Nov. 5, 1963 C. J. NAUTA 3,109,633

MIXING APPARATUS

Filed June 1, 1960

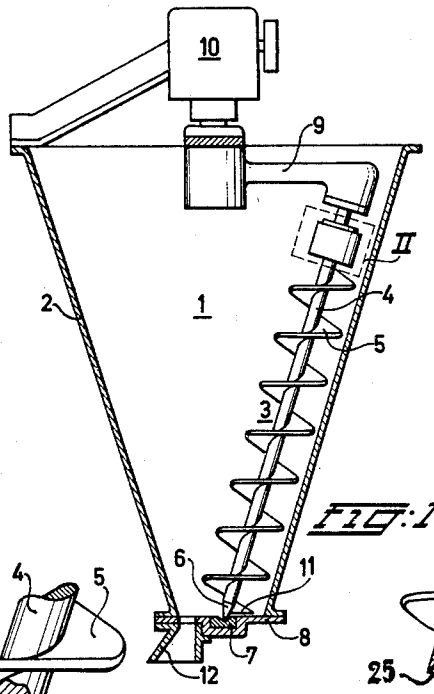


FIG. 1.

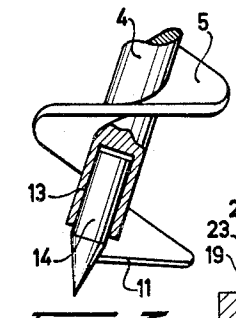


FIG. 3.

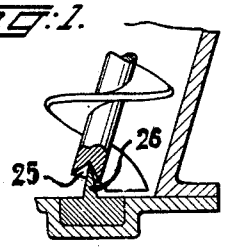


FIG. 4.

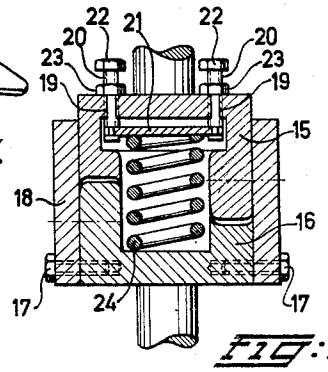


FIG. 2.

INVENTOR.

CONSTANT JOHAN NAUTA

BY Arnold Robinson

ATTORNEY

United States Patent Office 3,109,633 Patented Nov. 5, 1963

3,109,633

MIXING APPARATUS

Constant Johan Nauta, Overveen, Netherlands, assignor to Nautamix N.V., Haarlem, Netherlands, a limited-liability company of the Netherlands

Filed June 1, 1960, Ser. No. 33,186
Claims priority, application Netherlands June 2, 1959
2 Claims. (Cl. 259—102)

This invention relates to new and useful improvements in mixing apparatus of the type comprising at least one stationary mixing receptable of truncated cone form having its largest diameter at the upper end and formed with a discharge outlet at the lower end, a shaft extending longitudinally in each mixing receptacle and parallel to the side wall thereof, the lower end of the shaft being rotatably supported at the central axis of the receptacle, a helicoid conveyor blade extending along the shaft and arranged to convey the material in the receptacle in response to rotation of the shaft about its longitudinal axis, and means to rotate the shaft about its longitudinal axis and to simultaneously revolve the shaft about the central axis of the receptacle.

Apparatus of this type presently in use, has the lower end of the shaft supported in the receptacle by a ball and socket joint or similar bearing adjacent the bottom wall of the receptacle. This presents the disadvantage of a rather complicated bearing structure mounted in the mixing receptacle and surrounded completely by the mass of the substances to be mixed so that the bearing has to be periodically cleaned. Moreover, the complicated bearing construction make it necessary to terminate the helicoid conveyor blade at a distance from the bottom of the mixing receptacle, so that additional means must be provided for cleaning the bottom and thereby avoiding formation of a solid cake of substances thereon. Finally, in a mixing receptacle provided with such a bearing construction, the discharge outlet cannot be positioned in the bottom of the receptacle.

