Oct. 22, 1957 F. R. GONSETT 2,810,670

PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 1

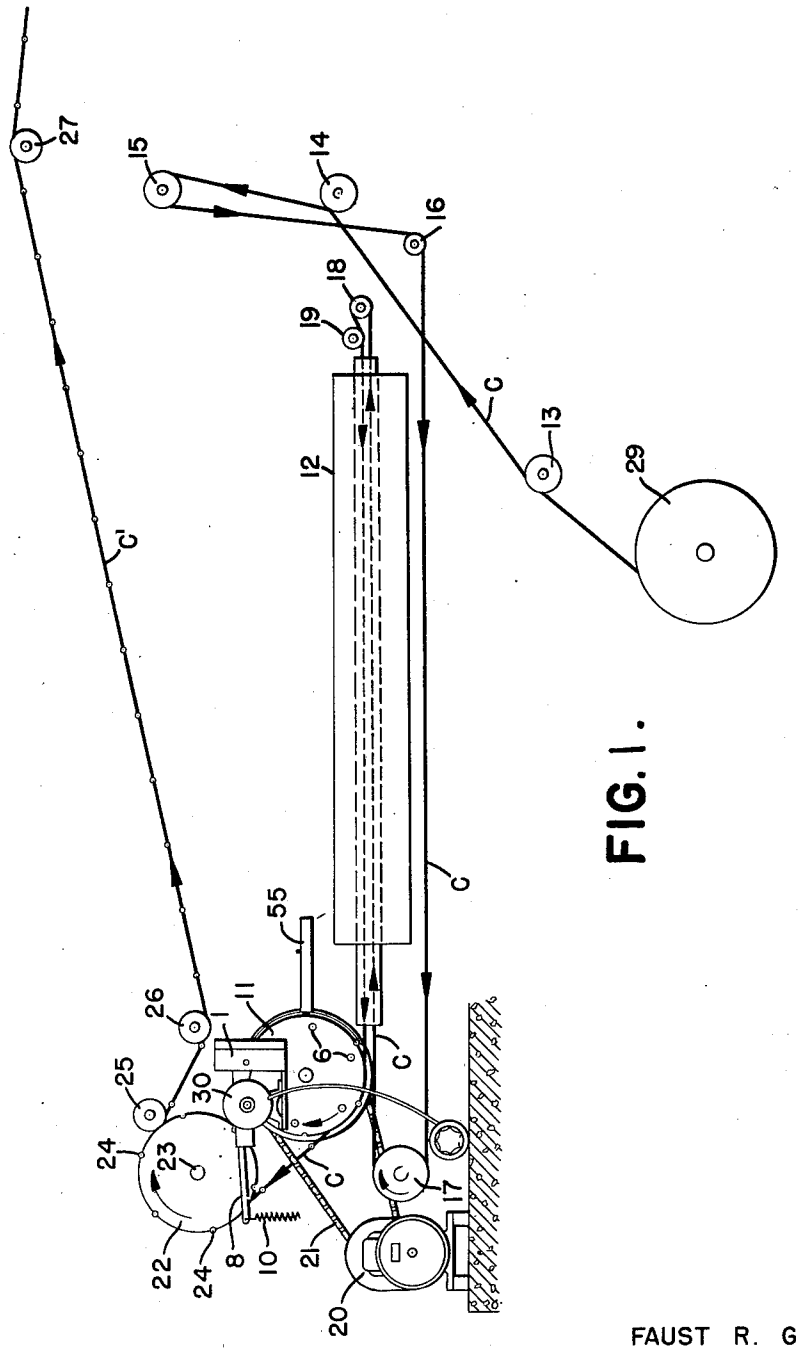


FIG. 1.

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Original Filed Dec. 5, 1951 9 Sheets-Sheet 2

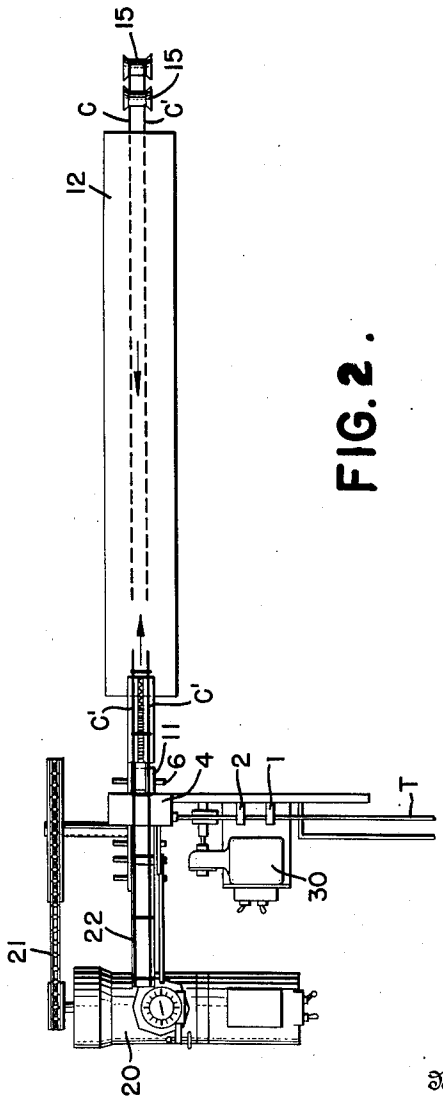


FIG. 2.

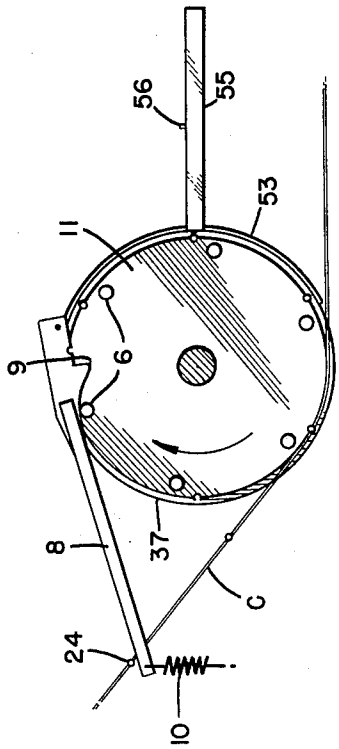


FIG. 8

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Oct. 22, 1957 F. R. GONSETT 2,810,670

PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 3

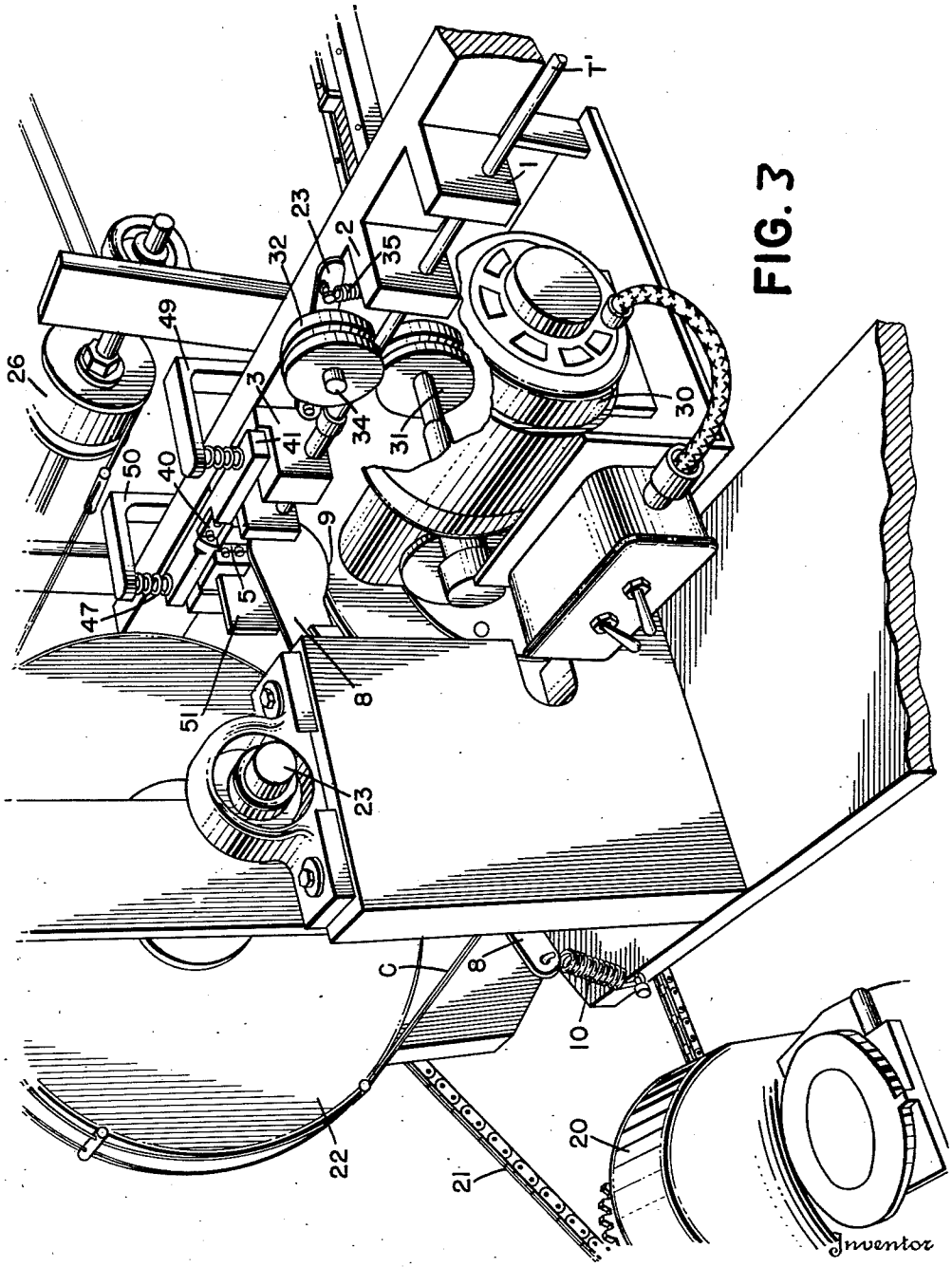


FIG. 3

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 4

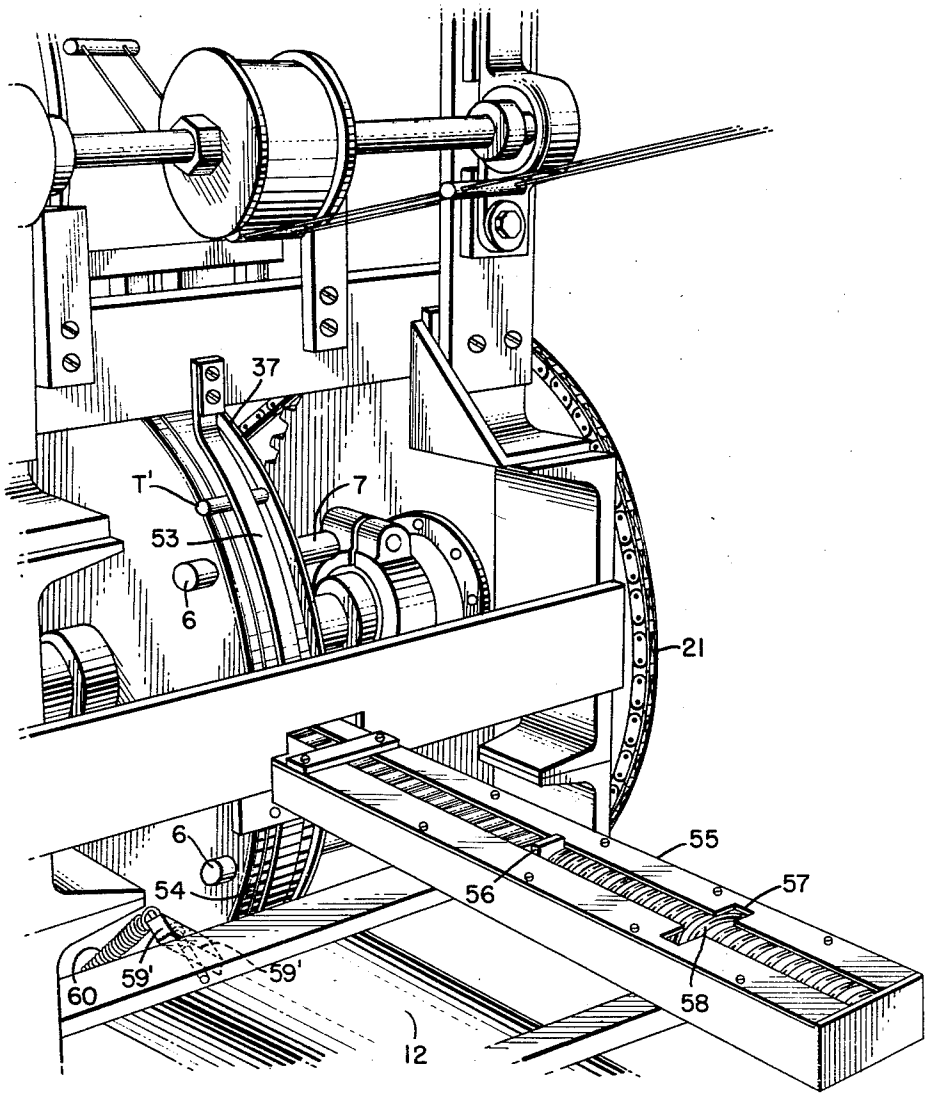


FIG. 4.

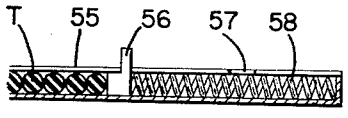


FIG. 7.

