FORM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952 599048

APPLICATION FOR A STANDARD PATENT

I\We,

BATTENFELD FISCHER
BLASFORMTECHNIK GmbH

of HERMANN-LONS-STRASSE 7
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GERMANY

hereby apply for the grant of a standard patent for an invention entitled:

EXTRUSION HEAD FOR EXTRUSION MOLDING

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
P3532996.3	DE	16 SEP 85

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 11th day of September 1986

BATTENFELD FISCHER
BLASFORMTECHNIK GmbH
CLEMENT HACK & CO.

TO: The Commissioner of Patents.

PATENT OFFICE
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11 SEP 1986

APPLICATION ACCEPTED AND AMENDMENTS
ALLOWED 27 · 4 · 90

Australia Patent Declaration Form

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s) — In support of the application made by Battenfeld Fischer Blasformtechnik GmbH

Title — for a patent for an invention entitled EXTRUSION HEAD FOR EXTRUSION MOLDING

Name(s) and address(es) of person(s) making declaration — I/We, Dieter Wollschläger, Zum kleinen Ölberg 27, 533o Königswinter 41; Dr. Paul Bernd Junk, Boettger Str. 5, 52o6 Neunkirchen-Seelscheid 1

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in W.-Germany on September 16, 1985
by Battenfeld Fischer Blasformtechnik GmbH
in ______ on ______ 19__
by ______

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are
1. Dr.-Ing. JOhannes Wortberg, Büzerhof, 463o Bochum
2. Dr.-Ing. Paul Bernd Junk, Boettgerstr. 5, 52o6 Neunkirchen 1
3. Harry Franke, Elbinger Str. 35, 463o Bochum 1

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-
1. - 3.: By claiming the rights of the law relating to invention of employees, claimed August 2o, 1985. such that the applicant would be entitled to have assigned to it a patent granted to the said actual inventors in respect of the said invention.

DECLARED at 533o Königswinter 41 / 52o6 Neunkirchen-Seelscheid 1 this 7th day of August 1986

Battenfeld Fischer Blasformtechnik GmbH

(Dieter Wollschläger)
Geschäftsführer

(Dr. Paul Bernd Junk)
(Geschäftsführer)

(12) PATENT ABRIDGMENT (11) Document No. AU-B-62604/86
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 599048

(54) Title
EXTRUSION HEAD FOR EXTRUSION MOULDING

International Patent Classification(s)
(51)[4] B29C 047/20 B29B 011/10 B29B 011/12 B29C 047/06

(21) Application No. : 62604/86 (22) Application Date : 11.09.86

(30) Priority Data

(31) Number (32) Date (33) Country
3532996 16.09.85 DE FEDERAL REPUBLIC OF GERMANY

(43) Publication Date : 19.03.87

(44) Publication Date of Accepted Application : 12.07.90

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(56) Prior Art Documents
EP 110493
US 3308508

(57) Claim

1. Extrusion head with a plurality of head sections arranged one behind the other for extrusion moulding of hose-or tube-shaped preform blanks with multi-layered walls made from synthetic plastics materials which are plastified in extruders, wherein the head sections are the same or similar and each is provided with a central annular discharge and/or flowthrough channel and can be selectively linked together one behind the other, and wherein each of the head sections contains up to three concentric helix distributors, seated one within the other, which open into an annular gap in the discharge and/or flowthrough channel, and wherein the ends of adjacent head sections which face towards one another have mutually complementary engagement members by means of which the discharge and/or flowthrough channels can be brought into axial alignment with each other.

59048

AUSTRALIA

PATENTS ACT 1952

Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title: 62604/86

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

This document contains the amendments made under Section 49.

and is correct for printing.

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled:
EXTRUSION HEAD FOR EXTRUSION MOLDING

The following statement is a full description of this invention including the best method of performing it known to me:-

The present invention relates to an extrusion head for extrusion molding of tube-shaped preform blanks with single- or multi-layered walls made from synthetic plastics material which are plastified in the extruder.

It is already known that containers made from synthetic plastics materials with single- or multi-layered walls may be produced by a blow-molding technique from tube-shaped preform blanks which are extrusion molded from synthetic plastics material, which has been plastified in the extruder, with the use of so-called extrusion heads.

Whereas, under these conditions, the preform blanks for containers with single-layered walls may readily be fabricated without any problems, difficulties often arise in the extrusion of preform blanks with multi-layered walls without defects so that the finished containers prepared by blow-molding from these blanks will be of unquestionably good quality.

If, during the extrusion molding of preform blanks with multi-layered walls, all of these layers are formed concentrically to each other in approximately the same plane, this leads to the situation where the outer layers must be extruded first of all with a larger diameter and subsequently, with the application of elastic peripheral deformation, they must be caused to undergo shrinkage to the final diameter of the tube, whereas the innermost layer with the smallest diameter in the dispenser system will be subjected to a very much smaller peripheral deformation because its diameter has to be altered to only a relatively very small extent. It can, therefore, very frequently happen - especially if different synthetic plastics materials are to be extruded to form a laminated structure - that the various layers have only very poor adhesion to one another, so that the properties of the finished articles are quite inadequate with respect to their resistance to compression or impact on being dropped.

