United States Patent

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[31] **P 17 29 396.8**

[54] **SCREEN-CHANGING APPARATUS FOR EXTRUDERS**
5 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **146/174,** 18/12
[51] **Int. Cl.** **B29f 3/00,** A47j 19/00
[50] **Field of Search** ..... 146/182, 186—189, 174; 18/12 B

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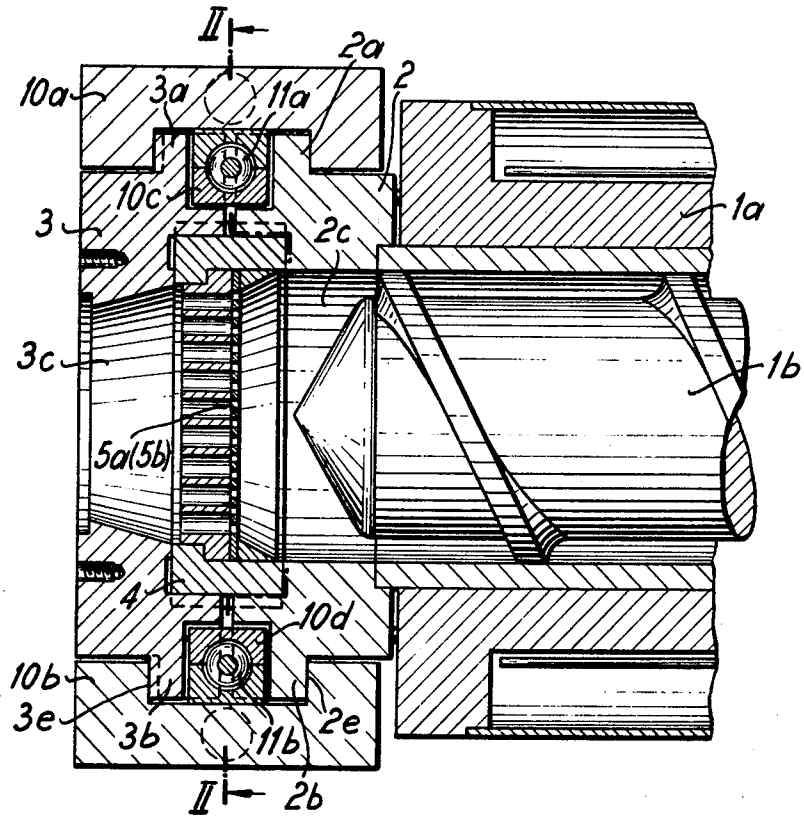
ABSTRACT: A slider is provided with two detachable sets of screens and is displaceable by a power-operated displacing device in a double slide track disposed at the discharge end of the extruder cylinder. The double slide track consists of two housing halves, which are relatively movable in the feeding direction of the material and on which engaging surfaces of the slider bear in both end positions thereof. The displacing device has an output member that is connected to the slider. An abutment cooperates with the displacing device and is movable relative to the double slide track in the direction of pressure and firmly connected to a clamping device for clamping the housing halves against the slider. Prestressed spring elements are provided between the clamping device and the housing halves and hold the clamping device in an ineffective position during the displacement of the slider. The spring force of said spring elements is smaller than the pressure exerted by the displacing device on the abutment when the slider has reached its end position. The initial stress of said spring elements exceeds the force required to displace the slider.