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 5

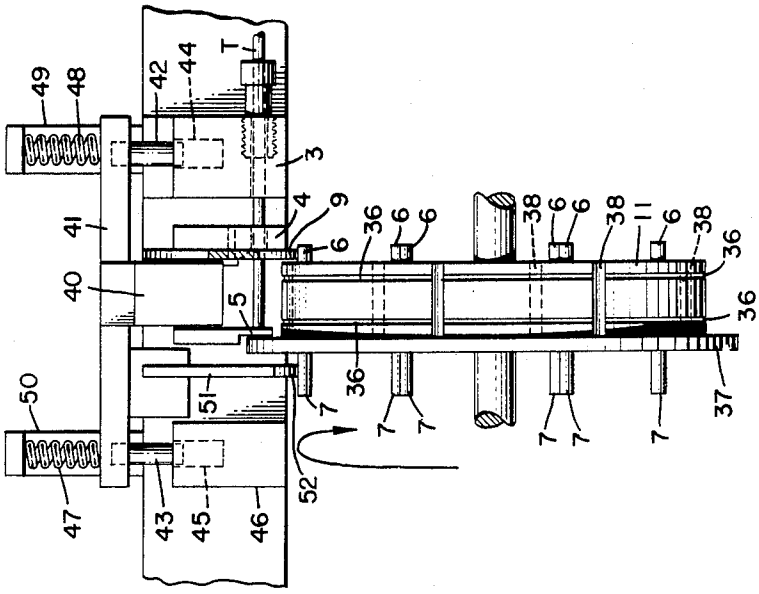


FIG. 6

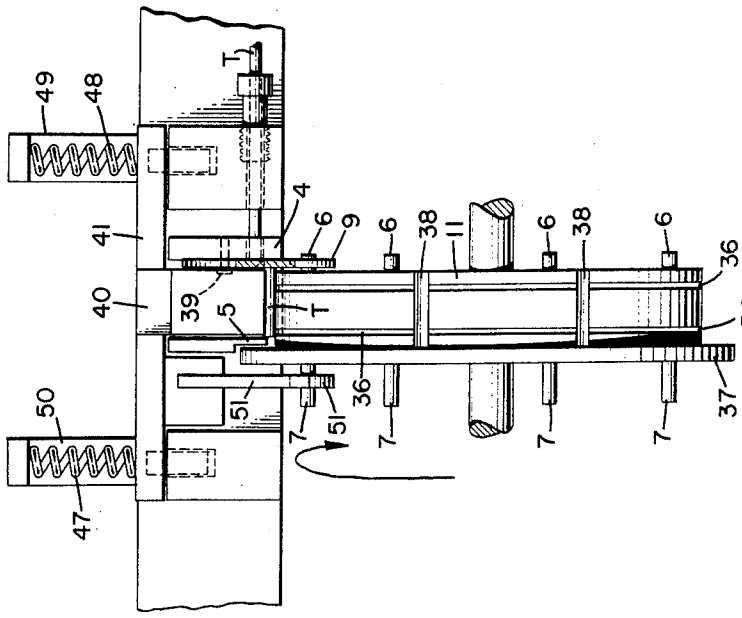


FIG. 5

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 6

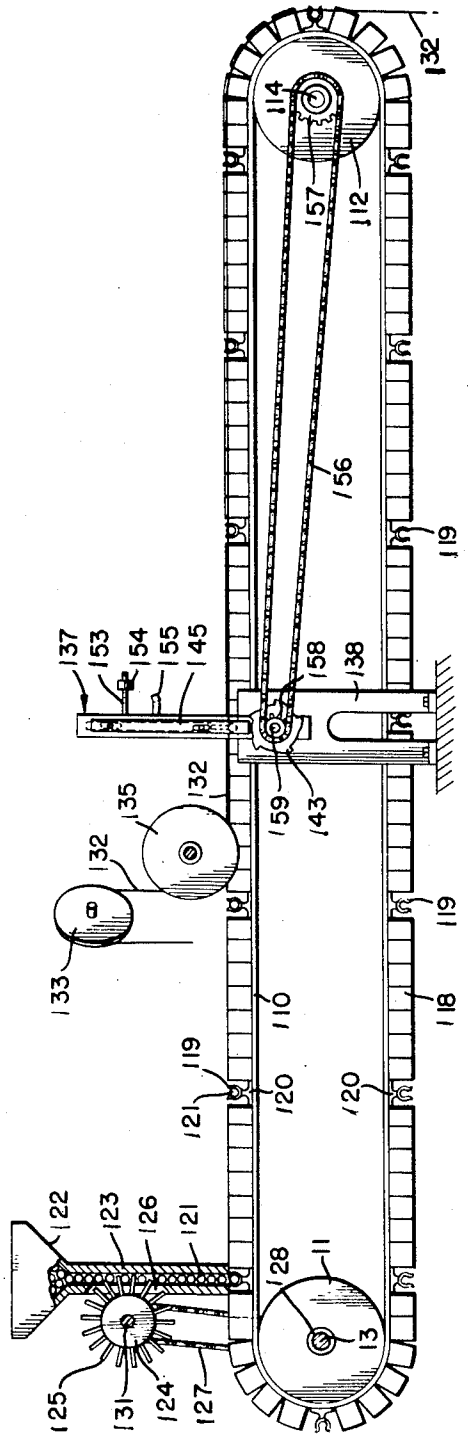


FIG. 9.

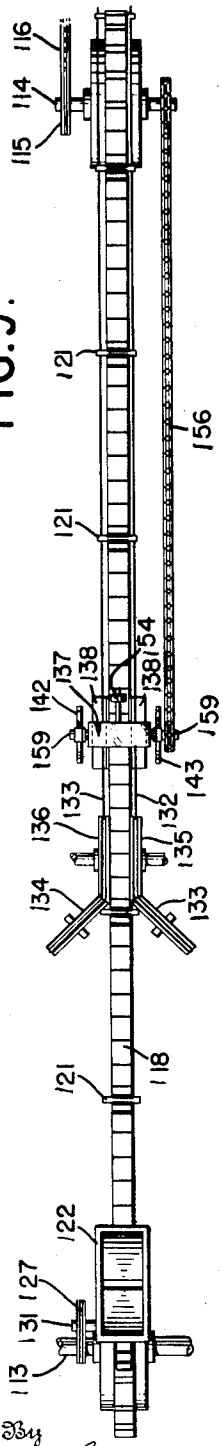


FIG. 10.

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 7

FIG. 11.

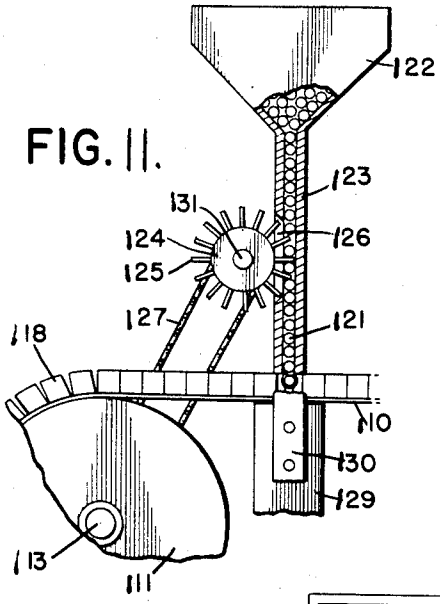
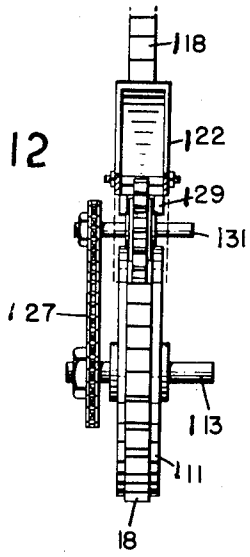


