Jan. 17, 1967 D. R. ALLAN 3,298,165

MACHINE FOR PROCESSING STRANDED MATERIAL

Filed May 11, 1964 4 Sheets-Sheet 1

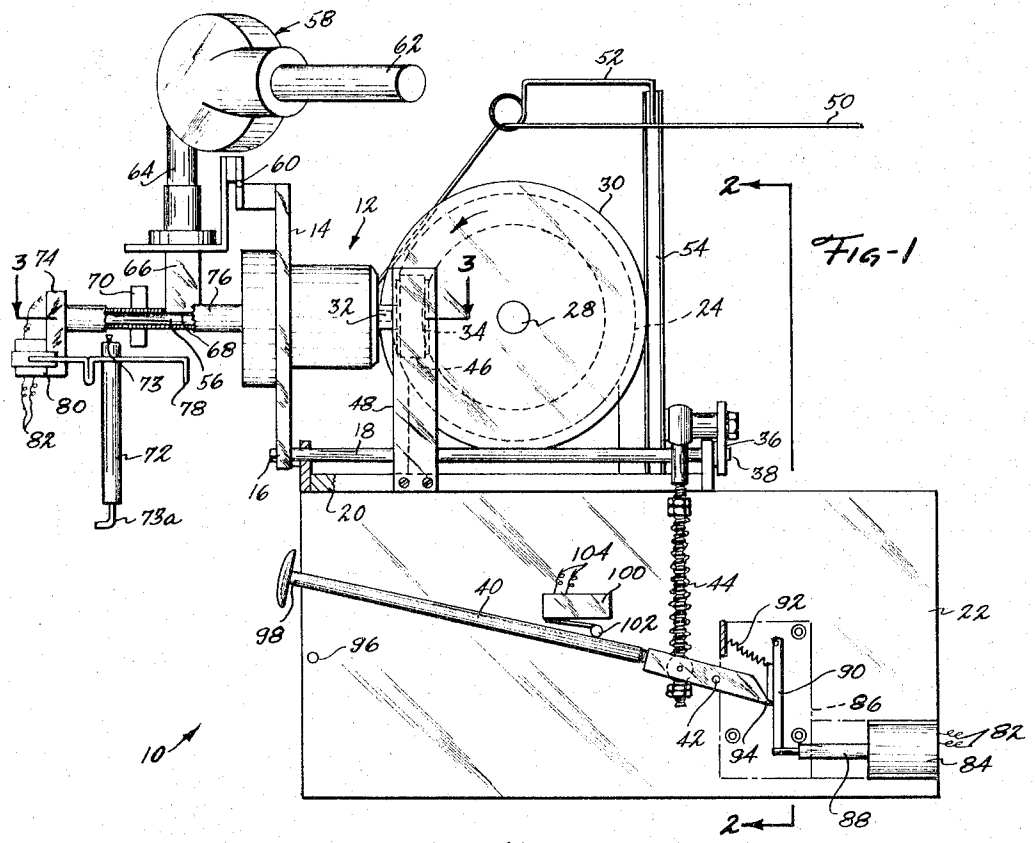


FIG-1

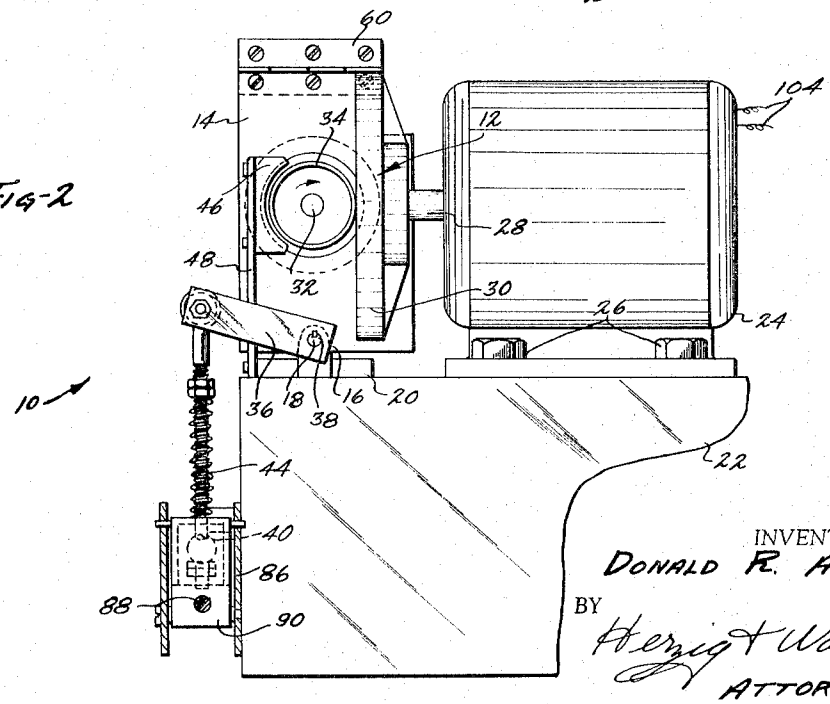


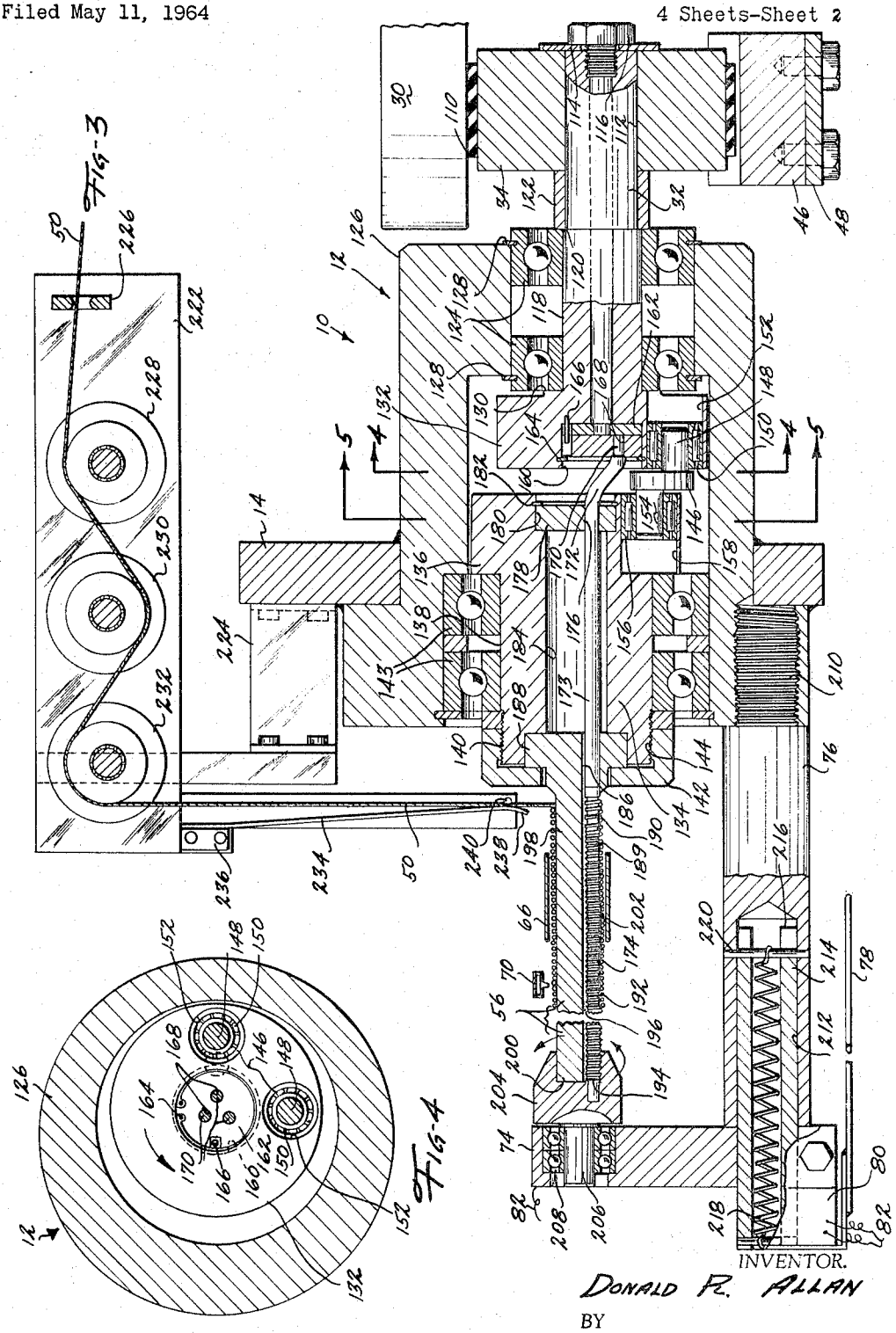
FIG-2

INVENTOR.
