

Feb. 16, 1971

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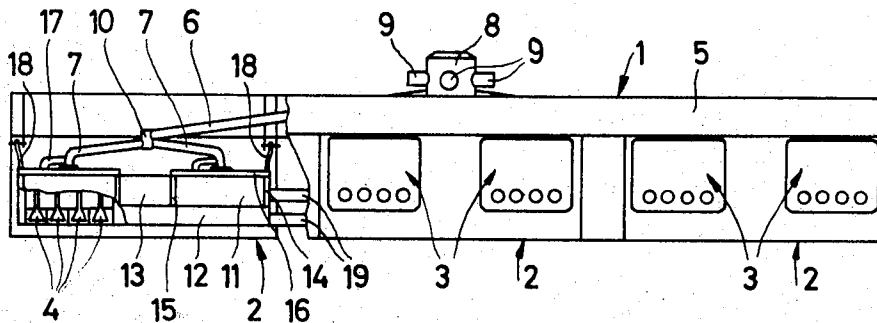
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APPARATUS FOR THE MANUFACTURE OF SYNTHETIC FIBERS

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4 Sheets-Sheet 1

FIG. 1



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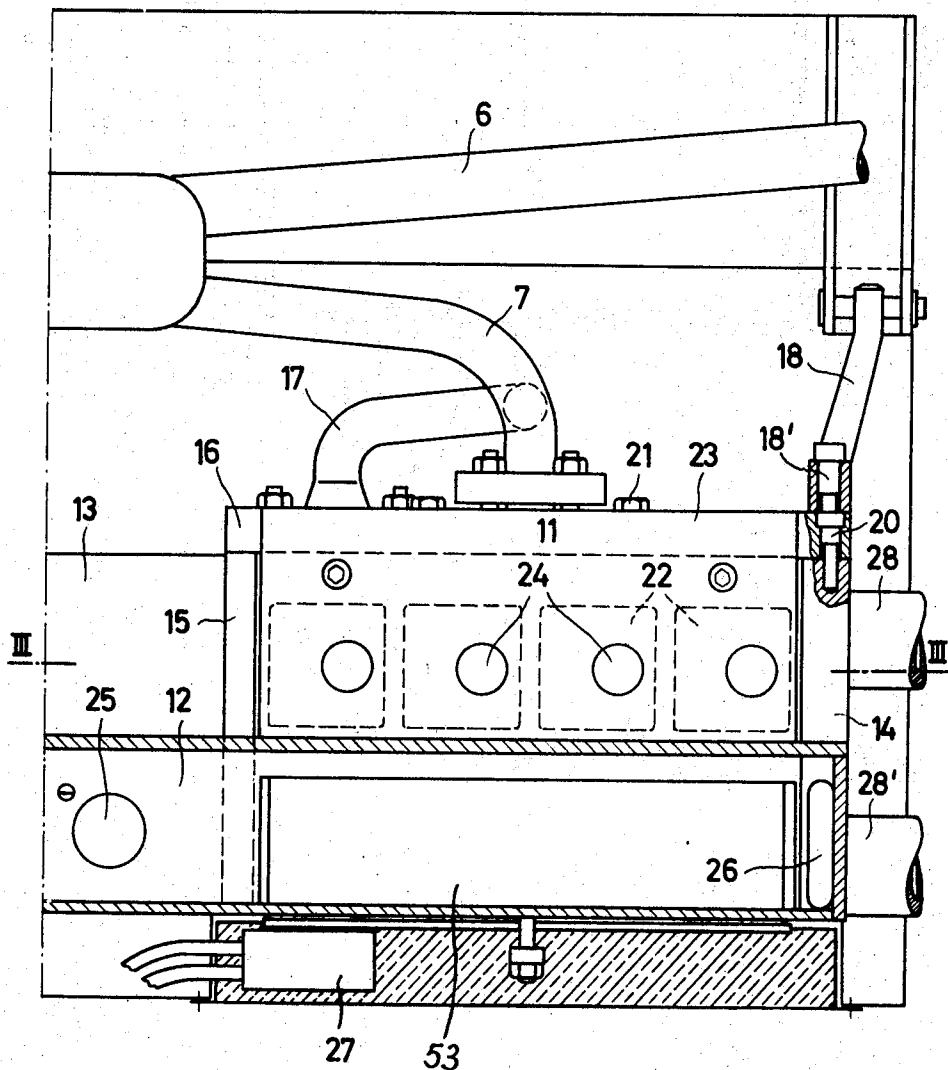
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FIG. 2



