ORGANISATION AFRICAINE DE LA PROPRIETE INTELLECTUELLE
(O.A.P.I.)

(19) OAPI

(11) N° 10003 (51) Int. Cl.[6] B 29 C 47/08
B 29 C 47/36
B 29 C 47/00

(12) BREVET D'INVENTION

(21) Numéro de dépôt: 60 610

(22) Date de dépôt: 10.02.1995

(30) Priorité(s): JAPON
1) 10.08.1992 N° 4-253392
2) 25.01.1993 N° 5-43135
3) 15.04.1993 N° 5-126479

(24) Délivré le: 29.03.1996

(45) Publié le: 29.03.1996

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(54) Titre: Plastic resin kneading/extruding method and apparatus by alternate extrusions of cylinders.

(57) Abrégé:

A plastic resin kneading/extruding method using one auxiliary equipment including a screw drive source and a resin feed hopper, and a plurality of extruding units each including a cylinder with a feed opening and a screw and having their operations composed of an extruding step of kneading and extruding the plastic resin and a cleaning step of cleaning the screw and the cylinder, characterized in that the extruding step and the cleaning step are sequentially alternated for each of the extruding units. Thus, it is possible to realize a kneading/extruding method and an apparatus

therefor, which can accomplish synthetically continuous extruding operations without the extruding step zone being interrupted by the cleaning step zone and which can eliminate the defects of the prior art thereby to have a high extruding efficiency.

# S P E C I F I C A T I O N

## TITLE OF THE INVENTION

Plastic Resin Kneading/Extruding Method and Apparatus by Alternate Extrusions of Cylinders

## TECHNICAL FIELD

The present invention relates to a kneading/extruding method and a kneading/extruding apparatus of plastic resins.

## BACKGROUND ART

The kneading/extruding method and apparatus of plastic resins are composed of an extruding unit and an auxiliary equipment and their operations.

The extruding unit is composed of a cylinder with a feed opening and a screw for kneading and extruding a resin. The extruding unit performs the kneading/extruding operation at an extruding step zone and the cleaning operation at a cleaning step zone.

The auxiliary equipment is mainly composed of a hopper and a drive source. The hopper feeds the resin to the extruding unit from a feed opening, and the drive source drives the screw.

The operations continuously circulates in the sequence of the extruding step zone, the cleaning step zone and the extruding step zone.

Although the extruding operation should be main, it has to be interrupted at the cleaning step zone. It is the defects of the method and apparatus of the prior art that the extruding efficiency must drop according to the interruption.

The basic concept of the present invention is to eliminate the interruption of the extruding step zone by combining a plurality of extruding units with a single auxiliary equipment.

An object of the present invention is to realize the kneading/extruding method and apparatus which are enabled to eliminate the defect of the prior art and to have a high extruding efficiency by making the synthetically continuous extruding operations possible.

## DISCLOSURE OF THE INVENTION

A plastic resin kneading/extruding method using one auxiliary equipment including a screw drive source and a resin feed hopper, and a plurality of extruding units each including a cylinder with a feed opening and a screw and having their operations composed of an extruding step of kneading and extruding the plastic

resin and a cleaning step of cleaning the screw and the cylinder. The extruding units are disposed in such relative positions as can have their positions interchanged with their feed openings being always held upright. The extruding units are disposed in such relative positions that one of them is set in an extruding position for an extruding step and used as an active extruding unit whereas the remaining extruding unit other than the active extruding unit is set in a cleaning position for a cleaning step and used as a cleaning unit. The active extruding unit has its position interchanged, when it is to be cleaned, by that of the cleaning unit.

## BRIEF DESCRIPTION OF DRAWINGS

Fig. 1 and Fig. 2 are a side elevation and a transverse section of the case of two extruding units. Fig. 3 is a transverse section of the case of four extruding units. Fig. 4 is a side elevation of the case in which a feed opening is upright; Fig. 5, Fig. 6 and Fig. 8 are transverse sections of the same case; and Fig. 7 is a side elevation of the same case.

