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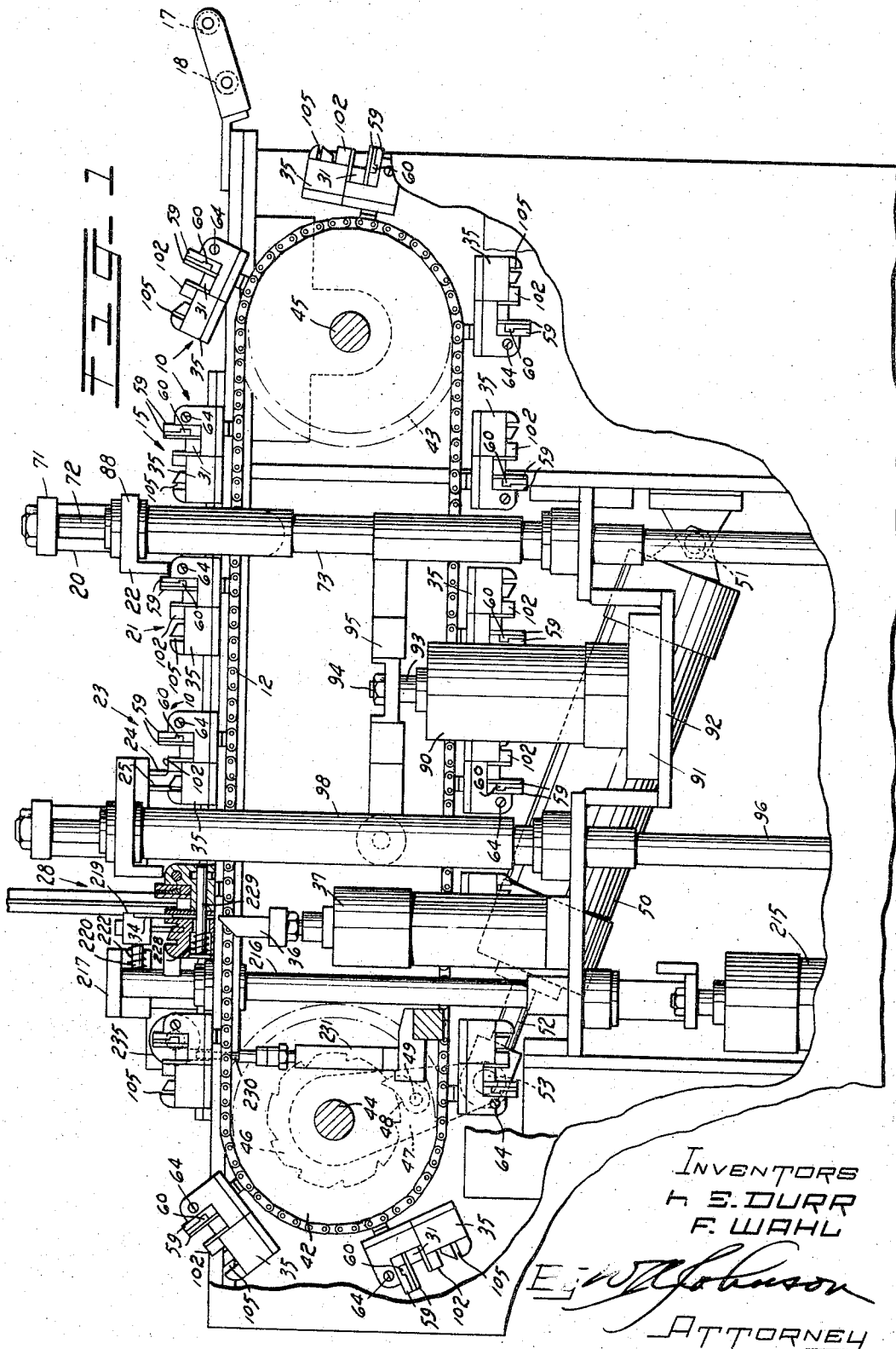
H. E. DURR ET AL

