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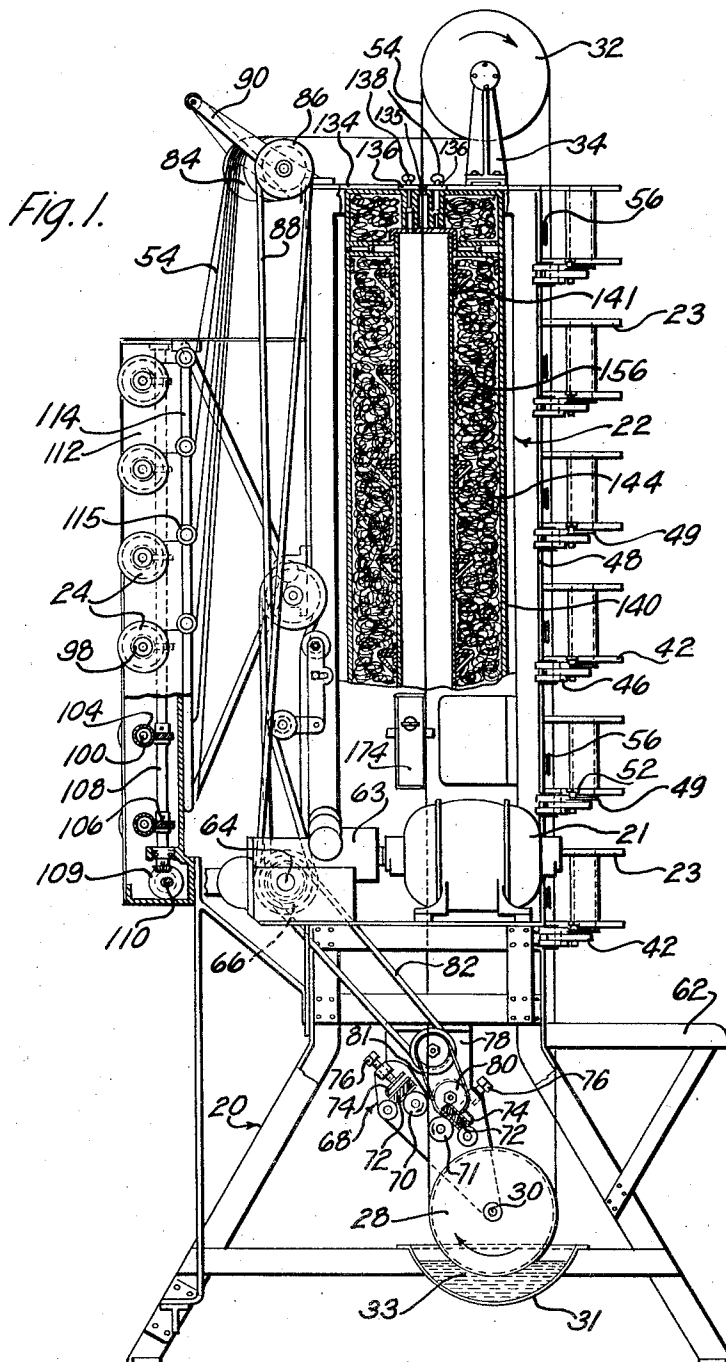
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1,991,171

