United States Patent

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[54] **CONTINUOUSLY OPERATING PLASTICIZING DEVICE**
6 Claims, 2 Drawing Figs.

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[51] **Int. Cl.** **B01f 5/00**
[50] **Field of Search** ..... 259/6, 9, 41, 21, 45, 104, K8, 25, Dough Kneaders Hor.; 198/213, 216; 100/145, 146

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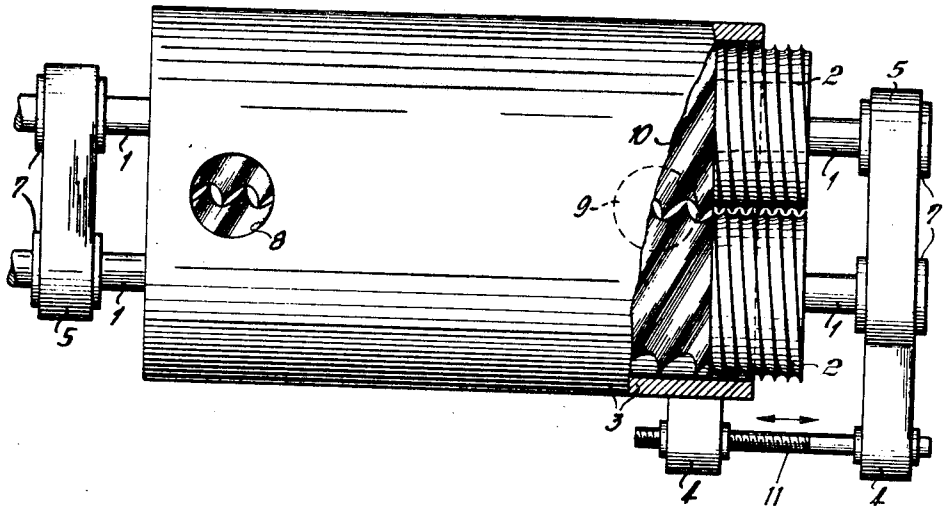
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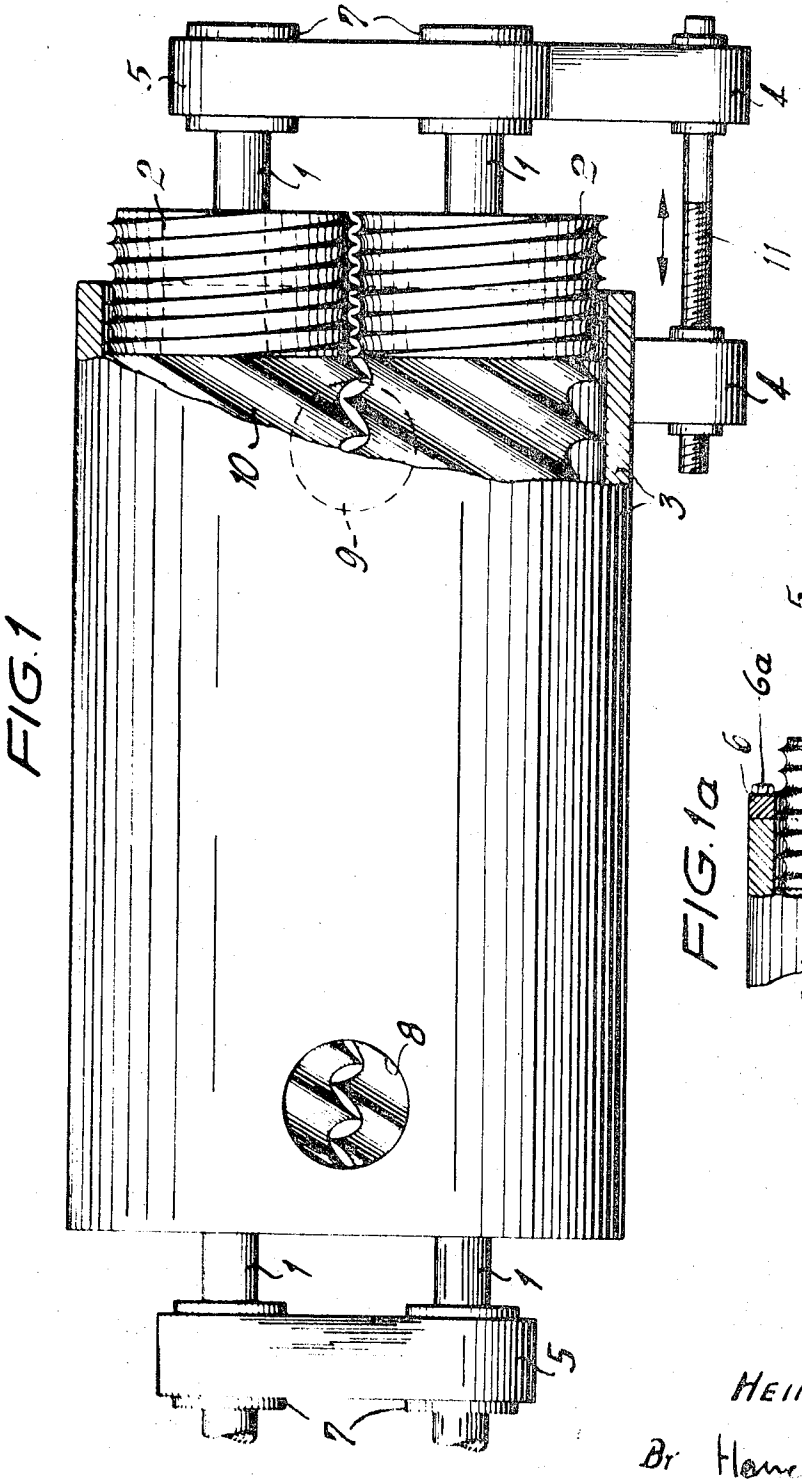
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ABSTRACT: A continuously-operating plasticizing device with two parallel unidirectionally-rotating conveyor screws for feeding material to be plasticized toward the outlet end of the conveyor casing is sealed at said end by screw conveyor sections mounted on the screw conveyor shafts in tight mesh with each other and conveying in opposition to the screw conveyors within the casing thereby preventing or making controllable for purpose of flushing leakage of material out of the casing at the outlet end thereof as may occur by the back pressure prevailing at said end during operation of the device.



