Feb. 25, 1941. L. R. McGUIRE 2,233,106

CABLE SHEATHING MACHINE

Filed Aug. 30, 1937 2 Sheets-Sheet 1

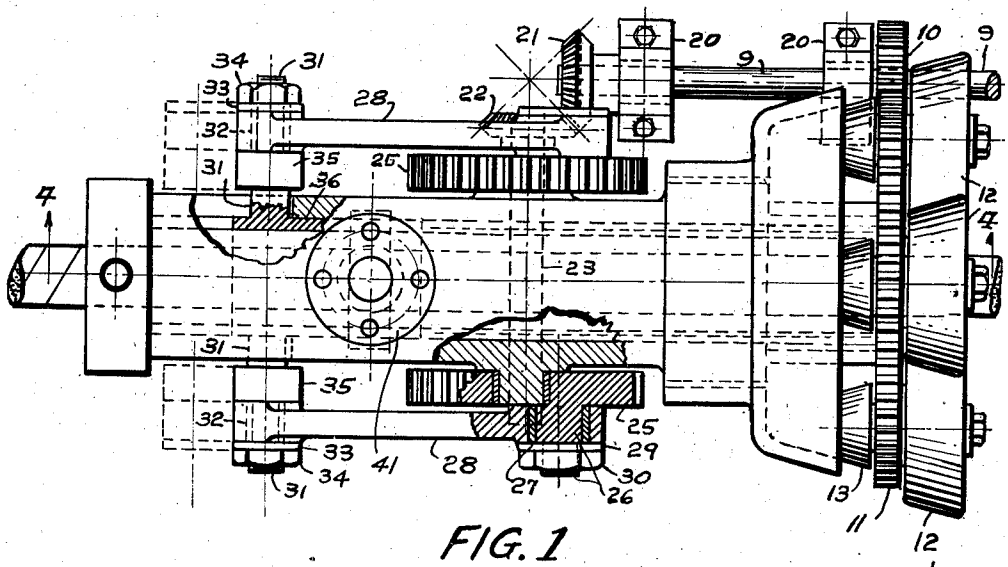


FIG. 1

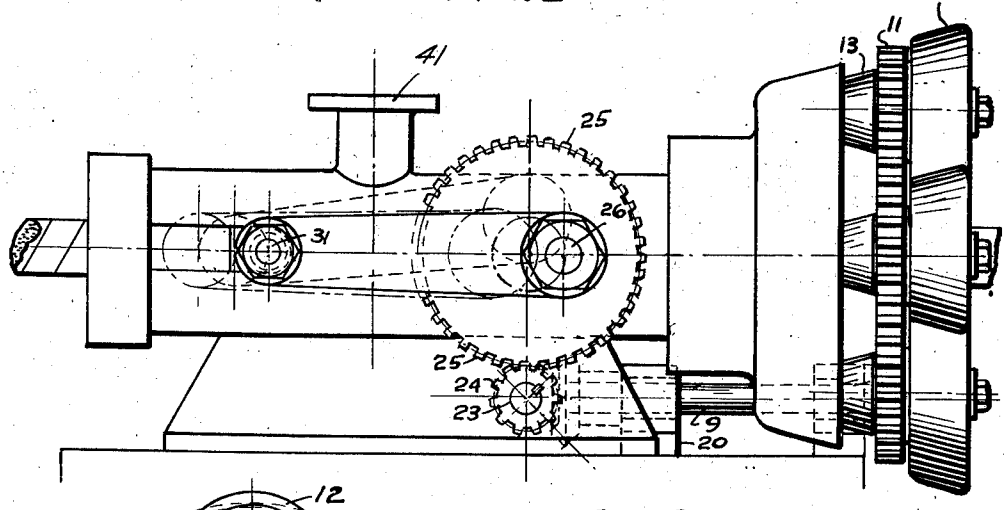


FIG. 2

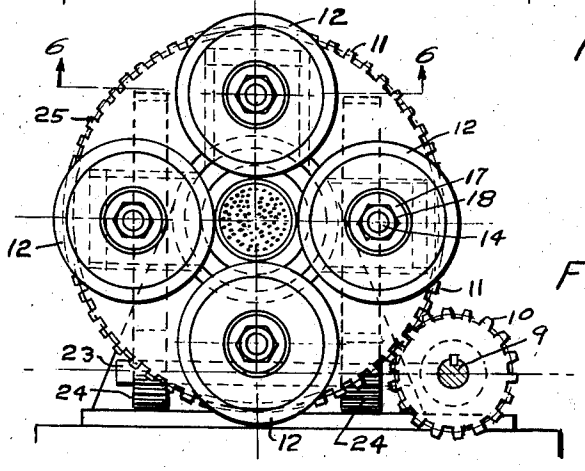


FIG. 3

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CABLE SHEATHING MACHINE