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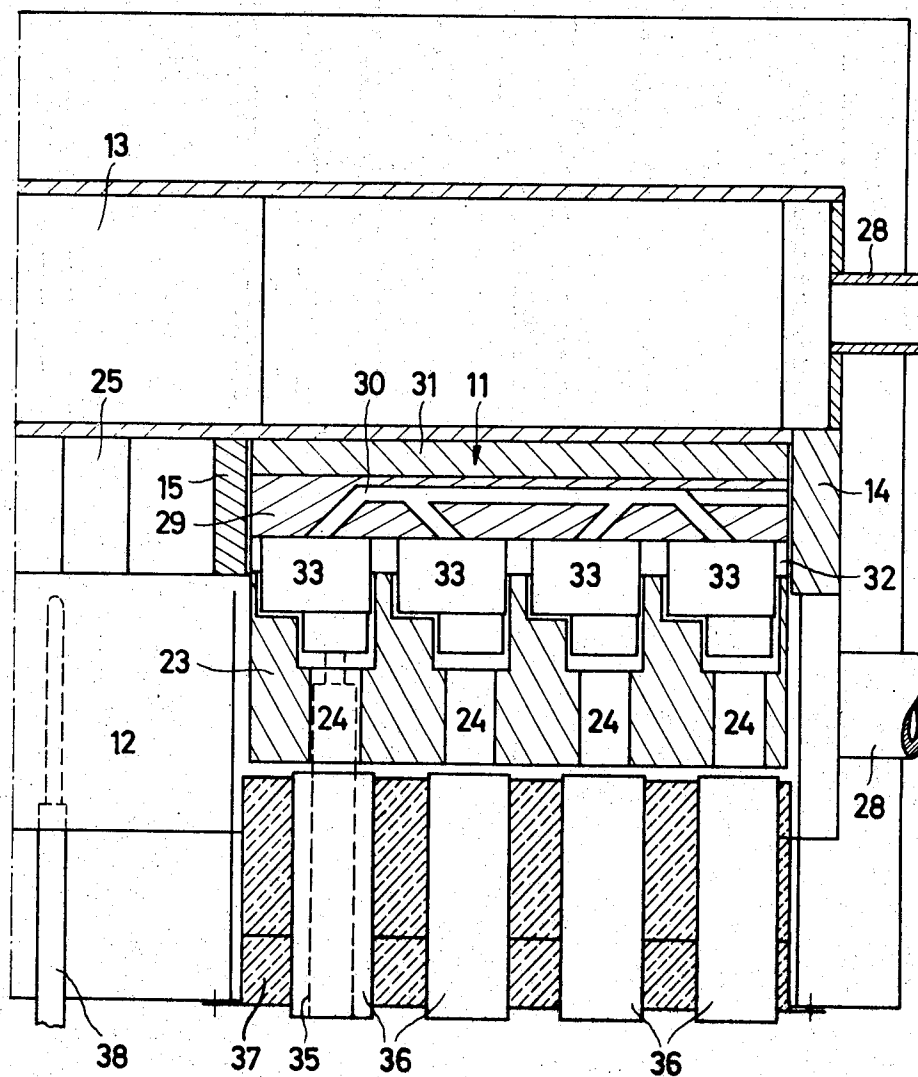
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FIG. 3



