

[54] **MULTIPLE-SPINDLE MIXING
KNEADER APPARATUS**

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[58] Field of Search.....259/104, 5, 6, 21, 40, 41,
259/64, 103, 179; 425/201, 204, 205, 209

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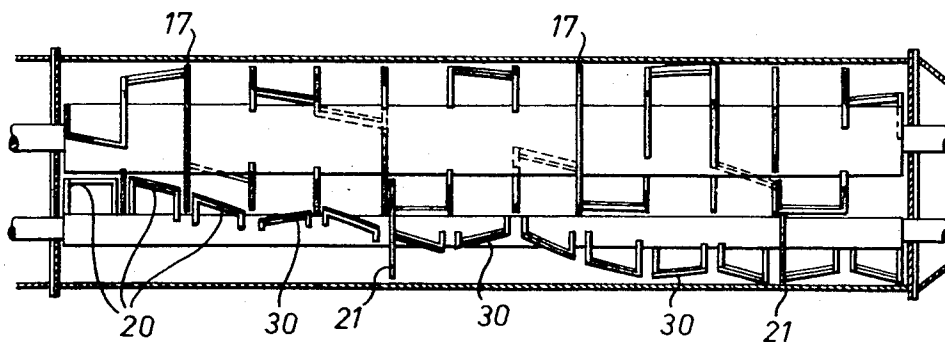
Primary Examiner—Robert W. Jenkins

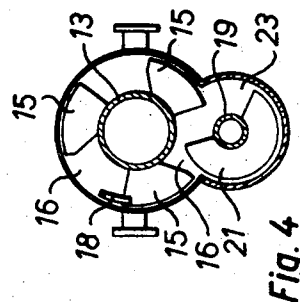
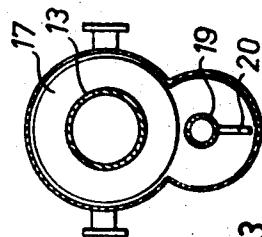
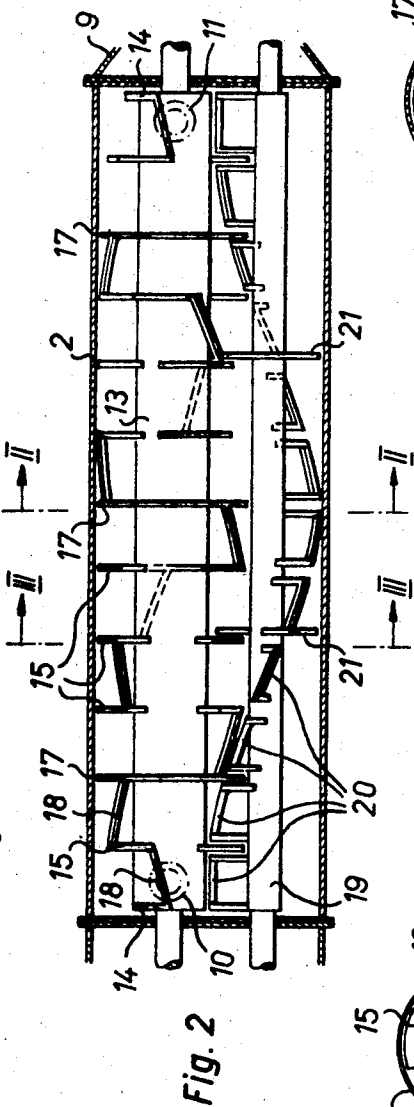
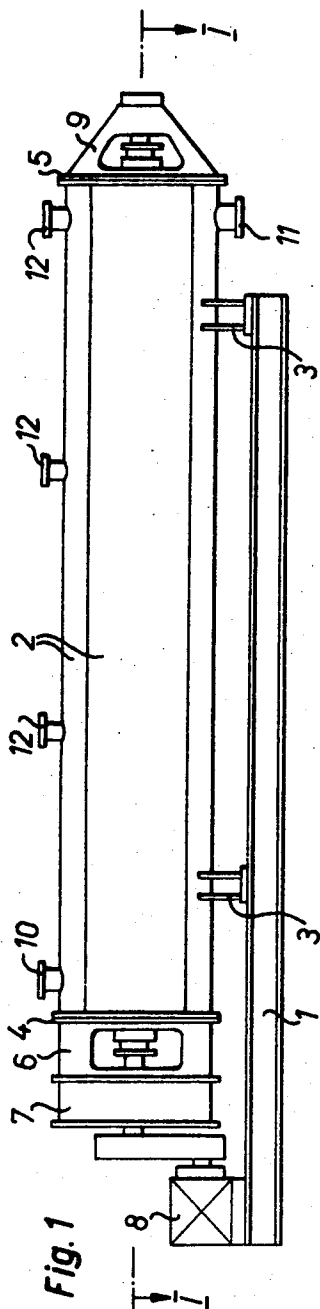
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[57] **ABSTRACT**