APPARATUS FOR HANDLING STRANDS

Filed May 31, 1929

6 Sheets-Sheet 1



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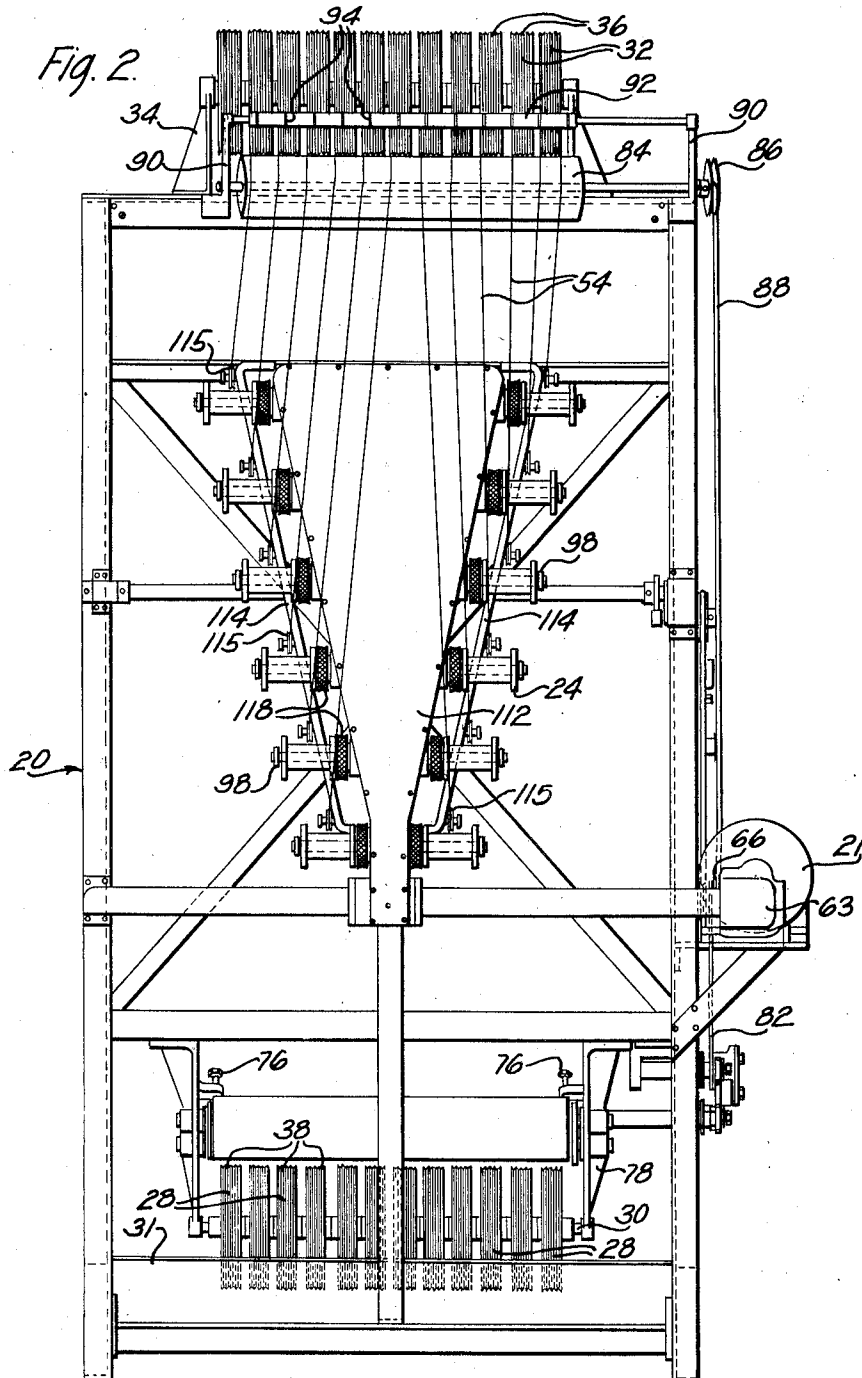
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APPARATUS FOR HANDLING STRANDS

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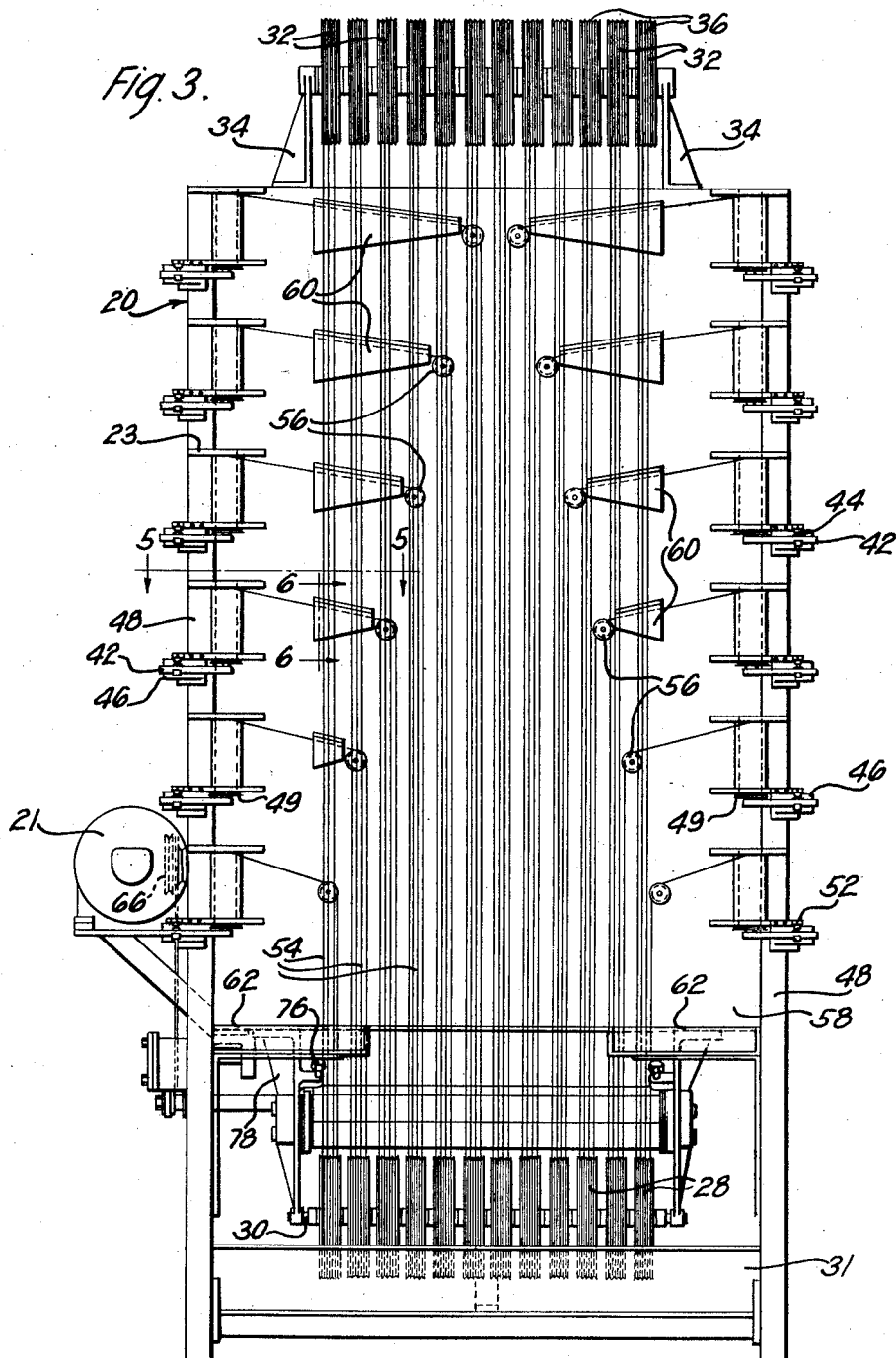
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APPARATUS FOR HANDLING STRANDS