In this situation, the great disadvantage is the relatively large diameter of each of the individual extrusion heads so that it is only with great difficulty that they can be operated in conjunction as multiple extrusion heads.

In order to overcome this disadvantage, it is certainly possible to arrange the dispenser systems for the build-up of the individual layers of the wall so that they are located behind one another in the extrusion head. However, the result of this arrangement is that the length of the extrusion head will vary quite considerably, depending upon the number of layers required to form the wall, thus giving rise to excessive lengths of flow paths for the synthetic plastics material in the individual layers.

Whereas extreme variations in the diameter ratios of the individual layers may occur with the construction of the extrusion heads as described initially for the dispenser systems, in the case of the other type of construction there may be extreme variations in the flow times, dwell times and shearing stresses for the individual layers.

The object of the present invention is to overcome the inadequacies associated with the already known types of constructions for extrusion heads. The goal of the invention is thus to provide an extrusion head of the type initially specified which, on the one hand, will make it possible to have smaller variations in the diameters of the individual layers and, on the other hand, will eliminate undesirably long flow paths and hence limit the length of the extrusion head.

According to the present invention there is provided an extrusion head with a plurality of head sections arranged one behind the other for extrusion molding of hose-or tube-shaped preform blanks with multi-layered walls made from synthetic plastics materials which are plastified in extruders, wherein the head sections are the same or similar and each is provided with a central annular discharge and/or flowthrough channel and can be selectively linked together one behind the other and wherein each of the head sections contains up to three concentric helix distributors, seated one within the other, which open into an annular gap in the discharge and/or flowthrough channel, and wherein the ends of adjacent head sections which face towards one another have mutually complementary engagement members by means of which the discharge and/or flowthrough channels can be brought into axial alignment with each other.

Because certain common flow path lengths of adjacent layers of synthetic plastics material are an advantage with regard to the best possible connecting or welding together, it is possible to design extrusion heads, on the basis of this feature, which take into consideration all the operational requirements of the most diverse types.

In accordance with the present invention, it is proposed that each of the head sections should be furnished with as many as three helical distributors which are nested concentrically within one another and which all open into the discharge- and/or flowthrough-channels of the head sections which contain them. It is thus possible to produce preform blanks by extrusion molding with the use of a single head section of relatively-short length, so that the wall of the blank consists of one to three layers. Two head sections arranged in line behind one another make it possible to produce preform blanks with from two up to six layers in their walls whereas, with the use of three head sections arranged in line behind one another, it is possible to produce preform blanks with from two up to nine layers in their walls.

By making use of different combinations of head sections, it is possible to adapt the equipment to meet the most diverse requirements and specifications with a relatively small expenditure of technical effort.

In accordance with a further important developmental feature of the invention, provision is made in Claim 2 that each of the head sections should have an end-piece which carries a number of connection-and supply-channels for the plasticized synthetic plastics material corresponding to the number of helical distributors.

With the employment of these end-pieces which have an angular peripheral displacement in relation to each other it is also possible to connect the extruder to sources of supply of various synthetic plastics materials.

In many cases it has been found to be expedient, in accordance with Claim 3, to insert a head section with only one flowthrough-channel between two of the same or similar head sections in order to be able to arrive at common lengths of flow paths for already laminated molten films and thus improve the adhesion between them.

In accordance with Claim 4 of the invention, it is also possible that a head section with only one flowthrough-channel may be inserted upstream of the discharge nozzle in order to provide a common flow path for all the laminated molten films at that location.

In addition, it has been found to be particularly valuable, in accordance with the teaching contained in Claim 5, to have up to three of the same or similar head sections, with at least one helical distributor each, coupled behind one another in series. In this case, the overall length of the extrusion head exceeds a value of three times the diameter by only a very small amount. It is possible, however, with such a type of extrusion head, to effect the extrusion molding of preform blanks which contain as many as nine superimposed layers.

In many instances, it has been found expedient to have a construction in accordance with Claim 6, that is to say, the number of helical distributors for each of the head sections coupled in series decreases in the direction towards the discharge nozzle. This give rise to several rheological-thermodynamic advantages.

In accordance with Claim 7 of the invention, the possibility is also provided that the helical distributors may be installed in thermal isolation from the head section and/or from one another, in which case, in accordance with Claim 9, they may be provided with, or connected to, independent temperature-regulating devices. It then becomes possible to effect differential temperature regulation of the streams of molten material flowing through the individual helical distributors and thus to exert an optimal influence on the various synthetic plastics materials which are to be processed. Thus it could be meaningful to feed synthetic plastics materials, with very different temperatures after extrusion, into the extrusion head and to maintain them at these temperatures during the material distribution procedure, in order to allow for temperature equilibration to take place only in the superimposed layers of extrudate.