DONALD R. ALLAN
BY
Herzig & Walsh
ATTORNEYS

Jan. 17, 1967 D. R. ALLAN 3,298,165

MACHINE FOR PROCESSING STRANDED MATERIAL

Filed May 11, 1964 4 Sheets-Sheet 2



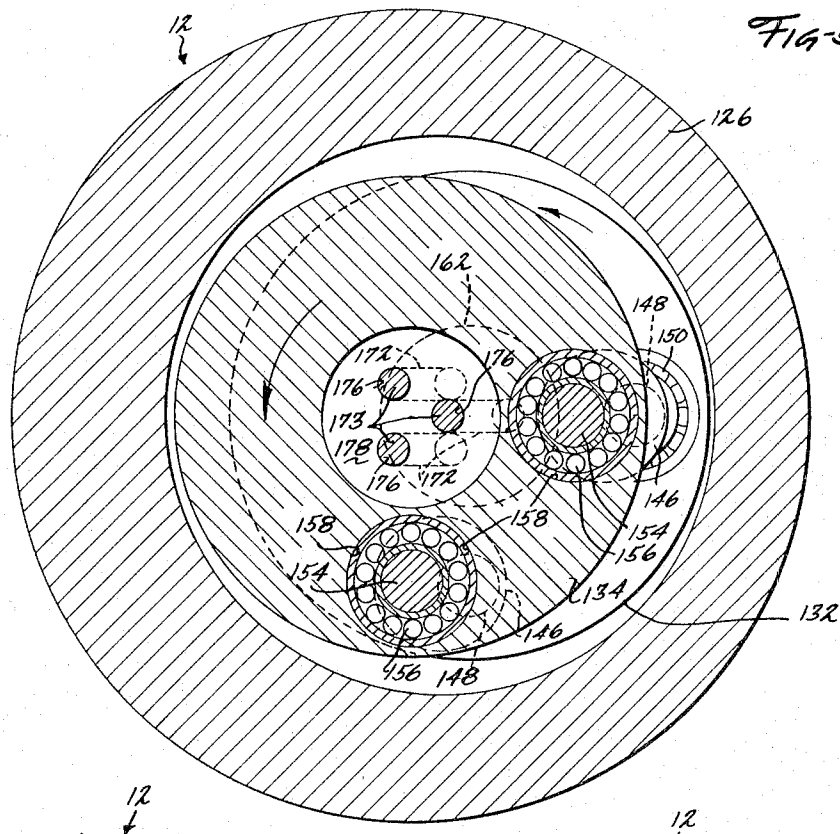
INVENTOR.
DONALD R. ALLAN
BY
Herzig & Walsh
ATTORNEYS