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SHEET 1 OF 3

FIG.1

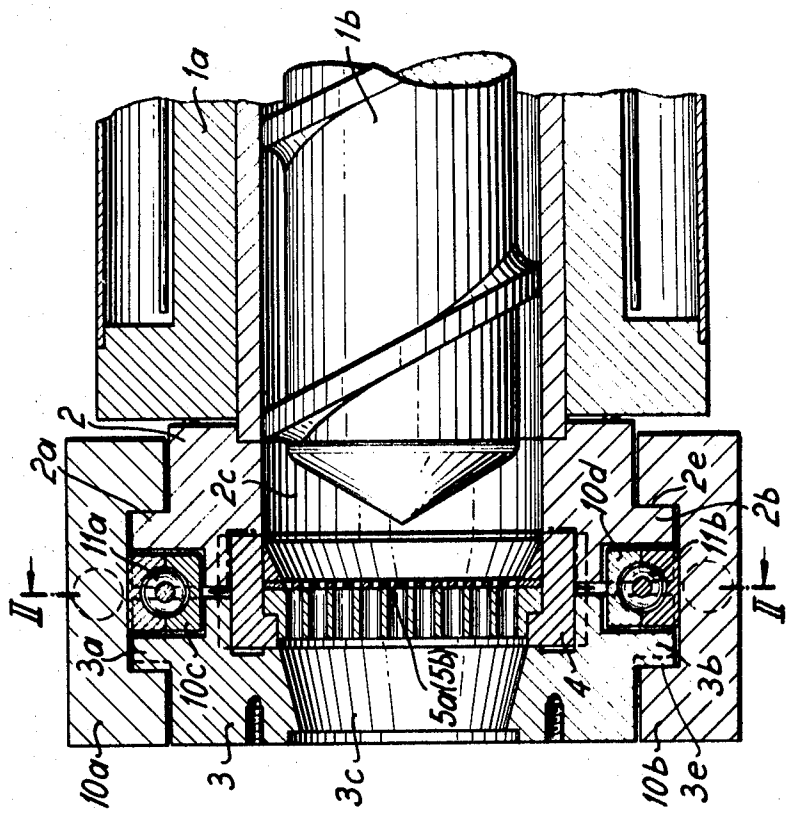

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FIG. 2

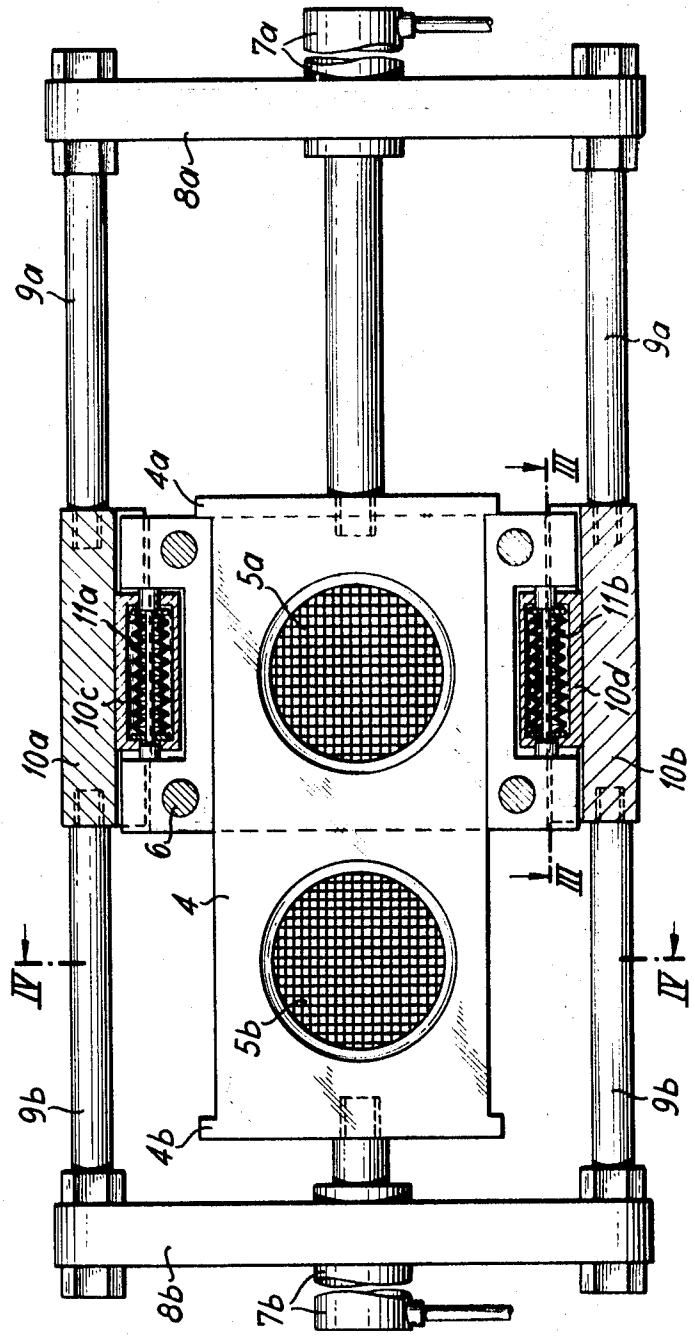

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FIG. 3

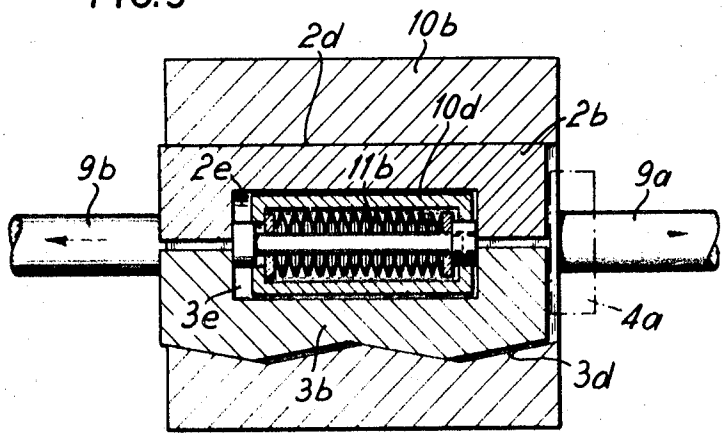
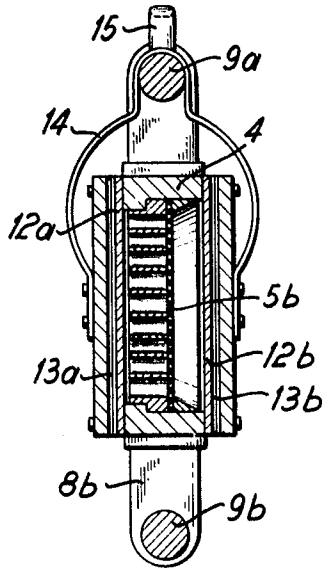


FIG. 4



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SCREEN-CHANGING APPARATUS FOR EXTRUDERS

This invention relates to a screen-changing apparatus for extruders used to process thermoplastic compostions, and it is an object of the invention to provide such apparatus which enables a fast change of soiled screens. Such screens filter and clean the thermoplastic compositions which are fed in the extruder. The screens retain, e.g., agglomerated materials, unblended admixtures of coloring matter or filler material, as well as particles of dust. With the aid of the screen-changing apparatus, it should be possible to replace a clean screen for the soiled screen without need to interrupt the work of the extruder. This will avoid a loss of output and will eliminate the need to thread the extruded product once more into the cooling and take-away means when the production is to be resumed.

It is known to use a screen slider, which is mechanically or hydraulically displaceable and comprises two replaceable sets or screens. In such arrangement, the slider is sealed by readjustable, resilient sealing rings against the bores which conduct the material to be extruded. In the operation of such known apparatus it has been found that a leakage of molten plastics material cannot be reliably prevented in this way and that the apparatus is soiled and rendered inoperative by the leaked molten material.

To improve the seal, it has also been proposed to use a slider in the form of a double wedge so that the surface of the slider is wedged between the sealing rings, which have spherical outside surfaces that are adjustable in mating hollow spherical bearing surfaces. These measures are adopted to provide a seal. It has been found, however, that a concentric position of the sets of screens before the material-conducting passages cannot be ensured owing to the inevitable wear of the wedge surfaces and the sealing rings so that dead corners result, which adversely affect the flow conditions.

In another known design, a certain improvement is accomplished in that an additional hydraulic cylinder forces a displaceable sealing sleeve against the slider, e.g., by means of wedge surfaces, when the movement of the slider has been completed. Whereas this arrangement has resulted in a good seal, it has the disadvantage that the sequence control of the two hydraulic cylinders is highly expensive and liable to be deranged because limit switches and servovalves must be used and the slidable sealing sleeve and the means for operating the same greatly increase the overall length of the screen-changing apparatus.