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APPARATUS FOR PREPARING INSULATING WIRES

Filed Aug. 19, 1964

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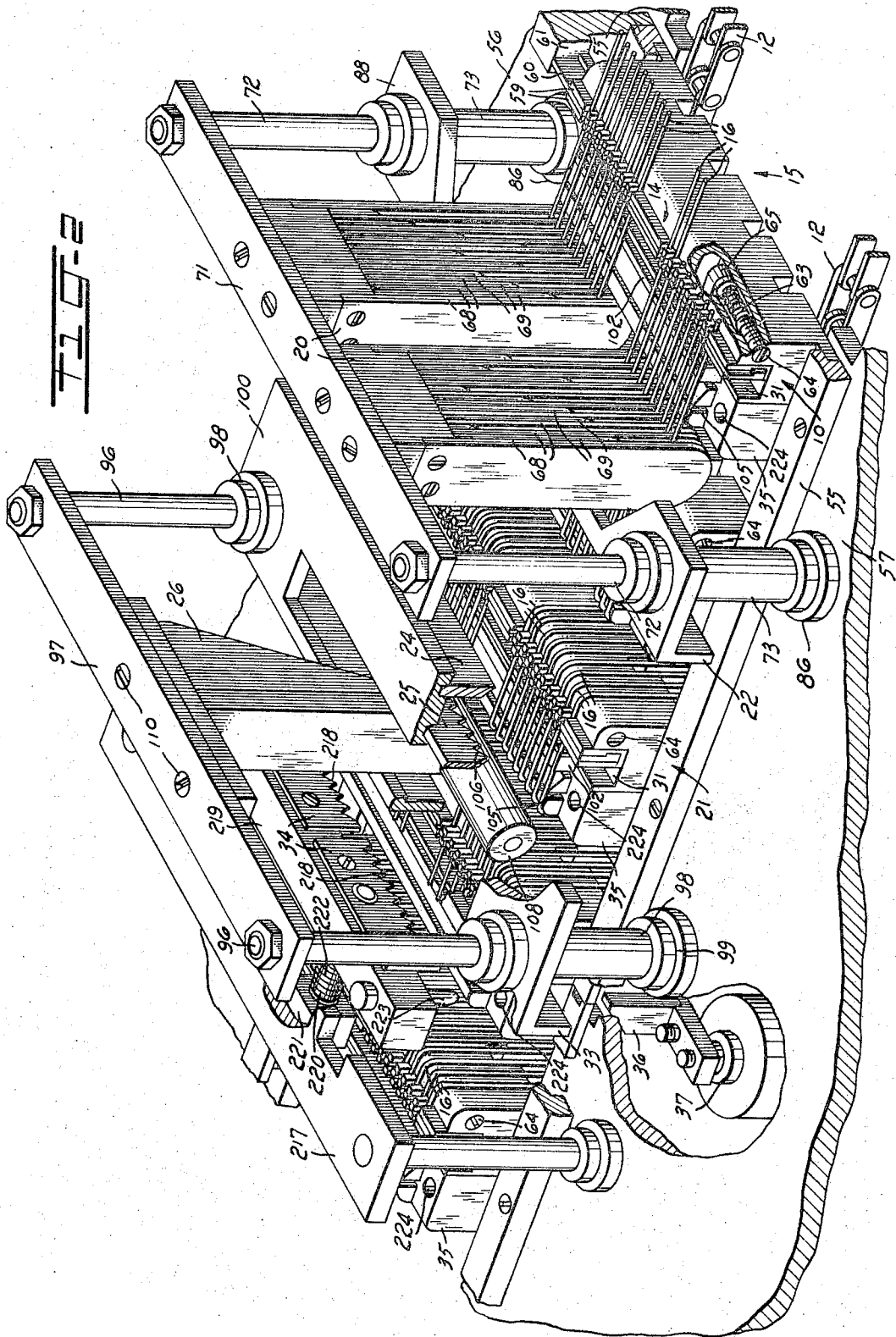