## BEST MODE FOR CARRYING OUT THE INVENTION

The present invention will be described in more

detail with reference to the accompanying drawings.

There is provided one auxiliary equipment which includes a screw drive source 18 and a resin feed hopper 19. There are provided a plurality of extruding units each of which includes a cylinder 1 with a feed opening and a screw 2. Numerals 3, 4, 5, 6 and 7 designate the extruding units. The extruding units 4 and 5 are supported on a revolver shaft 8 by support arms 9 in symmetry with respect to the revolver shaft 8. Likewise, in the case of Fig. 3, the extruding units 4, 5, 6 and 7 are held in relations to have their positions interchanged when revolved on the revolver shaft 8. These extruding units are arranged on a common circle around the revolver shaft 8, and their number may be two or more.

The revolver shaft 8 is revolved by a revolving mechanism 10.

One of the extruding units is used as the active extruding unit 4 in the extrusion position of the extruding step. The remaining extruding units other than the active extruding unit 4 are used as the cleaning units 5, 6 and 7 in the cleaning positions of the cleaning step. The active extruding unit 4 is revolved, when it is to be cleaned, to have its position interchanged by any of the cleaning units 5, 6 and 7.

The extruding unit transfers to the extruding step when it comes to the extruding position. When an extruding unit comes to the cleaning position, its cleaning step is ended by the next revolving. This revolving can be ended within a short time period. The position interchange has been executed by the revolving. However, the position interchanging method should not be limitative but can be exemplified by another method such as a parallel moving method, as taken in a horizontal direction.

With reference to Figs. 4 to 8, here will be described the case in which the extruding units have their positions interchanged with their feed openings being always held upright.

The extruding units 3 and 4 are supported on the revolver shaft 8 by the support arms 9 in symmetry with respect to the revolver shaft 8. These extruding units 3 and 4 are held in relation to have their positions interchanged when turned or revolved on the revolver shaft 8. The revolver shaft 8 is revolved by the revolving mechanism 10. One of the extruding units is used as the active extruding unit 3 in the extruding position of the extruding step. The remaining extruding unit other than the active extruding unit 3 is used as the cleaning unit 4 in the position

of the cleaning step. The active extruding unit 3 is revolved, when it is to be cleaned, to have its position interchanged with that of the cleaning unit 4. When the extruding unit comes to the extruding position, it transfers to the extruding step. The cleaning unit having reached the cleaning position is cleaned out by the next revolving. The resin is introduced from a feed opening 20. The position interchange is carried out with the feed opening 20 being always held upright. However, this mechanism is suitable but not limitative. One embodiment of this mechanism will be described with reference to the drawings.

The revolver shaft 8 has its leading end borne by a stationary cylinder 21. One support arm 9 is fixed on the revolver shaft 8 whereas the other support arm 9 is not fixed on the stationary cylinder 21. An endless band 11 such as a belt or chain is made to run between the stationary cylinder 21 and the extruding unit 3. The stationary cylinder 21 and the extruding unit 3 are given the same diameter at their portions on which the endless band 11 runs. The extruding units 3 and 4 are individually borne in a rotatable manner by the support arms 9. An endless band 12 is made to run between the stationary cylinder 21 and the

extruding unit 4. The stationary cylinder 21 and the extruding unit 4 are given the same diameter at their portions on which the endless band 12 runs. When the positions of the extruding units 3 and 4 are interchanged by revolving the revolver shaft 8, the feed openings 30 are always held upright by the actions of the endless bands 11 and 12. Fig. 6 shows the case of the extruding units 3, 4 and 5, in which the feed openings 20 are always held upright by the actions of the endless bands. A similar effect can also be attained even if the number of extruding units is four or more.