FIG. 12



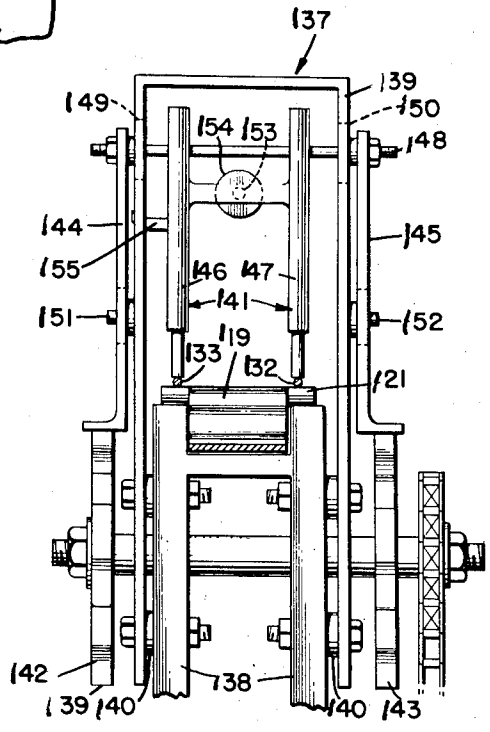


FIG. 13

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

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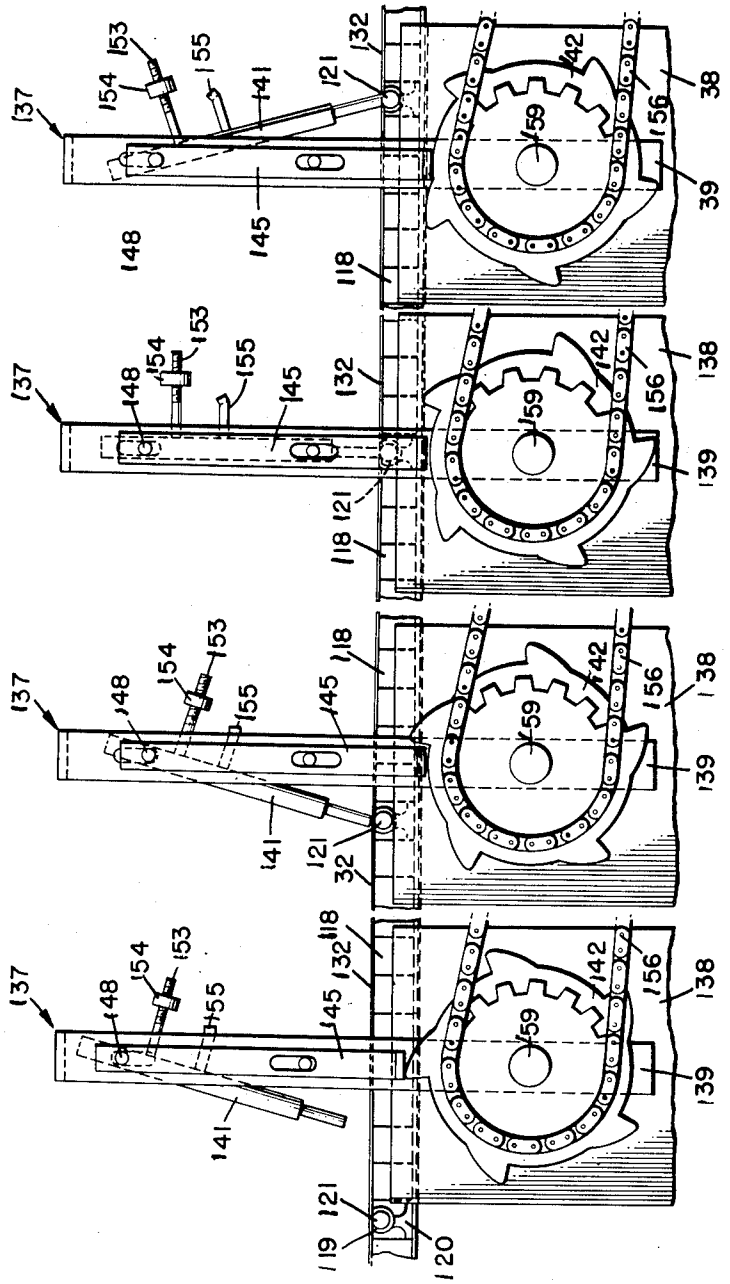


FIG. 17

FIG. 16

FIG. 15

FIG. 14

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PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Original Filed Dec. 5, 1951 9 Sheets-Sheet 9

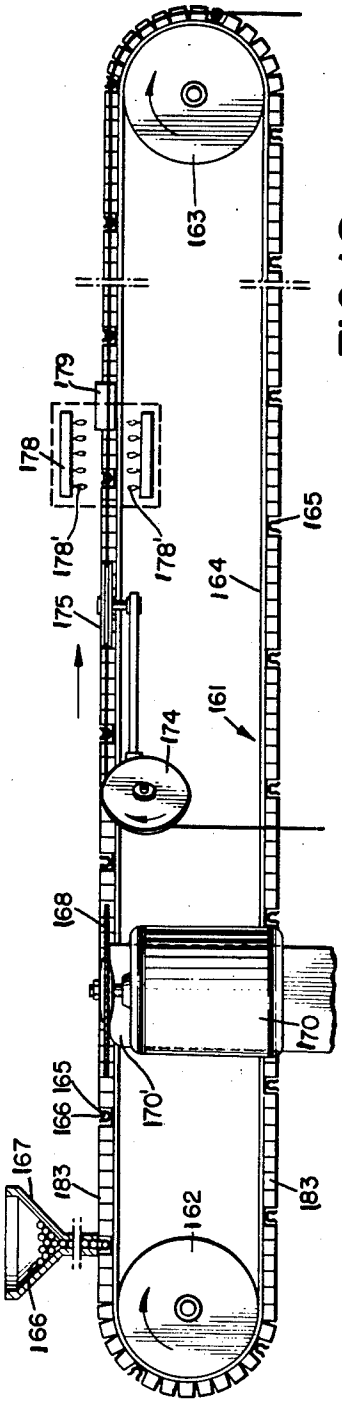


FIG. 18.

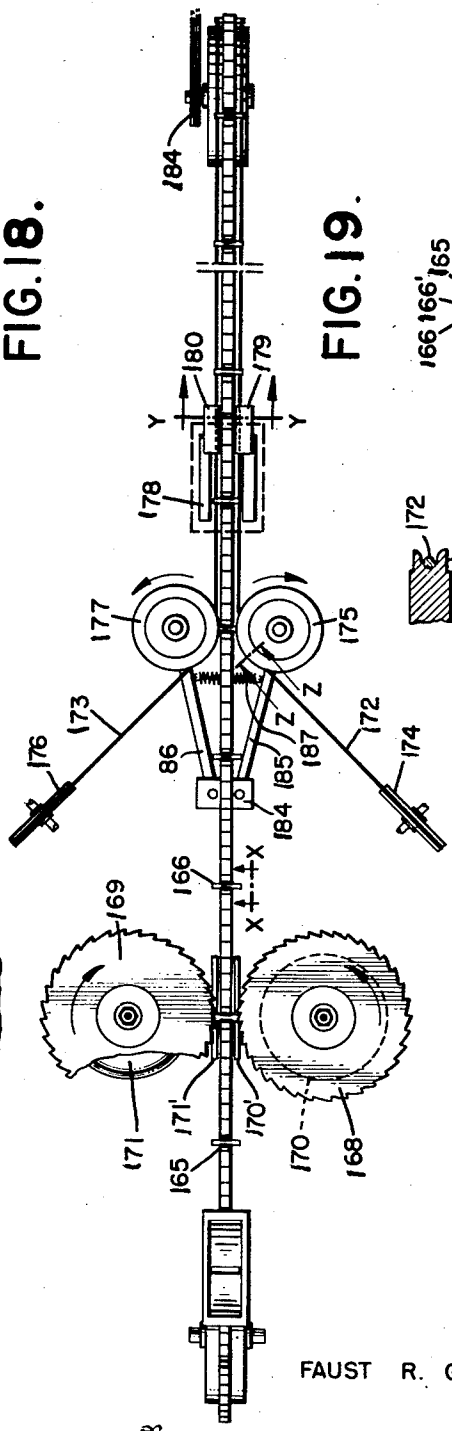


FIG. 19.

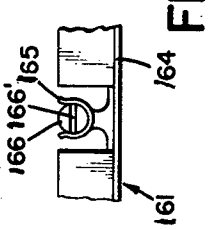


FIG. 20.

FIG. 22.

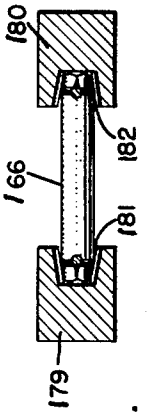


FIG. 21.