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6 Sheets-Sheet 3



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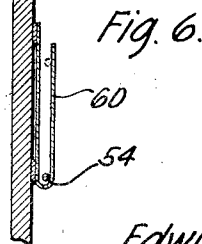
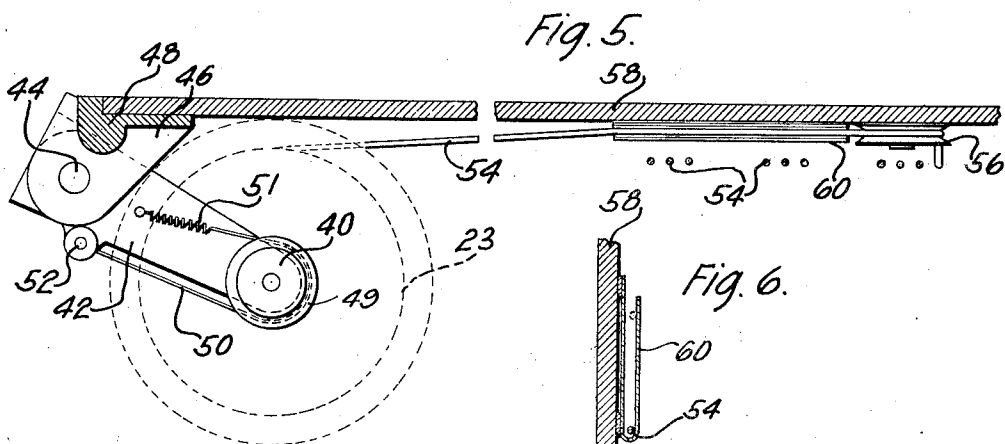
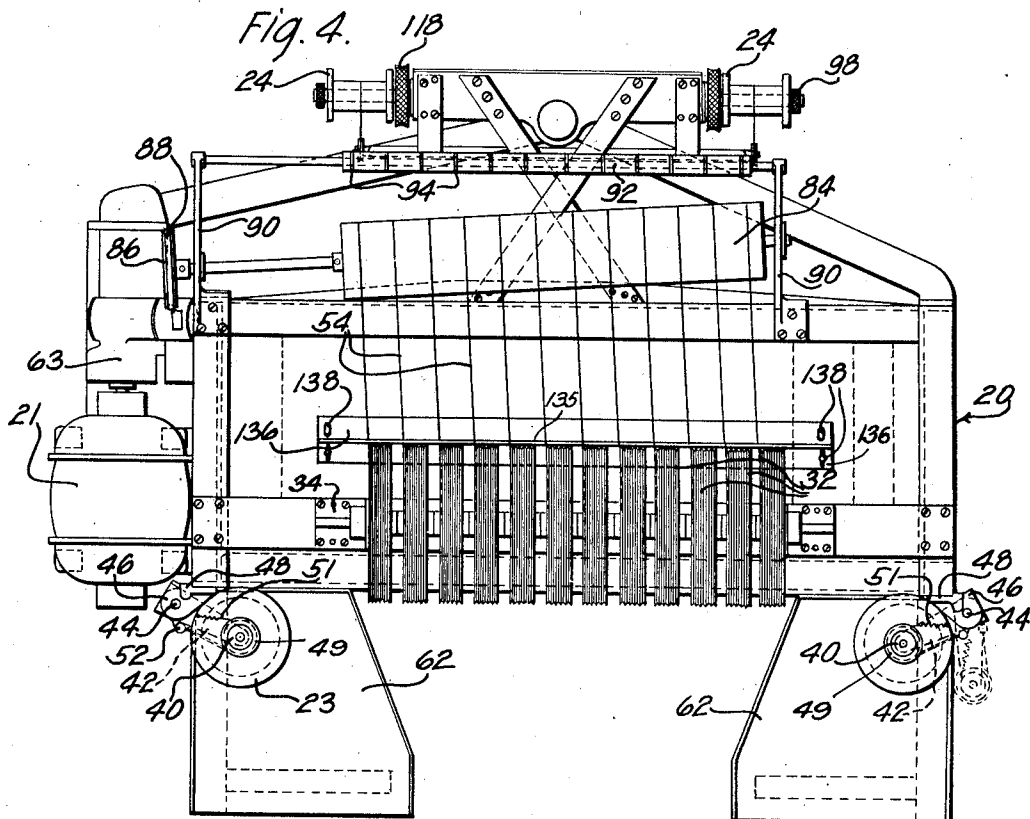
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APPARATUS FOR HANDLING STRANDS