Lastly, from the constructional point of view, in accordance with Claim 9 , provision is made for each of the helical distributors to consist of sleeves which have a slightly-conical outer jacket of greater length and a conical, more steeply sloping, shorter end section, whereas the inner jacket is cylindrical over the whole of its length.

Additional features and advantages of the object of the present invention will be described in greater detail in what follows with reference to the accompanying drawings of examples of embodiment of the invention, in which :

Fig. 1 is a longitudinal section through an extrusion head which consists of three similar head sections,

Fig. 2 is a cross-section through the extrusion head shown in Fig. 1, seen in the direction of arrow II,

Fig. 3 is a cross-section through the extrusion head shown in Fig. 1, along the line III - III,

Fig. 4 is a cross-section through the extrusion head shown in Fig. 1, along the line IV - IV,

Fig. 5 depicts the three head sections of the extrusion head shown in Fig. 1, separated from one another, whereas

Fig. 6 and Fig. 7 are diagrammatic longitudinal sections of constructional variants of an extrusion head.

An extrusion head 10 for extrusion molding of tube-shaped preform blanks is shown in longitudinal section in Fig. 1. This extrusion head, by way of example, consists of three similar head sections 11, 12 and 13 which are aligned axially behind one another. The discharge nozzle 14 is attached to the front-end head section 13 of the extrusion head 10 and the nozzle needle 15 passes coaxially right through all the head sections 11 to 13 so that it may be actuated from behind the rear-end head section 11. All the head sections 11, 12, 13 of the extrusion head 10 have at least a similar basic constructional design.

The head section 11 is provided with a jacket 16 which has a cylindrical inner surface 17 over the greater part of its length but which tapers conically inwards at its front end. This tapered conical section 18 ends in a central mouth opening 20 at the front end 19 of the jacket 16. This can be seen more clearly in Fig. 5.

From the rear end of the head section 11, a sleeve 21, which has a retaining flange 22 at its rear end, projects coaxially into the jacket 16 and its front end is at least almost flush with the front end 19 of the jacket 16 so that it serves to delimit an annular discharge channel 24 between it and the rim of the mouth opening 20.

The sleeve 21 has a central bore right through it to allow for the movement of the nozzle needle 15.

Around its periphery, at least for the greater part of its length, the sleeve 21 has a conical outer surface which tapers slightly towards its free end which, once again, has a waist like constriction 27 close its free end 23.

There are helical channels 28 for the molten material, cut into the surface 26 of the sleeve 21, which join up with a melt supply channel 29 which runs parallel to the longitudinal axis of the sleeve 21 and these helical channels have different profile depths. The profile depth of the melt channels 28 gradually decreases from the retaining flange 22 of the sleeve 21 all the way to its free end 23, as may be seen clearly in Fig. 1 and Fig. 5.

The retaining flange 22 for the sleeve 21, together with an end piece 30, is detachably affixed to the jacket 16 by means of screws 31 in such a manner that the supply channel 29 for the molten material passes over into a connecting channel 32 which debouches laterally in the end piece 30 to form the site of connection to an extruder.

At the free end 23 there are short expanded sections 34 and 35 which have cross-sectional areas greater than that of the longitudinal bore 25, in which case the expanded section 34 has a smooth cylindrical fitting surface, whereas the other expanded section 35 of larger diameter is provided with an internal screwthread 36.

The sleeve 21 which projects out from the retaining flange 22 is surrounded coaxially by a sleeve 37 having a greater diameter which is centred on the rear cylindrical surface 38 of sleeve 21 and has an inner cylindrical surface 39 over the whole of its length.

The cylindrical inner surface 39 of the sleeve 37, together with the slightly-conical outer surface 26 of the sleeve 21, forms a so-called helical distributor 40 which defines an annular flowthrough channel 41 for the molten material, within which the movement of the molten material gradually changes over from the so-called helical flow, in the region of the channel 28 for the melt, into an axial flow towards the free end 23 of the head section 11.

The external surface 42 of the second sleeve 37 is configured in a fashion similar to that of the outer surface 26 of the first sleeve 21. It has a conical shape which tapers inwards very slightly towards its free end and it has melt channels 43 cut into its rear section in such a way that the profile depth gradually decreases from the rear end towards the front end and, close to its free end, it is provided with a waist-like constriction 44.

However, the sleeve 37 differs from the sleeve 21 in that it is provided with a rapidly tapering conical end section 45 at its free end, the outer surface 46 of which lies in close proximity to the conical inner surface 18 of the jacket 16, with the formation of a conically tapering annular gap 47.

The second sleeve 37 is surrounded concentrically by a third sleeve 48 which projects inwards from a retaining flange 49 to which, on the one hand, the second sleeve 37 is detachably affixed by means of screws 50 and by way of which, on the other hand, the third sleeve 48 is retained in position with the jacket 16 and the end piece 30 by means of the screws 31.