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United States Patent Office 2,810,670 Patented Oct. 22, 1957

2,810,670

PROCESSES FOR THE MANUFACTURE OF MULTIPLE STRAND ELECTRICAL CONDUCTOR LEADS

Faust R. Gonsett, Burbank, Calif., assignor, by mesne assignments, of one-half to L. A. Young Spring & Wire Corporation, Detroit, Mich., a corporation of Michigan, and one-half to Fretco, Inc., Pittsburgh, Pa., a corporation of Pennsylvania

Original application December 5, 1951, Serial No. 260,646. Divided and this application October 16, 1953, Serial No. 386,626

10 Claims. (Cl. 154—2.24)

This invention relates to a process for the manufacture of multiple strand electrical conductor leads of the air insulated variety. The leads are for use primarily as conductor leads electrically uniting a television antenna and a television receiving set.

It is an object of this invention to provide a machine which will take a pair of bare conducting wires, preferably copper, from a spool or spools of wire, heat the wires simultaneously and maintain said wires under suitable tension pressing the heated wires into the plastic in uniformly spaced relation while they are being united by short lengths of an insulating thermoplastic material such as polystyrene or similar suitable thermoplastic dielectric or nonconductor of electricity.

It is an object of this invention to provide a finished product comprising a multiple wire conductor lead, said wires being united in uniformly spaced relation by pieces of thermoplastic material, preferably polystyrene, whereing the union of the plastic material pieces or elements are united by heated wires pressed to some extent into the end portions of the pieces while the wires are heated and maintained under tension resulting in pressure to cause the wires to sink sufficiently into the plastic pieces to make firmly united joints between the plastic elements or pieces and the wires.

It is an object of this invention to provide a process for making an article of manufacture comprising a pair of bare wires, preferably copper, united adhesively in uniformly spaced relation by heat and pressure applied simultaneously in localized areas to be designated as spot heating and joining, comprising the use of thermoplastic material pieces or elements uniting the wires wherein the heated wires sink sufficiently into the end portions of the pieces and are embedded and sealed therein and arranged transversely of the wires, to form a firm union or joint between the wires and the plastic pieces, the pressure being maintained by the tension of the wires.

It is broadly a process whereby a plurality of bare wires are united by thermoplastic means wherein both the wires and the plastic means are spaced from each other respectively, the wires and plastic means being united by means of heat and pressure, so that the wires extend transversely through portions of the plastic elements or pieces and are in permanent union therewith.

Other objects and advantages will become apparent from the detailed description of the drawings which constitute a part of my application.

In the drawings:

Fig. 1 is a schematic side elevation of the machine disclosing generally the process for making spaced multiple conductor leads.

Fig. 2 is a schematic plan view of the machine of Fig. 1.

Fig. 3 is a fragmentary perspective view showing details of the means for feeding the plastic rod and the severing means for the rod and other essential construction.

Fig. 4 is a fragmentary perspective view showing portions of the frame construction, the main wire and plastic receiving wheel or pulley, the safety auxiliary feeding magazine, as well as other essential construction.

Fig. 5 is a fragmentary elevation of the edge of the main pulley with the feed control means for the plastic elements in its lower position adjacent the main pulley.

Fig. 6 is a fragmentary elevation similar to Fig. 5 with the plastic element feed control means in its elevated position some distance from the main pulley.

Fig. 7 is a longitudinal section of a fragment of the auxiliary feed magazine.

Fig. 8 is a side elevational view of a fragment of the machine showing schematically the main pulley and some of the related parts.

Fig. 9 is a view in side elevation disclosing the principal parts of my machine and the specific relation of those parts to each other.

Fig. 10 is a plan view of the machine disclosed in Fig. 9.

Fig. 11 is a fragmentary side elevational view, partly in section, of the force feed hopper in combination with a support for the belt just below the hopper.

Fig. 12 is a plan view of the subject matter of Fig. 3 except that a portion of the hopper is cut away and is shown in section; furthermore the support for the belt is not shown.

Fig. 13 is a fragmentary view in front elevation of the combined heating and pressure mechanism.

Figs. 14, 15, 16 and 17 are respectively side elevational views representing successive views of various positions assumed in its operation by the combined heat and pressure mechanism used in pressing the bare wires into the end portions of the thermoplastic pieces or elements.

Fig. 18 is a foreshortened side elevational view partly in section of the principal parts of a modified construction wherein the end portions of the thermoplastic pieces or elements are slitted to receive the bare wires.

Fig. 19 is a plan view of the construction shown in Fig. 18.

Fig. 20 is a fragmentary side elevational view of the belt including one of the receiving clips having a slitted thermoplastic element therein.

Fig. 21 is a fragmentary sectional view taken on the line Y—Y of Fig. 19 looking in the direction indicated by the arrows.

Fig. 22 is a sectional view of a pulley taken on the line Z—Z of Fig. 19.

In the machine of Figs. 1 and 2, the feeding means for the polystyrene rod works intermittently as shown. It will be seen that the polystyrene rod T is guided and fed between V type feed wheels or grooved rollers provided respectively with frictional slipping contact with the rod as it continues through the supporting guides **1**, **2**, **3**, **4**, Figs. 3, 4, 7, and finally ending against the stop bar **5**. The rod T is moved intermittently in cycles, timed with the actuating stud supported rollers **6** and **7** projecting laterally from the sides of the main wheel or pulley **11**.

The combined guide and cutting block **4** and cutting blade **8** work like a cigar tip cutter, and normally the blade **8** is down, thus keeping the thermoplastic rod from going through and making physical contact with the stop **5**. When an actuating stud or pin **6** comes into the proper position and hits the cam lobe **9** on the blade **8** it raises the blade **8** and thereby provides a path for the rod to shoot through and against the stop **5**, and then the blade **8** is propelled downwardly by the spring **10** to sever the plastic rod. After the pin **6** passes the peak of the cam lobe **9** on blade **8**, the blade is released from its elevated position to be propelled downwardly by the spring **10** as clearly disclosed.

In the general scheme, Figs. 1 and 2, there is an oven

12, gas or electric, through which a pair of bare wires *c*, preferably copper, are drawn, being reeved about pulleys 13, 14, 15, 16, 17, then through the oven 12 and reeved about pulley 18 and back through the oven 12 to the main pulley 11. The pulley 19 is merely a tension pulley.

The main pulley 11 is driven by the principal motor 20 which is provided with speed regulating means. A chain drive 21, preferably, connects the main pulley with the principal motor. The main pulley is driven at a suitably reduced speed from that of the principal motor, as clearly shown. A second or additional pulley 22 is supported on a shaft 23 arranged on a higher level than the main pulley 11 and the shaft thereof. The additional pulley 22 receives the wires *c*, *c* which are reeved about the major portion of pulley 22. The wires *c* are now carrying the polystyrene spacing elements or pieces 24. The pulley 22 is a cooling means and is propelled, preferably, by a chain drive connecting both of the pulleys 11 and 22 so that they maintain the same peripheral speed. A pair of tension pulleys 25 and 26 assist in maintaining the now finished conductor lead on the cooling pulley 22. The pulley 26 and the pulley 27 guide the finished lead C' to the winding reel (not shown).

The reel or reels 29 comprise the supply of bare conducting wire which is conducted and guided through the oven. In order to maintain a suitable tension on the wires *c*, *c* from the supply reel or reels, they are provided with suitable brakes (not shown).

In order to feed the polystyrene T forward an auxiliary or additional motor 30 is provided to actuate the grooved pulley 31. The opposed grooved idler pulley 32 is mounted on a spring actuated pivoted lever 33, said arm having a stub shaft 34 carrying said idler pulley. The tension spring 35 merely urges the pulley 32 against the polystyrene rod T.

Further detailed description is to be noted in connection with Figs. 3 to 8 inclusive. The main pulley 11 is provided on its circumferential face with parallel or equally spaced grooves 36.