Another embodiment is shown in Fig. 7 and Fig. 8. A stationary wheel 15 is fixed on the stationary cylinder 21. Extruder wheels 13 and 14 are fixed on the extrusion units 3 and 4, respectively. The extruder wheels 13 and 14 and the stationary wheel 15 may be exemplified by friction pulleys or gears. Their external diameters are equalized in the case of the friction wheels, whereas the pitch circle diameters are equalized in the case of the gears. An intermediate wheel 16 is associated with the extruder wheel 13 and the stationary wheel 15 and has its shaft borne by the support arm 9. An intermediate wheel 17 is associated with the extruder wheel 14 and the stationary

wheel 15 and has its shaft borne by the support arm 7. When the positions of the extruding units 3 and 4 are interchanged by revolving the revolver shaft 8, the feed openings 20 are always held upright by the actions of the extruder wheels 13 and 14, the stationary wheel 15 and the intermediate wheels 16 and 17. When the support arm 9 is revolved by the revolver shaft 8, the active extruder unit 3 at the extruding step is interchanged by the cleaning unit 4 and is cleaned out to stand by until its position is interchanged with the position of the active extruding unit 3 by the next revolution.

Thus, the interruption of the extruding step for cleaning the extruding unit can be substantially eliminated to effect the practically continuous extruding process. The feed openings are always positioned upright to facilitate the resin introduction and the cleaning operation and simplify the attachment and detachment of the auxiliary equipment.

CLAIMS

1. A plastic resin kneading/extruding method using one auxiliary equipment including a screw drive source and a resin feed hopper, and a plurality of extruding units each including a cylinder with a feed opening and a screw and having their operations composed of an extruding step of kneading and extruding the plastic resin and a cleaning step of cleaning the screw and the cylinder, characterized in that the extruding step and the cleaning step are sequentially alternated for each of the extruding units.

2. A plastic resin kneading/extruding apparatus comprising extruding units disposed in such relative positions that one of them is set in an extruding position for an extruding step and used as an active extruding unit whereas the remaining extruding unit other than the active extruding unit is set in a cleaning position for a cleaning step and used as a cleaning unit, characterized in that the active extruding unit has its position interchanged, when it is to be cleaned, by that of the cleaning unit.

3. A plastic resin kneading/extruding apparatus as set forth in the preceding claim, characterized in that the extruding units are disposed in such relative positions as can have their positions interchanged

with their feed openings being always held upright.