Jan. 17, 1967 D. R. ALLAN 3,298,165

MACHINE FOR PROCESSING STRANDED MATERIAL

Filed May 11, 1964 4 Sheets-Sheet 3

FIG-5



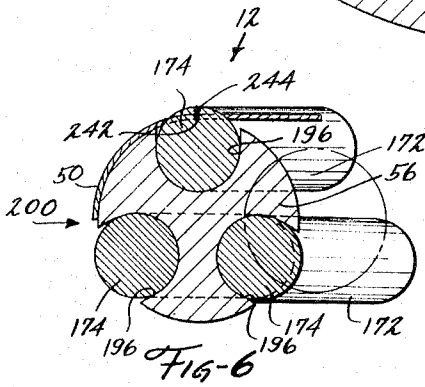


FIG-6

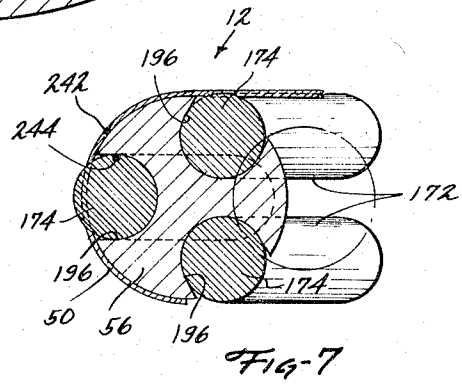


FIG-7

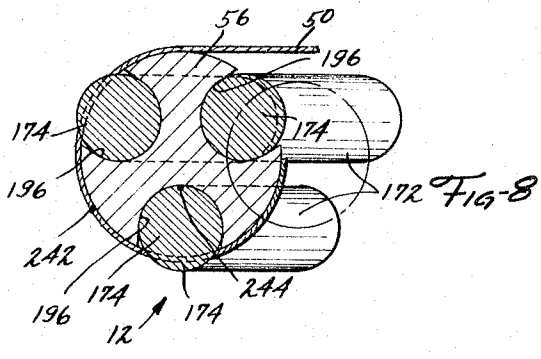


FIG-8

INVENTOR.
DONALD R. ALLAN

BY

Herzig & Walsh

ATTORNEYS

Jan. 17, 1967 D. R. ALLAN 3,298,165

MACHINE FOR PROCESSING STRANDED MATERIAL

Filed May 11, 1964 4 Sheets-Sheet 4

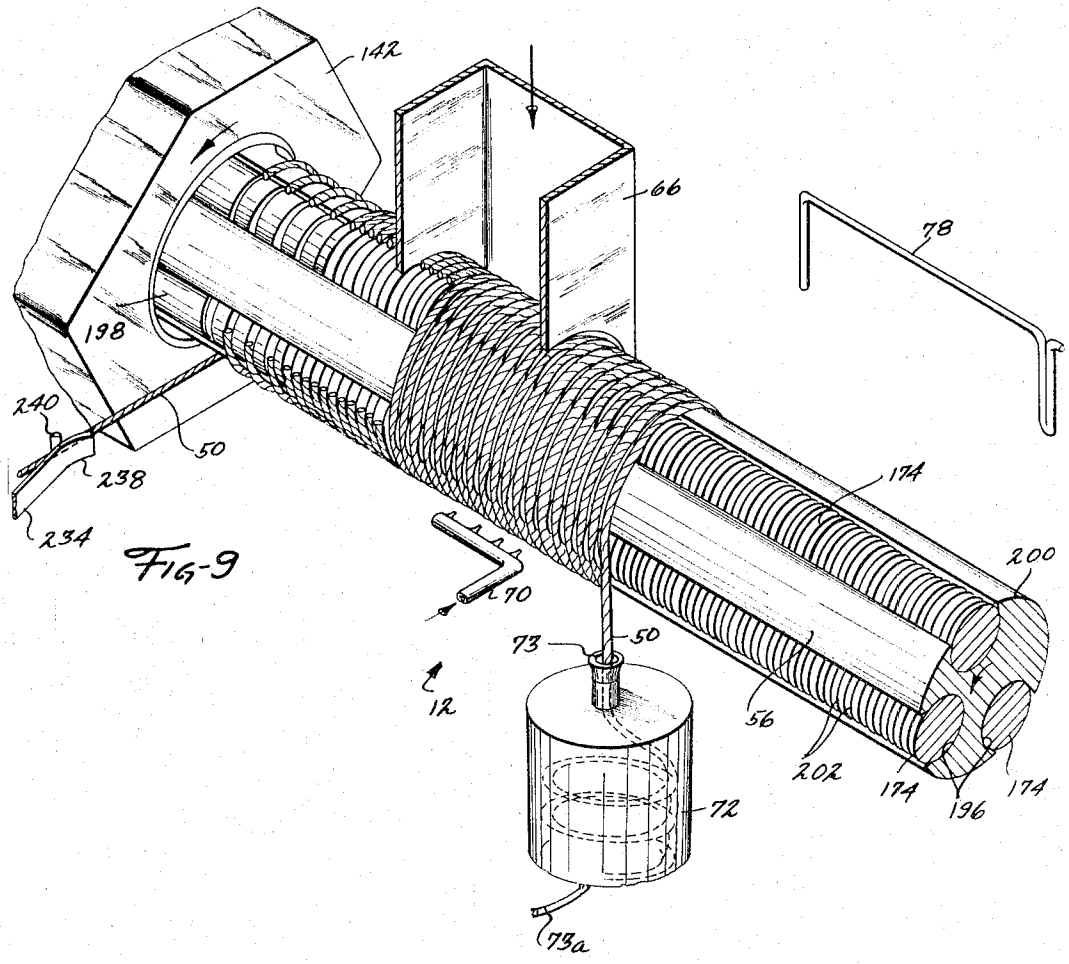


FIG-9

FIG-10

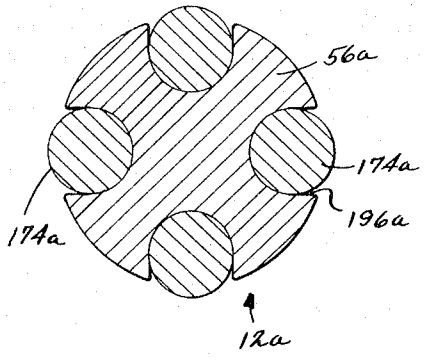
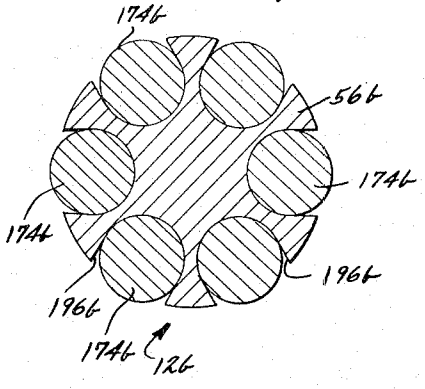


FIG-11



INVENTOR.
DONALD R. ALLAN
BY
Hespig & Walsh
ATTORNEYS

United States Patent Office 3,298,165 Patented Jan. 17, 1967

3,298,165

MACHINE FOR PROCESSING STRANDED MATERIAL

Donald R. Allan, Lakewood, Calif., assignor to Mattel, Inc., Hawthorne, Calif., a corporation of California

Filed May 11, 1964, Ser. No. 366,449
16 Claims. (Cl. 57—34)

This invention relates to a machine for processing stranded material, and more particularly to a machine for continuously curling a fine strand of a thermal-setting plastic material which is fed onto the machine from a spool and which is removed from the machine in a single strand in a continuous operation.

There is quite a demand in the toy industry for dolls having artificial hair which is coiffured to simulate popular adult fashions. In addition, high fashion wigs are available in different colors and styles to enhance the various ensembles worn by a particular doll. These doll coiffures and wigs are often manufactured from strands of a thermal-setting plastic material which has been set with a curl during a previous step in the manufacturing operation.

Although prior art machines are available for setting strands of thermal-setting plastic material with a curl, they do have certain disadvantages.

One disadvantage resides in the fact that prior art machines do not usually lend themselves to mass-production techniques.

Another disadvantage resides in the fact that they are not usually designed to accept a continuous strand of material from a spool, set it with a curl and then discharge it in the form of a continuous strand efficiently and expeditiously.

It has been recognized that the production of simulated, curled hair could be accelerated by winding a fine strand of thermal-setting plastic material around a cylindrical mandrel to set a curl in the strand and then advancing the strand longitudinally along the mandrel to a point of discharge from the mandrel. It is exceedingly difficult to accomplish this result in a satisfactory manner, though, because the fine strand of material tends to bind or tighten about the mandrel and bunch together instead of advancing longitudinally along the mandrel in an orderly manner. It has also been rather difficult to remove the curled strand from the mandrel in a satisfactory, convenient manner while minimizing damage to the curls formed in the strand by the mandrel.

