixing machine according to claim 1, including a member comprising an inlet funnel arranged within said mixing vessel and attached to a portion of the housing extending into said mixing vessel while another portion of said housing being surrounded by said hollow guide, said member having a circular circumference and is adapted to be axially moved with said housing in sliding engagement with the interior wall of said hollow guide when said housing is moved to discharging position.

5. A mixing machine according to claim 1, in which said means for adjusting said housing permits an arresting of the same in any position between said two mentioned end positions.

6. A mixing machine according to claim 1, in which said means for adjusting said housing comprises means for rotatably adjusting said housing relatively to said hollow guide which is arranged to surround said housing, said hollow guide being provided with discharge apertures which are in communication with the interior of said mixing vessel and which in the mixing position of said housing are in registration with corresponding apertures in said housing, said last-named apertures upon a rotative adjustment of said housing being adapted to be moved gradually out of registration with said discharge apertures, said housing having other apertures which when said discharge apertures of said guide are closed by said housing are in communication with said discharge means.

7. A mixing machine according to claim 6, in which said housing has a hollow cylindrical wall which surrounds said rotor and that said apertures are arranged in said cylindrical wall which is surrounded by a cylindrical wall of said hollow guide having said discharge apertures therein, and that superimposed plane annular walls of said housing and said hollow guide and through the center of which extends a shaft carrying the rotor are provided with apertures adapted to be moved upon relative rotative adjustment of housing and guide in and out of registration for establishing communication between the interior of said mixing vessel and said discharge means via said rotor.

8. A mixing machine according to claim 7, that the end face of said annular wall of said housing has mounted thereon an annular member provided with a central conical aperture serving as a funnel for feeding the material to be mixed in said mixing vessel to said rotor.

9. A mixing machine according to claim 7, including means to secure said motor to the end of the housing which is disposed opposite the end of the housing which is provided with said hollow cylindrical wall.

10. A mixing machine according to claim 7, in which the apertures in said plane annular walls of said housing and said hollow guide are of substantially the same size.

11. A mixing machine according to claim 7, in which the apertures in said hollow cylindrical wall of said housing and in the surrounding cylindrical wall of said hollow guide are substantially of the same size.

12. A mixing machine according to claim 7 including sealing members between the cylindrical walls of said housing and said hollow guide.

13. A mixing machine according to claim 6, in which said housing has a hollow cylindrical wall which surrounds said rotor and that said apertures are arranged in said cylindrical wall which is surrounded by a cylindrical wall of said hollow guide having said discharge apertures therein, and that superimposed plane annular walls of said housing and said hollow guide and through the center of which extends a shaft carrying the rotor are provided with apertures adapted to be moved upon relative rotative adjustment of housing and guide in and out of registration for establishing communication between the interior of said mixing vessel and said discharge means via said rotor, said annular member being fixedly attached to said annular wall of said housing to rotate therewith.