A multiple-spindle mixing kneader, especially for carrying out thermal processes in liquid, pasty and solid phases, which is of the type comprising a stationary, generally horizontally disposed housing in the form of a drum member having a substantially centrally arranged stirrer shaft member upon which there are mounted radially extending members, typically discs or disc segments. Kneading bar members are arranged between the disc members or segments, also between the latter and the stirrer or agitator arms which move past the end walls of the housing, these kneader bar members wiping the inner surfaces of such housing. Further, a second stirrer shaft member is arranged parallel to the first stirrer shaft member in a further housing disposed parallel to the first housing. This second shaft member possesses stirrer arm members which, on the one hand, clean the inner surfaces of the aforementioned further housing and, on the other hand, also clean the shaft member and the lateral disc surfaces of the first stirrer shaft member. The invention specifically contemplates the provision of deflecting means for the material undergoing treatment in order to deflect such material from one cylindrical housing portion into the other, such deflecting means comprising deflecting discs mounted at the stirrer shaft members at a predetermined axial spacing from one another.

5 Claims, 7 Drawing Figures





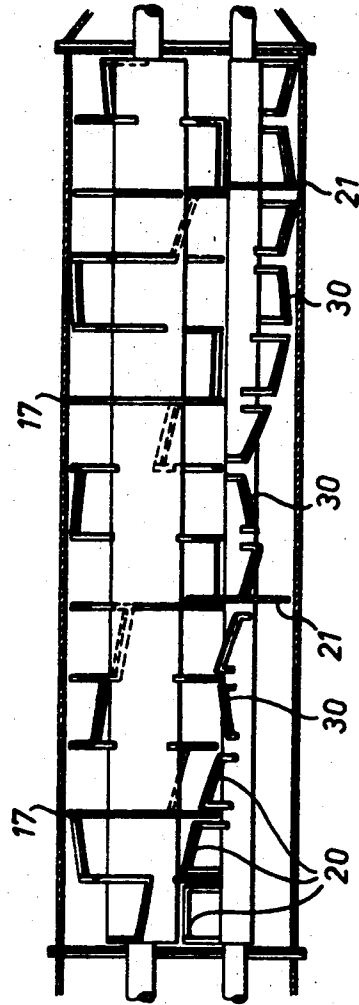


Fig. 5

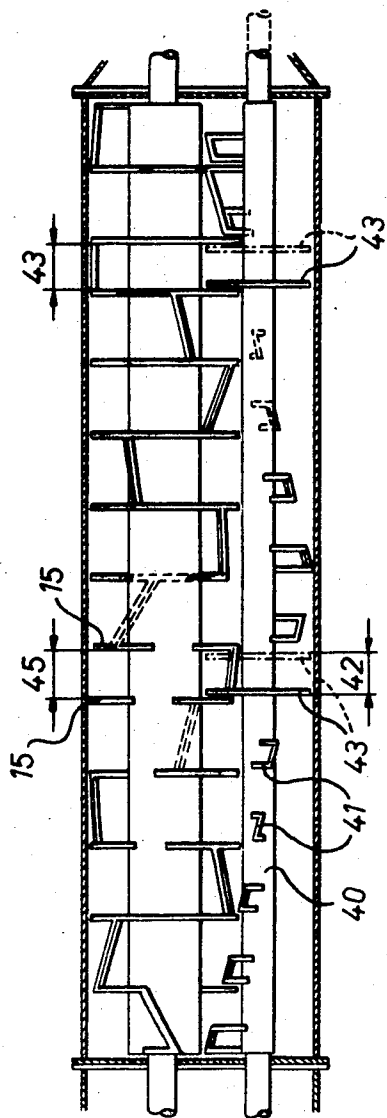


Fig. 6

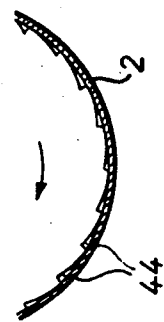


Fig. 7

MULTIPLE-SPINDLE MIXING KNEADER APPARATUS

CROSS-REFERENCE TO RELATED CASE

The instant development is an improvement upon the multiple-spindle mixing kneader disclosed in my co-pending United States application, Ser. No. 19,694, filed Mar. 16, 1970, and entitled "MULTIPLE SPINDLE MIXING DEVICE."

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved multiple-spindle mixing kneader apparatus, especially for carrying out thermal processes in liquid, pasty and solid phases.