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CONTINUOUSLY OPERATING PLASTICIZING DEVICE

SPECIFICATION

The invention relates to a continuously operating device for plasticizing plasticizable material such as mixtures of high polymer plastics and more particularly to a device in which two mutually parallel and unidirectionally rotatable screw conveyors are journaled at both ends and rotate in a casing which has at one end at least one inlet or feed port and at the other end a discharge or outlet port.

BACKGROUND

Continuously operating plasticizing devices of the general kind above referred to, that is, plasticizing devices with two mutually parallel rotary drive shafts mounting conveyor elements and sometimes also kneading elements and journaled at both ends have many advantages both as to manufacture and operation and are widely used in practice. However, devices of this kind as heretofore known, present a serious problem with respect to a satisfactory sealing of the device at the outlet end thereof. It has been found to be very difficult to seal the shafts at the outlet end of the casing against the same or the bearings. It is particularly difficult to seal the shafts when the material must be discharged from the casing against a resistance as is caused for instance, by an extrusion nozzle. Such resistance causes a back pressure in the casing which, in turn, tends to cause a leakage at the shafts as is readily apparent.

It has been attempted to seal the respective shaft ends by stuffing boxes or bushings but seals of this type were found to be unsuitable. Slide ring seals are more acceptable but still far from satisfactory. Residual material such as high polymer plastic material tends to harden when the device is at a standstill for a prolonged period of time and such hardened material causes frequently a collapse of the seal when the device is started up. The difficulties are particularly pronounced when the device is operated at comparatively high speed such as 200 r.p.m. and higher. Such high speeds entail basic operational difficulties when slide ring seals are used. Wear and tear at slide ring seals is rather high at rotational speeds of 200 r.p.m. and higher. Large leakages develop rather rapidly. Thermal deterioration of the material to be plasticized may occur and residual material tends to become baked to parts of the device.

THE INVENTION

It is an object of the invention to provide a novel and improved seal at the outlet end of the casing of a continuously operating plasticizing device of the general kind above referred to.

A more specific object of the invention is to provide a novel and improved seal for plasticizing devices of the general kind above referred to the sealing action of which can be controlled in accordance with the specific characteristics of the material to be plasticized so that a flushing action at the seal is obtained.

The afore pointed-out objects, features and advantages of the invention and other objects, features and advantages which will be pointed out hereinafter are obtained by sealing the shafts at the outlet end of the casing by providing on the shaft portions at the outlet end of the casing, partly within the casing and partly extending therefrom, screw conveyor sections which are in tight mesh with each other and convey in opposition to the screw conveyor elements within the casing and by also providing adjustment means for varying the sealing action of the screw conveyor sections.

According to one advantageous aspect of the invention adjustment of the sealing action of the conveyor sections is obtained by varying the axial length of the portion of the casing overlying the conveyor sections.

An adjustment of the sealing action has the advantage that the counter-conveying action of the conveyor sections according to the invention can be selected in accordance with the discharge pressure prevailing at the outlet port of the casing

which as is obvious, depends on the specific flow properties of the materials to be plasticized in the device. The sealing action can be adjusted for instance so that there is no leakage at all or a limited amount of leakage to effect flushing of the conveyor sections constituting the seal. Such flushing has the advantage that thermally damaged material as may be present due to a prolonged dwell time in the sealing zone, cannot reach the outlet port of the casing.