In view of the foregoing factors and conditions characteristic of machines for processing stranded material, it is a primary object of the present invention to provide a new and useful machine not subject to the disadvantages enumerated above, and having a composite mandrel especially designed for continuously processing a strand of material efficiently, safely and expeditiously.

Another object of the present invention is to provide an apparatus for setting a consistent curl into a thermal-setting plastic material.

Yet another object of the present invention is to provide new and improved means for off-feeding a curled strand of material from a rotating, composite mandrel continuously without disturbing the set of the curl.

A further object of the present invention is to provide a curling machine having a new and improved composite mandrel which automatically sets a curl in a strand of thermal-setting plastic material and feeds the material longitudinally along the mandrel in an orderly manner to a point of discharge.

A still further object of the present invention is to provide a new and improved composite mandrel for a curling machine having simplified, economical driving means for simultaneously rotating a cylindrical core and revolving

a plurality of screw-threaded rods about the major axis of the core.

According to the present invention, a machine for processing stranded material is provided which includes a feeding device for feeding a continuous strand of material to be set with a curl onto a composite mandrel. The composite mandrel includes a cylindrical core which is slotted along its periphery with two or more equally spaced, longitudinal slots. A screw-threaded rod is nested in each slot and the depth of each slot is such that the associated rod nests therein with the roots of its threads lying tangent to a circle inscribed about the periphery of the core. A drive unit is connected to the composite mandrel by first crank means which rotates the core and by a separate crank for each screw-threaded rod. The cranks are arranged in such a manner that the core is driven in one revolution about its own axis while each rod is revolved once about the major axis of the core. The combined effect of the screw-threaded rods and the core is to feed the strand of material continuously from one end of the mandrel to the other while, at the same time, imparting a frictional drag to the individual loops of the strand in a backward direction so that the strand will not bind upon the mandrel and so that the loops will be stretched somewhat to form uniform curls in the strand.