In my above-identified United States application there is disclosed a multiple-spindle mixing kneader which is of the type comprising a stationary, generally horizontally disposed housing in the form of a drum member having a substantially centrally arranged stirrer shaft member upon which there are mounted radially extending members, typically discs or disc segments. Kneading bar members are arranged between the disc members or segments, also between the latter and the stirrer or agitator arms which move past the end walls of the housing, these kneader bar members wiping the inner surfaces of such housing. Further, a second stirrer shaft member is arranged parallel to the first stirrer shaft member in a further housing disposed parallel to the first housing. This second shaft member possesses stirrer arm members which, on the one hand, clean the inner surfaces of the aforementioned further housing and, on the other hand, also clean the shaft member and the lateral disc surfaces of the first stirrer shaft member.

In accordance with the development of this application there is contemplated an improvement upon the above design of multiple-spindle mixing kneader, and specifically, this invention is manifested by the provision of deflecting means for the material undergoing treatment to deflect such material from one cylindrical housing portion into the other, such deflecting means comprising deflecting discs mounted at a predetermined axial spacing from one another upon the stirrer shafts.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a schematic front view of a mixing kneader designed for continuous operation;

FIG. 2 is a longitudinal sectional view through the mixing kneader shown in FIG. 1, taken substantially along the line I—I thereof;

FIG. 3 is a cross-sectional view of the mixing kneader depicted in FIG. 2, taken substantially along the line II—II thereof;

FIG. 4 is a cross-sectional view of the mixing kneader depicted in FIG. 2, taken substantially along the line III—III thereof;

FIG. 5 is a longitudinal sectional view of a mixing kneader, similar to the showing of FIG. 2, and provided

with intermediately arranged feedback conveying elements;

FIG. 6 is a longitudinal sectional view, similar to the showing of FIG. 5, of a mixing kneader equipped with a second shaft which rotates and oscillates; and

FIG. 7 is a fragmentary detailed view through the outer peripheral region of a specific construction of deflecting disc.

10 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, in FIG. 1 there is shown in front view the construction of mixing kneader apparatus according to one particular embodiment of this invention. More precisely, it will be understood that a substantially stationary cylindrical housing 2 is supported by means of the braces or support elements 3 upon the base frame 1. The end faces of housing 2 are closed by the flanged covers 4 and 5. At the end of the housing 2 which constitutes the drive side of the equipment there is flanged by means of the cage 6 the transmission 7 and drive motor 8 likewise supported upon the base frame 1. At the opposite end of the housing 2 there is located the bearing cage 9. The cages 6 and 9 are designed to possess a sufficient size that the packing sleeves, indicated at 6a and 9a, for the stirrer shafts 13 and 19 can be easily serviced. The stirrer shaft 13 is rotatably mounted in the main housing 2 whereas the other stirrer shaft 19 is rotatably mounted in the auxiliary housing 50, similar to the arrangement described in my aforementioned United States patent application. Further, the construction of the various members which are mounted at both stirrer shafts 13 and 19 may be similar to that disclosed in such application, and therefore, such will only be considered herein to the extent necessary to fully appreciate the underlying concepts of this development, particularly since reference may be had to this application for further details.

Now the product which is to be processed, with the embodiment under consideration, is introduced into the infeed stud or pipe 10 and departs from the equipment at the outlet or outfeed stud 11. Apart from these infeed and outfeed studs there are also provided a number of further studs 12 for withdrawing the vapors in the conventional manner. Also for the purpose of preserving clarity in illustration there have been omitted from the drawings a large number of the cleaning studs which are distributed along the equipment.

The mode of operation of the equipment as well as that of the deflecting discs will be most readily understood by referring to the cross-sectional views depicted in FIGS. 2, 3 and 4. Upon the main shaft 13 located within the main housing 2 there are mounted the end wall scrapers 14, the disc members or disc segments 15 provided with the throughflow opening 16 and the deflecting discs 17. The kneading bar members which are arranged between these elements have been designated by reference character 18. Now on the other shaft member 19 which is within the housing 50 and parallel to the first mentioned primary or main shaft 13 there are mounted the frame-shaped stirrer or agitator arms 20 and the deflecting discs 21. Owing to the pitch or inclination of the kneading bar members 18 and the axially parallel portion of the stirrer arms 20, and as described more fully in my aforementioned

application, the product or material is conveyed from the inlet or infeed stud 10 towards the outfeed or outlet stud 11 and thereby is continuously mixed by means of the achieved stirring and kneading effect. In order to maintain the residence time span of the material at the individual axial sections of the equipment narrower there are provided at the main shaft 13 the deflecting discs 17 and upon the auxiliary shaft 19 the deflecting discs 21. The product arriving from the inlet stud 10 initially is conveyed towards the first deflecting disc 17. This deflecting disc 17 either possesses no or only a very small throughpassage opening for the material in front of the associated kneading bar members 18 so that this material is forced to deviate into the second housing portion 50 for the stirrer shaft 19. After the material is further processed therein at two additional axial mixing- and kneading elements such material impacts against the deflecting disc 21. Also there the material does not find any or only a small throughpassage 23 so that the material which has dammed up at the deflecting disc 21 again is forced to deviate into the housing 2 of the main stirrer shaft 13. This procedure of alternately deflecting the material from the main housing portion into the auxiliary housing portion and then back again into the main housing portion and so forth repeats a number of times until the product departs from the equipment through the agency of the outlet stud 11.