Adjustment of the overlap of the sealing conveyor sections by the casing can be obtained by several advantageous arrangements. For instance, the casing can be axially displaceable with reference to the shafts or conversely the shafts may be axially displaceable with reference to the casing. It is, of course, also possible to mount the sealing conveyor sections so that they can be readily exchanged.

A further advantageous arrangement for varying the overlap of the conveyor sections by the casing is to provide detachable casing parts such as casing rings at the outlet end of the casing.

In the drawing several preferred embodiments of the invention are shown by way of illustration and not by way of limitation.

In the drawing:

FIG. 1 is a view, partly in section, of a continually operating plasticizing device according to the invention; and

FIG. 1*a* is a fragmentary sectional view of the device showing a modification of the means for adjusting the sealing action at the outlet end of the device.

Referring first to FIG. 1, the device according to the invention is schematically exemplified as a high-speed plasticizing device with two shafts journaled in bearings at both ends. Only those parts of the device which are essential for the understanding of the invention are shown.

The device comprises a casing or drum **3** in which are rotatable two parallel shafts **1** journaled at both ends in bearings **7**. The bearings are not illustrated in detail as the details thereof are not essential for the understanding of the invention. The bearings are separated from the respective casing ends but they can also be mounted directly on end walls of the casing. Each shaft mounts conveyor elements **10** of conventional design and also kneading elements, if desired. The elements are in close contact with the inner casing wall as shown. The casing has one or several inlet or feed ports **8** and an outlet or discharge port **9**.

As is apparent from the previous description, the invention is not concerned with the passage of shafts **1** through the inlet end of the casing as there is not sealing problem at this end but only with the passage of the shafts through the outlet end of the casing.

The sealing means at the outlet end comprise screw conveyor sections **2** which are in tight mesh with each other. The sections are rotated in unison with shafts **1** but convey in opposition to conveyor elements **10**, that is, while conveyor elements **10** convey from port **8** toward port **9**, that is, from left to right, sections **2** convey from right to left. The pitch of the turns of sections **2** is preferably steeper than that of conveyor elements **10** and is so shown. As is indicated in FIG. **1**, sections **2** are partly within the casing and partly protrude therefrom and in close contact with the inner wall of the casing.

The axial length of the casing portion overlying sections **2** controls the sealing action of the sections. Accordingly, the sealing action can be varied by changing the axial length of the overlying casing portion.

According to FIG. **1** such variation of the relative axial position of the casing and the screw sections is effected by providing on a spatially fixed support **5** for the bearings **7** and on the casing nut elements **4** within which a spindle **11** is rotatable. Obviously, rotation of the spindle in either direction as is indicated by a two-headed arrow displaces conveyor sections **2** and casing **3** with reference to each other provided the casing is axially displaceable with reference to shafts **1** or the shafts are axially displaceable with reference to the casing by suitable and conventional means.

Instead of a linkage in the form of a spindle and nuts, hydraulic means can, of course, also be used.

The same result, namely to vary the axial length of the casing portion overlying conveyor sections **2** is obtained according to FIG. **1***a* by providing casing attachments for instance in form of one or several rings **6** which are secured to the outlet end of casing **3**, for instance by screw bolts **6***a*.

I claim:

1. A continuous operating plasticizing device comprising in combination:

an elongate casing having an inlet port near one end and an outlet port near the opposite end;

a pair of mutually parallel screw conveyors extending through the casing and journaled at both ends for feeding plasticizable material from the inlet port toward the outlet port, each of said conveyors including a drive shaft protruding from the casing at least at the outlet end thereof;

sealing means at said outlet end, said sealing means including screw conveyor sections secured on said protruding shaft portions and disposed partly within the casing and partly protruding from said outlet end, said conveyor sections being in tight mesh with each other and conveying in opposition to the conveyors within the casing; and

adjustment means for varying the sealing action of said sealing means.

2. The device according to claim **1** wherein said adjustment means comprise setting means for varying the axial length of the casing portion overlying the screw conveyor sections thereby correspondingly varying the sealing action of the sealing means.

3. The device according to claim **2** wherein said casing is axially displaceable with reference to the screw conveyors and the screw conveyor sections.

4. The device according to claim **2** wherein said screw conveyors and said screw conveyor sections are axially displaceable with reference to the casing.

5. The device according to claim **2** wherein said casing is axially displaceable with reference to the screw conveyors and the screw conveyor sections, and wherein said setting means comprise a spatially stationary support and linkage means of adjustable effective length coupling said support to said casing for varying the axial position of the casing with reference to the screw conveyors and the screw conveyor sections by adjusting the effective length of the linkage means.

6. The device according to claim **2** wherein said setting means comprise an extension member attachable to the outlet end of the casing for correspondingly varying the axial length of the casing portion overlying the screw conveyor sections.