These grooves 36 receive the heated bare wires *c*, *c*. One face of pulley 11 is provided with a continuous circumferentially projecting flange 37 constituting a stop for one end of each piece of polystyrene. The circumferential face of pulley 11 is provided with equally spaced transverse receivers or grooves 38 which intersect the grooves 36 and extend to a greater depth into the pulley 11 than do the grooves 36, whereby the thermoplastic pieces in the grooves 38 are overlain transversely by the heated wires *c*, *c* under tension and pressure so as to cause them to locally fuse and sink into the thermoplastic end portions of the pieces. After both the wire and plastic pieces are cooled, it is found that both the wires and plastic pieces are firmly and permanently united to constitute an air insulated multiple conductor lead, very suitably adapted to connect an outside television antenna to a television set within a sheltered construction.

The blade 8 is pivoted at 39 to the combined cutting block and guide 4. The blade 8 is angularly elevated intermittently by the pins 6 as they contact the cam lobe 9 on the blade 8. The polystyrene rod T is axially in alignment with a position above the major portion of the circumference of pulley 11 but it is not above the stop flange 37. When a piece of the polystyrene is severed, it drops into a recess or receiver 38 aided and guided by the upright intermittently movable aligner plate 40. The plate 40 is secured to a transverse bar 41. The bar 41 is provided with depending guide pins 42 and 43 guided in sockets 44 and 45 in the blocks or brackets 3 and 46. The bar 41 and aligned plate 40 are actuated in one direction by the compression springs 47 and 48 which as shown are aided by the force of gravity. The compression springs are suitably located and maintained in brackets 49 and 50. The bar 41 is also provided with a depending arm 51 terminating in a cam lobe 52 on its lower extremity located in the path of the suitably spaced pins 7 on pulley 11.

The stop 5 is stationary and is located in the path of the rod T. The function of the stop 5 is to gauge the length of the pieces severed from the rod T. When the blade 8 is down it serves intermittently as a stop for the rod T, and when it is raised sufficiently the rod T is moved along rapidly by the friction drive of the pulleys 31 and 32 until the rod hits the stationary stop 5. Just after the severance of the rod, the aligner plate 40 descends sufficiently to aid in aligning the cut piece so as to drop into the adjacent transverse recess or receiver 38.

The pulley or wheel 11 may be designated as an indexing means, inasmuch as it carries the pieces of work in uniformly spaced relation.

The cut pieces of plastic T' are retained in the recesses 38 by curved leaf springs 53 and 54, as shown in Fig. 5. This retention is maintained until the pieces T' are engaged by the hot bare wires *c*, *c*.

In order to insure that a cut piece T' is in proper position in every passing recess 38, an auxiliary or safety supply magazine 55 is provided to automatically fill each empty passing recess, if any should occur for any reason whatsoever. The auxiliary magazine 55 is suitably secured to the frame of the machine with the feed exit located in the path of the recesses or receivers 38 and between the adjacent terminals of the springs 53 and 54.

The preferred construction of the magazine is disclosed in Figs. 4 and 7 in which the cut pieces of plastic are located in parallel relation between the feed exit and a spring pressed follower 56. In order to replenish the magazine, the follower 56 can be forced backwardly against the tension of the spring beyond the aligned transverse slots 57 and 58, so that suitable pieces could be dropped through the slots 57 and 58 into the magazine.

Inasmuch that the pieces or elements T' may not be aligned properly relative to the bare heated wires *c*, *c*, means 59 has been provided to push the pieces T' longitudinally to abut against the annular stop flange 37 and thereby insure the proper alignment of the pieces T' with the bare heated wires.

The means 59 preferably comprises a pivoted lever or pawl pivoted on the frame of the machine and actuated by a tension spring 60 urging the free end of the lever angularly and frictionally against the pulley 11 in the path of the pieces T' and the recesses or receivers 38.

The cooling pulley 22 is similar to pulley 11 in that it is provided with circumferential and transverse grooves or receivers. In view of the fact that the wires *c*, *c* engage firmly the major portion of the circumference of pulley 22, it is to be noted that pulley 22 produces the major drag or pull on the wires *c*, *c* in order to advance the work through the machine to its reception of the winding reel for the finished product.

The motors 20 and 30 are provided with switches and speed control means.

All of the driving means, gears, chains, belts, etc. are arranged and constructed to cooperate in synchronized relation so that the machine can operate successfully and smoothly.

In this machine, Figs. 9 to 22 inclusive, a chain or belt 110 is supported on a pair of pulleys 111 and 112 and a pair of shafts 113 and 114. The shafts 113 and 114 are fixed, respectively, in the pulleys 111 and 112. The shafts are supported in bearings (not shown). The pulley 112 and shaft 114 are driven by any suitable means such as a sprocket 115 and a chain 116. The pulley 111 and its shaft 113 are driven by the belt 110. The belt 110 may be made of any suitable belting material such as laminated canvas and rubber, or any other laminated belt construction. Generally, the belt would be comparatively narrow. Assuming that the thermoplastic elements or pieces are an inch long, then the belt 110 would be slightly less than three-fourths of an inch wide. A series of blocks 118 are secured to the outside

of the belt 110, as clearly shown. The blocks may be made of any suitable material such as wood or thermo-setting plastics such as: phenol aldehydes, cresol aldehydes, urea aldehydes, malamine-formaldehydes, analine formaldehydes and glycerol phthalates. These blocks are secured by metallic fasteners or a suitable cement or both to the outer face portion of the belt 110.

At substantially equally spaced distances, receiving clips 119 are mounted between groups of blocks 118 on the outer face portion of the belt 110. The base 120 of each clip is substantially as wide as a block and as long as the belt 110 is wide. These clips 119 are secured to the belt by rivets or cement or both (not shown). Each clip is adapted to firmly receive and embrace a piece 121 of the thermoplastic material, such as polystyrene or any other suitable thermoplastic material. The thermoplastic pieces or elements are contained in a hopper 122 having a chute 123 to conduct them to the clips 119.

In order to insure the reception of a piece of thermoplastic by each clip 119, I have provided a force-feed mechanism comprising a feed wheel or wheels 124 having radial fingers 125 extending through a slot or slots 126 in the chute 123. The feed wheel is driven by an adjustable friction clutch (not shown) actuated by a chain 127 propelled by a sprocket 128 secured on shaft 113. The feed wheel maintains a constant downward pressure on the pieces of polystyrene through the medium of the slipping or friction clutch means. The hopper 122 and chute 123 are supported in slight frictional engagement with the blocks 118. The supporting means for the hopper and chute is not shown on the drawings. Fig. 11 shows a support 129 for the belt 110 arranged in opposed relation to the chute 123. This support 129 cooperates with the force feed mechanism, in that, it maintains a constant position for the clips, blocks and belt as they advance along beneath the chute. The support 129 is provided with shallow upstanding guides 130, one of which is shown in Fig. 11. The shaft 131 for the feed wheel 124 is supported in suitable bearings (not shown).

The upper portions of the clips 119 are arranged in close proximity of its adjacent blocks 118 to prevent feeding a piece 121 of thermoplastic between a clip 119 and a block 118. The top portions of the clips are in a plane which coincides with a plane defining the top portions of the adjacent blocks when the feeding operation is taking place.

The bare conducting wires 132 and 133 are drawn from a supply (not shown) by pulleys 33 and 34 and these wires are received and guided by the pulley 135 and 136 over the end portions of the pieces 121 of polystrene. These pieces 121 extend transversely a suitable distance beyond both margins of the belt 110, the clips 119 and the blocks 118, so that, the heating elements 146 and 147 can be located in a slightly spaced relation from the blocks 118 and the clips 119.