The third sleeve 48 also has a cylindrical inner surface 51 over practically the whole of its length which, in conjunction with the conical outer surface 42 of the second sleeve 37, acts as a helical distributor 52 which encompasses an annular melt channel 53, within which the original helical flow is transformed into an axial flow before the melt arrives at the conically tapering annular gap 47 to move along in the direction of the discharge channel 24.

In the case of the third sleeve 48 also, the inner surface is slightly tapered conically inwards over the greater part of its length towards its free end and it also has a steeply tapered conical end section 55 at its free end, the outer surface 56 of which lies opposite to the conically tapering inner surface 18 of the jacket 16 to form the distancing gap 57. However, in the vicinity of the retaining flange 49, the third sleeve 48 possesses a cylindrical surface section 58 which mates with the inner cylindrical surface 17 of the jacket 16 to perform a centering function.

There are also melt channels 59 cut into the outer surface 54 of the third sleeve 48 and these channels have a profile depth which gradually decreases in the direction towards the free end of the sleeve, in which case the outer surface 54 acts in conjunction with the cylindrical inner surface 17 of the jacket 16 as a so-called helical distributor 60 which delimits an annular space that gradually expands conically towards the free end, within which the helical flow of the melt gradually passes over into an axial flow before the melt passes through the gap 57 and the gap 47 into the region of the annular discharge channel 24.

It must also be mentioned here that the melt channels 43 of the second sleeve 37 are in communication with a supply channel 62 which passes out from the sleeve 37 through the retaining flange 49 and the retaining flange 22 into the end piece 30 where it opens to the outside, as may be seen in Fig. 2.

A similar supply channel 63 for the melt is also associated with the melt channels 59 in the third sleeve 48 and this is apparent from Fig. 1 and Fig. 2 without the need for any further explanation.

The construction of the head section 12 of the extrusion head 10 as shown in Fig. 1 corresponds substantially to the head section 11 with respect to the jacket 16 and the two coaxially enclosed sleeves 37 and 48.

However there is a variation when compared with the head section 11 in that the head section 12 includes an inner sleeve 64 with a central bore 65 for the through passage of the nozzle needle 15. This inner sleeve 64 differs in construction and arrangement from the inner sleeve 21 of the head section 11.

The inner sleeve 64 in the head section 12 is relatively loosely fitted into the remaining parts, that is to say, it can easily be inserted coaxially through the sleeve 37 as well as through the end piece 67 of the head section 12. Under these conditions it defines an annular flowthrough channel 68 for the molten material coming from the head section 11 between its outer peripheral surface, the inner surface of the sleeve 37 and a flowthrough channel 68 ~~aperture 67~~ in the end piece 67. The flowthrough channel 68 in this case has two stepwise offset longitudinal sections 69, 70 which, because of the appropriate configuration of the peripheral outer surface of the sleeve 64, very gradually expand conically in the flowthrough direction for the molten material.

The rear end 71 of the sleeve 64 projects slightly from the rear of the end piece 67 where it has two short stepped down sections 72 and 73. Whereas the peripheral step 72 has a smooth surface for fitting into the mating stepped portion 34 in the sleeve 21, the peripheral step 73 is provided with an external screwthread 74 which engages in the internal screwthread 36 in the sleeve 21 of the head section 11.

The other, front, end of the sleeve 64 has a configuration the same as that possessed by the free end of the sleeve 21 of the head section 11 and thus has two stepped enlargements 75 and 76 in relation to the central bore 65. The first of these enlarged sections 75 has a smooth internal surface for fitting onto a smooth mating surface, whereas the second enlarged section 76 is provided with an internal screwthread 77. The external surface of the sleeve 64, at the free end

78 of the sleeve , together with the end section 20 of the jacket 16, defines an annular discharge channel 79 for the molten material, into which the annular gaps 57, 47 open up from radially outwards, which is delimited between the conical inner surface 18 of the jacket 16 as well as between the conical end sections 55 and 45 of the two sleeves 48 and 37 respectively.

The head section 13 of the extrusion head 10, in accordance with Fig. 1, has a jacket 80, the inner surface of which has a main cylindrical section 81 as well as a conical end section 82 which opens into a flowthrough opening 83 at its free end 84. From the rear end of the head section 13, a sleeve 85 projects forward from a retaining flange 86 into the jacket 80 and this sleeve 85, together with the end piece 87 is detachably affixed to the jacket 80 by means of screws 88.

The sleeve 85 has a cylindrical bore 89 which is aligned with a corresponding cylindrical passage 90 in the end piece 87 (see Fig. 5).