The primary object of the present invention is to avoid the above-mentioned drawbacks of the known apparatus and to provide mounting means for the shaft which is very simple in construction and effective in use. According to the present invention these objectives are realized by providing the bottom end of the shaft and the bottom wall of the mixing receptacle with co-operating bearing means which engage each other exclusively at one point only.

Another object of the invention is to provide the shaft with means to prevent disengagement of the cooperating bearing means as a result of the forces applied axially to the shaft, especially when the helicoid conveyor blade extending along the shaft is conveying the substances downwardly in the mixing receptacle. This particular object is achieved by forming the shaft in two axially aligned parts having cooperating claw clutch members at their adjacent ends with spring means therebetween to urge the two shaft parts axially apart and thereby maintain engagement of the bearing means at the lower end of the shaft and the bottom of the mixing vessel.

In the accompanying diagrammatic drawings showing preferred embodiments of a mixing apparatus provided with bearing means for its shaft according to the invention:

FIG. 1 is a vertical sectional view of a mixing apparatus,

FIG. 2 is an enlarged vertical cross-section of a claw clutch interposed in the shaft of the mixing apparatus in FIG. 1,

FIG. 3 is an enlarged detail sectional view of the bottom end of a shaft provided with a replaceable bearing element; and

FIG. 4 is a fragmentary, enlarged sectional view of a detail of another embodiment of the shaft supporting bearing means according to the invention.

Referring to FIG. 1, it will be seen that the mixing apparatus there illustrated by way of example, has only one stationary mixing receptacle 1 including a side wall 2 of truncated cone form with its largest diameter at the upper end. In the mixing receptacle is arranged a mixing screw 3 comprising a shaft 4 extending longitudinally of the receptacle and parallel to the side wall 2 thereof, and a helicoid conveyor blade 5 extending along the shaft. The shaft 4 has a conical point 6 at its bottom end which is supported at one point only in a foot bearing 7 arranged in the bottom wall 8 of the mixing receptacle 1. To avoid the possibility of the point 6 of shaft 4 slipping from the conical recess of the foot bearing, a claw clutch II is mounted at the supper end of shaft 4 between the upper end of the helicoid conveyor blade 5 and the driving arm 9 of the apparatus. The arm 9 is connected to the driving mechanism 10 which causes the mixing screw 3 to rotate about its own axis and to revolve about the axis of the receptacle at the same time, for exemple, as disclosed in detail in U.S. Letters Patent No. 2,831,663. The helicoid conveyor blade 5 extends to the bottom end of shaft 4 and close to the flat bottom wall 8 of the mixing receptacle. Consequently the lower end edge 11 of conveyor blade 5 serves as a scraper for bottom wall 8. Moreover, the discharge outlet 12 is connected to an opening in the bottom wall 8 which facilitates the discharge of mixed substances from the receptacle.

The foot bearing 7 may be replaceable and slidably removable from a pocket in the bottom wall which is provided with means to exert a driving force upwardly against the under side of foot bearing 7. Preferably the shaft 4 is provided with a bore 13 extending axially and opening at the bottom end of the shaft to receive a replaceable pointed pin 14 which is held in bore 13 by inward pinching of shaft 4 to define the conical point at the bottom end of the latter (FIG. 3).