The heating and pressure mechanism 137 comprises upright supporting means 138 which supports the belt, the clips and the end portions of the thermoplastic pieces 118. The wires 132 and 133 are supported respectively on the end portions of each piece 118, as clearly shown in Fig. 13. The inverted U-frame 139 is stationary and is bolted to the support 138 and is maintained in spaced relation therefrom by washers 140. The movable unit 141 can be elevated by the pair of ratchet cams 142 and 143 which engage the outside arms 144 and 145, as clearly indicated in Figs. 13 to 17 inclusive. The depending heater elements 146 and 147 have their upper ends fixed on the shaft 148. The end portions of the shaft 148 are mounted in bearings in the side arms 144 and 145. The shaft 148 is guided by slotted portions 149 and 150. The side arms 144 and 145 are slotted to receive the fixed guide pins 151 and 152. The projecting rod 153 on the shaft 148 has a weight 154 adjustably mounted thereon to swing the depending heater elements 146 and 147 forwardly when sufficiently elevated. One of the heater elements is provided with a stop 155 to prevent the heater elements from swinging too far forwardly when the heater elements are sufficiently elevated by the ratchet cams.

Each heater element is heated by an electric current arranged and applied like a heating element such as that used in soldering irons or copper bits. These heating elements are slightly grooved at their blunt ends to take over the bare wire in a straddling manner.

The combined heating and pressure mechanism is driven by a chain 156 engaging the driven sprocket wheel 157 on shaft 114 and engages the sprocket wheel 158 on shaft 159.

Operation.—In the construction disclosed in Figs. 9 to 17 inclusive, the bare conductor wires 132 and 133 are drawn, respectively, from a pair of supply spools or drums (not shown) by a pair of grooved pulleys 133 and 134, which guide the wires to the grooved pulleys 135 and 136. Each supply spool or drum is retarded by a suitable means such as a brake to maintain each wire under suitable tension as the wires 132 and 133 are drawn along by the belt or chain 110. Since the pieces 121 and the wires 132 and 133 are eventually permanently secured together by heat and pressure, hereinafter explained, the belt 110 carries and draws the connected wires along to winding spools or drums (not shown) upon which the finished product is collected for future use.

The belt or chain 110 is driven, preferably by a sprocket chain 116, and the pulley 111 and its shaft 113 are driven by the belt or chain 110. The chain 127 drives the force feed means, but since the force feed means can only operate intermittently, a slipping friction clutch (not shown) is provided either on shaft 113 or 131 to provide for the slippage of sprocket and clutch over which chain 127 runs.

As the chain or belt 110 with its blocks 118 and clips 119 move along beneath the chute 123, a piece of thermoplastic 121 is forced into the clip 119 when in position below the chute 123. The belt or chain 110 and its blocks and clips are supported by the support 129, Fig. 11, during the instant of time when the piece of thermoplastic 121 is forced into the clip 119.

Each advancing thermoplastic piece has its end portions in the path of the lower edges of the pulleys 135 and 136, and said end portions pass beneath the pulleys in a depressed position. Next the piece engages the combined guide and support 138. At the instant the piece engages the support 138, the heater has been elevated and has swung forwardly, urged forwardly by the weight 154. At this point, the control arms 144 and 145 of the heater have dropped their lower end portions into elongated valleys between pairs of cam lobes on the ratchets 142 and 143.

Now, the heater elements are pressing downwardly by gravity on the wires 132 and 133 and forcing them by heat and pressure into the end portions of the thermoplastic piece. The continued heat and pressure on the bare wires causes the thermoplastic to fuse at the points of physical contact of the heated wires and the wires sink into the heated and fused portions of the thermoplastic to make permanent joints or connections between the wires and the thermoplastic pieces. As soon as the heater is elevated by a pair of cam lobes on the ratchets 142 and 143, the wires and thermoplastic begin to cool and quickly the joints are permanently established.

A study of Figs. 14, 15, 16 and 17, successively, will enable anyone to visualize the operation of the combined heater and pressure mechanism.

Since the thermoplastic pieces 121 are united permanently to the wires 132 and 133, they are pulled out of the clips 119 at the end of the lap defined by the belt by a winding spool, reel or drum (not shown).

In the construction shown in Figs. 18 to 22, inclusive, a chain or belt 161 is arranged horizontally and supported on two suitably spaced upright pulleys 162 and 163. The belt 161 is of special construction comprising a web 164 having thereon transversely arranged receivers

or clips 165 to receive the thermoplastic pieces 166 one by one successively in the receivers, respectively. The pieces 166 are fed by gravity from the hopper 167 to the chute and, as disclosed in Figs. 9 and 11, are delivered by force feed to the clips 165. The thermoplastic pieces 166 are retained in the clips 165 by the friction grip of the clips. Each piece 166 projects laterally beyond each side of the belt.

In order to provide kerfs or slots in each end of each piece, two circular saws 168 and 169 are arranged horizontally and in the path of the projecting ends of the pieces 166. The saws 168 and 169 are located on opposite sides of the top lap of the belt 161. In plan view, saw 169 is operated clockwise by an individual motor 171 connected thereto. The saw 168 is rotated in an anticlockwise direction by a suitable motor 170 connected thereto.

Both the motors 170 and 171 and the belt 161 are provided with suitable supports 170' and 171' to maintain the projecting ends of the pieces properly centered in the paths of the saws so that the kerfs or slots 166' will be properly centered in the ends of the pieces 166.

The supply wires or conductors 172 and 173 are guided by pulleys 174 and 175 on one side and 176 and 177 on the other side of the belt 161 into the kerfs 166' in the ends of the thermoplastic pieces 166.

Beyond the assembled wires and pieces, a heating means or oven 178 is provided to heat both the wires and the slotted projections of the pieces 166. The heating means softens the ends of the pieces sufficiently so that the ends of the pieces 166 can be pinched or collapsed around the wires to make a substantially permanent union or joint between the pieces and wires respectively.

In order to collapse the kerfed ends of the pieces, a shaping or forming means 179 and 180 is provided and is located partly within the oven 178 and partly beyond the exit of the oven. The forming means is provided with opposed wedge shaped recessed portions or channels 181 and 182. These recesses or recessed portions are tapered both longitudinally and transversely, thereby providing a large portion or mouth portion for the initial reception of the heated kerfed ends of the pieces respectively. As the pieces are propelled through the forming means, by the belt, the kerfed heated ends of the pieces are gradually collapsed and pressed or pinched together about the wires, respectively.

In view of the fact that the combined shaping and uniting means 179 and 180 are partly within the oven, said means is heated to some extent to facilitate the uniting of the wires and pieces. The union of the wires and pieces is substantially permanent.

The blocks 183 on the belt 161 are substantially as tall as the receivers 165, and said blocks prevent the escape of the pieces 166 from the feed means except when a receiver 165 is in alignment with the exit of the hopper chute.

The whole machine except the saws is propelled by the sprocket wheel 184 which is connected with a suitable source of power supply.

It is to be noted that the heating and uniting of the wires and pieces takes place while the wires and pieces are advancing through the heating means or oven 178 and the shaping means 179 and 180. Both the wires 172 and 173 and the ends of the plastic pieces are heated simultaneously in the oven 178.

Although the drawings show gas flames 178' for heating purposes, it is contemplated that an electrical heater (not shown) may be used.

It is further to be observed that a force feed means like that shown in Figs. 9 and 11 is to be used in the modification disclosed in Figs. 18 to 22 inclusive.

The annular receiving grooves of pulleys 175 and 177 are broad enough in their outer circumferences to receive the kerfed ends of the pieces 166 which can pass into the grooves without undue distorting pressure as illustrated in Fig. 22. The pulleys 175 and 177 are yieldably and pivotally mounted in a stationary bracket 184 by arms or links 185 and 186. The tension spring 187 connects the arms and urges the arms and pulleys 175 and 177 toward each other to facilitate the feeding or guiding the wires, respectively, into the kerfs 166'. Furthermore, if it should happen that a plastic piece is longer or shorter than the regulation length, then the pulleys 175 and 177 could yield accordingly to accommodate any piece of irregular length.