Different arrangements are possible for the deflecting discs in order to achieve different effects. Thus as shown with the modification of FIG. 5 there is provided an arrangement wherein, by reversing the angle at the kneading bar members 30 between the deflecting discs 17 and 21 it is possible to achieve a partial feedback of the material and therefore an improvement of the mixing effect and the damming up.

FIG. 6 illustrates still a further embodiment of the multiple-spindle mixing kneader of this invention wherein the second shaft 40 equipped with the stirrer blades or elements 41 both rotates and oscillates, this being achieved through the provision of a suitable drive schematically indicated at reference character 100. The extent of the oscillating movement, represented by reference character 42, has been indicated by the phantom line position of the deflecting disc 43 when it assumes its second axial terminal position. In this case the deflecting discs 43 simultaneously serve to clean the lateral surfaces of the disc segments 15, and thus they also tend to maintain themselves clean, in other words provide a self-cleaning effect. In order to accommodate this short axial stroke it is advantageous to maintain the axial distance 45 between the disc segments 15 of the kneading elements and within which function the deflecting discs 43, smaller than for the normal kneading elements.

The embodiments of the equipment shown in the drawings are preferably designed for continuous operation. However, the deflecting discs can be also be utilized in conjunction with batch-wise operating mixing kneaders of the type disclosed in the aforementioned United States application.

In the case of mixing kneader equipment possessing considerable length it can be of advantage to employ the deflecting discs also for supporting the shafts. Apart from the selection of suitable materials possessing good

dry running properties for the outside surface regions of the deflecting discs, with this embodiment there is also advantageously selected a special material for the contact locations of the associated housing, such as stellite, nitriding steel, and so forth, serving as the counter support. Similar to feed worms it is possible to improve the bearing or support characteristics of the construction by providing wedge-shaped grooves at the outer periphery of the deflecting discs or at the housing. Such construction has been shown, by way of example, in FIG. 7 wherein the lower portion of the housing has been indicated by reference character 2' and within which travels the deflecting disc 21. This deflecting disc 21 is provided at its external periphery with wedge-shaped grooves 44 which improve the bearing or support function of such discs. The arrow shown in FIG. 7 indicates the direction of rotation, and by virtue of the wedge effect of the grooves 44 the support characteristics for the deflecting discs 21 are thus improved.

The mode of heating or cooling the heat transfer surfaces of the equipment is conventional and undertaken with the aid of standard measures which, here also, for the purpose of preserving clarity in illustration, and inasmuch as such does not constitute part of the subject matter of this development, have been conveniently omitted from the drawing.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. A multiple-spindle mixing kneader apparatus, especially for carrying out thermal processes upon materials in liquid, pasty and solid phases, comprising a first stationary housing having end walls, a first stirrer shaft member mounted in said first housing, radially extending members and stirrer arm means mounted upon said first stirrer shaft member, kneading bar members disposed between said radially extending members and between said radially extending members and said stirrer arm means which pass the end walls of said housing and serving to wipe the inner surfaces of said housing, a second housing mounted substantially parallel to the first-mentioned housing, a second stirrer shaft member arranged substantially parallel to said first stirrer shaft member, said second stirrer shaft member possessing stirrer arm means which clean the inner surfaces of said second housing and also said first stirrer shaft member and the lateral surfaces of said radially extending members of said first stirrer shaft member, means for deflecting the material from one of the housings into the other housing, said deflecting means comprising deflecting discs mounted at a predetermined axial spacing from one another upon each of said stirrer shaft members.

2. A multiple-spindle mixing kneader apparatus as defined in claim 1, further including means providing wedge-shaped grooves at least at the deflecting discs or the associated housing thereof to support the associated shaft member.

3. A multiple-spindle mixing kneader apparatus as defined in claim 1, wherein said radially extending members are discs.

4. A multiple-spindle mixing kneader apparatus as defined in claim 1, wherein said radially extending members are disc segments.

5. A multiple-spindle mixing kneader apparatus as defined in claim 1, wherein said kneading bar members exhibit a worm-like pitch in order to achieve increased agitation and processing of the material.

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