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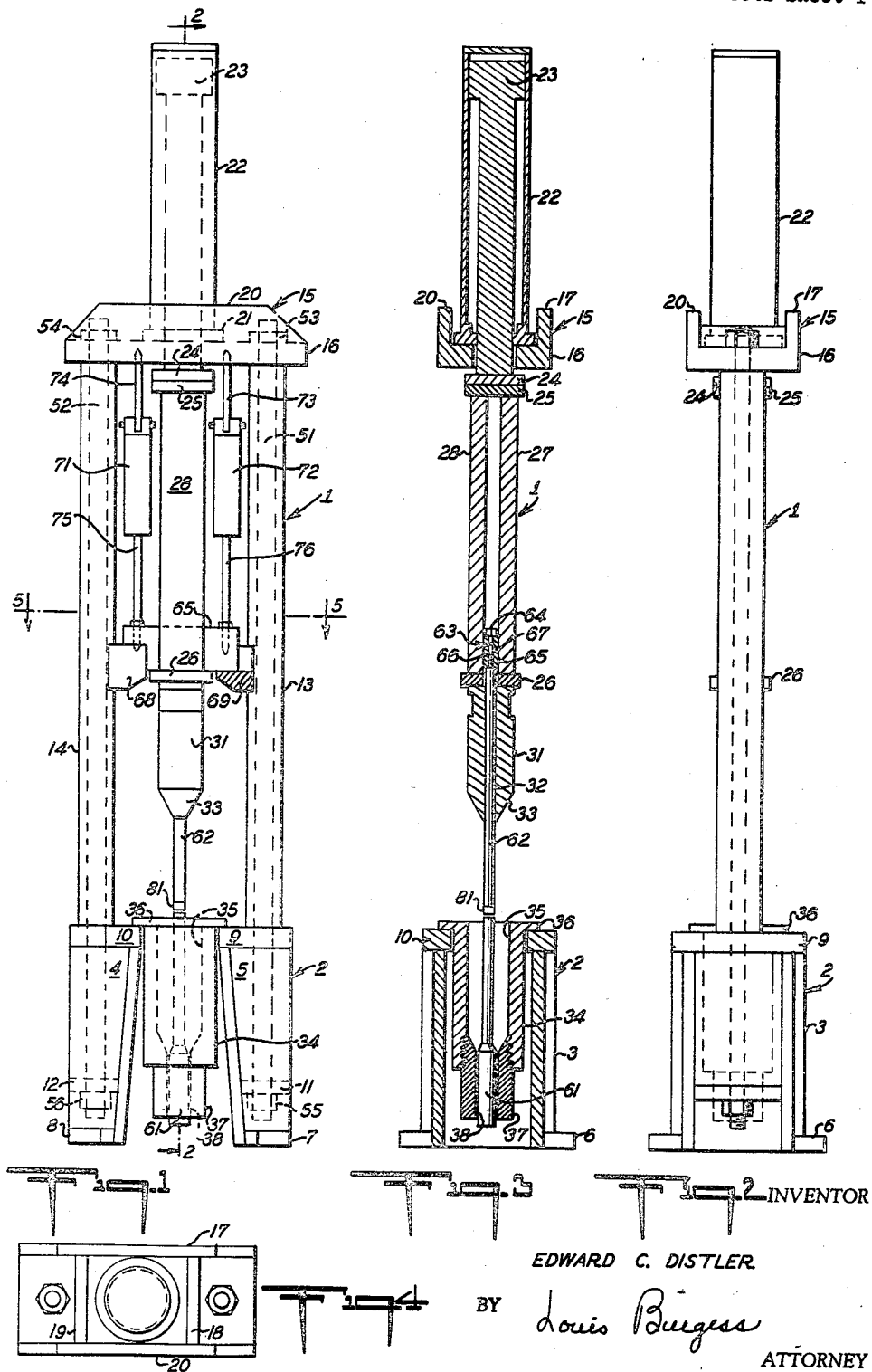
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APPARATUS FOR EXTRUDING TUBING OF POLYTETRAFLUOROETHYLENE