The claw clutch II (FIG. 2) comprises two claws 15 and 16 gripping each other by means of partly lapping teeth and being guided in the interior of a housing 18 which, by means of screw bolts 17, is connected to the bottom claw 16. The bottom claw 16 is fixed to the portion of the shaft 4 extending to the lower bearing of the mixing screw, and the second claw 15 is fixed to the portion of shaft 4 which is connected to the driving arm 9. The claws 15 and 16 define recesses opening axially toward each other. Threaded bores 19 are arranged in the upper wall of the claw 15 and screw bolts 20 extend through bores 19 and carry a presser plate 21 situated in the recess formed by the claw 15. Thus, the presser plate 21 can be adjusted relative to the claws 15 and 16 by means of a wrench or other tool applied to the heads 22 of the screw bolts 20. Further, lock nuts 23 are provided on the bolts 20 for holding the presser plate 21 in a fixed position after the adjustment of said plate. A compression spring 24 is disposed in the recesses of claws 15 and 16 between the presser plate 21 and the bottom wall of the claw 16, and the plate 21 is adjusted to pre-stress the spring 24 so that the latter urges the lower portion of shaft 4 in the downward direction.

In a second embodiment of the bearing supporting the bottom end of the shaft of the mixing screw is provided with a conical recess 25 (FIG. 4), while the bottom wall of the mixing receptacle is provided with an upwardly directed conical point 26, which is formed as part of a replaceable portion of said bottom wall, and which extends into the recess 25. It will be understood that in this embodiment the apex angle of the recess 25 is very substantially greater than the apex angle of the conical

point 26 thus enabling the mixing screw to revolve freely about the axis of the mixing receptacle with the point 26 and recess 25 contacting each other at one point only.

It will be understood that the invention, described above with respect to a mixing apparatus having a single mixing receptacle, is also applicable to apparatus having a plurality of mixing receptacles, for example, as disclosed in U.S. Letters Patent No. 2,893,709. It is further apparent that the invention is not limited to the precise details of the illustrative embodiments described above, and that various changes and modifications may be made therein by one skilled in the art without departing from the scope or spirit of the invention, except as defined in the appended claims.

What is claimed is:

1. In a mixing apparatus, the combination of an upstanding mixing vessel having a truncated conical side wall with the large diameter end at the top thereof and a bottom wall with an outlet therein; a shaft extending longitudinally in said vessel parallel to said side wall and being divided, at the upper portion of the shaft, into first and second parts; a helicoidal conveyor blade extending along said shaft; means mounting said shaft in said vessel for rotation about the longitudinal axis of the shaft and for simultaneous revolving movement about the central axis of said vessel, said mounting means including an arm rotatable about said central axis of the vessel and having the upper end of said shaft journalled therein, and cooperating bearing means at the lower end of said shaft and on said bottom wall, respectively, said cooperating bearing means consisting of means defining a conical recess and a conical point engaging in said recess, said conical recess having an apex angle greater than the apex angle of said conical point by more than twice the angle enclosed by said axis of the shaft and said central axis of the vessel so that said conical point and recess have

only single point contact with each other during the rotation and revolving movement of the shaft; engaged first and second claw clutch members on said first and second parts, respectively, of the shaft, said clutch members having recesses opening axially toward each other; and spring means disposed under compression in said recesses of the clutch members for urging said first and second parts of the shaft axially apart and thereby maintaining engagement of said conical point in said conical recess.

2. In a mixing apparatus, the combination as in claim 1; wherein one of said clutch members has axially extending threaded bores opening into the recess of said one clutch member; and further comprising a presser plate in the recess of said one clutch member with an end of said spring means bearing against said plate, and screws connected to said plate and engaged in said threaded bores for adjusting the axial position of said plate in the recess of said one clutch member and thereby varying the force exerted by said spring means for maintaining engagement of said conical point in said conical recess.

References Cited in the file of this patent

UNITED STATES PATENTS

911,348	Viedt	Feb. 2, 1909
1,725,290	Matthews	Aug. 20, 1929
2,181,089	Kettleborough	Nov. 21, 1939
2,611,071	Palmieri	Sept. 16, 1952
2,706,860	Suter	Apr. 26, 1955
2,831,663	Nauta	Apr. 22, 1958
2,840,357	Nauta	June 24, 1958
2,919,961	Matthey	Jan. 5, 1960

FOREIGN PATENTS

927,905	France	May 19, 1947
1,135,654	France	Dec. 17, 1956