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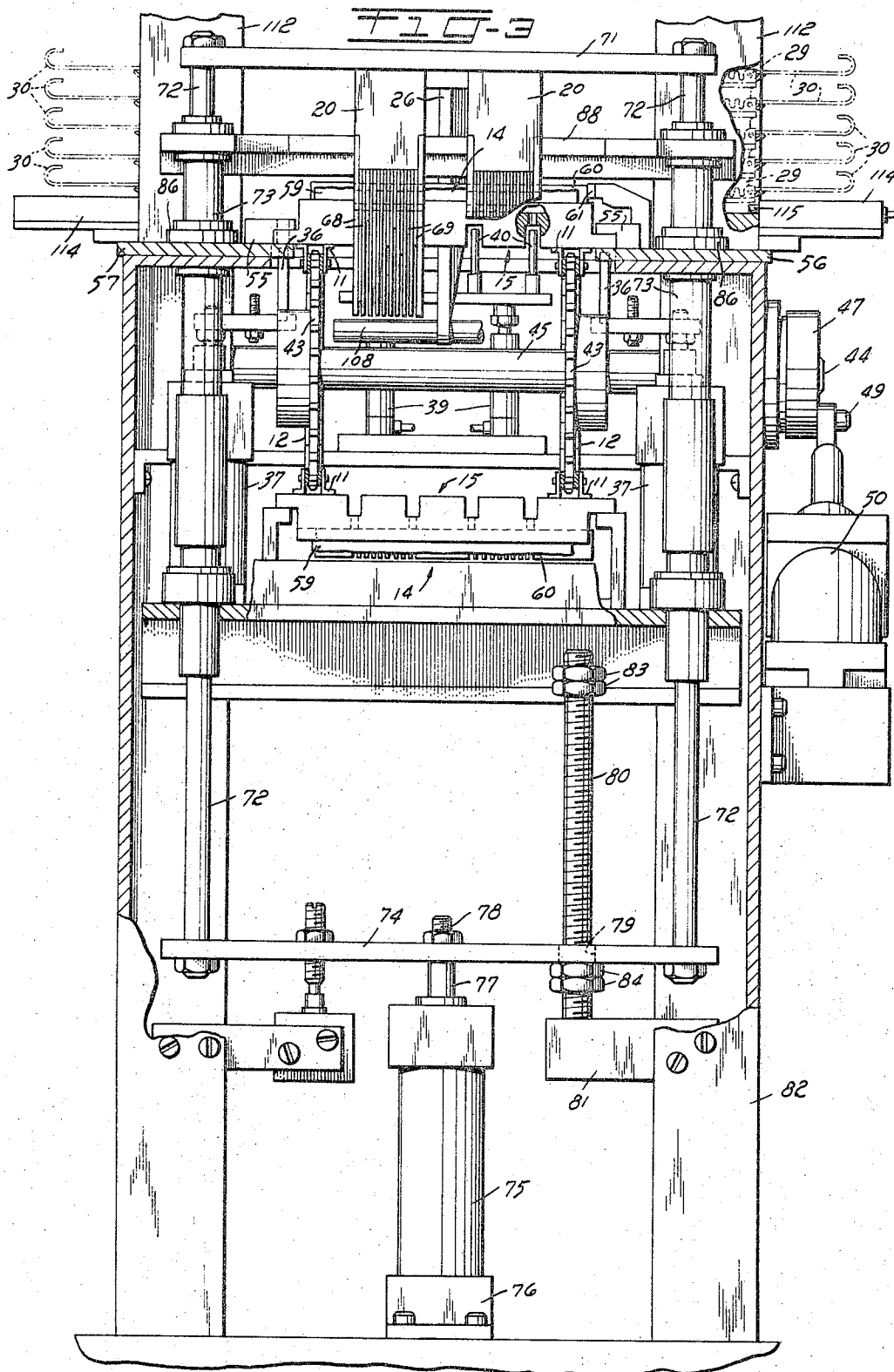
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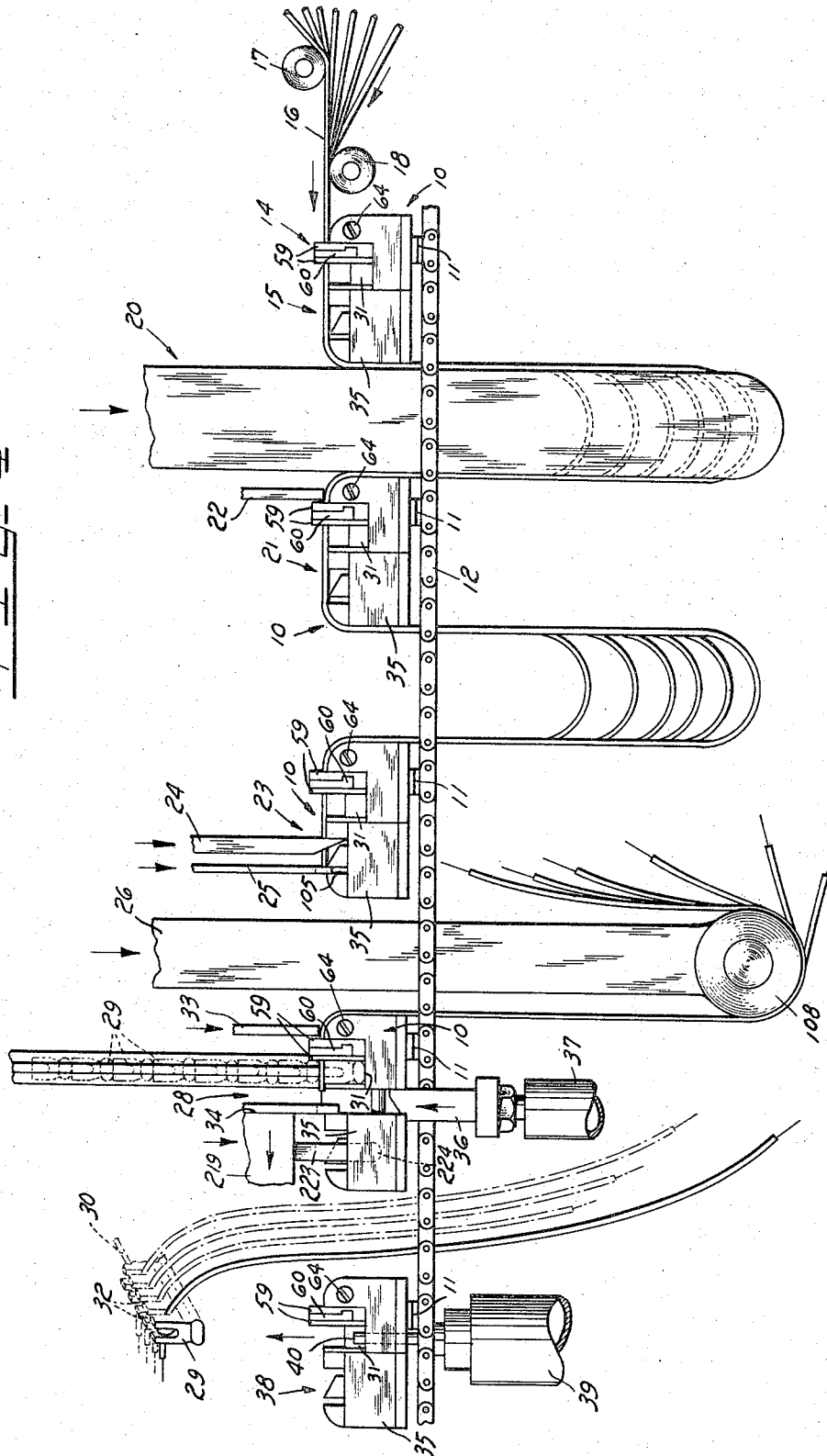
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FIG. 4