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2 Sheets-Sheet 1



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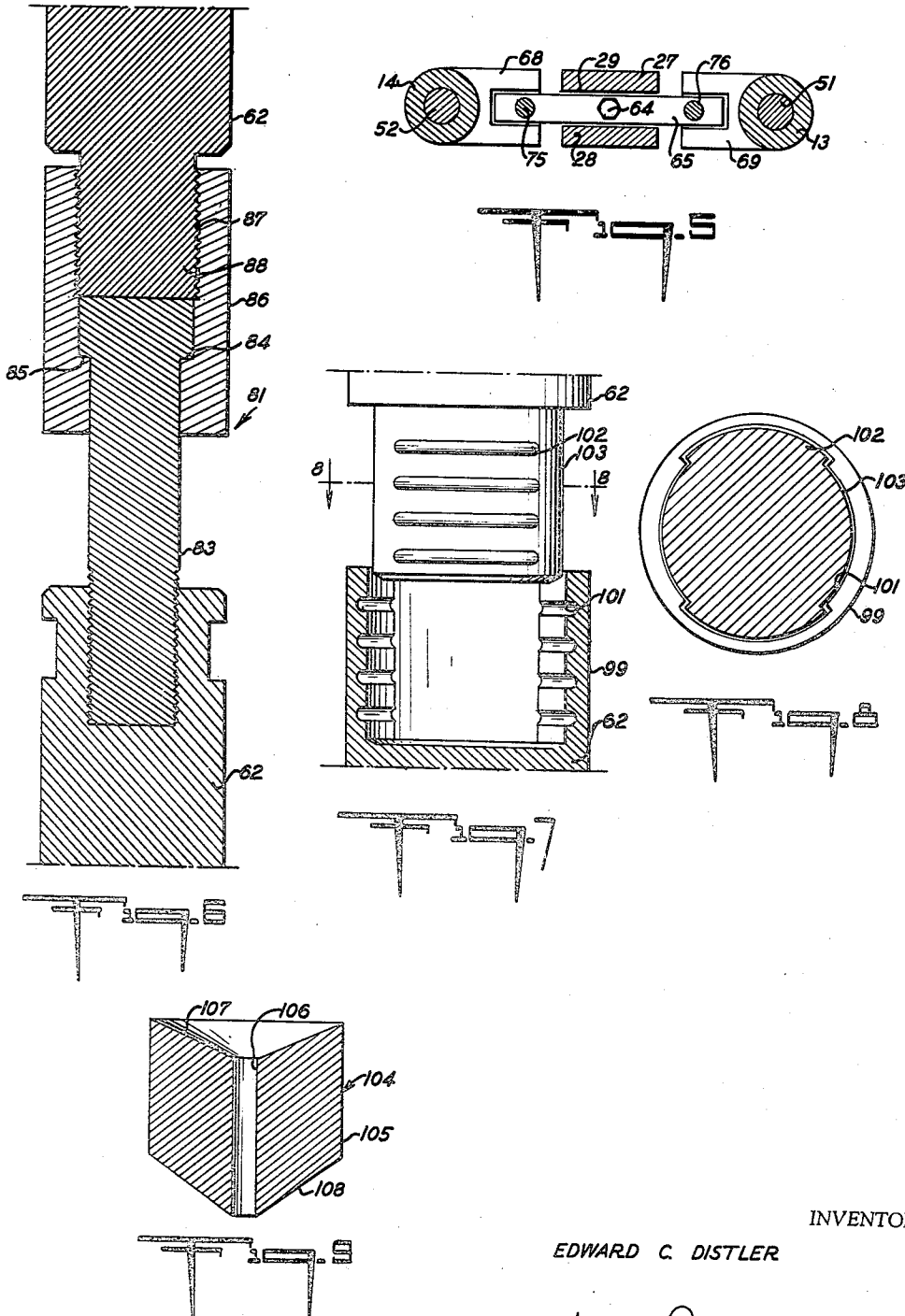
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APPARATUS FOR EXTRUDING TUBING OF POLYTETRAFLUOROETHYLENE

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This invention is a new and useful apparatus for extruding tubing of polytetrafluoroethylene from a preform of this material.