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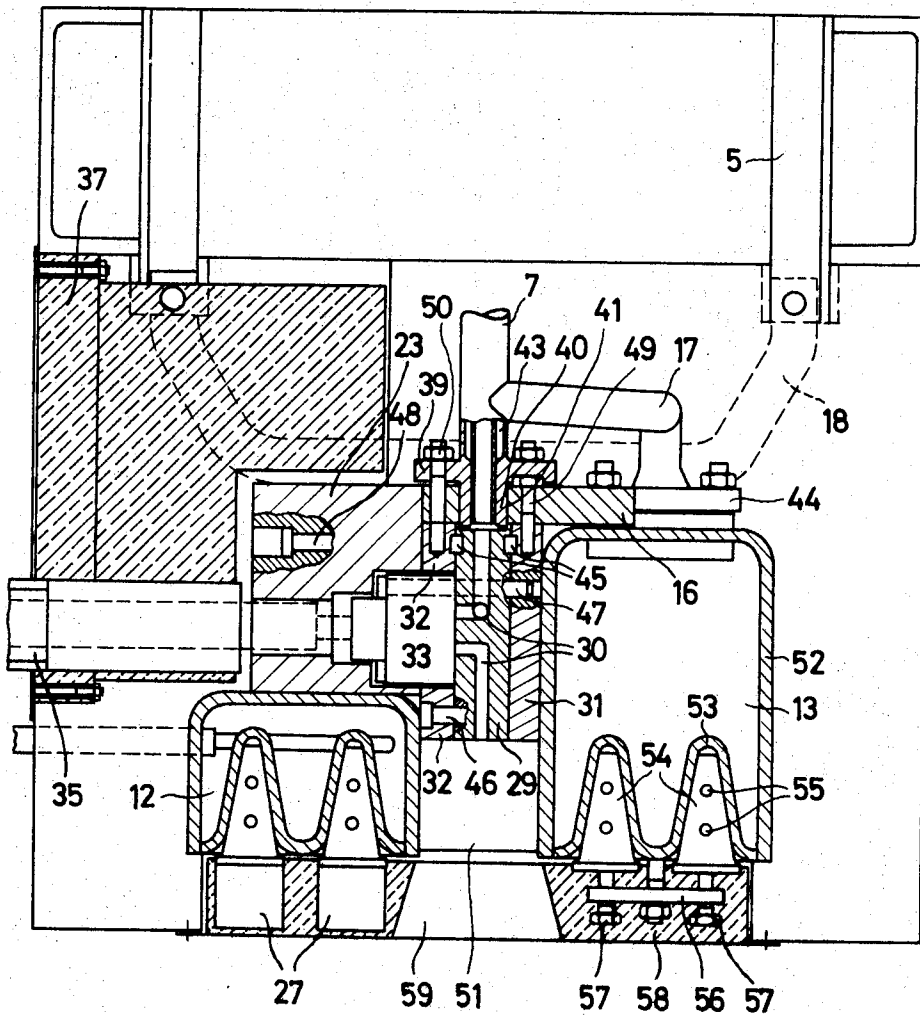
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APPARATUS FOR THE MANUFACTURE OF SYNTHETIC FIBERS

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4 Sheets-Sheet 4

FIG. 4



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APPARATUS FOR THE MANUFACTURE OF SYNTHETIC FIBERS

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Int. Cl. D01d 3/00

U.S. Cl. 18—8

6 Claims

ABSTRACT OF THE DISCLOSURE

The present disclosure provides a novel apparatus for the manufacture of fibers or the like from a melt or a solution of a synthetic polymer. The novel apparatus of the invention comprises pre-formed spinning units which are jointable to form a complete structural unit capable of forming said fibers from a melt of synthetic polymer. The pre-formed spinning units comprise a spinning block, at least one spinning pump and at least one spinning nozzle casing. The elements of a spinning unit are joined together so that several spinning units can be combined in the manner of building blocks.

This invention relates to an apparatus for the spinning of threads, bands or the like from a melt or a solution of higher linear polymers with several spinning units arranged in a row, consisting mainly of the spinning block, the spinning pump or pumps and the nozzle casing or casings, which are connected with a central distributor over product lines.