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APPARATUS FOR PREPARING INSULATING WIRES

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This invention relates to apparatus for feeding and stripping insulated wires particularly groups of insulated wires of predetermined varied lengths.

The wiring of certain electrical structures such as, in the present instance, station key connectors requires the use of groups of insulated wires of various lengths with the insulation stripped from the ends thereof. Such wiring operations may be performed more rapidly and more efficiently if the wires are pre-cut, their ends stripped of insulation, and arranged in a definite order.

In the present instance, two groups of twenty-five wires each and of predetermined varied lengths are required for each station key connector. These wires must be selected from supplies of insulated wires of predetermined color codes and located in their relative positions for mounting on the connectors.

An object of the present invention is an apparatus which is simple in structure, completely automatic and highly efficient in feeding and stripping groups of insulated wires.

A further object of the invention includes selectable means for feeding strands of different lengths from supply sources in accordance with a predetermined pattern.

In accordance with the objects the apparatus comprises a plurality of like units with means to support the units at spaced positions and move them intermittently in a given path between intervals of rest while additional means feeds groups of insulated wires of predetermined lengths from the supplies to the units and separate means adapted to strip insulation from the trailing ends and the leading ends of the groups of wires.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings wherein:

FIG. 1 is a side elevational view of the apparatus;

FIG. 2 is an isometric view of the apparatus;

FIG. 3 is a vertical sectional view of the apparatus; and

FIG. 4 is a fragmentary side elevational view of a portion of the apparatus.

Apparatus in general

The apparatus includes a plurality of equally spaced units 10 mounted, at points indicated at 11, on an endless chain or conveyor 12 which constitutes means for moving the units in a given path between intervals of rest. Each unit 10 has a comb-like wire gripper 14 adapted at the first position 15 to be open to receive insulated wires 16 at spaced positions therein from their individual supplies (not shown) and directed to the unit through the aid of rollers 17 and 18. A wire length feeder 20 is adapted to move downwardly between units 10 at the first position 15 and the second position 21 while a clamp 22 holds the wires of the unit 10 at the second position against backward movement. The feeder 20 is adapted to individually engage the various wires 16 and feed them predetermined distances, or rather form loops or feed predetermined lengths thereof to the space between the units 10 at the first and second positions 15 and 21. The feeder 20 moves upwardly to allow the next advancement of the units 10 and these varied lengths of wires retain their positions. When the unit 10 reaches the third position 23 a cutter 24 will be