The invention will be fully understood from the following description read in conjunction with the drawings, in which:

Fig. 1 is a front view, with parts in section, of one embodiment of my invention;

Fig. 2 is a side view of the construction shown in Fig. 1;

Fig. 3 is a vertical section through the construction shown in Fig. 2;

Fig. 4 is a top view of the construction shown in Fig. 1;

Fig. 5 is a horizontal section through the construction shown in Fig. 1 on the plane indicated by 5—5;

Fig. 6 is a vertical section through a part of the construction shown in Fig. 1;

Fig. 7 is a vertical section through an alternative form of the part of the construction shown in Fig. 6;

Fig. 8 is a cross-section through the construction shown in Fig. 7; and

Fig. 9 is a vertical section through a preform of polytetrafluoroethylene of the type used in the practice of my invention.

Referring to the drawings in extruder 1, 2 is a base supporting member in the form of a stress-relieved weldment having the upstanding portions 3, 4 and 5 integral with the horizontal flanges 6, 7 and 8, upon which the support 2 is rested. The upstanding portions carry horizontal shelves 9 and 10. The upstanding portions also carry horizontal shelves 11 and 12. The horizontal shelves 9 and 10 respectively carry vertical tubular shafts 13 and 14, which are in compression.

The upper ends of the tubular shafts 13 and 14 carry the supporting member 15 consisting of the horizontal floor 16 and the upstanding fins 17, 18, 19 and 20. The floor 16 in turn is secured to the flange 21 constituting the lower end of the cylinder 22, which houses the hydraulic ram 23. The lower end of ram 23 is integral with a rectangular flange 24, which in turn is secured to rectangular flange 25. The rectangular flange 25 is secured to rectangular flange 26 through the two push-rods 27 and 28 of rectangular outline (Fig. 5) defining the central opening 29. The flange 26 carries ram 31 defining the coaxial bore 32 and terminating at its lower end in the conic surface 33. Below the ram 31 there is located the cylinder 34 consisting of the tubular section 35, terminating in its upper end in the horizontal flange 36 which rests upon the horizontal shelves 9 and 10, and terminating at its lower end in the removable die 37 which defines the coaxial orifice 38.

For the purpose of extruding preform of polytetrafluoroethylene through the orifice 38, the ram 31 may be advanced into the cylinder 34 by means of the hydraulic ram 23. The forces in tension created by the downward thrust of the ram 23 are taken up by the vertical shafts 51 and 52. These are in tension and are provided at their

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upper ends respectively with the nuts 53 and 54 bearing against the upper surface of the floor 16 and at their lower ends with the nuts 55 and 56 bearing against the lower surfaces of the shelves 11 and 12.