The curling machine also includes a suitable tensioner for controlling the feeding of a strand of materials onto the mandrel and an evacuated storage container which draws the curled strand from the discharge end of the mandrel. A heating device is employed to heat the strand while it is in position on the mandrel to soften it after which the strand is cooled by a cooling device to set the curls formed in the strand.

The features of the present invention which are believed to be novel are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings, in which like reference characters refer to like elements in the several views.

In the drawings:

FIGURE 1 is a somewhat schematic elevational view, with parts shown in perspective, of a curling machine of the present invention;

FIGURE 2 is an end view taken in the direction of line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged, cross-sectional view taken along line 3—3 of FIGURE 1;

FIGURE 4 is a cross-sectional view taken along line 4—4 of FIGURE 3;

FIGURE 5 is an enlarged cross-sectional view taken along line 5—5 of FIGURE 3;

FIGURES 6, 7 and 8 are cross-sectional views showing somewhat schematically the relationship of the various parts forming the composite mandrel of the machine of FIGURE 1 during a partial revolution thereof;

FIGURE 9 is an enlarged, exploded perspective view of the composite mandrel and associated parts;

FIGURE 10 is a cross-sectional view of a first modified composite mandrel; and

FIGURE 11 is a cross-sectional view of a second modified composite mandrel.

Referring again to the drawings, and particularly to FIGURES 1 and 2, a machine for processing stranded material, which constitutes a presently preferred embodiment of the invention and which is generally designated 10, includes a composite mandrel assembly 12 which is rigidly affixed to a plate 14. The plate 14 is non-rotatably connected to the end 16 of a sahft 18 which is rotatably mounted in a U-shaped bracket 20. The bracket 20 is

supported by a suitable support member 22 to which an electric motor 24 is affixed by bolts 26. The motor 24 includes an output shaft 28 to which a drive wheel 30 is affixed for rotation therewith.

The composite mandrel assembly 12 includes an input shaft or spindle 32 which is rotated by a driven wheel 34. The wheels 30 and 34 are mounted at right angles to each other so that the periphery of wheel 34 can be brought into engagement with the face of wheel 30 for rotation thereby. The driven wheel 34 is swung into contact with the drive wheel 30 by rotating the shaft 18 by a crank arm 36 which is keyed to the end 38 of the shaft 18. The crank arm 36 is operated by a lever 40 which is pinned to the support member 22 by a pin 42 and which is connected to the crank arm 36 by a linkage mechanism 44.

A brake shoe 46 is supported closely adjacent the wheel 34 by an upstanding plate 48 so that the wheel 34 will engage the brake shoe 46 when the wheel 34 is swung out of engagement with the wheel 30.

The composite mandrel assembly 12 processes a strand of thermal-setting plastic material which has the approximate fineness of a human hair and which represented by the numeral 50. The strand 50 may be fed to the machine 10 from a spool, not shown. The strand 50 is guided to a tensioner, to be hereinafter described, by a guide member 52 which is supported on the end of an upstanding rod 54. The strand 50 is wound upon the core 56 of the composite mandrel assembly 12 in a manner to be hereinafter described, after which the wheel 34 is swung into engagement with the wheel 30 to rotate core 56 through spindle 32 and advance the strand 50 longitudinally along the core 56. The moving strand 50 is heated to a suitable temperature, such as 300° F., by a heater 58 which is swingably mounted on the plate 14 by a hinge 60. The heater 58 draws ambient air in through an inlet pipe 62, heats the air and then discharges it through an outlet pipe 64 into a nozzle 66 having a discharge end 68 positioned closely adjacent the core 56. Heat from the nozzle 66 softens the advancing strand 50, the individual loops of which have been stretched in a manner to be hereinafter described, so that uniform curls will be formed in the strand 50 as it advances along core 56. The curls are then set by a suitable cold medium, such as a cold water mist, liquid nitrogen or the like, issuing from a spray device 70 which is suitably supported downstream of the nozzle 66 adjacent the cylindrical core 56. As the strand 50 continues downstream of the spray device 70, it is off-fed from the core 56 and into an off-feed device comprising an evacuated container or chamber 72 which also serves as a storage container for the curled material. The chamber 72 includes an orifice 73 and is evacuated through a line 73*a* so that the strand 50 will be drawn thereinto as it comes off the core 56 through orifice 73.

The downstream or outboard end of the cylindrical core 56, to be hereinafter described, is supported by a block 74 which, in turn, derives support from the plate 14 through a rod or tubular member 76. The rod 76 is mounted in front of the cylindrical core 56 and is shown broken away in FIGURE 1 to expose the core.