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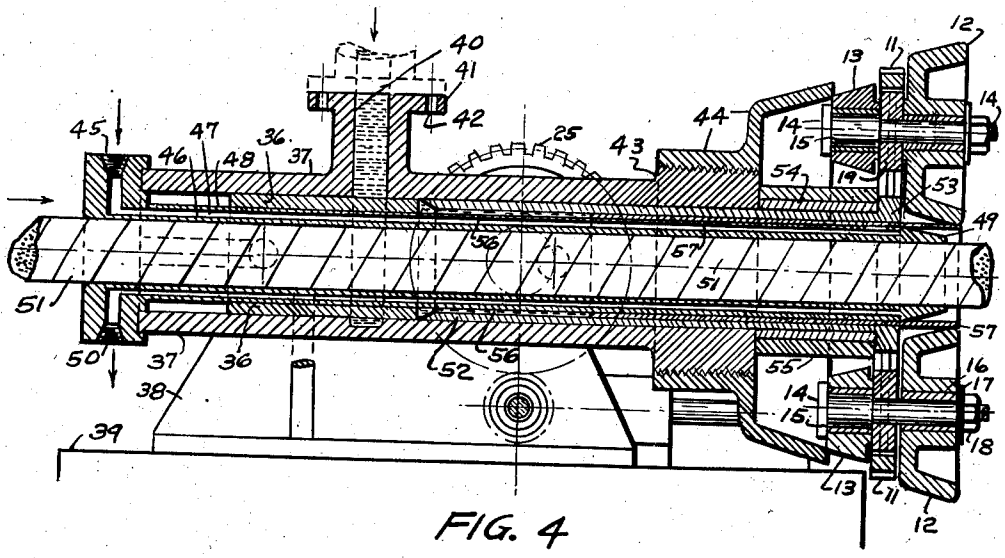


FIG. 4

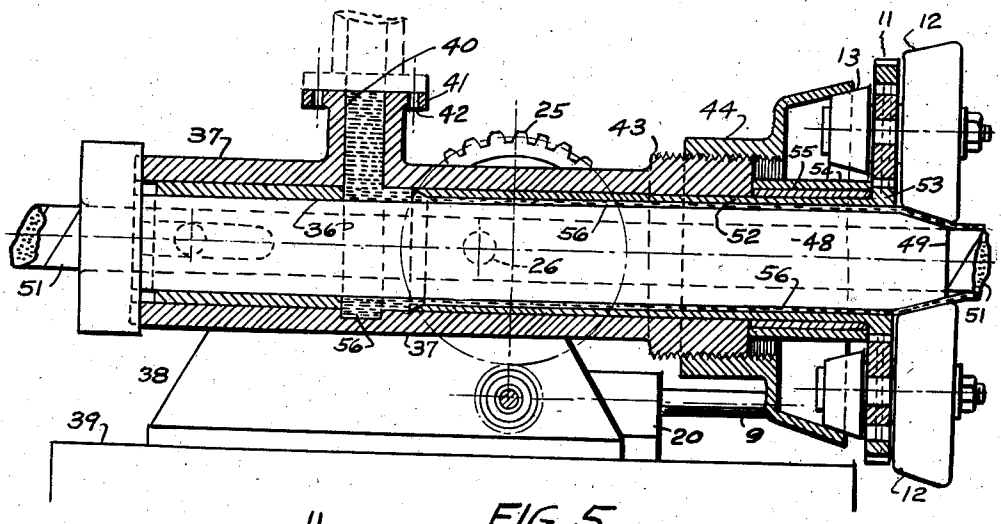


FIG. 5

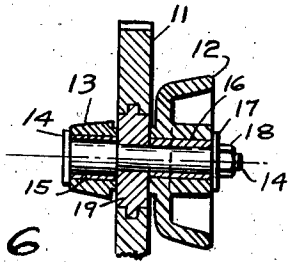


FIG. 6

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UNITED STATES PATENT OFFICE

2,233,106

CABLE SHEATHING MACHINE

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Application August 30, 1937, Serial No. 161,620