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6 Sheets-Sheet 4



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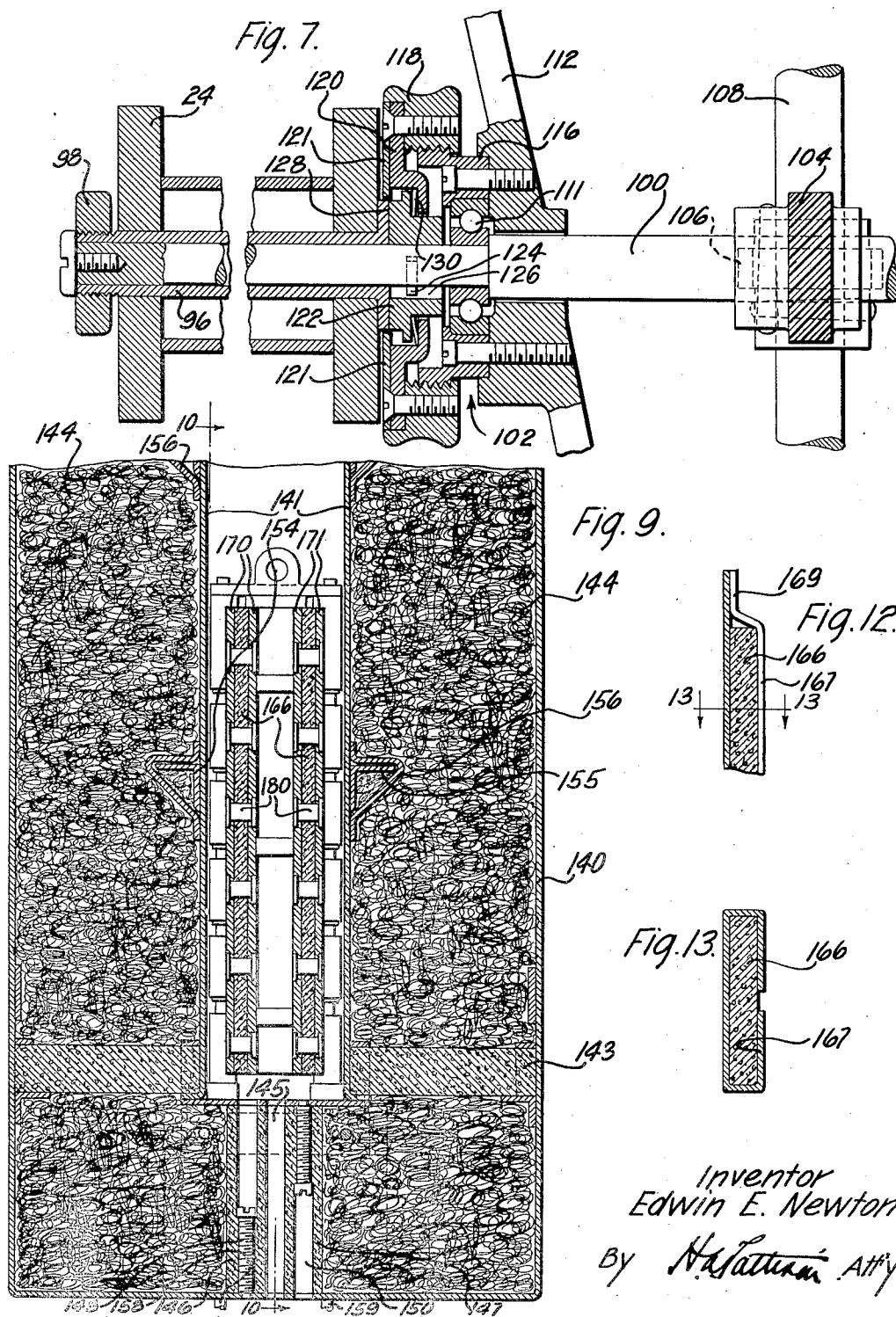
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APPARATUS FOR HANDLING STRANDS

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APPARATUS FOR HANDLING STRANDS