Operation.—This modified construction, Figs. 18 to 22, is generally the same as that disclosed in Figs. 9 to 17 and, of course, the force feed of Figs. 9 and 11 are to be applied to the modified construction of Figs. 18 to 22. The saws 168 and 169 operate at a high speed in the direction indicated by the arrows. The guiding supports 170' and 171' guide the plastic pieces 166 so that their end portions shall be substantially centrally and longitudinally kerfed by the saws.

The guiding pulleys 175 and 177 guide the bare wires 172 and 173 into the kerfed ends of the pieces 166. If a plastic piece 166 is not of the exact contemplated length, then the pulleys can yield to properly contact the ends of the plastic pieces.

Both the ends of the plastic pieces and the wires are heated by the heater 178. The kerfed ends are sufficiently heated to make them pliable so that the heated furcations can be forced together and form a joint between the wires and the respective end portions of the plastic pieces.

The advancing belt or chain 161 drags or pulls the heated plastic pieces through the wedge shaped grooves 181 and 182 of the shaping and compressing elements 179 and 180. The forward ends of the elements 179 and 180 are located in the heater 178 so that the elements 179 and 180 are constantly in a heated condition so that a substantially permanent union or joint can be made between the plastic pieces 166 and the wires 172 and 173 which constitutes the finished product comprising a multiple wire air insulated conductor lead.

It is to be noted that the thermoplastic elements and the bare wires are not a part of my machine but are materials worked on and manipulated by my machine.

It is contemplated that a combined transmission and conveyor chain can be used instead of a so-called belt.

The force feed mechanism may vibrate during the operation of the machine. This is not objectionable but, on the contrary, aids the feed by shaking the thermoplastic elements or pieces into suitable positions. The force feed is also aided by the force of gravity because of the upright position of my force feed mechanism.

It can now be readily understood that I have produced a machine requiring the use of low temperatures to form the union between the copper wires and the thermoplastic elements. The temperature of the wires at the exit of the oven 12 is approximately 600° F. and just before the wires physically contact the elements T', the temperature has fallen to approximately 300° F. This substantially continuous operation at substantially low temperatures is deemed to be a very desirable quality and spells continued success as well as mass production at a low cost.

This application is a refiled one plus additional information and is a substitute for application Ser. No. 244,906, now abandoned, by Faust R. Gonsett, now Ser. No. 333,086, filed January 26, 1953.

The specification and claims of this application are taken from applications by Faust R. Gonsett Ser. Nos. 260,046, now abandoned, and 333,086 respectively, on account of requirements for division.

Having fully disclosed my said invention what I claim is:

1. A process of manufacturing multiple conductor leads of the air insulated variety, said process comprising the selection of thermoplastic elements of suitable length

and maintaining said elements in suitably spaced parallel relation, applying heated bare copper wires transversely over the end portions of said elements while said heated wires are maintained under tension at a temperature of substantially 300° F., whereby said wires are united to said elements at a low temperature and suitable pressure causing said heated wires to fuse into said elements to make a permanent union between the wires and the elements.

2. A process of manufacturing multiple conductor leads of the air insulated variety, said process comprising the selection of suitable thermoplastic elements of suitable length, maintaining said elements in suitably spaced parallel relation, taking a pair of bare heated conductor wires and applying them in transverse relation across the end portions of said elements while said wires are maintained under tension and thereby fusing said heated wires into the elements to make a permanent union therewith, and finally cooling the wires and the elements.

3. The process of manufacturing multiple conductor leads of the air insulated variety, said process comprising selecting a suitable thermoplastic material and providing a multiplicity of elements made therefrom of a suitable length, placing and maintaining said elements in suitably spaced parallel relation, applying a pair of bare conducting wires transversely across the end portions of said elements, heating said wires and maintaining them under tension whereby said wires are fused into the elements to make a permanent union between said elements and the wires and finally cooling said wires and elements.

4. The process of manufacturing multiple conductor leads of the air insulated variety, said process comprising the selection of a multiplicity of thermoplastic elements of suitable length, arranging and maintaining said elements in suitably spaced parallel relation, placing a pair of copper wires transversely across the end portions of said elements while maintaining said wires in a heated condition of approximately 300° F. and under tension whereby said wires are spot fused into said elements to form permanent joints therewith and finally cooling all of the heated portions of said lead.

5. The process of manufacturing multiple conductor leads of the air insulated variety, said process comprising the following steps: first, selecting a multiplicity of thermoplastic elements of suitable and of equal lengths, secondly, arranging and maintaining said elements in a suitable spaced parallel relation, thirdly, selecting a pair of electrically conducting wires, fourthly, heating said wires while maintaining them under tension, fifthly, applying said heated wires under tension across the end portions of said elements whereby said heated wires under tension are fused into the elements to make permanent joints therewith, and sixthly, cooling the heated portions of the assembled elements and wire.

6. A process for the manufacture of multiple conductor leads of the air insulated variety, said process comprising the selection of thermoplastic elements of suitable length and thickness, arranging said elements in spaced parallel relation and maintaining them in such relation, selecting a pair of bare conductor wires and arranging said wires in engagement transversely with the end portions of said elements, then uniting all of said wires and thermoplastic elements simultaneously and successively by the application simultaneously of heat and pressure whereby said wires are permanently united to said thermoplastic elements by fusing portions of said thermoplastic elements sufficiently to receive the proximate heated portions of the wires and finally cooling the heated portions of the thermoplastic elements and the wires.

7. A process for the manufacture of multiple wire leads of the air insulated variety, said process comprising the selection of thermoplastic elements of suitable dielectric quality and of suitable length and thickness having dimensions susbtantially within the range of from three-fourths of an inch in length to two inches in length and a thickness of three-sixteenths to three-eighths of an inch, arranging, supporting and maintaining said elements in substantially uniformly spaced parallel relation, then selecting a pair of bare electrical conducting wires, arranging and maintaining said wires in parallel relation transversely of the end portions of said thermoplastic elements, uniting simultaneously all of said wires and thermoplastic elements successively by the simultaneous application of heat and pressure to said wires and to the end portions of said elements to fuse said elements successively and sufficiently to receive said wires in a captive condition in said elements, finally cooling said elements and wires.

8. A process for the manufacture of multiple strand conductor leads of the air insulated variety, said process comprising the selection of a multiplicity of suitable thermoplastic connector elements of suitable length and thickness, arranging and maintaining said elements in uniformly spaced parallel relation, providing right and left hand sets of horizontal kerfs respectively in the end portions of said elements, selecting a pair of suitable bare conductor wires and guiding each wire into one set of kerfs, heating both the kerfed end portions of said elements and said wires, pressing each kerfed end portion, while heated, about the contained portion of the heated wire, and finally cooling both said elements and said wires.

9. The process of making an open wire transmission line comprising sawing slots in each end of a series of thermoplastic spacers, inserting a wire in each of said slots of said spacers, heating said wire and said spacers to at least a softening temperature of the plastic and crimpling the ends of said softened plastic whereby said spacers are firmly attached to the wire.

10. A process for the manufacture of multiple conductor leads of the air insulated variety, said process comprising the selection of thermoplastic elements of suitable length and thickness, arranging said elements in spaced parallel relation and maintaining them in such relation, selecting a pair of bare conductor wires and arranging said wires in engagement transversely with the end portions of said plastic elements successively, and uniting said wires with said elements successively by the simultaneous application of heat and pressure, and subsequent cooling.

No references cited.