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operated to cut the trailing end of a previously advanced group of wires and a rear stripper 25 will be operated in cooperation with the unit 10 at that position so that when an element 26 is moved downwardly the trailing ends of the wire of this particular group will be stripped. At position 28, a holder 29, in the form of a U-shaped comb with a wire-like holding clamp 30, is fed longitudinally into a groove 31 of the unit 10 with the pairs of notches 32 in the comb-like holder positioned beneath the insulated wires. At this time another clamp 33 holds the wires at position 28 against backward movement while a front stripper 34 is moved downwardly to engage the insulation near the leading ends of the wires and be operatively connected to a sliding portion 35 of the unit 10 so that during lateral movement of this sliding portion by a cam or wedge-like member 36 of an air cylinder 37, the leading ends of the wires will be stripped of their insulation. At the last position in this group identified as 38, an air cylinder 39, is operated to cause a piston-supported plunger 40 to move the comb-like holder 29 upwardly causing its notches 32 to receive their respective wires after which the clamp 30 may be moved into place either manually or automatically and through the aid of the holder 29 the prepared groups of wires 25 may be removed from the apparatus.

The apparatus

The conveyor 12, as shown in FIGS. 1, 2, and 3, is composed of two endless chains extending around pairs of sprocket wheels 42 and 43 fixedly mounted on their respective shafts 44 and 45, the shafts being journaled in suitable bearings. A ratchet wheel 46 is mounted fixedly on the shaft 44 and a lever 47 is supported by the shaft 44 to rock thereon. A spring-pressed pawl 48 is pivotally mounted at 49 on the lever 47 to engage the teeth of the ratchet 46 during each rocking movement of the lever to impart advancing movements to the conveyor 12 to feed the units 10 to their successive positions. The means to rock the lever 47 is an air cylinder 50 having one end pivotally supported at 51 and its piston rod 52 connected at 53 to the lower end of the lever 47, this connection being in the form of a pin mounted on the lever. The units 10 are identical in structure and a description of one of the units will apply to all of them. Attention is directed to the unit 10 at the far right of FIG. 2. This unit is of sufficient length to straddle an opening 56 in a table 57 and have its ends rest on the table after the unit has moved about the pair of sprocket wheels 43 as illustrated in FIG. 1 and is to be advanced intermittently in a predetermined path between guides 55. The groove 31 extends the full length of the unit 10 and a portion of this groove is occupied by the comb-like section indicated generally at 14. The comb-like section 14 has fixed outer members 59 and a movable central or L-shaped inner member 60 all of which members have notches in their upper structures to receive the insulated wires 16 from their supplies (not shown). It should be made clear that although the present apparatus is designed and constructed to prepare two groups of insulated wires with twenty-five wires in each group, the figures of the drawings have not been held to these numbers solely for the purpose of more clearly illustrating the invention. When each unit 10 moves into what in FIG. 4 has been identified as the first position 15, the central portion 60 engages a fixed cam 61 to hold the central portion in position to align its notches with the notches of the fixed outer members 59, permitting the insulated wires 16 to be moved freely by each of the wire length feeders 20. As soon as the conveyor 12 starts its next movement the central member 60 moves beyond the cam 61 and is forced outwardly to move the notches therein out of alignment with the notches of the fixed

members 59 to individually grip the wires and hold them against longitudinal movement. This action is brought about through the force of a spring 63, which force may be varied by adjustment of a screw 64, to urge an arm 65 integral with the central member 60 to the right in FIG. 2 establishing the holding effect of the wires between the central member 60 and the fixed outer members 59.

While the unit 10 is in the first position 15 and the central member 60 is held with its notches aligned with the notches of the outer members 59, the wire length feeders 20 are actuated. The feeders 20 have stacks of alternately disposed spacers 68 and length controlling elements 69 so that when mounted in the selected groups the spacers 68 may straddle the wires as illustrated in FIG. 2 and the rounded ends of the length controlling elements 69 will engage their respective wires and move them downwardly predetermined distances between the units 10 at the first position 15 and the second position 21. The feeders 20 are mounted on a horizontal member 70, the ends of which are supported by rods 72 movable vertically in sleeves 73.

As illustrated in FIG. 3 the rods 72 extend downwardly through the sleeves 73 and have their lower ends fixed to a connecting member 74. The operating means for the rods 72 originates in an air cylinder 75 mounted at 76 and having its piston rod 77 connected at 78 to the connecting member 74. The connecting member has an aperture 79 to receive a threaded rod 80, the lower end of which is mounted in a bracket 81 fixed to the adjacent frame member 82. Pairs of nuts 83 and 84 adjustably positioned on the threaded rod 80 respectively control the upper and lower positions of the connecting member 74 and thus control the upper and lower positions of the feeders 20 relative to the paths of the wires 16. The sleeves 73 are supported for vertical movement in bearings or bushings 86 mounted in apertures of the table 57. A laterally extending member 88 has its ends apertured for mounting on the upper ends of the sleeves 73, the clamp 22 being integral with this member and extending downwardly therefrom. The power means for moving the sleeves 73 is embodied in an air cylinder 90, mounted at 91 on a frame structure 92 and having its piston rod 93 connected at 94 to a lateral member 95 which is fixed to the sleeves 73.