In the production of synthetic threads from a melt or a solution it is a known practice to supply to the melt or spinning solution over a product line to a spinning pump and from there to the spinning nozzle or die plate. The use of a so-called melter or solution tank for only one spinning pump with spinning nozzle is, as a rule, uneconomical and systems were developed in which one melter or solution tank supplied several spinning units simultaneously. These spinning units were arranged in a row next to each other on a so-called spinning beam (Spinnbalken), with free spaces present between the spinning units. In further development of this known spinning beam, it was also proposed to connect the individual spinning units of the spinning beam with the central distributor, which is located underneath the melter or solution tank and over the melt conduits, said melt conduits being constructed of equal length and have the same inside diameter. In this manner, the difficulties arising in the melt feed occurring in the spinning beams were avoided, which had resulted in non-uniformities in the properties of the finished product. Through this method, there were balanced out, in particular, the residence times of the spinning melt in the individual feed lines and thus threads having extremely uniform properties were obtained. The production of these prior art spinning beams is relatively expensive—especially for the reason that the very often differing requirements in the industry do not permit production in advance. In order to do justice to these differing requirements, as a rule, it is necessary in each case to design a special new arrangement for the spinning units. Such arrangement is governed primarily according to whether the spinning beam is to be equipped with two, three, four or more spinning units and in what distribution, that is, distance apart. A further drawback of the hither to known spinning beams lies in the fact that in equipping a spinning unit with more than two, for example four, spinning

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nozzle plates with the corresponding spinning pumps and spinning pump drives, each spinning beam has a considerable space requirement and the use of modern space-saving spooling (wind-up) machines in a so-called back-to back arrangement is not possible. Neither is the mounting of more than four nozzle plates on one spinning unit possible, since the space required for the further spinning pumps and drive is not available on the spinning block.

The primary object of the present invention is to avoid the disadvantages mentioned above in the spinning apparatuses hitherto known and to produce a spinning beam which presents an extremely simple construction, which can be produced in desired size without special designs and, moreover, can be equipped with a larger number of nozzle plates per spinning unit than was possible hitherto. The solution of the problem is accomplished in an apparatus of the type mentioned at the outset by means that the individual spinning units, by themselves or in groups of two or more, form essential structural units complete in themselves, which are jointable to one another in building block manner. Each spinning unit, therefore, is provided with the individual parts requisite for its operation and is, individually or in groups, a structural unit which can be connected to any other structural unit of the same type of construction. Several such structural units which can be manufactured in advance in series (or in mass production) are thus joined into a spinning beam of any desired length and distribution.

In accordance with the present invention, the individual spinning units are provided with slab-form spinning blocks which may be equipped with one or more spinning nozzle plates arranged in a row in longitudinal direction of the apparatus. The spinning blocks are formed essentially of a pump plate provided with bores for passage of the melt, one or more spinning pumps arranged on one side of this pump plate, which spinning pump is preferably secured to the pump plate by two fastening strips on the pump plate and running horizontally, and fastening plate arranged on the other side of the pump plate having a length and breadth approximately corresponding to the dimensions of the pump plate. Such a construction of the spinning block is extremely simple and achieves the building block-type design for the spinning unit.

Advantageously, all the supporting surfaces or screw threadings of the fastening screws of the spinning blocks are arranged on or in the fastening plate or the fastening strips. In the pump plate, which is normally made of relatively high-value rustproof material having low working strength with respect to a steel tool, there are no screw threads or supporting surfaces for the fastening screws of any kind. The pump plate is provided merely with passage openings for the common fastening screws of the fastening plate and of the fastening strips and spinning pumps lying on the other side of the pump plate.

In a preferred embodiment, the heating of the structural unit is achieved by heating chambers running in the longitudinal direction of the apparatus. Preferably, two heating chambers are used which lie against the spinning unit on opposite sides. The heating chamber lying on the drive side of the spinning unit is constructed in such a way that there is a sufficiently great amount of space available for mounting the spinning pumps on the pump plate and allowing access to the spinning pumps without hampering by the heating. The heating chambers of the individual spinning units and those of the individual structural units are connected with one another by passage channels, so that there is unimpeded interchange of the heating medium between the heating chambers.

In order to achieve a closed and rigid structure, the heating chambers can be connected rigidly with one another at their ends by boundary plates. Moreover, in structural units with several spinning units, bracing plates

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may be used between the heating chambers in such a manner that each spinning block is framed by the heating chambers, a bracing plate and another bracing plate or a boundary plate. For securing the spinning block in position with the rigid structure of the heating chambers and the boundary plates, the spinning block can be provided with a cover plate having its edges projecting beyond the pump plate to be detachably connected by screws with the fastening plate, the adjoining fastening strip and the boundary plate or plates of the heating chambers. In this manner, all the essential parts of the structural unit are rigidly bound to one another. For the promotion of heat transfer, especially to the spinning pumps, the heating chamber lying on the drive side of the spinning unit can be adjoined by a heat storage block, formed of a material with high heat conductivity, which has openings for the spinning pump or spinning pumps and their drive and lies against the spinning block. A uniform heating of the whole spinning unit is thereby ensured.