For the same purposes, a screen assembly has been disclosed in which two firmly installed sets of screens are flown through by the molten plastics material and the latter is controlled by a system of four three-way valves in such a manner that part of the cleaned molten material flows in the opposite direction through the soiled screen to wash out the impurities which have accumulated.

This arrangement is highly expensive and basically results in undesired flow conditions so that it cannot be used for plastics materials which are sensitive to heat. Besides, the molten material which is used to wash the soiled screen involves a considerable loss of material. Moreover, the output rate is much reduced during the backwashing operation so that a continuous production is not enabled.

It is an object of the invention to provide a screen-changing apparatus which avoids the disadvantages of the earlier designs which have been described and which enables an extremely fast change of screens without interfering with the production. On the other hand, the apparatus should ensure a satisfactory seal in the final position of the slider which carries the sets of screens.

In a screen-changing apparatus for extruders for processing thermoplastic compositions, the present improved apparatus comprises a slider which is provided with two detachable sets of screens and which is displaceable by a power-operated displacing device in a double slide track disposed at the discharge end of the extruder cylinder. The object is accomplished in that the double slide track consists of two housing halves, which are relatively movable in the feeding direction of the material and on which engaging surfaces of the slider bear in both end positions thereof. The displacing device has an output member that is connected to the slider and an abutment which cooperates with the displacing device and is movable relative to the double slide track in the direction of pressure and firmly connected to a clamping device for clamping the housing halves against the slider. Prestressed spring elements are provided between the clamping device and the housing halves and hold the clamping device in an ineffective position during the displacement of the slider, the spring force of the spring elements being smaller than the pressure exerted by the displacing device on the abutment when the slider has reached its end position, and the initial stress of said spring elements exceeds the force required to displace the slider. The seal is thus effected by the reaction of the displacing device, which consists preferably of a hydraulic cylinder which is movably mounted, and does not require additional switching and control devices. Because the spring element which acts during the displacement has a spring force which is larger than the pressure required to displace the slider, but smaller than the reaction between the displacing device and its abutment when the slider has reached its end position, a clamping of the housing halves defining the double slide track against the slider during the displacement is reliably prevented.

With the design according to the invention, the screen-changing device has a short overall length in the direction of flow so that favorable flow conditions for the molten plastics material are ensured. In addition, the displacing device designed according to the invention enables a change of screens to be performed within a very short time because the actuation of the displacing device results automatically in an unclamping operation, then in a displacement of the slider carrying the sets of screens, and in a reclamping when the slider has reached its end position. This change of screens may be effected within fractions of a second without need for control elements which are liable to be deranged so that an interruption of the continuous production will be reliably avoided. The slider is reliably sealed and the inevitable wear of the sealing surfaces and the wedge surfaces does not affect at all the correct position of the sets of screens relative to the passage for conducting the material.

In a development of the invention, the clamping device may comprise wedge clamps, which are connected to the abutment for the displacing device and embrace the housing halves, and which comprise at least one obtuse-angled double wedge on at least one pressure surface and complementary double wedge surfaces on the complementary reaction surface of the housing halves. It is desirable if a multiple double wedge shape, preferably a dual double wedge shape, is used only between one housing half and the two wedge clamps whereas the other housing half and that surface of the wedge-shaped clamps which engage said housing half are planoparallel. Alternatively, the clamping device may comprise toggle joints, which are connected between the housing halves and actuating members firmly connected to the abutment for the displacing device.

According to the invention, each of the spring elements which hold the clamping device in an ineffective position during the displacement of the slider preferably consists of a set of prestressed disc springs provided in spring sleeves, which are attached to the wedge clamps and extend into openings of the housing half but are shorter than the opening. Each set of disc springs are adapted to bear at each end by a thrust washer on an end flange of the spring sleeve and a pressure member, which extends through the central opening of the end flange and bears on the end faces of the housing halves, the pressure member being longer in the direction of pressure than the end flange of the spring sleeve.