FIG. 1

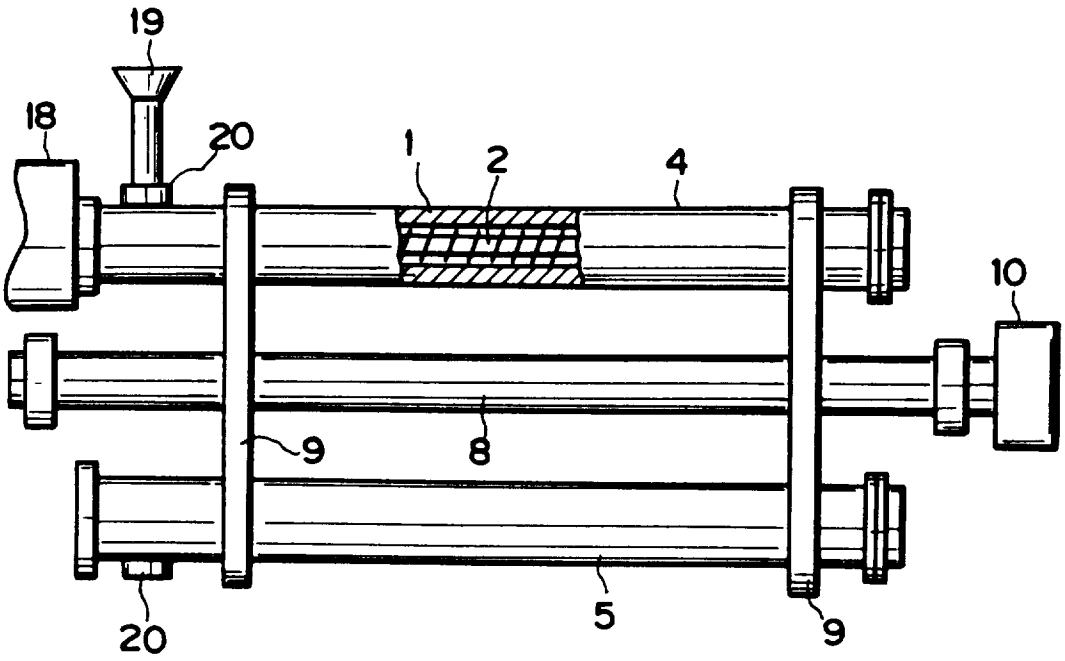


FIG. 2

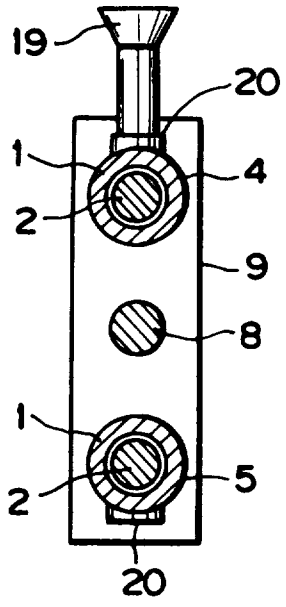

FIG. 3

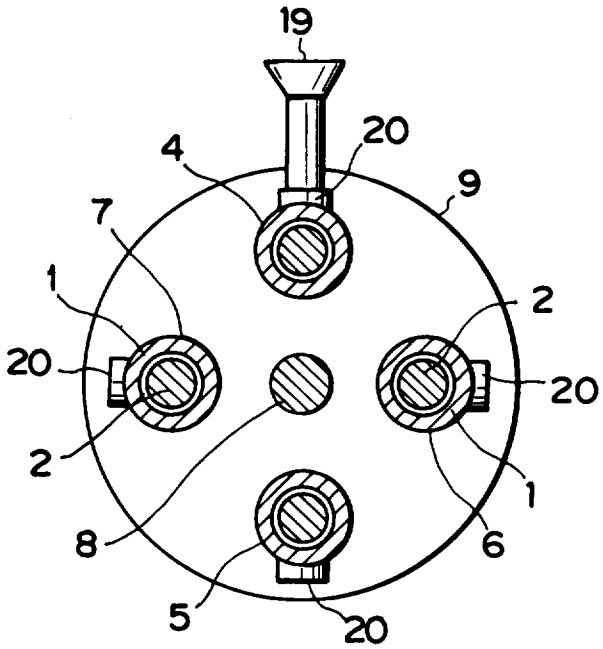


FIG. 4