14 Claims. (Cl. 29—33)

This invention relates to a machine for producing long lengths of tubing, and more particularly tubing for sheathing electrical cables, cable cores and the like.

One of the primary objects of the invention is to produce by extrusion or otherwise cable sheathing or tubing of considerable substantially continuous length in integral form, uniform in structure and of accurately controlled diameter.

Another object is to provide a means of producing substantially continuous tubing of considerable length for the purpose of sheathing long electrical cable cores, cables or the like with an extruded or otherwise formed and solidified tube of material requiring high temperature for forming procedures, such as aluminum, copper, etc., in a manner whereby the low temperature combustible materials commonly used for electrical insulation will not be damaged by the high temperatures prevailing during the sheathing procedure.

The above and other objects of the invention will be made more apparent as this description proceeds, especially when considered with the accompanying drawings wherein:

Figure 1 is a plan view partly in section of an apparatus constructed in accordance with the invention for sheathing an electrical cable;

Figure 2 is a side elevation view thereof;

Figure 3 is a front end elevation view thereof;

Figure 4 is a section on the line 4—4 of Figure 1;

Figure 5 is a view similar to Figure 4 except that certain movable parts are shown in a different relation; and

Figure 6 is a fragmentary sectional view on line 6—6 of Figure 3.

Referring to Figure 1 of the several views wherein the like reference numerals refer to similar parts of the embodiment here disclosed; Shaft 9 is driven by any convenient means (not shown), and 10 is a pinion driven thereby to which is meshed gear 11. On gear 11 is mounted a plurality of sheath reducing members or rollers 12 each paired with one of a similar plurality of radial position adjusting rollers 13 as shown in further detail by reference to Figures 4 and 6, wherein such additional parts as roller pins 14 on each of which pins a roller 12 and a roller 13 are rotatably mounted, the adjusting roller bushings 15, swaging roller bushings 16, washers 17, nuts 18 and sliding blocks 19 are shown mounted in such manner on the gear 11 that they are caused to revolve about the center of and with gear 11.

Again referring to Figure 1, the shaft 9 is supported by bearings 20 and has a bevel gear 21 secured to the end thereof and meshing with bevel gear 22 for the purpose of rotating shaft 23 which extends at right angles to shaft 9. This shaft 23 rotates two pinions 24 which mesh with and rotate two gears 25 (also see Figures 2 and 3) to which are integrally fixed the crank pins 26 which rotate in the bearing bushings 27 that are secured in the respective crank pin ends of connecting rods 28. These connecting rods 28 are held in position by washers 29 and nuts 30. The opposite or wrist pin ends of connecting rods 28 are pivotably mounted on slidable wrist pins 31 by means of bearing bushings 32, and held thereon by means of the washers 33 and nuts 34.

The wrist pins 31 have integral enlargements 35 thereon and are themselves a fixed part of the annular piston or plunger sleeve 36. From the descriptive details above mentioned it will be noted that the rotation of gears 25 with their eccentrically located crank pins 26 will produce a reciprocation of connecting rods 28, wrist pins 31 and all parts attached to the latter including the plunger sleeve 36 which last is slidably mounted in a manner subsequently to be disclosed.