The outer surface of the sleeve 85 has a very-slightly tapering conical peripheral surface region 91 which adjoins a steeply sloping conical end section 92, the surface 93 of which lies opposite to the conical inner surface 82 of the jacket 80 to form an annular conical gap 94. In this situation, the annular gap 94 opens up directly into the discharge opening 83. The conical surface region 91 of the sleeve 85 has melt channels 95 cut into it, and the profile depth of these channels gradually decreases towards the free end of the sleeve, as clearly indicated in Fig. 1 and Fig. 5. The melt channel 95 is supplied with molten material coming from the extruder by way of a connecting channel 96. For this purpose, the connecting channel 96 passes through the retaining flange 86 and the end piece 87 so that it opens out laterally through this latter piece. The inner surface 81 of the jacket 80 and the outer surface of the sleeve 85 together form a helical distributor 97 for the molten material which encloses an annular gap 98 that enlarges in a wedge shape in the direction of flow and within which the flow of molten material gradually changes over from a helical flow to an axial annular flow before it reaches the discharge opening 83 through the conical annular gap 94. Concentric with the sleeve 85 there is yet another sleeve 99 provided in the head section 13 and this additional sleeve has a smooth cylindrical bore 100 for the passage through it of the nozzle needle 15, as well as having a cylindrical peripheral surface 101. An annular flowthrough channel 102 is defined by the cylindrical inner surface 89 of the sleeve 85 and the outer cylindrical surface 101 of the sleeve 99 and this channel also continues on through the end piece 87.

The rear end of the sleeve 99 projects beyond the rear end of the end piece 87 and is there provided with peripheral offsets 103 and 104. The peripheral offset 103 has a smooth surface to act as a mating fitting surface, whereas the peripheral offset 104 is provided with an external screw-thread 105.

In a similar fashion to the way in which the sleeve 64 of the head section 12 is connected to the sleeve 21 of the head section 11 by means of screwing, the sleeve 99 of the head section 13 is also connected with the sleeve 64 of the head section 12 by means of screwthreads, as clearly indicated in Fig. 1.

Once again, the front end of the sleeve 99 has short stepwise enlarged recesses 107 and 108 in comparison with the cylindrical bore 100, where the first section 107 is provided with a smooth mating fitting surface, whereas the second section 108 has an internal screwthread 109.

The front end 106 of the sleeve 99 is seen to lie in approximately the same plane as the free end 84 of the head section 13 and there, together with the flowthrough opening 83, it defines an annular discharge channel 110 into which the conical annular gap 94 opens radially from the outside.

The head section 11 of the extrusion head 10 in accordance with Fig. 1 has a structure which allows for the production of a triple-layered tube-shaped preform blank.

The head section 12 of the extrusion head 10 in accordance with Fig. 1 is constructed in such a manner that it applies two additional laminar layers of melt to the material coming from the head section 11, whereas the head section 13 of the extrusion head 10 shown in Fig. 1 is suitable for the application of one more layer to the laminated product coming to it from head section 12.

Each of the head sections 11, 12 and 13, as depicted in Fig. 5, is designed in such a way that it may be used independently in the manufacture, from plasticized synthetic plastics material, of preform blanks with multi-layered walls. It is thus possible to utilize the head section 11 on its own, with the addition of the discharge nozzle 14, to yield a preform blank which has a triple-layered wall structure.

The head section 12 used on its own, with the addition of the discharge nozzle 14, is suitable for the manufacture of a preform blank with only two layers in its wall structure.

Lastly, the head section 13 used independently, again with the addition of the discharge nozzle 14, will yield a preform blank with a wall consisting of only one layer.

When the three head sections 11, 12 and 13 are coupled axially, one behind the other in that order, to form a composite extrusion head 10, it is possible to manufacture a preform blank with a six-layered wall structure.

It would be possible to obtain a preform blank with seven layers in its wall if one head section 11 was coupled in series with two following head sections 12 to form an extrusion head 10.

A preform blank with a four-layered wall could be obtained by coupling a head section 13 to the front end of a head section 11 to form an extrusion head 10.

In order to be able to couple the individual head sections 11, 12 and 13 together in the appropriate sequence(s) in a simple manner, so that a different structural arrangement of the layers in the wall of a preform blank could be obtained which would comply with the limits of a particular specification, the ends of the adjacent head sections which are to be connected together are provided with appropriate mating means for their attachment to one another.

To ensure the proper engagement and alignment of the head sections 11, 12 and 13, depressions 111 are molded into the rear ends and projections 112 are molded onto the front ends of all these head sections. These projections and depressions can then be fitted together to produce an axial alignment of the head sections 11, 12 and 13, in which the discharge channels 24 and/or the flowthrough channels 68 and 102 are in functionally correct alignment. The individual head sections 11, 12 and 13 which form the extrusion head 10 are held together detachably by means of the screws 113 as illustrated in Fig. 1, for example.

The discharge nozzle 14, as depicted in Fig. 1 and Fig. 5, is also configured in such a way that it may be coupled to any of the head sections 11, 12 and 13 respectively as desired without any difficulty.

It may be seen quite readily from Fig. 1 and Fig. 5 that the sleeves 21, 37 and 48, or 37 and 48, or 85, which are associated with the individual helical distributors, have different configurations and may be installed independently of one another. Thus, there is the practical possibility that the different helical distributors of the particular head sections 11, 12 and 13 may be installed separately and/or thermally separated from one another and they may be provided with, or connected to, independent temperature-regulation devices.