In the case of an individual spinning unit formed into a structural unit, the structural unit consists, in the preferred form, of the spinning block and the accompanying spinning pumps. The spinning block is formed of the pump plate, the fastening plate and the fastening strips. The spinning pumps are installed between two oblong heating chambers, connected rigidly with one another by boundary plates at their ends, and framed by a heat storage block.

In a structural unit which is composed of two spinning units, the fundamental structure is the same as described above, with the differences that the heating chambers extend longitudinally over both spinning units and that on the inside surfaces of the spinning units there are provided transversely positioned bracing plates connecting the heating chambers rigidly with each other.

The individual structural units are detachably connected with the cover plates on downwardly-directed bows which are arranged on the supporting framework of the apparatus at a distance apart corresponding approximately to the length of the structural units.

In further development of the invention, the melt conduits are provided, in a known manner, with mantle or jacketing tubes and the mantle tubes are connected with at least one heating chamber of each structural unit, preferably with the higher heating chamber, by way of connecting nipples or sockets. Through this direct connection of the mantle tubes of the conduits with the heating chambers there is obtained a uniform heating system for the whole apparatus, over which both the individual spinning units and the conduits can be heated. Thereby there is achieved the special advantage that at all the spinning units there is a uniform temperature and, furthermore, the regulation of the whole heating system is considerably simplified as compared to the separate heating systems hitherto usually used for the spinning units and the conduits.

The heating of the heating chambers can be carried out over an electric base heating system. In order to obtain as great as possible a heat transfer surface, the floors of the heating chambers can be corrugated in longitudinal direction. Preferably, the heating apparatus is installed in the corrugations open to the outside. In this manner, it is possible to change or work on the heating apparatus without the necessity of going into the interior of the heating chambers.

The spinning pumps of each spinning unit can be driven over a suitable common gear which is described in another patent application.

Further features and details of the invention are to be learned from the example represented in the following drawings, in part schematically, with the aid of which the invention will be explained in detail.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a front elevation view of a spinning beam formed of three structural units.

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FIG. 2 shows a spinning unit of the spinning beam of FIG. 1 in longitudinal section.

FIG. 3 shows a section through the spinning unit of FIG. 2 along the line III—III.

FIG. 4 shows a cross section through the spinning unit.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The spinning beam 1 represented in FIG. 1 consists essentially of three adjacently arranged structural units 2. Each structural unit 2 contains two spinning units 3 each with four spinning nozzle plates or casings 4. The division of the spinning beam 1, i.e., the spacing of the individual spinning units 3 from one another, is governed in this case by the division of the individual structural units 2. This division or distribution is also maintained in adjacent spinning units 3 of different structural units 2. The structural units 2 are fastened to a carrier frame 5. Furthermore, there are provided conduits 6 and 7, formed of mantle tubes, connected to a central distributor 8 located above the middle of the spinning beam. For each structural unit there is provided a main conduit 6, for passage of the melt, which is subdivided on the structural unit into two conduits 7. Each of these conduits 7 leads to a spinning unit 3. The main conduits 6 and the sub-conduits 7 are, respectively, made with equal length and equal inside diameter, in order to obtain a constant residence time of the melt supplied to each of the spinning units 3.

The central distributor 8 has a feed line coming from melters or solution tanks (not shown) and is provided with three valves 9, each of which is allocated to a conduit 6. Through the valve a particular conduit 6 can be blocked off directly underneath the melter or solution tank and the melt remaining between the main feed line of distributor 8 and the blocking point is reduced to a minimum. This is especially advantageous as compared to earlier valve arrangements in which the valves were provided in the vicinity of the spinning units.