A probe or sensing device 78 is attached to a first limit switch 80 and extends along the core 56. When the probe 78 is contacted by an operator of the machine 10 or by the strand 50, in the event that it becomes bunched upon the core 56 or breaks, the switch 80 completes a circuit through electrical leads 82 to a solenoid 84 which is attached to the support member 22 by a mounting plate 86. This energizes the solenoid 84 retracting its plunger 88 and an upstanding dog 90 which is rigidly affixed thereto. A spring 92 normally biases the dog 90 into engagement with the end 94 of lever 40 when it is in its up position thereby maintaining the wheel 34 in engagement with the wheel 30. When the plunger 88 retracts the dog 90, the lever 40 automatically swings about pivot pin 42 in a counter-clockwise direction, as viewed in FIGURE 1, moving the crank arm 36 in a counter-clockwise direction, as viewed in FIGURE 2, to swing the wheel 34 from its engagement with the wheel 30 to a position where it engages the brake shoe 46 to stop core 56. A stop pin 96 is mounted on the base member 22 below the end 98 of lever 40 to limit its downward travel when dog 90 releases it. A second limit switch 100 is mounted on the base member 22 and carries a roller 102 which is engageable by the lever 40 when it is in its up position. Electrical leads 104 connect the switch 100 to the motor 24 so that the switch will close an electrical circuit to the motor 24 when the lever 40 is in its up position and open the circuit to de-energize motor 24 when the lever 40 moves downwardly.

Reference may now be had to FIGURES 3–5 and 9 for a detailed description of the composite mandrel 12.

Friction between the drive wheel 30 and the driven wheel 34 (FIG. 3) is increased by a high coefficient of friction member 110 which encompasses the wheel 34. The driven wheel 34 is mounted on the outboard portion 112 of the output spindle 32 with a friction fit and is maintained in driving connection therewith by a washer 114, a cap screw 116 and associated parts to be hereinafter described. The outboard portion 112 has a smaller diameter than the intermediate portion 118 of input spindle 32 so that an annular shoulder 120 is formed between the two portions. A sleeve 122 encompasses the outboard portion 112 in abutting relationship with both the wheel 34 and the shoulder 120. A pair of ball-bearing assemblies 124 are mounted on the intermediate portion 118, are maintained in position with respect to a housing member 126 by snap rings 128 and are maintained in position with respect to the input spindle 32 by abutment with the sleeve 122 and a shoulder 130, respectively, when cap screw 116 is tightened. The shoulder 130 is formed on the inboard end 132 of spindle 32 which comprises a cylindrical head member serving to couple the input spindle 32 in driving engagement with an output spindle 134.

The output spindle 134 includes a cylindrical head portion 136, a reduced diameter intermediate portion 138 and an externally threaded end portion 140. A pair of ball bearings 143 rotatably mount the output spindle 134 in the housing 126. The core member 56 is rigidly affixed to the output spindle 134 by a collar 142 having internal threads 144 which threadedly engage the externally threaded end portion 140.

The head 132 of input spindle 32 is drivingly connected to the head 136 of output spindle 134 by a pair of cranks 146. Each crank 146 has a first crank pin 148 journalled in a ball bearing 150 which, in turn, is mounted in a cylindrical bore 152 in head 132. Each crank 146 also includes a second pin 154 which is journalled in a ball bearing 156 which, in turn, is mounted in a cylindrical bore 158 provided in the head portion 136 of the output spindle 134.

The head 132 of the input spindle 32 is also provided with a central, cylindrical bore or recess 160 in which a cylindrical hub 162 is loosely mounted. The hub 162 is retained in the recess 160 by a snap ring 164 and is keyed to the head 132 for rotation thereby by a key 166. The cylindrical hub 162 is provided with three individual apertures or bores 168 each of which receives an end 170 of a crank 172 formed on the unthreaded, inboard end 173 of a screw-threaded rod 174. Each crank 172 is mounted in a bore or aperture 176 provided in a cylindrical hub 178 which, in turn, is retained in a cylindrical recess 180 formed in head 136 by a snap ring 182. The inboards ends 173 for all three of the screw-threaded rods 174 extend through a common cylindrical bore 184 provided in the intermediate portion 138 of the output spindle 134. Each inboard end 173 then passes through an aperture 186 provided in the head portion 188 of core 56 in alignment with an associated aperture 176 and merges into the screw-threaded portion 189 of its rod 174. The

screw-threaded portion 189 of each rod 174 includes a coarsely threaded portion 190 at its upstream or inboard end which merges into a finely threaded portion 192 extending to the downstream or outboard end 194 of rod 174. The coarsely threaded portions 190 serve to guide the strand 50 into position on the finely threaded portions 192 of the screw-threaded rods 174 when the core 56 is rotated.

Each screw-threaded rod 174 is nested in a slot 196 provided in the cylindrical core 56 and extending along its periphery from its inboard or upstream end 198 to its outboard or downstream end 200. The depth of each slot 196 is such that the root portions 202 of threads 192 will be tangent to a circle inscribed about the periphery of core 56. Also, each slot is aligned with an associated aperture 186 in head portion 188 of core 56.

It is to be noted that the major axes of core 56 and output spindle 134 are in alignment and that the major axis of the input spindle 32, although parallel thereto, is offset therefrom. Also, the major axes of the screw-threaded rods 174 including their unthreaded inboard ends 173 lie parallel to and are offset from a common axis formed by the major axes of the core 56 and output spindle 134. Furthermore, the major axes of the ends 170 of cranks 172 are parallel to and offset from the major axis of the input spindle 32. The amount of offset of the common major axis for the threaded portion 189 and unthreaded portion 173 of each rod 174 from the common major axis for the core 56 and output spindle 134 is approximately equal to the amount of offset of the major axis of each end 170 from the major axis of the input spindle 32. Thus, when the input spindle 32 rotates the output spindle 134 through cranks 146, the rods 174 will be revolved about the major axis of the core 56. This is a simple and inexpensive arrangement for imparting to the rods 174 the effect of a reverse rotation about their own axes with respect to the major axis of the core 56, whereby the strand 50 will be moved uniformly along the core 56 from its inboard end 198 to its outboard end 200 by rotation of core 56 while, at the same time, the reverse frictional drag imparted to the individual loops formed about the core 56 by strand 50 will impart a reverse movement to the loops thereby stretching them. This produces more uniform curls in the strand 50 and prevents the strand 50 from binding and bunching upon the core 56.