In a further development of the invention, the cleaned set of screens which are not used at a time may be held in position by pressure plates, which are connected by a spring clamp and engageable with both sides of that portion of the slider which extends out of the guide housing. In another embodiment of

the invention, these pressure plates may be provided with flat heaters for heating that portion of the slide which protrudes out of the slide housing. The latter proposal may also be used to advantage in other screen-changing apparatus having double screen sliders. This external heating eliminates the need for a separate heater and a separate temperature feeler in each half of the slider. The heating according to the invention reduces the height of the slider and the structural expenditure for the heating. The holding of the set of screens in position by the pressure plates affords the advantage that the set of screens which have been cleaned and reinserted into the slider cannot protrude from the slider as a result of shaking of the machine. Such screens producing from the slider would be destroyed when the slider is subsequently displaced.

The invention will be described more fully hereinafter with reference to the drawings in which:

FIG. 1 is a longitudinal sectional view showing a screen-changing apparatus according to the invention.

FIG. 2 is a sectional view taken on line II–II in FIG. 1.

FIG. 3 is an enlarged sectional view taken on line III–III in FIG. 2 and

FIG. 4 is a sectional view taken on line IV–IV in FIG. 2 together with a detachably fitted device, which is not shown in FIG. 2 and serves to hold in position the set of screens in that one-half portion of the slider which protrudes at a time, and to heat the same.

A first housing half 2 formed with clamping noses 2*a* and 2*b* is screw-connected to the end of an extruder cylinder 1*a* of an extruder, other parts of which are not shown. A second housing half 3 of the slide guide housing is provided with clamping noses 3*a* and 3*b*. A slider 4 for two detachable sets of screens 5*a* and 5*b* is laterally slidably mounted between the first and second housing halves 2 and 3. Bolts 6 shown in FIG. 2 lock the two housing halves 2 and 3 against a lateral displacement relative to each other. The housing halves 2 and 3 are slightly movable relative to each other in the direction of flow of the material.

In each of the two end positions of the slider 4, cams 4*a* and 4*b* engage the housing halves 2 and 3, respectively, to ensure that the set of screens 5*a* or 5*b* which are used at a time are concentric to the bores 2*c* and 3*c* formed in the housing halves 2 and 3 and serving to conduct the material to be extruded. When one end position or the other has been reached, the full pressure of the respective single-acting cylinder 7*a* or 7*b* which has effected the displacement acts on the yoke 8*a* or 8*b* and is transmitted by the tie rods 9*a* or 9*b* on wedge clamps 10*a*, 10*b*, which are laterally displaced against the force of prestressed sets of springs 11*a*, 11*b*, which bear on the housing halves 2, 3. The housing halves 2 and 3 are sealingly compressed against the slider 4 at this time by means of wedge surfaces 3*d*. The hydraulic cylinders 7 *a*, 7*b* are supplied with pressure oil in alternation for each displacing operation in known manner.

During the displacement of the slider 4, the sets of springs 11*a*, 11*b* serve to hold the wedge clamps 10*a*, 10*b* in an ineffective intermediate position so that the housing halves 2 and 3 will not be forced against the slider 4 as long as the latter is displaced. To enable a clamping in both directions, the wedge clamps are provided with dual double wedge surfaces. To hold the wedge clamps in an inoperative intermediate position, the sets of springs have an initial stress which exceeds the largest force which may be applied to displace the slide. On the other hand, the spring force of the sets of springs can readily be overcome by the reaction of the displacing cylinder which is in operation at a time when the slider has reached its respective end position.