For the purpose of extruding tubing, I provide mandrel 61 held longitudinally in position within orifice 38 by mandrel holding rod 62. The mandrel holding rod 62 is longitudinally slidable in the bore 32 of ram 31. The upper end of the mandrel holding rod 62 is provided with a bolt 63, the head 64 of which rests upon the upper surface of the transverse member 65. The shaft 66 of the bolt 63 is freely turnable in a hole 67 bored in the transverse supporting member 65. In the position shown in Figs. 1 and 2, in which the mandrel 61 is held within the orifice 38 by the mandrel holding rod 62, the transverse supporting member 65 rests upon, and is carried by, the saddles 68 and 69 which are welded to the sides of the vertical tubular shafts 13 and 14. In addition I provide the retraction cylinders 71 and 72 secured at their upper ends to studs 73 and 74, which are anchored in the floor 16. The pistons (not shown) in the retraction cylinders 71 and 72 respectively actuate the pull rods 75 and 76, the lower ends of which are threaded into and immobilized with respect to, the transverse supporting member 65. In addition I provide in mandrel holding rod 62 the separable joint 81 (Fig. 6). This is located below the lower end of the ram 31 when in raised position, as indicated in Fig. 1, and preferably a short distance above the upper edge of the flange 36. This separable joint 81 may be of the threaded type comprising neck 83 (of reduced diameter) formed in rod 62 terminating at its upper end in shoulder 84 supported by mating shoulder 85 of sleeve 86. Sleeve 86 is detachably secured by thread 87 to the lower end 88 (of reduced diameter) of the upper portion of mandrel holding rod 62. I may alternatively employ the quick demountable joint shown in Figs. 7 and 8, in which the sleeve 99 is integral with the upper end of the lower portion of rod 62 and is provided with the interrupted female thread 101 coacting with interrupted thread 102 formed in the lower end 103 of the upper portion of rod 62. As evident from Fig. 8, the two mating elements of the quickly demountable joint may be moved into or out of interlocking engagement by rotating them relative to each other for only a fraction of a turn.

In the past, in the extrusion of preforms of polytetrafluoroethylene to make tubing, it has been the practice to start with a split preform, which is forced transversely over the mandrel rod and thence down into the cylinder. The preform is then extruded in part by advancing the ram in the cylinder. Whenever this preform approaches exhaustion it has been found necessary to retract the ram, remove the exhausted preform and introduce a fresh preform in the same manner, i.e., by starting with a split preform which is loaded in the same manner. The exhausted preform may, if desired, be reintroduced as backing for the new preform and the ram again advanced in the cylinder. In any event, the continuity is broken and formation of the tube must be started anew.

In accordance with the new method, however, I start with a cylindrical preform 104 (Fig. 9) whose outer tubular surface 105 is dimensioned snugly to fit the inner surface of the cylinder 34 and whose central bore 106 is dimensioned snugly to fit the outer surface of the mandrel holding rod 62. With the ram in the upper position indicated in Fig. 1 the separable joint 81 is broken and the upper part of the mandrel rod 62 is lifted up out of the way by operation of the retraction cylinders 71 and 72. The first preform 104 is then slipped into position over the upper end of the lower portion of mandrel rod 62 and thence down into the cylinder 34, whereupon the joint 81 is again

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made up and the ram 31 advanced downwardly from its aforesaid upper position by operation of cylinder 22. During insertion of the first preform, the exposed bottom end of mandrel 61 may be momentarily supported by hand or by a suitable tool. With the preform in place in cylinder 34 and about the lower portion of mandrel rod 62, the engagement of its aforesaid surfaces with the cylinder and rod positions the preform for re-connection of the lower portion of mandrel rod 62 with the upper portion thereof as lowered for such purpose by operation of the cylinders 71, 72.

The result of downward movement of ram 31 is the extrusion of a continuous length of tube, the dimensions of whose inner and outer diameters are determined by the inner surface of the orifice 38 and the outer surface of the mandrel 61.

When this first preform approaches exhaustion the ram 31 is again lifted up out of the way by operation of cylinder 22 to the position indicated in Fig. 1. Following this the joint 81 is again broken; the upper part of the mandrel rod 62 is lifted up out of the way by operation of the retraction cylinders 71 and 72. The lower part of the mandrel rod 62 and the attached mandrel 61 remain held in position by their frictional engagement with the partially exhausted preform in the cylinder 34 and by the extruded tubing between the mandrel and die 38. A new preform 104, preferably having upper and lower conic surfaces as illustrated in Fig. 9, is then slipped in position over the upper end of the lower section of the mandrel rod 62 and down into the cylinder. The lower conic surface 108 of the new preform will snugly engage the upper conic surface 107 of the partly exhausted preform remaining in the lower end of the cylinder 34. The cylinders 71 and 72 are then operated to move the upper section of mandrel rod 62 downwardly for re-connection to the lower section of the mandrel rod as above described. The ram 31 is again advanced into position engaging the upper surface of the new preform, whereupon the operation is resumed. The aforesaid sequence of operations may be repeated with additional new preforms and for each re-charging that portion of the tube newly produced is continuous with the portion produced before recharging.