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6 Sheets-Sheet 6

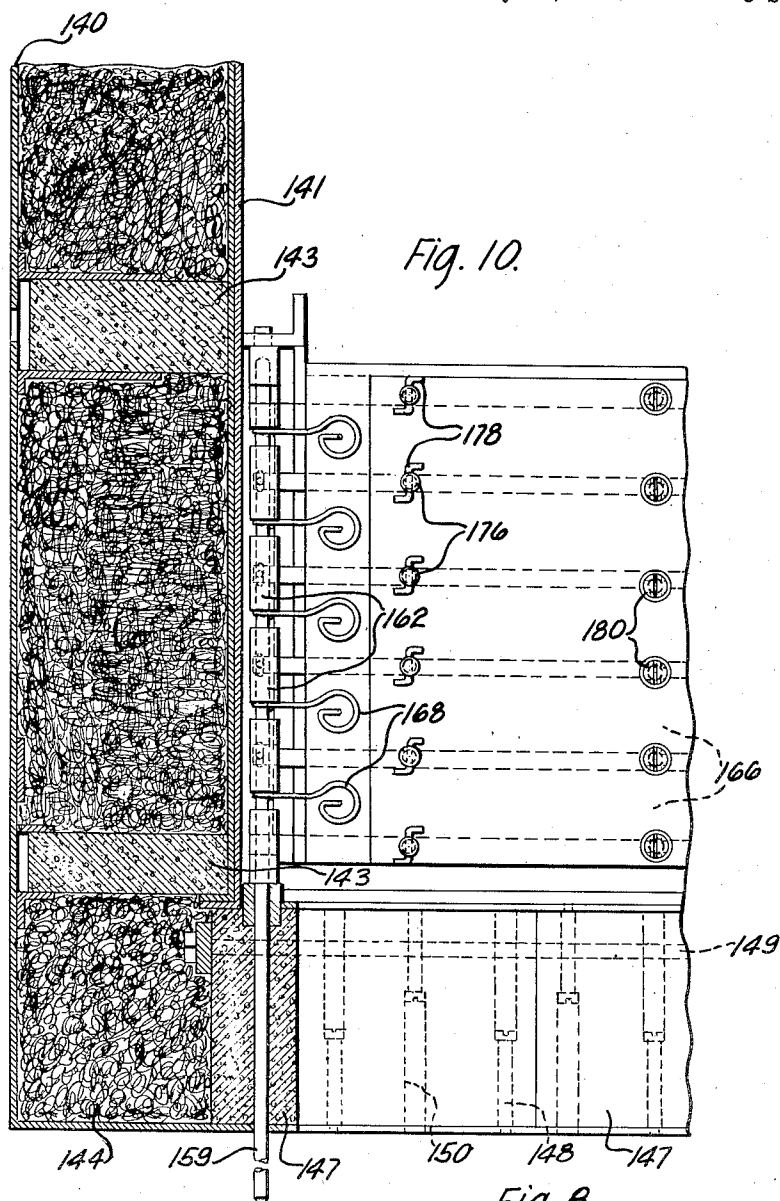


Fig. 11.

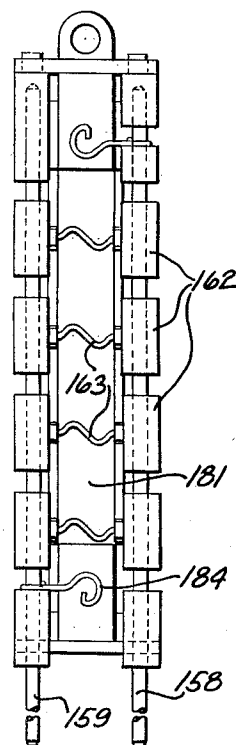
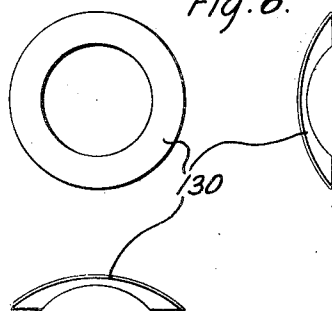


Fig. 8.



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UNITED STATES PATENT OFFICE

1,991,171

APPARATUS FOR HANDLING STRANDS

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7 Claims. (Cl. 219—35)

This invention relates to an apparatus for handling strands, and more particularly to an apparatus for applying an insulating enamel coating to an electrical conductor in wire form.

5 The invention is particularly applicable to an apparatus wherein wire is drawn from a supply spool, through a receptacle containing enameling material a plurality of times and through a baking oven a corresponding number of times to
 10 harden the enamel coatings, after which the enameled wire passes over a capstan which draws it at the desired speed through the apparatus and from which it passes to a take-up spool.

15 Objects of the invention are to provide an improved apparatus for handling strands, and to provide an improved apparatus for uniformly coating strands rapidly, efficiently and requiring a minimum amount of manual labor in connection therewith.

In accordance with one embodiment of the invention, the wire to be coated is supplied to the apparatus from a plurality of supply reels which are mounted on vertical axes and carried by a common vertical support, the wire being led by suitable guiding means to idler pulleys which pass it through an enameling bath, over a pair of driven wiping rolls and through a baking oven where the coating of enamel is baked on the wire. The steps of coating and baking are repeated a number of times, the guiding means being arranged to maintain the uncoated wire from engagement with the various passes of the coated wire, and the wire then passes over a capstan to a plurality of take-up spools upon which it is wound.
 25 The take-up spools are rotated by a frictional drive which is designed to allow for the difference in effective diameter between an empty spool and a spool which is fully loaded. In the oven the wire is passed rapidly between electrical heating elements of special construction which maintain a very high temperature therein, the entire oven being provided with special heat insulating means to prevent heat losses.