The design of the wedge clamps is shown more in detail in FIG. 3. The clamping noses 2*a*, 2*b* of the housing half 2 have preferably a planar pressure surface 2*d* having no wedgelike obliquity. Those clamping surfaces of the clamping jaws 10*a* and 10*b* which engage the surface 2*d* are similarly shaped. The clamping noses 3*a* and 3*b* of the housing half 3 and the corresponding clamping surface of the clamps 10*a*, 10*b* have preferably a dual double wedge profile 3*d*, which is effective in either direction with two wedge surfaces. This results in an approximately concentric clamping force in both directions of displacement. The sets of springs 11*a*, 11*b* are inserted in two-part sleeves 10*c*, 10*d*, which are secured to the wedge clamps 10*a*, 10*b*. The sets of springs 11*a*, 11*b* extend virtually without play in corresponding openings 2*e*, 3*e* of the clamping noses 2*a*, 2*b* and 3*a*, 3*b*, respectively. These openings are longer than the spring sleeves 10*c*, 10*d*. During the displacement, the sets of springs bear by means of thrust washers provided at the ends of the sets of springs on the end flanges formed at both ends of the spring sleeves 10*c*, 10*d*. FIG. 3 shows a clamping condition in which the set of springs is compressed to the right by the left-hand end flange of the sleeves 10*c*, 10*d* and bears to the right on the housing halves 2 and 3 by means of a pressure member, which extends through the right-hand end flange and in this position forms the abutment for the corresponding thrust washer. As a result, the housing halves 2 and 3 are clamped against the slider 4. As the slider 4 is displaced, the force exerted by the wedge clamps on the sets of springs corresponds only to the displacing force so that the latter relax until they engage both end flanges of the sleeves 10*c* and 10*d*. Because the sets of springs and the pressure members are accommodated without play in the clamping noses, the wedge clamps assume an intermediate position in which the clamping action is eliminated.

FIG. 4 shows the device according to the invention which prevents a protruding of the cleaned set of screens 5*a* or 5*b* out of the slider 4 as a result of shapes of the machine. Such protruding set of screens could be destroyed or damaged when the slider is subsequently displaced. Flat pressure plates 12*a* and 12*b* are resiliently forced against the slider by the spring clamp 14 and are provided with attached flat heaters 13*a* and 13*b* serving to heat the protruding portion of the slider, which is thus heated to the operating temperature. The spring clamp 14 is hung on the upper tie rod 9*a* or 9*b* and can be fitted on the other side of the slider with the aid of the handle 15 when the screens have been changed and cleaned.

I claim:

1. A screen-changing apparatus for extruders for processing thermoplastic material; said apparatus comprising a slider which is provided with two detachable sets of screens and is displaceable by a power-operated displacing device in a double slide track disposed at the discharge end of an extruder cylinder, said double slide track comprising two housing halves, which are relatively movable in the feeding direction of the material and on which engaging surfaces of the slider bear in both end positions thereof, said displacing device having an output member that is connected to the slider, an abutment cooperates with the displacing device and is movable relative to the double slide track in the direction of pressure and firmly connected to a clamping device for clamping the housing halves against the slider, prestressed spring elements are provided between the clamping device and the housing halves and hold the clamping device in an ineffective position during the displacement of the slider, the spring force of said spring elements being smaller than the pressure exerted by the displacing device on the abutment when the slider has reached its end position, and the initial stress of said spring elements exceeds the force required to displace the slider.

2. A screen-changing apparatus according to claim 1, wherein the clamping device comprises wedge clamps, which are connected to the abutment for the displacing device and embrace the housing halves, and which comprise at least one obtuse-angled double wedge on at least one pressure surface and complementary double wedge surfaces on the complementary reaction surface of the housing halves.

3. A screen-changing apparatus according to claim 2, wherein each of the spring elements which hold the clamping device in an ineffective position during the displacement of the slider consists of a set of prestressed disc springs, which are provided in spring sleeves, which are attached to the wedge clamps and extend into openings of the housing half but

are shorter than the opening, and each set of disc springs are adapted to bear at each end by a thrust washer on an end flange of the spring sleeve and a pressure member, which extends through the central opening of the end flange and bears on the end faces of the housing halves, said pressure member being longer in the direction of pressure than the end flange of the spring sleeve.

4. A screen-changing apparatus according to claim 1, wherein pressure plates are connected by a spring clamp and

engageable with both sides of that portion of the slider which extends out of the guide housing to hold in position the cleaned set of screens not used at a time.

5. A screen-changing apparatus according to claim 4, wherein the pressure plates are provided with flat heaters for heating that portion of the slider which protrudes from the housing.