

KNEADER

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This invention relates to a kneader for kneading a viscous, liquid or powdery material.

5 Figs. 5 and 6 show a conventional kneader. This kneader includes a barrel 1 having a kneading chamber 2 having a cocoon-shaped section and provided with a material inlet port 3 at one end and a discharge port 4 at the other end. Two parallel spindles 5 extend through
10 the kneading chamber 2. Each spindle 5 has each end thereof rotatably supported by one bearing 6 provided at each end of the barrel 1.

Each spindle 5 carries on its portion in the kneading chamber 2 a plurality of screws 7 and paddles 8
15 arranged axially from the inlet port 3 toward the discharge port 4. The screws 7 and the paddles 8 are nonrotatably coupled to the respective spindles 5 e.g. by keys. Each paddle 8 is convex lens-shaped in cross-section in a plane perpendicular to the axis of the
20 spindles). Each pair of paddles 8 on the spindles 5 are 90 ° out of phase with each other. As shown in Fig. 7, any adjacent paddles 8 arranged axially on the same spindle 5 are 45° out of phase with each other.

The spindles 5 are rotated in the same direction by
25 a driving means 9 such as a motor. The screws 7 and the paddles 8 rotate together with the spindles 5. Material



introduced into the kneading chamber 2 through the inlet
port 3 is fed downstream by the rotating screws 7 while
being kneaded, i.e. compressed, pulled and sheared as the
paddles 8 are rotated as shown in Fig. 8, and discharged
5 through the discharge port 4.

As the paddles 8 rotate, the tips of the paddles 8
on one of the spindles 5 move while keeping a small gap
from the inner surface of the kneading chamber 2 and the
paddles 8 on the other spindle 5, thus scraping off any
10 material stuck on the inner surface of the kneading
chamber 2 and the surface of each paddle 8 for self-
cleaning.

The spindles 5 tend to be deflected vertically by
their own weights and the weights of the screws 7 and
15 paddles 8. If they deflect excessively, the paddles 8 may
come into contact at their tips with the inner surface of
the kneading chamber 2, causing damage to the paddles 8
or the barrel 1.

If, in order to avoid this problem, the gaps
20 between the tips of the paddles 8 and the inner surface
of the kneading chamber 2 are widened, the amount of
material stuck in the chamber 2 will increase and the
material shearing force will decrease. That is, the
kneading and self-cleaning properties will deteriorate.

25 An object of this invention is to minimize the
deflection of the spindles.

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According to this invention, there is provided a kneader comprising a barrel having a kneading chamber therein, a plurality of parallel spindles extending through the kneading chamber and having either end thereof rotatably supported by a plurality of bearings arranged spaced from each other, each of the spindles nonrotatably carrying on its portion located inside the kneading chamber a plurality of paddles arranged axially of the spindle so as to be rotatable with the spindles in the kneading chamber while keeping a small gap from the inner surface of the kneading chamber and from the paddles on the adjacent spindle.

With this arrangement, the plurality of spindles are connected together to form a single continuous beam, so that upward moment that counteracts a vertical load will act on the central part of each spindle, thus reducing deflection of the spindles.

Also, by using hollow paddles, it is possible to further reduce the vertical load that acts on the spindles and thus the deflection of the spindles.

Other features and objects of the present invention will become apparent from the following description made with reference to the accompanying drawings, in which:

Fig. 1 is a front view of the kneader embodying this invention;

Fig. 2A is a front view, in partially cross-section,



of a flat paddle;

Fig. 2B is its side view;

Fig. 2C is its plan view;

Fig. 3A is a front view of a helical paddle;

5 Fig. 3B is its side view;

Fig. 3C is its plan view;

Fig. 4A is a front view of an inverse helical
paddle;

Fig. 4B is its side view;

10 Fig. 4C is its plan view;

Fig. 5 is a vertical sectional front view of a
conventional kneader;

Fig. 6 is a schematic vertical sectional view of
Fig. 5;

15 Fig. 7 is a sectional view of a kneading chamber of
the device of Fig. 5, showing how paddles are mounted;
and

Figs. 8A-8D illustrate the kneading steps.

The embodiment of this invention is now described
20 with reference to the accompanying drawings. Any members
corresponding to members in the above-described prior art
are denoted by the same numerals, and their description
is omitted.

In the kneader shown in Fig. 1, a bearing box 11 is
25 mounted to either end of the barrel 1 through an end
plate 10. A pair of bearings 6 are mounted, spaced from



each other, in each bearing box 11.

In this arrangement, the spindles 5 are supported at either end to each other by the two bearings 6 so as to form a continuous beam, so that upward moment that counteracts a vertical load acts on the central part of each spindle 5, thereby minimizing the degree of deflection of the spindles 5. Since the bearings 6 are mounted in the bearing box 11 coupled to the barrel 1, the axes of the spindles 5 can be accurately aligned with the axis of the kneading chamber 2.

The paddles 8 used in this kneader comprise flat paddles having, as shown in Fig. 2, an outer periphery extending parallel to the axis of the spindle and used for kneading material, helical paddles having, as shown in Fig. 3, a helically twisted outer periphery and used to knead and feed material, and inverse helical paddles having, as shown in Fig. 4, an inversely helically twisted outer periphery and used to knead material and feed it backward. The paddles 8, made by casting, have hollow portions 12 to reduce their weights. This reduces the vertical load acting on the spindles 5, minimizing their deflection.

Since the spindles are supported by a plurality of bearings at both ends, upward moment that counteracts the vertical load acts on the central portion of each spindle, minimizing deflection of the spindles.



This makes it possible to narrow the gaps between the tips of the paddles and the inner surface of the kneading chamber and thus to greatly improve the kneading and self-cleaning properties.

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What is claimed is:

1. A kneader comprising a barrel having a kneading chamber therein, a plurality of parallel spindles
5 extending through said kneading chamber and having either end thereof rotatably supported by a plurality of bearings arranged spaced from each other, each of said spindles nonrotatably carrying on its portion located inside said kneading chamber a plurality of paddles
10 arranged axially of said spindle so as to be rotatable with said spindles in said kneading chamber while keeping a small gap from the inner surface of said kneading chamber and from said paddles on said adjacent spindle.
- 15 2. A kneader as claimed in claim 1 wherein said paddles are hollow members.



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