40 Other objects and advantages of the invention will more fully appear from the accompanying drawings which illustrate one embodiment thereof, in which

Fig. 1 is a side elevation of a strand coating apparatus embodying the invention, certain parts being shown in section,

Fig. 2 is a front elevation thereof,

Fig. 3 is a rear elevation thereof,

Fig. 4 is a plan view thereof,

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 3, but with the supply reel removed,

Fig. 6 is a sectional view taken on the line 6—6 of Fig. 3,

Fig. 7 is an enlarged sectional view of the driving mechanism for one of the take-up spools,

Fig. 8 shows various detailed views of a resilient member forming part of the apparatus shown in Fig. 7,

Fig. 9 is an enlarged detailed view of a part of the heating apparatus,

Fig. 10 is a view taken on line 10—10 of Fig. 9,

Fig. 11 is an enlarged end view of one of the heating units shown in Fig. 10,

Fig. 12 is a fragmentary sectional view of one of the heating elements, and

Fig. 13 is a sectional view taken on the line 13—13 of Fig. 12.

Referring to the drawings, in which similar parts are similarly designated throughout the various views, the reference numeral 20 designates generally a framework which supports a motor 21, an oven 22, a plurality of supply reels 23, and an equal number of take-up spools 24. A series of independently rotatable idler pulleys 28 are mounted at the lower part of frame 20 on a shaft 30, and have their peripheries extending into a receptacle 31 secured to the frame 20 and containing a quantity of any suitable insulating enameling compound 33. It may be here noted that the enameling compound tends to collect particles of metal which drop from the wire and may be frequently removed and centrifuged to remove such particles. A series of co-operating independently rotatable idler pulleys 32 are mounted at the top of the frame on a common shaft which is mounted in a bracket 34. Each of pulleys 32 is provided with a plurality of peripheral grooves 36 (Figs. 2 and 3) one for each pass of the wire through the enameling bath, and similar grooves 38 are formed in pulleys 28.

The supply reels 23 are mounted with their axes in a common vertical plane on one side of the apparatus, each reel being rotatably supported on a vertical stud shaft 40 (Fig. 5) which is journaled in an arm 42 pivoted at 44 to a bracket 46 fixed to one of two vertical supporting members 48. The stud shafts are thereby arranged to be moved from their normal position, shown in full lines in Figs. 1 and 4, to a reloading position shown in dotted lines at the right of Fig. 4. Suitable friction means are provided to prevent the supply reels from over-running, such means comprising a plurality of sheaves 49 one of which is fixed to each of the stud shafts 40 and having a belt 50 passing thereover, one end of the belt being secured to a coil spring 51 which

in turn is secured to the arm 42, while the other end of the belt is threaded through an adjusting screw 52 in the manner of a violin key, the screw 52 being mounted in arm 42. From the supply reels 23 the wires 54 pass over sheaves 56 which are mounted in upwardly converging relation on a vertical plate 58 extending between the supporting members 48. As best seen in Figs. 5 and 6, the wire in passing from any given supply reel 23 to its corresponding sheave 56, passes transversely behind the other vertically moving wires coming from the reels 23 mounted below it. In order to prevent contact between the transversely moving wire and the vertically moving wires, the upper reels each have associated therewith a guide plate 60 attached to the plate 58 and shaped to restrain the wire from moving outwardly away from plate 58.

A pair of platforms 62 are positioned below the supply reels 23 to support the operator while changing reels or adjusting the mechanism.

An electrical motor 21, of any suitable character, is connected to a gear reducing mechanism 63, of any suitable type, which operates to drive a shaft 64 upon which are mounted a plurality of pulleys 66 (Fig. 1), from which extends a plurality of belts for driving various parts of the apparatus, as will be more fully described hereinafter.

Above the pulleys 28 is mounted a wiping mechanism 68 which comprises a series of metallic wiping rolls 70 and 71 having polished surfaces which contact with the coated wire leaving the pulleys 28 after having passed through the bath of enameling material 33. Each of rolls 70 and 71 is driven in such a direction that the portion of its periphery which is in contact with the wire 54 at any instant moves oppositely to the direction of movement of the wire so as to wipe the excess of enameling material therefrom and to break up any globules that may adhere to the wire from its passage through the bath and thereby leave a uniform coating on the wire. The rolls 70 and 71 are themselves kept clean by wiping members 72 having coverings of chamolite or other absorbent material thereon. Each wiping member is yieldingly held against its corresponding wiping roll by a spring plate 74 which is adjustably compressed by screws 76 mounted in the supporting brackets 78 of the wiping mechanism. Rolls 70 and 71 are driven from pulley 80 which is connected to drive shaft 64 by means of belts 81 and 82.

At the upper portion of frame 20 is mounted a capstan 84 which is driven through the medium of a pulley 86 connected to one of pulleys 66 by a belt 88. Capstan 84 is preferably mounted askew with respect to pulleys 32 in order to tend to cause all the wires to move laterally in the same direction to guide them and prevent them from contacting with each other. A pair of supporting members 90, which support capstan 84, also support a mandrel 92 (Fig. 4) having a plurality of peripheral grooves 94 equal in number to the number of pulleys 32 and adapted to form a conveniently accessible member to which loose ends of wires may be temporarily attached when threading the machine or when one of the wires breaks during the operation of the machine.