This possibility of different configurations makes it feasible to use synthetic plastics materials from the extruders at widely different temperatures for feeding into the extrusion head 10 and to maintain these different temperatures even during the distribution of the molten material within the extrusion head 10. Temperature equilibration can then take place in the final laminated extrudate.

With the employment of the measures described in the foregoing text, it is possible to manufacture preform blanks, which have different laminated wall structures, with the expenditure of only a relatively small amount of technical effort.

A purely diagrammatic representation of an extrusion head 10 is presented in Fig. 6 which includes one head section 11 and one head section 12, but with the interposition of a head section 114 between the head section 12 and the discharge nozzle 14, where this head section 114 contains only one flowthrough channel 115 for the tube-shaped preform blank with five layers in its laminated wall structure. In this way, the effect is achieved where all the superimposed melt layers in the laminated wall must pass through a predetermined length of flow path in common before they arrive at the discharge nozzle 14 where the final extrudate is produced.

In the example of embodiment of an extrusion head 10 in accordance with Fig. 7, a head section 114, with only one flowthrough channel 115, is installed between a head section 11 and a head section 13, where both head sections 11 and 13 are the same as those depicted in Fig. 5. This arrangement allows for the manufacture of a preform blank with four layers in its wall structure, in which case the three layers superimposed on top of one another in the head section 11 must first of all pass through a predetermined length of flow path in common before the fourth and final layer is added to the laminated preform blank in head section 13.

The constructional configurations, obtained with the use of head sections 11, 12, 13 and 114 for the extrusion head 10, which have been described in the foregoing text, make it possible to achieve a richly varied assortment of wall structures in the extrusion molding of preform blanks from synthetic plastics materials on the basis of the so-called co-extrusion process, with the utilization of relatively small-diameter and relatively short extrusion heads 10.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS :

1. Extrusion head with a plurality of head sections arranged one behind the other for extrusion moulding of hose-or tube-shaped preform blanks with multi-layered walls made from synthetic plastics materials which are plastified in extruders, wherein the head sections are the same or similar and each is provided with a central annular discharge and/or flowthrough channel and can be selectively linked together one behind the other, and wherein each of the head sections contains up to three concentric helix distributors, seated one within the other, which open into an annular gap in the discharge and/or flowthrough channel, and wherein the ends of adjacent head sections which face towards one another have mutually complementary engagement members by means of which the discharge and/or flowthrough channels can be brought into axial alignment with each other.

2. The extrusion head in accordance with Claim 1 wherein each of the head sections carries an end piece which contains a number of connection and supply channels for the plastified synthetic plastics material corresponding to the number of helical distributors.

3. The extrusion head in accordance with Claims 1 or 2 wherein a head section, with only one flowthrough channel, is installed between two of the same or similar head sections.

4. The extrusion head in accordance with any one of Claims 1 to 3, wherein a head section, with only one flowthrough channel, is installed before a discharge nozzle.

5. The extrusion head in accordance with any one of Claims 1 to 4, wherein up to three of the same or similar head sections each containing at least one helical distributor are coupled together one behind the other.

6. The extrusion head in accordance with any one of Claims 1 to 5, wherein, in the case of the head sections which are coupled together, the number of helical distributors in said sections decreases in the direction towards the discharge nozzle.

7. The extrusion head in accordance with any one of Claims 1 to 6, wherein the helical distributors are thermally insulated from the head section and/or from one another.

8. The extrusion head in accordance with any one of Claims 1 to 7, wherein the helical distributors are provided with, or connected to, independent temperature-regulation devices.

9. The extrusion head in accordance with any one of Claims 1 to 8, wherein the helical distributors are each associated with sleeves which have on their outer surfaces a very slightly conical main section of greater length and a steeply conical end section which is much shorter, whereas their inner surfaces are cylindrical over the whole of their length.

10. The extrusion head in accordance with any one of Claims 1 to 9, wherein each of the head sections possesses a central sleeve with a central bore through which the nozzle needle passes and the sleeves of adjacent head section are connected together by means of screwthreads.

11. Extrusion head substantially as hereinbefore described with reference to any one of the accompanying drawings.

DATED this 26th day of April, 1990
BATTENFELD FISCHER BLASFORMTECHNIK GMBH
By Its Patent Attorneys:
GRIFFITH HACK & CO.
Fellows Institute of Patent
Attorneys of Australia.