Referring now to Figure 4, wherein 37 is a cylinder supported by base 38 which may be located on any suitable foundation 39. This cylinder is provided with a lateral extension formed with a port 40 for the entry of hot fluid material, the extension being also formed with a flange 41 having holes 42 for bolting with the companion flange on any suitable hot fluid supply source. At the forward end of the cylinder 37 is the threaded enlargement 43 and engaging this is the threaded conical adjusting head 44. The inner tapered face of head 44 contacts with the rollers 13 which are correspondingly tapered and are radially movable with supporting slide 19 in the tongue and grooves machined into gear 11 as most clearly indicated by reference to Figure 6. By screwing the adjusting head 44 to a forward position on the cylinder 37 (as shown in Figure 5) its tapering inner surface forces the rollers 13 and all parts slidably mounted therewith into closer radial relationship with the central axis of the coaxially positioned gear 11 and cylinder 37. It will be further understood that the slidably mounted rollers 12 and 13 together with their attached parts are normally held in their outward radial position due to the centrifugal force resulting from the high speed rotation of gear 11.

With further reference to Figure 4; 45 is a tapped hole in the enlarged head of the supply end of a tubular water cooled mandrel or core guide that includes inner wall 46, water jacket space 47 and outer wall 48. This mandrel extends approximately the entire length of the machine axially of the cylinder 37 and terminates at its forward end with an externally tapering nose 49. Cooling water under pressure enters the mandrel head at tapped hole 45 from any suitable supply (not shown) and is circulated through jacket space 47 by any suitable arrangement of forward and return passages to the outlet or tapped hole 50. By means of the water circulated through jacket space 47 the combustible spirally wrapped paper covering or other relatively delicate insulating sheathing of the cable or cable core 51 is protected from the deteriorating effect of heat which might otherwise be transferred to it from the hot sheathing material subsequently described, the coolant also insuring a workable temperature for the reciprocating plunger sleeve 36 which is slidably positioned between the outside of mandrel wall 48 and the inside of cylinder 37.

Also positioned in the space between the outside of mandrel wall 48 and the inside of cylinder 37 is the long tubular bushing 52 which is tightly fitted into cylinder 37. This bushing 52 has an inwardly tapered end slightly forward from plunger sleeve 36 when said plunger is in its maximum forward position (Figure 4) and terminates at the right hand or front end of the machine in an enlargement 53, which enlargement acts to retain the bearing bushing 54 and hub 55 of gear 11 which last is rotatably mounted on bushing 52.

A relatively narrow tubular space 56 extends between the inside of bushing 52 and the exterior wall 48 of the mandrel and it is through this space that the hot sheathing material is progressively moved, cooled and solidified and finally ejected by the reciprocating movements of plunger sleeve 36. During this ejective movement the initially hot sheathing material loses its heat largely through its contact with mandrel wall 48 from which the heat is removed by the water or other coolant circulated in jacket space 47. The gradual reduction of sheathing material temperature as aforesaid results in increased density, decreased plasticity and finally solidification of the material within the space 56 from which it is ejected in the following manner.

A sheath forming material in fluid state as a result of its high temperature enters the machine through the opening or port 40 which as shown in Figure 4 is closed at its bottom by the overlapping position of the reciprocating plunger sleeve 36. As this plunger sleeve 36 is caused to move back into the position shown in Figure 5 the hot molten material passes down and into the space between the left end of the sleeve 52 and the right end of the retracted plunger and vacated by plunger 36 during its backward movement, and the fluid material would then tend to flow freely through space 56 and out of the machine were not some obstruction placed in its path to avoid its so doing, as an unobstructed flow of said material would not entail sufficient time in contact with the chilled mandrel wall 48 to effect solidification under the fluid pressure as caused by the force of a forward stroke of the plunger 36.

Thus before starting up the empty machine, a steel tube of accurate dimensions is tightly forced into space 56 as indicated in Figure 4 by numeral 57. The function of this steel tube 57 is to prevent the fluid sheathing material from flowing freely out of space 56 for reasons above stated and it also serves to correctly maintain the concentricity of the tubular mandrel wall 48 and the inner wall of bushing 52 pending the solidification of sufficient sheathing material to insure continued concentricity of these parts after the steel tube 57 has been ejected from space 56 by successive forward strokes of plunger 36 through the medium of fluid pressure developed thereby.