Nothing occurs to the measured lengths of wires when the unit 10 moves from position 15 to position 21, but in the areas of the positions 23 and 28 operations are performed such as cutting the wires in position 23 and stripping insulation from the trailing end of the group of wires between the units in positions 23 and 28. Other operations are performed at position 28. Considering first the operations in the area of position 23, another pair of rods 96, similar to rods 72, are joined at their upper ends by a horizontal member 97 and extending downwardly through sleeves 98. The sleeves 98 are supported for vertical movement in bushings 99, mounted in apertures of the table 57, and are secured to the connector 95, FIG. 1, so that operation of the air cylinder 90 will cause the sleeves 98 to move in unison with the sleeves 73. The lower ends of the rods 96 are secured to the connecting member 74, FIG. 3, so that during operation of the air cylinder 75, the rods 96 will be moved in unison with the rods 72.

A laterally extending member 100, fixed to the upper ends of the sleeves 98, has the clamp 33 formed integral with one edge thereof so as to clamp the wires on the unit 10 at position 28 to prevent backward movement of the wires. A movable cutter 24 extends longitudinally of the member 100 and is supported thereby in a position so that it will cooperate with a fixed cutter 102 of each unit 10 when in the position 23 thereby cutting the group of wires extending between the units 10 in positions 23 and 28. Stripping elements 25, positioned parallel with the cutters 24, and supported by the member 100 are receivable in notches 105 of each unit 10 in the posi-

tion 23 so that when the trailing ends of the wires, which have been severed by the cutters 24, may have the insulation stripped therefrom by the serrated edges 106 of the strippers 25. The element 26 for pulling the trailing ends of the cut wires from the unit 10 at position 23 includes a cylindrical member 108, mounted laterally thereon. The element 26 is fixed at 110 to the horizontal member 97 and positioned in alignment with the space between the units 10 at position 23 and 28. The member 108 normally is positioned above the paths of the units 10 until the units are at rest at which time operation of the air cylinder 75 will cause the feeders 20 to function between positions 15 and 21 and also cause the rods 96 to move the element 26 with the cylindrical member 108 downwardly a distance sufficient to pull the trailing ends of all of the wires in each group from the unit 10 at position 23, the wires having been severed by the cutters 24 and during this movement the trailing ends will be stripped of their insulation by the strippers 25.

There are hoppers 112 mounted on opposite sides of the conveyor and the path of the units 10 receive the comb-like holders 29 in stacked formation. Suitable means such as air cylinders 114, FIG. 3, are operated, causing their plungers 115 to successively move the holders 29 from the hoppers and into positions in the grooves 31 of the adjacent unit 10 to align the notches 32 with the wires in each group. At position 28, the air cylinders 37 follow in operation that of an air cylinder 215, FIG. 1. The air cylinder 215 operates a pair of rods 216 which supports a lateral member 217 for the front stripper 34. The front stripper, FIG. 2, includes two stripper plates 34 provided with serrated lower edges 218, mounted on a head 219 having a pair of rods 220 fixed thereto and slidable in apertured blocks 221 of the horizontal member 217. The head 219 is urged by springs 222 to normal positions to align locating pins 223, disposed at opposing ends thereof, with their respective apertures 224 of each unit 10 when in the position 28. The sliding portion 35 of each unit 10, in which the cutter 102, the notches 103, and the apertures 124 are disposed, is normally held at its extreme right position by springs 228 disposed on rods 229, FIG. 1, but when connection is made through the pins 223 with this portion of the unit in position 28, actuation of the air cylinder 37 to move its cam-like plunger 36, as shown in FIG. 4, will result in the sliding portion 35 being moved against the force of the spring 228 to effectively strip insulation from the leading ends of the wires.

After the unit 10 leaves position 28, it is moved into general alignment with pairs of plungers 230, FIGS. 1 and 3, operated by air cylinders 231 to force the comb-like holders 29, located in the unit, upwardly to force the insulated portions of the wires in the notches of the holders. After the air cylinder 231 is operated to force the comb-like holders 29 into registration with the groups of wires and the clamps 30 have been moved into position, an air cylinder 235 is operated to move the inner member 60 of the wire retaining members 59 and 60 to free the wires so that both groups of wires now held by the comb-like holders 29 may be removed from the apparatus.