The take-up spools 24 are mounted at the other side of the machine in downwardly converging relation, as shown in Fig. 2, each spool being clamped to a horizontally disposed flanged sleeve 96 (Fig. 7) by means of a nut 98 threaded thereon. Each of sleeves 96 is rotatably mounted on a trans-

verse shaft 100, a frictional connection between the sleeve and the shaft being provided by clutch mechanism 102, described below. Each of shafts 100 is designed to support two spools 24, and is provided midway of its length with a spiral gear 104 meshing with a cooperating spiral gear 106 on a vertical shaft 108 (Fig. 1) which is driven, by means of a horizontal shaft 110 and suitable gearing 109, from the gear reducing mechanism 63.

Shafts 100 are journaled in bearings 111 mounted in frame members 112, to the rear of which are positioned vertical members 114 which carry sheaves 115 under which the wire 54 passes from capstan 84 to the take-up spools 24.

The clutch mechanism 102 (Fig. 7) for each take-up spool comprises an annular member 116 fixed to frame member 112 and exteriorly threaded to receive a correspondingly threaded adjusting nut 118 which has fixed thereto an inwardly extending annular flange 120 and a washer 121. A collar 122 is splined to shaft 100 by means of a spline or pin 124 which is fixed to the shaft and projects slidably into a groove 126 of the collar. The collar 122 is provided with a surface 128 which frictionally engages a corresponding surface at the end of sleeve 96 to frictionally drive the sleeve. An annular compressible spring 130 deformed into the irregular shape shown in detail in Fig. 8, is interposed between collar 122 and flange 120. It will thus be seen that the friction between the collar and the sleeve, and hence the driving torque exerted on the sleeve and the take-up spool, may be increased by turning nut 118 to compress spring 130 and force the surface 128 into close contact with the end of the sleeve, and may be decreased by turning nut 118 to allow surface 128 to move out of engagement with the end of the sleeve, whereupon the spool 24 will be rotated only by the frictional engagement of shaft 100 with sleeve 96.

Within the framework 20 the oven 22 is supported, through which the wires pass upwardly from the enameling bath 33. The upper plate 134 of the oven is provided with an aperture 135 for the passage of the wire, and a pair of cooperating adjustable slides 136—136 (Figs. 1 and 4) are mounted adjacent the aperture and are movable toward and away from each other to control the opening thereof and limit the escape of heated gases therethrough, the slides being held in their adjusted position by means of thumb screws 138.

The oven 22 comprises outer walls 140 and inner walls 141 (Figs. 9 and 10) spaced from each other by spacing blocks 143, of any suitable refractory ceramic material such as lavite. The space between walls 140 and 141 is filled with rock wool or other heat insulating material 144, a slot 145 being provided in the base of the oven to permit the wire 54 to pass therethrough, said slot being formed by spaced blocks 146 and 147 which are composed of material similar to that of blocks 143 and held together by means of tie rods 149. Blocks 146 and 147 are secured in position by means of screws 148 seated in recesses 150 formed in blocks and threaded into the walls 140 and 141, the recesses forming heat insulating dead air spaces when the screws are in position. As will be seen from Figs. 9 and 10, the adjacent screws in each of the blocks are oppositely disposed, and oppositely disposed apertures are formed in the walls 140 and 141 to permit the screws to be inserted. Suitable reinforcing for the walls 141 against stresses due to temperature changes is

provided by means of angle bars 154 and 155 secured thereto by means of stirrups 156 which are fixed in any suitable manner to the walls 141 and slidably enclose the angle bars in such a manner as to permit relative movement between the angle bars and the walls due to temperature changes.

At the lower portion of the oven 22 is mounted a heating unit having at each of its ends a pair of oppositely disposed vertically extending bus bars 158 and 159, which extend downwardly through spacing blocks 146 and 147 and project beyond the exterior of the oven to permit them to be attached to a suitable source of electromotive force (not shown). The bus bars 158 and 159 are interconnected by means of curved conductors 163 and carry a plurality of spaced insulating members 162.

A series of vertically spaced heating elements 166 are positioned at opposite sides of the wires 54 and have electrical resistance elements embedded therein in the known manner and connected to bus bars 158 and 159 between the insulating members 162 by means of leads 168, the leads being coiled as shown in Fig. 10 to allow for expansion and contraction due to temperature changes. The heating elements 166 are formed of any suitable refractory material and are covered with a sheath 167 of suitable metal, the ends of each sheath being crimped as indicated at 169 in Fig. 12 to enable the heating elements to be secured in place. The lowermost heating elements are preferably provided with electrical resistance elements of greater heating capacity than the other elements in order to provide the maximum temperature at the point where the wires enter the oven. Plates 170 and 171 are positioned at opposite faces of the heating elements 166, and are preferably formed of substantially pure nickel, since nickel does not scale at the high temperatures employed. The plates are secured to the heating elements by means of studs 176, held in place by keys 178, and by countersunk bolts 180 which pass through the plates in the spaces between the heating elements and engage countersunk nuts which are positioned flush with the surface of the opposite plates.