On starting the machine in operation, the reciprocating plunger 36 with its relatively small displacement causes a relatively high fluid pressure in the sheathing material that is trapped in space 56 between the inner end of steel bushing or tube 57 and the forward end of plunger 36 after the port 40 has become closed. It will be understood that the frictional resistance of tube 57 to ejection is considerable and that each successive forward stroke of plunger 36 will move it outward by a small distance only thus allowing time for a complete solidification of the more advanced portions of the sheath tube which contracts in cooling and thus provides a shrunk fit around mandrel wall 48 and the desired resistance to further ejective movement due to the frictional resistance thus established and maintained throughout the operation of the machine.

The fact that the accretion to the sheath in the form of an annulus of molten material, formed at each stroke of the annular combined ram and valve member 36, is small as compared with the progressively more and more solidified portion of the sheath extending along the mandrel and inside of the sleeve 52 is important to the satisfactory working of the invention.

After the steel tube 57 has been completely ejected from the machine by the forward advance of the sheathing material, the next step in the operation consists of screwing the conical adjusting head 44 from the position shown in Figure 4 into that position indicated by Figure 5. This adjustment has been previously described and results in an inward radial movement of rollers 12 towards cable core 51. As the rollers 12 are caused to move radially inward from the position shown in Figure 4 they come into contact with the solidified tube of sheathing material as it is being ejected from space 56 and the resulting contact further increases the resistance to and force required to eject the sheath material, also the frictional contact causes the rollers 12 to rotate at high speed on their own axes or pins 14 (see Figure 6) in addition to their revolution as planetary units mounted on gear 11.

The inwardly radial and rotative movement of rollers 12 against the thin solidified tube of sheathing material produces a spinning or rolling action, as a result of which the ejected sheath tube is caused to be reduced in diameter. Of course, if a spinning effect be desired, the sheath reducing members 12 will be rigid on the pins 14 instead of rotatable on these pins. The maximum inward radial position of rollers 12 is limited by contact of the end of the tapered nose 49 of the mandrel with the inner surface of the sheathing tube as shown in Figure 5.

By further reference to Figure 5, it should be noted that the tapered rollers 12 extend a small distance beyond tapered mandrel terminus 49 as a result of which it is possible to roll the sheath

tube to a slightly smaller diameter than that of the minimum tapered diameter of the mandrel tapered end 49 and thus tightly envelope the cable core 51 in a manner whereby the frictional contact between the cable core and the enveloping sheath tube will be sufficient to pull the cable core 51 through the mandrel interior at a rate of speed corresponding to the rate of cable sheath ejection from space 56, although the advancement of the sheath tube itself, and hence of the core with the tube may also be aided by the pull of whatever means may be used to take up the sheathed cable, or by some other pulling means, if desired.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those persons skilled in the art to which it is related, without further description and it will be understood that various changes in position, size, shape, proportion and details of construction may be resorted to without departing from the scope of the invention and the accompanying claims.

That which I claim is:

1. In a machine for sheathing cables, a tubular mandrel to receive a cable to be sheathed, means to cool the mandrel, and a cylinder coaxially surrounding the mandrel and enclosing a tubular space between the mandrel and the cylinder through which space a molten sheathing material may be progressively moved and cooled and solidified by contact with the mandrel and cylinder surfaces prior to ejection from said space in combination with an annular piston contained in the space and reciprocable therein to advance the material therethrough.

2. In a machine for sheathing cables, a tubular mandrel to receive a cable to be sheathed, means to cool the mandrel, and a cylinder coaxially surrounding the mandrel and enclosing a tubular space between the mandrel and the cylinder through which space a molten sheathing material may be progressively moved and cooled and solidified by contact with the mandrel and cylinder surfaces prior to ejection from said space, in combination with a reciprocable annular piston positioned between the mandrel and the cylinder to move material through the space.

3. In an apparatus for sheathing an elongated core, means to form about a core a sheath of greater internal diameter than the diameter of the core, in combination with means to reduce the diameter of the sheath, which means comprises a rotatable carrier mounted to rotate about the sheath, and a plurality of tapered sheath reducing rollers mounted on the carrier to be revolved about the sheath by the rotation of the carrier.

4. In an apparatus for sheathing an elongated core, means to form about a core a sheath of greater internal diameter than the diameter of the core, in combination with means to reduce the diameter of the sheath, which means comprises a rotatable carrier mounted to rotate about the sheath, and a plurality of tapered sheath reducing rollers mounted on the carrier to be individually rotatable thereon and to be revolved about the sheath by the rotation of the carrier.