Operation

Once the leading ends of the groups of wires 16 have been advanced beyond their rollers 17 and 18 and connected suitably to the first unit 10 in position 15 the apparatus will carry out automatically its various operations. In other words, successive operations will be performed on successive groups of wires or successive lengths of wires from the same supplies so that at position 15 comb-like holders are held open for free advancement of predetermined lengths of various wires resulting from operation of the feeders 20. The feeders 20 perform their functions between the units 10 at position 15 and 21 allowing free flowing of the wires through unit 10 at position 15 while the clamp 22 holds the wires against backward movement during downward movement of the feeders 20.

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Nothing occurs between the units 10 at positions 21 and 23, but two things occur at position 23. At this position the predetermined lengths of the various wires of both groups have been determined, this having been controlled by the feeders 20, and while both the leading and trailing ends of the groups of wires between positions 21 and 23 are firmly held the wires are cut at a controlled position by the cutter 24 severing the trailing ends of previous groups of wires from the groups between positions 21 and 23 and at the same time, through action of the cylindrical member 108 on the element 26, the trailing ends of the groups of wires between positions 23 and 28 are forced free of the unit 10 at position 23 at which time the stripper 25 will function to strip the insulation from the said trailing ends. While this action takes place, the clamps 33 assist the retaining members 59 and 60 of the unit 10 at position 28 to prevent any backward movement of these groups of wires. While the unit 10 is in the position 28, the comb-like holders 29 are moved into the grooves 31 beneath the groups of wires so that they will not in any way interfere with the movement of wires, but will be positioned so that their notches 32 will be aligned with their respective wires. At position 28, the strippers 34 function first in their downward movement to bring about connections through the pins 223 of the heads and the apertures 224 of the sliding portion 35 of the unit 10 after which the air cylinders 37 are operated to cause their cam-like members 36 to force the sliding portion of the unit 10 to the left to complete stripping insulation from the leading ends of these groups of wires. At the next position 38, while the wires continue to be held momentarily by the members 59 and 60 the air cylinders 39 are operated to force the plungers 40 upwardly forcing the comb-like holders 29 to receive the wires in their respective notches 32. At this time the clamps 30 may be moved into position and the air cylinders 235, FIG. 1, operated to move the central member 60 to align its notches with those of the fixed members 59 freeing the groups of wires so that they may be removed from the apparatus with the holders 29.

It is to be understood that the above-described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. An apparatus for feeding and stripping groups of insulated wires from supplies of wires comprising:

a plurality of like units,

means to support the units at spaced positions and move them intermittently in a given path between intervals of rest,

means to feed groups of insulated wires of predetermined varied lengths from supplies to the units,

separate means adapted to strip insulation from the trailing ends and the leading ends of the groups of wires, and

means for feeding successive holders into position to receive the groups of wires after the stripping operations are completed.

2. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

a comb-like section is mounted in each unit with relatively movable members having notches to receive the wires individually.

3. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

a comb-like section is mounted in each unit with relatively movable members having notches to receive the wires individually, and

means normally causing relative movement of the notched members to hold the wires against displacement.

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4. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

a comb-like section is mounted in each unit with relatively movable members having notches to receive the wires individually,

means normally causing relative movement of the notched members to hold the wires against displacement, and

means disposed adjacent one position to hold the notched members at relative positions to match the notches in alignment to receive their respective insulated wires.

5. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with length-controlling elements of varied lengths for the individual wires.

6. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with length-controlling elements of varied lengths for the individual wires, and

means operable to move the feeder between successive units to cause advancing of successive groups of varied lengths of the wires therebetween.

7. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with length-controlling elements of varied lengths for the individual wires, and

spacers for the feeder disposed on opposing sides of the elements thereof to straddle the wires and guide the elements into engagement with the wires.

8. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with elements adapted to engage the wires individually and form loops of predetermined lengths therein between adjacent leading and following units.

9. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with elements adapted to engage the wires individually and form loops of predetermined lengths therein between adjacent leading and following units, and

a cutter operable at a position above the path of the units to cooperate with the unit in said position to cut the wires to sever trailing ends of one group of wires from leading ends of another group.

10. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with elements adapted to engage the wires individually and form loops of predetermined lengths therein between adjacent leading and following units,

a cutter operable at a position above the path of the units to cooperate with the unit in said position to cut the wires to sever trailing ends of one group of wires from leading ends of another group,

a stripper operable at said position and in cooperation with the adjacent unit to engage the insulation of the wires short of the trailing ends thereof, and

means operable to engage the loops of wires and pull the trailing ends thereof free of the stripper to cause the stripper to remove the insulation from the said trailing ends.