The core 56 is prevented from whip lashing by supporting its outboard end 200 in a hub member 204 which, in turn, is supported in block 74 by a stub shaft 206. The shaft 206 is journalled in a ball bearing 208 which is mounted in block 74. The rod 76 has an externally threaded end 210 which threadedly engages internal threads on the housing 126 and a bore 212 at its other end which slidably receives a cylindrical member 214 having a T-shaped head 216. The slidable member 214 carries the block 74 which is rigidly affixed thereto and which is biased into engagement with the stub shaft 206 by a compression spring 218. When the member 214 is slid to the left, as viewed in FIGURE 3, against the bias of spring 218, the block 74 becomes disengaged from the stub shaft 206 and the T-shaped head 216 passes to the left of pin 220 extending transversely through the rod 76 whereupon the block 74 can be swung to one side and released so that the T-shaped head 216 engages the pin 220 to retain the member 214 in its extended position.

A tensioner 222 is rigidly affixed to the plate 14 by a bracket 224 and serves to tension the strand 50 as it passes through an eyelet 226, over a first spool 228, under a second spool 230 and over a third spool 232. A leaf spring 234 is connected to the tensioner 222 by a bracket 236 and has a curved end 238 which extends to a point closely adjacent the starting threads 190 on the core 56 where it engages a fixed pin 240. The strand 50 is threaded between the curved end 238 and the pin 240 whereby a drag is imparted to the strand 50.

Referring now to FIGURES 6–8, each figure shows progressive views of the composite mandrel 12 as it rotates counter-clockwise about its axis in 90° steps. The direction of rotation is counter-clockwise when looking in at the outboard end 200, as shown in FIGURE 9. The cranks 146 rotate the composite mandrel 12 through one revolution while the cranks 172 are revolving the rods 174 one revolution about the major axis of the core 56 in the same direction. This produces the same effect, with respect to core 56, as would be produced if the rods 174 were rotated about their own axes in a reverse direction on a mandrel. Thus, if a strand 50 is provided with a mark 242, then as the core 56 rotates from the position shown in FIGURE 6 90° to the position shown in FIGURE 7, the point 242 will back slide a slight amount with respect to the screw 174 due to the reverse frictional drive of the screws. Thus, the point 242 will appear to move clockwise with respect to the core 56 while the core 56 continues its counter-clockwise rotation to advance the strand 50 from the inboard end 198 to the outboard end 200 of the mandrel. While the vertical centerline of the upper screw 174 in FIGURE 6 travels 90° counter-clockwise from the position shown in FIGURE 6 to the position shown in FIGURE 7, a mark 244 on screw 174 will be displaced clockwise 90° with respect to its slot 196 to the position shown in FIGURE 7. As the vertical centerline of the screw 174, which carries mark 244, travels from the position shown in FIGURE 7 to the position shown in FIGURE 8, the mark 244 on screw 174 is displaced clockwise another 90° with respect to its slot 196 to the position shown in FIGURE 8. During each revolution of core 56, the strand 50 is displaced one thread pitch toward the outboard end 200 without being bound tightly about the core 56 because the reverse drag imparted to the individual loops of the strand 50 keeps the strand in a stretched condition and forms more uniform curls therein.

The mandrel 12 may be provided with only two screws 174 or, as shown in FIGURES 10 and 11, modified mandrels 12*a* and 12*b*, respectively, may be provided with four screw-threaded rods 174*a* and six screw-threaded rods 174*b* which are mounted in slots 196*a* and 196*b* of cores 56*a* and 56*b*, respectively.

Operation of the machine will be readily understood. A continuous strand of a thermal-setting plastic material having the approximate fineness of a human hair may be pulled from a spool, not shown, and threaded through the guide member 52 and thence down to the eyelet 226 on the tensioner 222, over roller 228, under roller 230, over roller 232, between the leaf spring 234 and the pin 240 and onto the composite mandrel 12. The continuous strand 50 is then wound about the mandrel 12 in such a manner that the strand seats in the roots of the coarse threads 190 and the fine threads 192 from the inboard end 198 of the mandrel to the container 72 adjacent the outboard end 200 of the mandrel. The strand 50 is then fed into the inlet orifice 73 of container 72 which is then evacuated by drawing a vacuum through conduit 73*a*.

The motor 24 is energized by elevating lever 40 to swing the driven wheel 34 into engagement with the drive wheel 30 whereupon the core 56 is revolved in a counter-clockwise direction, as viewed in FIGURE 9, and the rods 174 are revolved about the major axis of the core 56 by their associated cranks 146 and 172, respectively.

The heater 58 is then energized to blow 300° F. air onto the coiled strand 50 to increase its elasticity so that a curl will be imparted thereto as its loops are reversely stretched while advancing longitudinally along the core 56. The advancing strand 50 then passes through a fine spray of cold water, liquid nitrogen or the like, issuing from the spray device 70 to set the curls in the strand 50. As the strand 50 leaves the core 56, it is drawn into the chamber 72 and stored therein preliminarily to being transferred to the next step in the process which com-

prises fashioning the curled strand 50 into a suitable coiffure.

While the particular machines for processing stranded material herein shown and described in detail are fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that they are merely illustrative of the presently preferred embodiments of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.