The structural units 2 joined to one another are of approximately rectangular form. They contain all the parts necessary for the operation of the spinning units 3. On the left-hand side of FIG. 1 there is shown a structural unit 2 with front parts partially broken away. The material supplied over the main conduit 6 is allocated over a sub-distributor 10 to the sub-conduit lines 7. Through the sub-conduit lines 7 the melt is supplied to the individual spinning units 3. Each spinning unit 3 consists of the spinning block with the associated spinning pumps, which are not shown, and the spinning nozzle casings. The nozzle casings are equipped in a known manner with the usual spinning nozzle plates 4 and wire-and-sand-filters. Each spinning unit is framed by two heating chambers 12 and 13. Since in the present embodiment two spinning units 3 are comprised into a structural unit 2, it is expedient to group the heating chambers 12 and 13 of the individual spinning units 3 into common heating chambers. The front heating chamber 12 and the rear heating chamber 13 thus extend over the entire length of the structural unit 2. At their ends, the heating chambers 12 and 13 are rigidly connected with each other by a boundary plate 14. Moreover, two bracing plates 15 are provided, which likewise connect the heating chambers. Between the heating chambers 12 and 13 and a boundary plate 14 and bracing plate 15 there are installed the spinning blocks 11. In the zone between the two supporting plates 15 the heating chambers 12 and 13 are connected with one another by nipples or pipe connecting pieces. Moreover, at the lower ends of the boundary plates 14 there are arranged passage openings for the heating medium. Above each spinning block 11 there is provided a cover plate 16, which projects with its edges beyond the spinning block 11 and rests on the boundary plate 14 and bracing plate 15. The cover plate 16 is detachably connected with the boundary plates 14 and the spinning block 11. In the middle of the cover plate 16 there is

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situated an opening through which the sub-conduit 7 can be led up to the spinning block 11. The sub-conduit 7 is equipped, moreover, with a branch-off tube 17, which is in communication with the mantle tube or jacket of conduit 7 and is connected to the rear heating chamber 13. The structural unit 2 as a whole is secured over two bows 18 to the framework 5 of the spinning beam 1. Over passage channels 19 the heating chambers of the individual structural units 2 are connected with one another.

An important advantage of the present invention is that nearly all the parts of such a spinning beam 1 can be prefabricated. The individual structural units 2 are, when an order has been received, then merely combined with one another in the desired number and division or distribution and suspended on the frame 5. The finished structural units 2 with spinning blocks 11, heating systems 12 and 13, sub-conduits 7, etc., can be supplied for assembly on site where it is merely necessary to suspend the structural units 2 onto the framework 5 and install the main melt conduits 6 and the pipe connections 19 between the individual structural units 2. The assembly can be carried out by the use of main conduits 6 and pipe connections 19 provided with corresponding flanges within an extremely small time.

In FIG. 2 there is represented on a larger scale a spinning unit 3 of the spinning beam of FIG. 1. The spinning block 11 with the heating chambers 12 and 13 is suspended from the bow or strap 18 on the framework 5. For the suspension, there is the cover plate 16 of the spinning block 11, which is fastened by means of screws 18' to the bow 18, and which is itself connected with the boundary plate 14 by screws 20 and further connected with the spinning block 11 by screws 21. On the spinning block 11 itself, in the present embodiment, there is provided the mounting of four spinning pumps 22, whose arrangement is indicated by broken lines. The spinning pumps 22 are covered by a heat storage block 23 and partially framed in. This heat storage block 23 is provided with openings 24 for the pump shafts. Its special design will be further explained in the following figures. In front of the spinning block 11 there is provided a relatively low heating chamber 12 which, in the drawing, is represented in section. The bottom of the heating chamber 12 has corrugations 53 which in the present example are arranged only in the zone of the spinning block 11. The front heating chamber 12 is connected with the higher situated heating chamber 13 behind the spinning block 11 by passage channels 25 formed of pipes. Furthermore, in the boundary plate 14 there is present an oblong-shaped passage 26 for the heating medium. Underneath the heating chambers 12 and 13 there are connections or terminals 27 for the electric heating system. At the ends of the heating chambers 12 and 13 there are arranged the connecting tubes 28 and 28' to the heating chambers of the adjoining structural unit. The supplying of the melt takes place over the main conduit 6 and the sub-conduit 7.