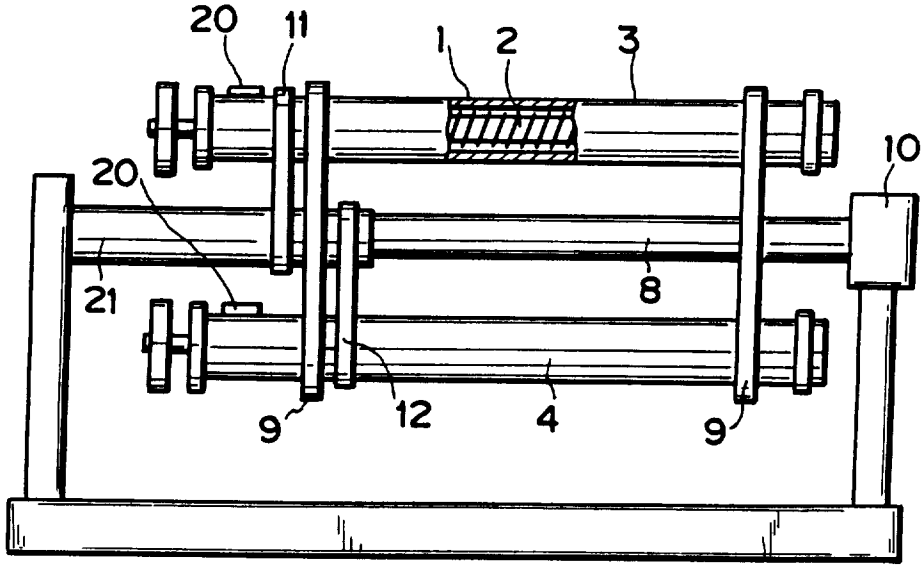

FIG. 5

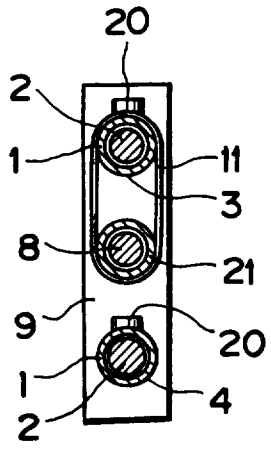


FIG. 6

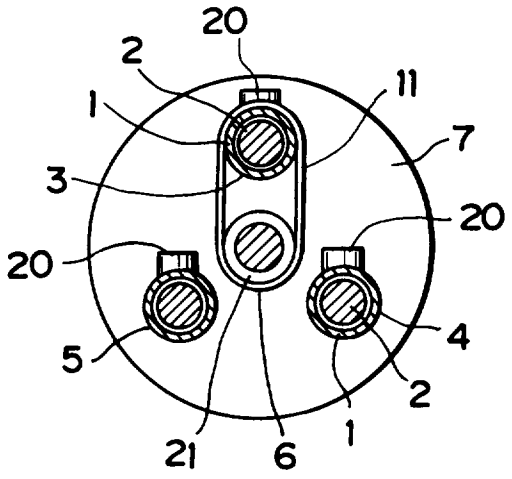

FIG. 7

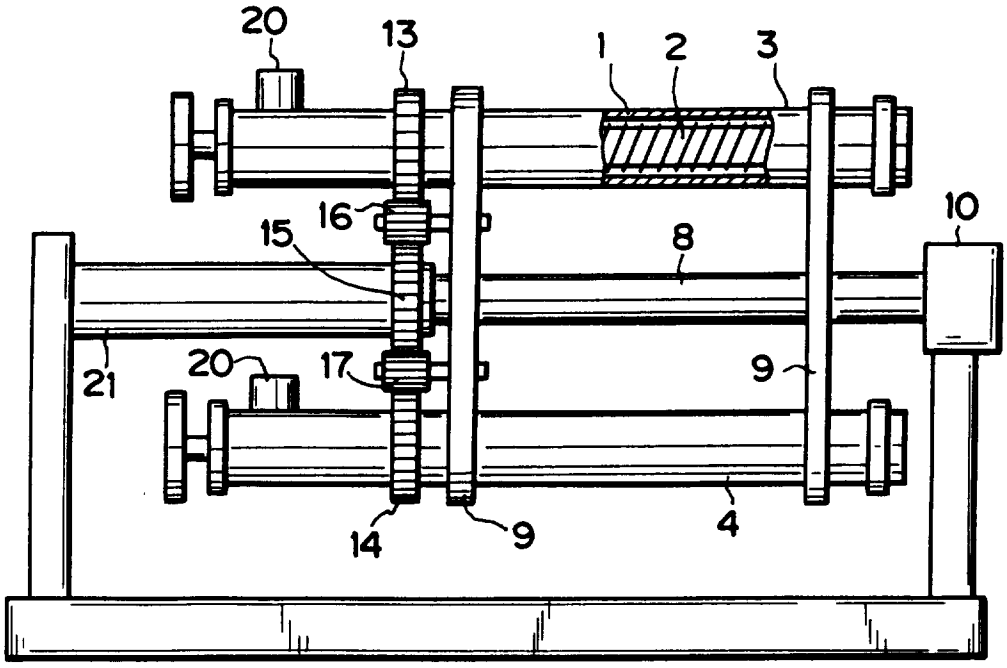


FIG. 8