What is claimed is:

1. In a machine for automatically setting a curl in a strand of material and feeding the material to a discharge point, the combination comprising:

mandrel means having an upstream end and a downstream end and also having slot means extending along its periphery spaced from and parallel to its major axis;

rod means nested in said slot means said rod means including external threads having root portions, said slot means being so dimensioned that said rod means nests therein with said root portions lying tangent to a circle inscribed about said periphery of said mandrel means, said strand being adapted to be looped about said mandrel means with the individual loops thereof seated in said root portions; and

drive means connected to said mandrel means for simultaneously rotating said manrdel means about its major axis, said drive means including means connected to said rod means for maintaining said rod means in a given orientation relative to said machine, said mandrel means being rotated one revolution about its major axis while said rod means is revolved once about the major axis of said mandrel means, whereby said strand of material is fed continuously along said mandrel means while said individual loops are subjected to a frictional drag in a backward direction so that said loops will be stretched to form uniform curls in said strand.

2. In a machine for processing stranded material, the combination comprising:

mandrel means having an upstream end and a downstream end and also having slot means extending along its periphery spaced from and parallel to its major axis;

externally threaded rod means nested in said slot means;

drive means for simultaneously rotating said mandrel means about its major axis and revolving said rod means about the major axis of said mandrel means, the major axis of said drive means being offset from the major axis of said mandrel means; and

means connecting said drive means to said mandrel means and to said rod means, said connecting means including first crank means connecting said rod means to said drive means at a point which is offset from the major axis of said drive means a distance approximately equal to the amount the major axis of said rod means is spaced from the major axis of said mandrel means.

3. The combination of claim 2 wherein said connecting means includes second crank means connecting said mandrel means to said drive means.

4. The combination of claim 3 including tensioner means for controlling the feeding of said stranded material onto said mandrel means.

5. In a machine for processing stranded material, the combination comprising:

mandrel means having an upstream end and a downstream end and also having slot means extending along its periphery spaced from and parallel to its major axis;

externally threaded rod means nested in said slot means;

drive means for simultaneously rotating said mandrel means about its major axis and revolving said rod means about the major axis of said mandrel means, the major axis of said drive means being offset from the major axis of said mandrel means;

first crank means connecting said rod means to said drive means at a point which is offset from the major axis of said drive means a distance approximately equal to the amount the major axis of said rod means is spaced from the major axis of said mandrel means;

second crank means connecting said mandrel means to said drive means;

tensioner means for controlling the feeding of said stranded material onto said mandrel means; and

heater means mounted adjacent said mandrel means for heating said material as it is moved longitudinally along said mandrel means by said rod means.

6. The combination of claim 5 including coolant supply means mounted adjacent said mandrel means downstream of said heater means for cooling said material after it has been heated.

7. The combination of claim 6 including evacuated chamber means positioned adjacent said mandrel means downstream of said coolant supply means for receiving said material after it has been heated and cooled.

8. The combination of claim 7 wherein said slot means comprises at least two slots and said rod means comprises a rod nested in each slot.

9. The combination of claim 7 wherein said slot means comprises three slots and said rod means comprises a rod nested in each slot.

10. The combination of claim 7 wherein said slot means comprises four slots and said rod means comprises a rod nested in each slot.

11. The combination of claim 7 wherein said slot means comprises six slots and said rod means comprises a rod nested in each slot.

12. In a machine for processing stranded material, a composite mandrel comprising:

a cylindrical core having an inboard end and an outboard end, said core including an enlarged head on its inboard end, said core being provided with a plurality of slots extending along its periphery from said inboard end to said outboard end, each of said slots being offset from the major axis of said core a like amount and being parallel to the major axis of said core;

an aperture provided in said enlarged head of said core in alignment with each of said slots;

an externally threaded rod nested in each of said slots, each of said rods including a portion extending through an associated aperture in said head and having a major axis lying parallel to and being offset a like amount from said major axis of said core;

a first rotatable spindle connected to said enlarged head of said core in such a manner that rotation of said first spindle will rotate said core, said first spindle having a major axis in alignment with the major axis of said core and an aperture provided in its end remote from said enlarged head of said core in alignment with each of said apertures in said enlarged head of said core, said extensions on said rods extending through said apertures in said first spindle;

a second spindle rotatably mounted adjacent the remote end of said first spindle, the major axis of said second spindle lying parallel to and being offset from the major axis of said first spindle;

first crank means connecting each of said extensions of said rods to said second spindle at a point which is offset from the major axis of said second spindle a distance approximately equal to the amount the major axis of each rod is offset from the major axis of said core;

second crank means connecting said second spindle to said first spindle in such a manner that rotation of

said second spindle will impart rotation to said first spindle; and

drive means connected to said second spindle for imparting rotation thereto.

13. The composite mandrel of claim **12** wherein said slots are four in number.

14. The composite mandrel of claim **12** wherein said slots are six in number.

15. The composite mandrel of claim **12** wherein said slots are three in number.

16. The composite mandrel of claim **12** wherein the roots of said threads are tangent to a circle inscribed about said core.

References Cited by the Examiner

UNITED STATES PATENTS

2,599,692	6/1952	Castellan	242—47.04 X
2,605,536	6/1952	Litzler	242—47.11
2,796,724	6/1957	Jaros	57—34.5
2,878,514	3/1959	Nichols et al.	18—19
2,929,179	3/1960	George	57—29 X
2,980,959	4/1961	Genovese	18—19
3,050,819	8/1962	Allman et al.	57—34 X

FRANK J. COHEN, *Primary Examiner.*

BILLY S. TAYLOR, *Examiner.*