As is to be learned from FIG. 3, which represents a sectional view along the line III—III of FIG. 2, the spinning block 11 consists essentially of a pump plate 29 with the corresponding melt passage bores 30. On the one side of the pump plate 29 there is arranged a fastening plate 31 and on the other side two fastening strips 32. Between the fastening strips 32 there are mounted the spinning pumps 33, on the spinning pump plate 29, which extend into recesses of the heat storage block. The recesses follow the contours of the individual spinning pumps 33 and are made in the form of step bores. The heat storage block is provided, furthermore, with bores 24 for the drive shafts 35 of the spinning pumps 33. One of the drive shafts 35 has been drawn in in broken lines. The drive shafts of the spinning pumps 33 are passed, furthermore, through the openings 36 of a special insulating part 37 which is installed in the insulating frame in the spinning unit 3 and the heating system 12 and 13.

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At the right side of the spinning block in the drawing is the boundary plate 14 and at the left side of the spinning block 11 the bracing plate 15, which connect the two heating chambers 12 and 13 with one another. In the front heating chamber 12 there is arranged a control check measuring place 38.

In FIG. 4 the spinning unit 3 is represented in cross section. The conduit 7 is formed of two concentric tubes and is brought up directly to the pump plate 29. For this, the conduit 7 is equipped with a flange 39 which has a projection 40. This projection 40 is led through an opening 41 in the cover plate 16 of the spinning block 11. Between the projection 40 and the cover plate 16 there is placed a packing or seal. The mantle pipe 43 of the conduit 7 is connected with a pipe connecting socket 17 which is connected over a flange connection 44 to the upper heating chamber 13.

The pump plate 29 itself is made of high-quality stainless steel and is provided with bores 30 for the passage of the melt. On the pump plate 29 there are arranged the spinning pumps 33. The spinning pumps 33 are framed in by fastening strips 32 made of tool steel, which likewise lie against the pump plate 29. On the other side of the pump plate 29 there is provided a fastening plate 31 of tool steel corresponding to the length and width of the pump plate 29. The pump plate 29, the fastening plate 31 and the fastening strips 32 are fixed in their position with respect to one another by fitting springs 45 running through in the longitudinal direction of these parts. Furthermore, the pump plate 29, the fastening plate 31 and the fastening strips 32 are held together by special screws 46. The supporting surfaces as well as the thread for these screws 46 are arranged in the fastening strips 32 and the fastening plate 31. The pump plate 29 itself is provided only with openings for passing screws 46 therethrough. In like manner, the spinning pumps 33 are mounted on the spinning block 11, so that their fastening screws 47 engage only on the fastening plate 31 and are merely passed through the pump plate 29. All the other parts fastened to the spinning block 11 are mounted in this manner. The heat storage block 23 is mounted by the screws 48. The spinning block itself is mounted on the cover plate 16 by the screws 49. This cover plate 16, as stated above, is connected at its ends with the boundary plates 14 and serves as intermediate part in the fastening of the structural unit 2 to the bow 18 of the carrier frame 5 of the spinning beam 1. The screws 50 of the flange connection 39 of the conduit 7 are likewise utilized for the fastening of the spinning block 11, so that conduits 7 participate in the supporting. On the spinning block 11 there is mounted a nozzle casing 51 which is of a known design and, for this reason, is not shown in detail. On the spinning block and on the nozzle casings 51 there lie in contact heating chambers 12 and 13 running in the longitudinal direction of the apparatus. The heating chambers 12 and 13 are made in a simple manner of a profile iron 52, which is provided with corrugated bottom insets 53. The corrugations are made relatively large, so that the resulting heat surface loads are kept in narrow limits and local overheatings are avoided. The heating chamber 12 lying on drive side of the spinning unit 3 extends from about the nozzle emergence plane to nearly the bottom of the spinning pumps 33. Above this heating chamber there is arranged the heat storage block 23, which houses, in part, the pumps 33 and their drive shafts 35. On the other side of the spinning unit 3 there is provided a taller heating chamber 13, which extends up to the upper plane of the pump plate 29. The heating insets 54 are made from aluminum wedges and have in their interior electric heating bars 55. The fastening of the heating insets 54 in the corrugations is carried out by a two-armed tightening bow 56, which is provided on each arm with a set screw 57. Through the wedge-shaped design of the heating insets 54, the installed heating insets easily come into inti-

mate contact with the walls of the corrugations. It is unnecessary, therefore, to observe special manufacturing tolerances.