FIG. 1

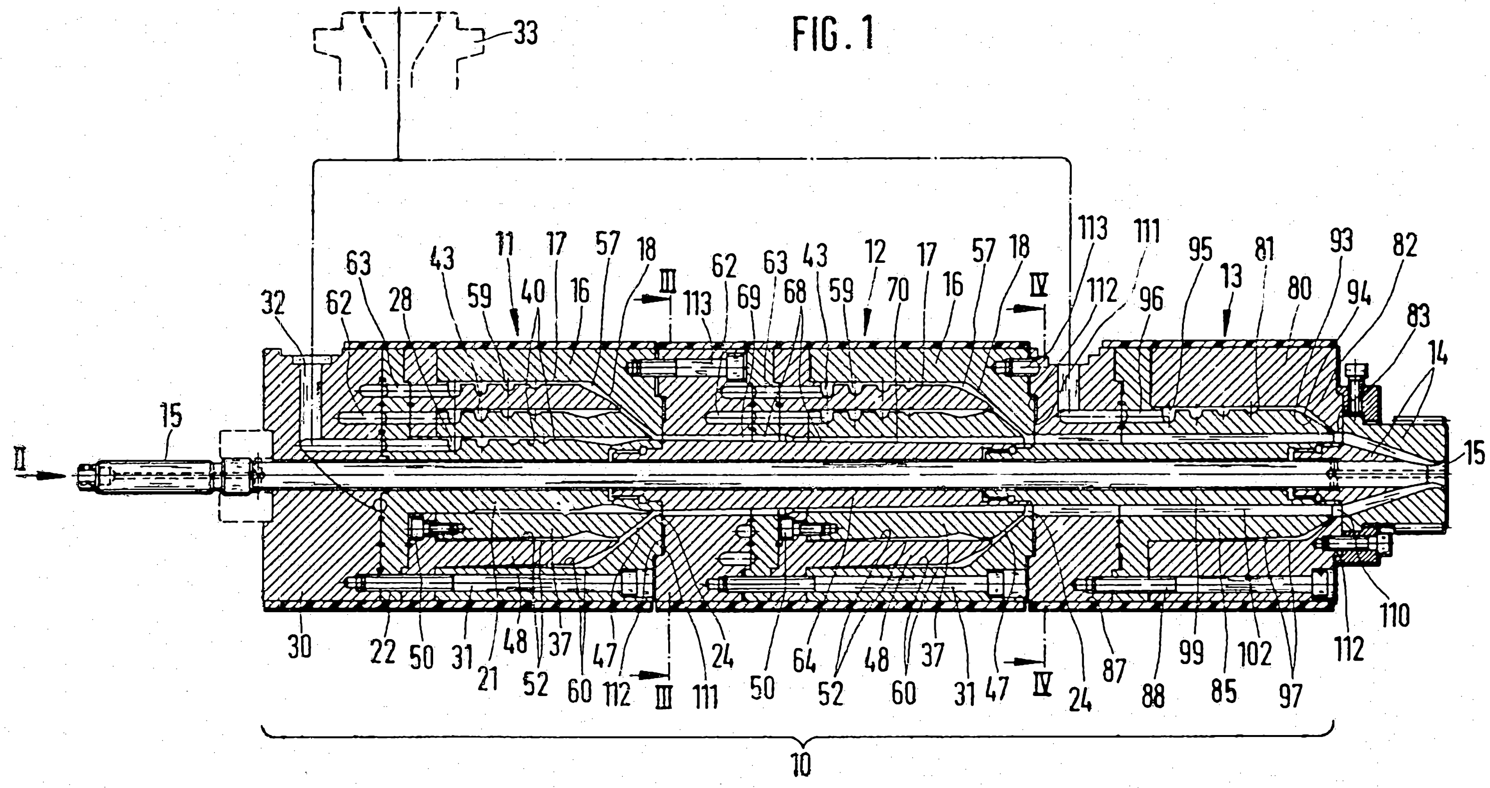

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FIG. 2

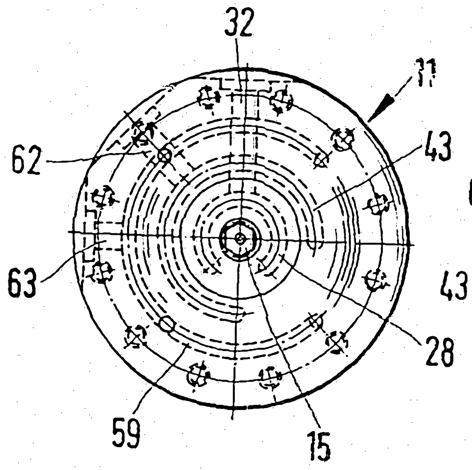

FIG. 3

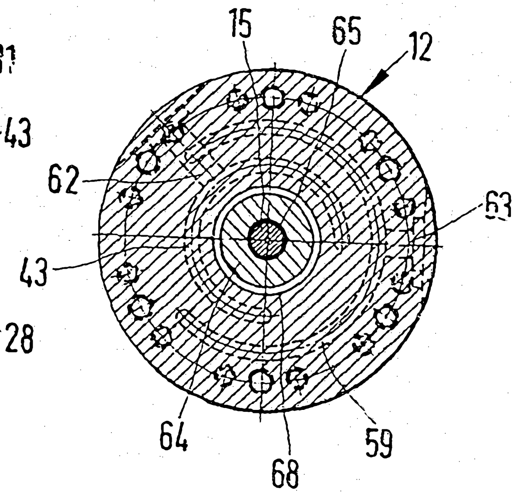