I claim:

1. Apparatus suited for extruding tubing of polytetrafluoroethylene comprising a cylinder, a coaxial orifice at one end of said cylinder, a mandrel in said orifice, a mandrel rod holding said mandrel within said orifice, a ram fitting said cylinder surrounding said mandrel rod and slidable with respect thereto, means moving said ram rectilinearly into and out of said cylinder, a separable joint in said mandrel rod, and disposed for access in the space between said ram and said cylinder when the ram is moved out of and away from said cylinder, and means moving the upper part of said mandrel rod above said separable joint away from the lower part of said mandrel rod below said separable joint to permit a circumferentially-continuous tubular preform to be slipped onto the lower part of the mandrel rod and into said cylinder.

2. Apparatus according to claim 1 in which the said separable joint is of the quick demountable type and comprises two mating elements respectively carried by said upper and lower parts of the mandrel rod and movable into and out of interlocking engagement by relative rotation of less than one turn.

3. Apparatus suited for extruding tubing of polytetrafluoroethylene comprising a cylinder, a coaxial orifice at one end of said cylinder, an extrusion ram fitting said

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cylinder, a hydraulic ram in line with said extrusion ram, a split connecting rod operatively connecting said hydraulic ram with said extrusion ram to move it into and out of said cylinder, a transverse member longitudinally slidable in the space between the parts of said split connecting rod, a mandrel in said orifice, a mandrel rod anchored at its upper end in said transverse member extending through said extrusion ram and anchored at its lower end to said mandrel to hold said mandrel within said orifice, a separable joint in said mandrel rod and disposed for access in the space between said extrusion ram and said cylinder when the extrusion ram is moved out of and away from the cylinder, and means moving said transverse member and the upper part of said mandrel rod away from said cylinder to permit a circumferentially-continuous tubular preform to be slipped onto the lower part of the mandrel rod and into said cylinder.

4. Apparatus according to claim 3 in which the said separable joint is of the quick demountable type and comprises two mating elements respectively carried by said upper and lower parts of the mandrel rod and movable into and out of interlocking engagement by relative rotation of less than one turn.

5. Apparatus suited for extrusion of tubing from preforms of synthetic resin comprising structure having a cylindrical cavity of diameter at its charging end fitting the external diameter of said preforms, said cavity having at its extrusion end an orifice of diameter corresponding with the external diameter of said tubing, a mandrel concentric with said orifice and of diameter corresponding with the internal diameter of the tubing, a first section of rod attached at one end to said mandrel and having its free end extending through said cavity, said section of rod being of diameter smaller than said mandrel and fitting the internal bore of the preforms, a reciprocating ram having an external diameter fitting said cylindrical cavity and having a concentric bore of internal diameter fitting said mandrel rod, said reciprocating ram at one end of its stroke clearing the charging end of said cavity and said free end of said first section of rod by a distance at least equal to the length of the individual preforms, a second section of rod extending through said bore of the ram with a free end adjacent the free end of said first section of rod, a separable joint for detachably connecting said free ends of said rod sections, said joint being accessible to decouple said rod sections when the ram is at said limit of its stroke and of cross-section not exceeding the internal bore of the ram, structure attached to the other end of said second section of rod and effective when the rod sections are coupled by said joint to hold said mandrel stationary during reciprocation of the ram to and from said end of its stroke into and out of said cylindrical cavity, and means operative when said rod sections are decoupled by said separable joint to move said structure to a position for which the free ends of said rod sections are spaced by a distance at least equal to the length of the individual preforms.

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