11. An apparatus for feeding and stripping groups of insulated wires according to claim 1 in which:

the feeding means includes a feeder with elements adapted to engage the wires individually and form loops of predetermined lengths therein between adjacent leading and following units,

a cutter operable at a position above the path of the units to cooperate with the unit in said position to

cut the wires to sever trailing ends of one group of wires from leading ends of another group,
 a stripper operable at said position and in cooperation with the adjacent unit to engage the insulation of the wires short of the trailing ends thereof,
 means operable to engage the loops of wires and pull the trailing ends thereof free of the stripper to cause the stripper to remove the insulation from the said trailing ends, and
 a clamp engaging the wires near the leading ends thereof to hold them against backward movement.
 12. An apparatus for feeding and stripping groups of wires according to claim 1 in which:
 each unit has a fixed part and a movable part, one of the stripping means including a head, a stripper supported thereby, and means to move the head to cause it to interengage the movable part of each unit and cause the stripper to engage the insulation of the wires short of their leadings ends, and
 means to move the movable part of each unit to cause the stripper to remove the insulation from the leading ends of the wires.
 13. An apparatus for feeding and stripping groups of insulated wires from supplies of wires comprising:
 a plurality of like units having longitudinal grooves therein,
 normally closed comb-like wire grippers mounted on each unit,
 means to support the units at spaced positions, move them intermittently in a given path between intervals of rest, and locate them successively at a first position at intermediate positions and at a last position,
 means at the first position to hold the grippers open for movement of a group of wires therethrough and free the grippers to close as each unit moves out of the first position, and
 a feeder having wire engaging elements of varying lengths movable between the units at the first position and the next intermediate position to form loops of varying lengths in the wires.
 14. An apparatus for feeding and stripping groups of insulated wires according to claim 13 in which:
 a cutter cooperates with each unit at an intermediate position to cut the trailing ends of each group of wires from the leading ends of each following group of wires.
 15. An apparatus for feeding and stripping groups of insulated wires according to claim 13 in which:
 a cutter cooperates with each unit at an intermediate position to cut the trailing ends of each group of wires from the leading ends of each following group of wires,
 strippers operable to strip insulation from the trailing and leading ends of the wires,
 means to move comb-like holders having notches in the grooves of the units short of the last position.
 16. An apparatus for feeding and stripping groups of insulated wires according to claim 13 in which:
 a cutter cooperates with each unit at an intermediate position to cut the trailing ends of each group of wires from the leading ends of each following group of wires,
 strippers operable to strip insulation from the trailing and leading ends of the wires,
 means to move comb-like holders having notches in the grooves of the units short of the last position, and
 means at the last position to move the holders successively to position the wires in the notches thereof.

17. An apparatus for feeding and stripping groups of insulated wires according to claim 13 in which:
 a cutter cooperates with each unit at an intermediate position to cut the trailing ends of each group of wires from the leading ends of each following group of wires,
 strippers operable to strip insulation from the trailing and leading ends of the wires,
 means to move comb-like holders having notches in the grooves of the units short of the last position,
 means at the last position to move the holders successively to position the wires in the notches thereof, and
 means disposed adjacent the last position to actuate the grippers into open positions to free the prepared groups of wires.
 18. A wire feeding and stripping apparatus for groups of wires comprising:
 a series of wire clamping units adapted to receive groups of wires from individual supplies,
 means for intermittently feeding the clamping units from position to position,
 means at a first position for controlling the clamping units to clamp and release the wires,
 means intermediate the first and second position operative while the intermittent feeding means is in the rest condition, while a clamping unit at the first position is in the release condition, and while a clamping unit at the second position is in the clamping condition, to engage the individual wires and move them preselected distances transverse to the direction of intermittent feed to form loops of predetermined lengths in the wires, and
 means for thereafter cutting the wires of a group having the predetermined lengths and stripping the insulation from the trailing and leading ends of the severed wires.
 19. A wire feeding and stripping apparatus according to claim 18 wherein:
 the intermediate means comprises a series of alternately disposed spacers and length controlling elements.
 20. A wire feeding and stripping apparatus according to claim 18 comprising:
 means at a final position for receiving holders fed in succession thereto and for inserting a severed group of stripped wires into each holder.
 21. A wire feeding and stripping apparatus according to claim 18 wherein:
 the loops are advanced beyond the second position by the intermittent feed means and means are provided at one succeeding position for cutting the wires and stripping the insulation from the trailing ends of a previously severed group, and
 means are provided at the next succeeding position for stripping insulation from the leading ends of a severed group of wires.

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