FIG. 4

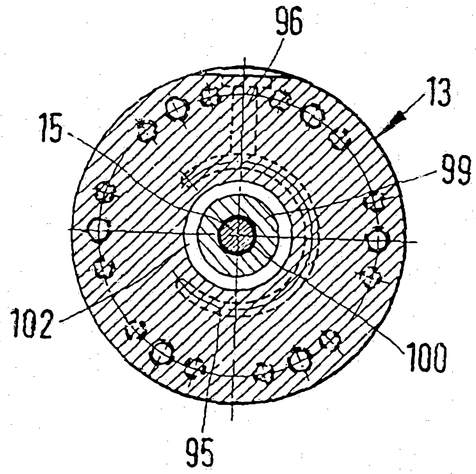

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FIG. 5

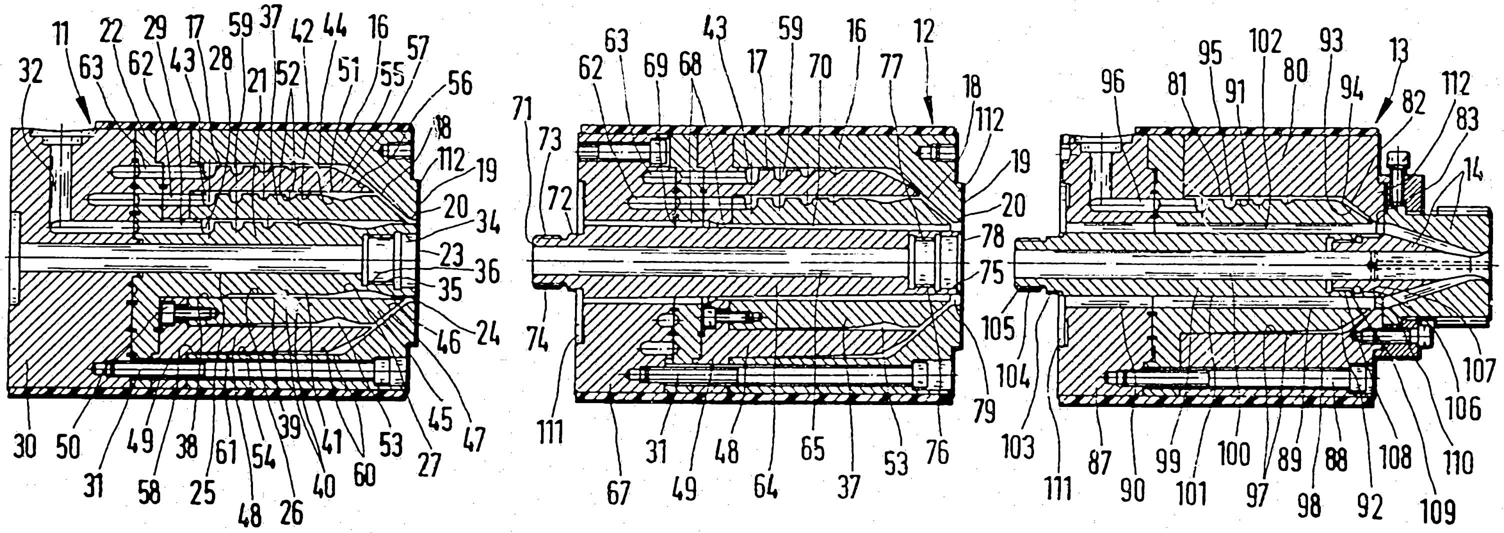

FIG. 6

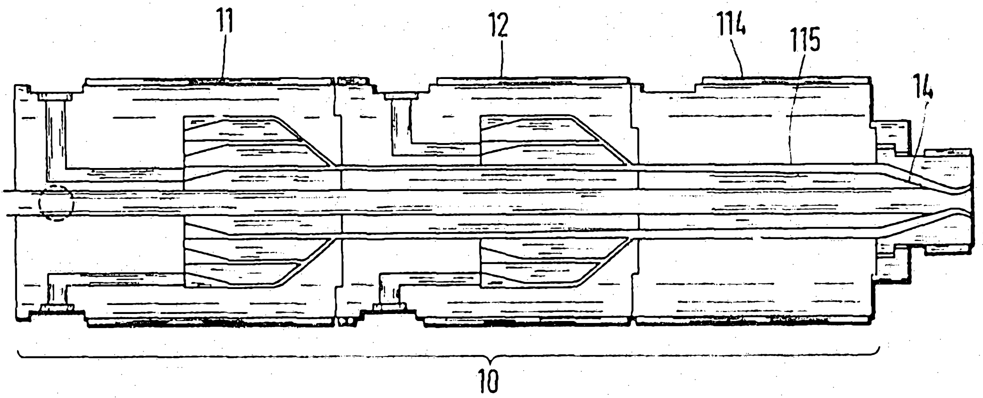

FIG. 7