5. In an apparatus for sheathing an elongated core, means to form about a core a sheath of greater internal diameter than the diameter of the core, in combination with means to reduce the diameter of the sheath, which means comprises a rotatable carrier mounted to rotate about the sheath, a plurality of tapered sheath reducing rollers mounted on the carrier to be revolved about the sheath by the rotation of the carrier, and means to adjust the sheath reducing rollers on the carrier radially of the sheath.

6. In an apparatus for sheathing an elongated core, means to form about a core a sheath of greater internal diameter than the diameter of the core, in combination with means to reduce the diameter of the sheath, which means comprises a rotatable carrier mounted to rotate about the sheath, a plurality of tapered sheath reducing rollers mounted on the carrier to be individually rotatable thereon and to be revolved about the sheath by the rotation of the carrier, and means to adjust the sheath reducing rollers on the carrier radially of the sheath.

7. In a machine for sheathing cables, a tubular mandrel to receive a cable to be sheathed, means to cool the mandrel, and a cylinder coaxially surrounding the mandrel and enclosing a tubular space between the mandrel and the cylinder through which space a molten sheathing material may be progressively moved and cooled and solidified by contact with the mandrel and cylinder surfaces prior to ejection from said space, the cylinder being formed with a port for the entry of molten sheathing material to the tubular space, in combination with an annular piston contained in the space and reciprocable therein to advance the material therethrough and to act as a valve to control the flow of material through the port.

8. In a machine for sheathing cables, a pair of radially spaced coaxial tubular members to receive a core coaxially therein, means to supply molten sheathing material to the tubular space between the members, and an annular piston in the space and reciprocable therein to progressively move the material therethrough while being cooled and solidified therein.

9. In a machine for sheathing cables, a pair of radially spaced coaxial tubular members to receive a core coaxially therein, means to supply molten sheathing material to the tubular space between the members, an annular piston in the space and reciprocable therein to progressively move the material therethrough while being cooled and solidified therein, and means to cool one of the members.

10. In a machine for forming material, a pair of members defining a tubular space therebetween, means to supply molten sheathing material to the tubular space between the members, an annular piston in the space and reciprocable therein to progressively move the material therethrough while being cooled and solidified therein and to control the flow of material from the supply means, and means to cool one of the members.

11. In an apparatus for forming material and having means to produce a tubular product of predetermined diameter, means to reduce the diameter of the product to another smaller predetermined value and comprising a tapering mandrel over which the product is advanced, and a spinning roller freely rotatable on its own axis and revoluble about the axis of the mandrel in a position to run continuously on the product and thereby to spin down the product to smaller diameter as it passes over the taper of the mandrel.

12. In an apparatus for forming material and having means to produce a tubular product of predetermined diameter, means to reduce the

diameter of the product to another smaller predetermined value and comprising a tapering mandrel over which the product is advanced, a spinning roller freely rotatable on its own axis and revoluble about the axis of the mandrel in a position to run continuously on the product and thereby to spin down the product to smaller diameter as it passes over the taper of the mandrel, and means to adjust the radial distance of the roller from the axis of the mandrel.

13. In an apparatus for forming material and having means to produce a tubular product of predetermined diameter, means to reduce the diameter of the product to another smaller predetermined value and comprising a tapering mandrel over which the product is advanced, a rotatable disk coaxial to the mandrel and having a central aperture through which the product passes over the mandrel, a plurality of freely rotatable rollers mounted on the disk to be radially movable thereon and to be revolved thereby about the product to spin the same down on the tapering mandrel, and a cam member to adjustably fix the radial distance of the rollers from the axis of the mandrel.

14. In an apparatus for forming material and having means to produce a tubular product of predetermined diameter, means to reduce the diameter of the product to another smaller predetermined value and comprising a tapering mandrel over which the product is advanced, and a spinning roller freely rotatable on its own axis and revoluble about the axis of the mandrel in a position to run continuously on the product and thereby to spin down the product to smaller diameter as it passes over the taper of the mandrel, the roller being tapered around its periphery to correspond to the taper of the mandrel.

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