At the ends of each of the heating units are positioned heating elements 181, constructed and connected similarly to the heating elements 166 above described and connected to bus bars 158 and 159 by leads 184, similar to leads 168.

An inspection opening is provided in the wall of the oven 22 and is normally closed by means of a removable door 174 (Fig. 1).

In the operation of the apparatus, the wire to be coated is fed from the supply reels 23, threaded through guide plates 60, over sheaves 56, around pulleys 28, through the oven 22, looped several times from pulleys 32 to pulleys 28 and back, thence over capstan 84, under sheaves 115 and secured to the take-up spools 24.

Upon completion of the stringing of the wire through the apparatus from the supply reels to the take-up spools, the motor 21 is started to drive capstan 84 and cause the wires to be drawn through the apparatus. As the apparatus operates, it will be apparent that each wire passes through the enameling bath 33, is then wiped by wiping rolls 70 and 71 and then heated in oven 22 to drive off the enamel solvent and bake the enamel, the wire being returned to the bath by pulleys 32 and 28, the process of coating and baking being repeated several times according to the number of coatings it is desired to bake upon

the wire, which in the illustrated embodiment is four. After the wire has been passed through the oven 22 for the last time, it passes around pulleys 32, over capstan 84, and under sheaves 115 to the take-up spools 24.

The take-up spools are frictionally driven, by shaft 108, at such a rate as to prevent the development of slack in the wire forwardly of the capstan 84. As the effective diameter of the spooled wire increases, the speed of rotation of each spool 24 decreases from a maximum at the time the wire is being wound upon an empty spool to a minimum when the spool is fully loaded with wire and ready to be removed, this variation in speed being brought about by the increased slippage between collar 122 and sleeve 96, as will be readily understood.

When a take-up spool 24 is filled with wire, the operator rotates adjusting nut 118 to move flange 120 away from the spool, thereby releasing the compression in spring 130, the rotation being continued until washer 121 contacts with collar 122 and positively moves it out of engagement with surface 128, whereupon the sleeve 96 is rotated solely by the friction between the shaft 100 and the sleeve. The spool may then be stopped by hand and nut 98 removed to permit the loaded spool to be removed and an empty spool substituted therefor.

While the invention has been described with special reference to the embodiment illustrated herein, it is to be understood that various modifications may be made therein without departing from the spirit of the invention as defined by the appended claims.

What is claimed is:

1. In an oven for a strand coating apparatus, heating means comprising an electric resistance heating element in combination with protecting walls therefor of massive nickel to protect the same against abrasion and to protect the coated material from metallic flakes.
2. In a baking oven for a strand coating apparatus, oppositely disposed electric resistance heating units in combination with massive protecting plates of nickel therefor.
3. In an oven for a strand coating apparatus, a spaced series of heating units in combination with a massive protecting plate of nickel secured thereto.
4. In a wire coating apparatus, an upright heating chamber, adapted to have a plurality of coated wires drawn therethrough in a row, chamber heating means for heating the air in said chamber, comprising electric resistance elements located in close proximity to and on each side of said row of coated wires and massive metallic plates of nickel located between said resistance elements and said row of wires.
5. In a strand coating apparatus, a vertical heating chamber, comprising walls formed with spaced metallic plates, a plurality of solid blocks of an insulating material for holding said walls in spaced relation to each other, a pair of spaced heat insulating blocks interposed between the metallic walls adapted to have a plurality of coated strands drawn between said last mentioned blocks and through the chamber, chamber heating means for heating the air in said chamber comprising electric resistance elements located in close proximity to said coated strands between said strands and said metallic wall plates and heavy metallic nickel plates located between said resistance elements and said strands.
6. In a wire coating apparatus, an upright

- heating chamber adapted to have a plurality of coated wires arranged in a row drawn there-through, said heating chamber comprising walls formed with spaced metallic plates, a plurality of blocks of ceramic material for holding said walls in spaced relation to each other, heat insulating material disposed between said plates and said ceramic blocks, a pair of spaced insulating blocks interposed between the metallic walls on either side of and adjacent to said row of coated wires, chamber heating means for heating the air in said chamber, comprising electric resistance elements located in close proximity to and on each side of said row of coated wires and heavy metallic elements of nickel located between said resistance elements and said row of wires.
7. In a wire coating apparatus, an upright heating chamber adapted to have a plurality of coated wires arranged in a row drawn there-through, said heating chamber comprising walls formed with spaced metallic plates, a plurality of blocks of ceramic material for holding said walls in spaced relation to each other, heat insulating material disposed between said plates and said ceramic blocks, metallic reinforcing means for the inner one of said metallic plates and means to allow relative movement between said last mentioned metallic plate and said reinforcing means in one direction due to the expansion of said plates and to prevent relative movement in another direction, a pair of spaced insulating blocks interposed between the metallic walls on either side of said row of coated wires and attached to said walls by means positioned in deeply countersunk holes in said blocks whereby a heat insulating dead air space is formed over the top of each of said last mentioned means, chamber heating means for heating the air in said chamber comprising vertically disposed electric resistance elements located in close proximity to and on each side of said row of coated wires and heavy plates of a substantially non-oxidizable metal located between said resistance elements and said row of wires.

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