The individual spinning units 3 are surrounded on all sides with an insulation. On the drive side of each spinning unit 3 there is provided an easily detachable insulating part 37, which can be removed after loosening fastening screws. After the insulating part 37 is removed, the heat storage block 23 is exposed. Also the flange connections 39 and 44 of the conduit 7 and the connecting socket 17 are accessible. If a spinning pump 33 is to be changed, it is only necessary to remove the heat storage block 23. The pumps 33 are then freely accessible. In like manner, on the underside of the apparatus in the region of each spinning unit 3 and the associated heating chambers 12 and 13 there is present a further easily detachable insulating part 58. This insulating part 58 is provided with a passage 59 for the nozzle casing. After insulating part 58 is removed, the heating insets 54, their electrical connections 27 and fastening places 56, 57 are accessible. Without being necessary to reach into the interior of the heating chambers 12 and 13, it is thus possible to change the heating insets 54. For the sake of clarity, in all figures the insulation of the spinning units is omitted in the drawing.

It is preferred that as heating agent there is used a diphenyl-diphenyl oxide mixture.

It is to be understood that the term "melt" as used herein is intended to include both a molten body of a synthetic polymer or a solution of the same.

As indicated above, the spinning pumps of each spinning unit can be driven over a suitable common gear. Such an arrangement is disclosed in my co-pending application filed on even date and entitled Apparatus for Drive of Pumps, Ser. No. 679,848, filed Nov. 1, 1967.

The invention has been described with particular reference to preferred embodiments thereof. It should be understood that the detailed description is illustrative only since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from a reading of the above detailed description.

What is claimed is:

1. In an apparatus for the manufacture of fibers or the like from a melt of a synthetic polymer comprising a plurality of integral pre-formed spinning units arranged in series each of said pre-formed spinning units consisting essentially of a spinning block, at least one spinning pump, at least one spinning nozzle casing, and heating and fastening means, each of said spinning units being connected to a melt distributor by conduit lines, the improvement which comprises pre-formed structural units which contain the essential parts of a spinning beam and which can be combined with like units to form said spinning beam, said pre-formed structural unit comprising at least one of said spinning unit and two heating chambers disposed in a longitudinal direction of said structural unit, one of said heating chambers lying on the pump side of said structural unit and the other lying on the

opposite side of said structural unit, said heating chambers being functionally jointable with corresponding heating chambers of other structural units through passage means for passing heating medium, and said pre-formed spinning unit spinning block includes a pump plate in slab form having bores therein for passage and distribution of said melt from said conduit lines to said pump and from said pump to said spinning nozzle.

2. An apparatus according to claim 1 wherein said spinning block is provided with four spinning pumps and four spinning nozzle casings, said spinning pumps are arranged on one side of said spinning block in its lengthwise direction, each of said pumps acting on one of said nozzle casings and each of said nozzle casings containing a nozzle plate for the forming of said fibers.

3. An apparatus according to claim 1 wherein said spinning block is provided with four double spinning pumps and eight spinning nozzle casings, each of said double spinning pumps acting on two of said nozzle casings.

4. An apparatus according to claim 1 wherein said spinning block is in slab form and said fastening means comprises, as part of said block, a fastening plate, said spinning pump is secured to one side of said pump plate, and said fastening plate is secured to the other side of said pump plate.

5. An apparatus according to claim 1 wherein said heating chamber lying on the pump side of said structural unit extends vertically from the plane of the discharge end of the nozzle to the bottom of the spinning pump, and the other of said heating chambers lying on the opposite side of said structural unit extends vertically from the plane of the discharge end of the nozzle to the top of said spinning pump, said heating chambers for said structural unit are rigidly connected to one another near their ends by boundary plates, and said heating chambers for said structural unit communicate with one another through passage channels.

6. An apparatus according to claim 1 further comprising a heat storage block for each of said spinning units, said heat storage block contacting said heating chamber on the pump side of said spinning unit, said heat storage block being formed of a high heat conductivity material and containing recesses for housing said spinning pumps and associated drive shafts.

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