June 18, 1963 E. J. WILLIAMS ET AL 3,093,956

CABLE MAKING MACHINES

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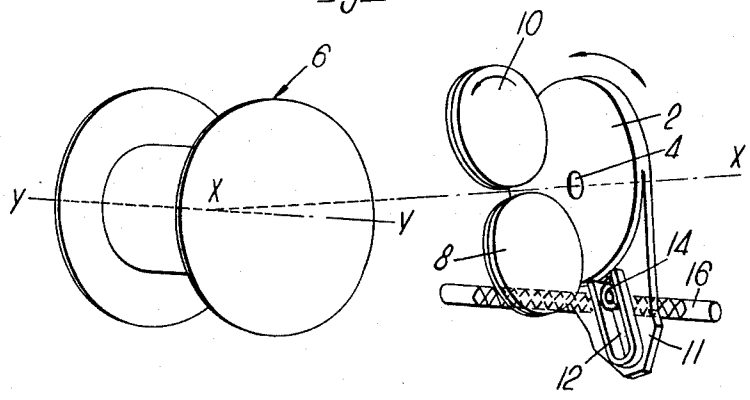
Fig. 1.



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CABLE MAKING MACHINES

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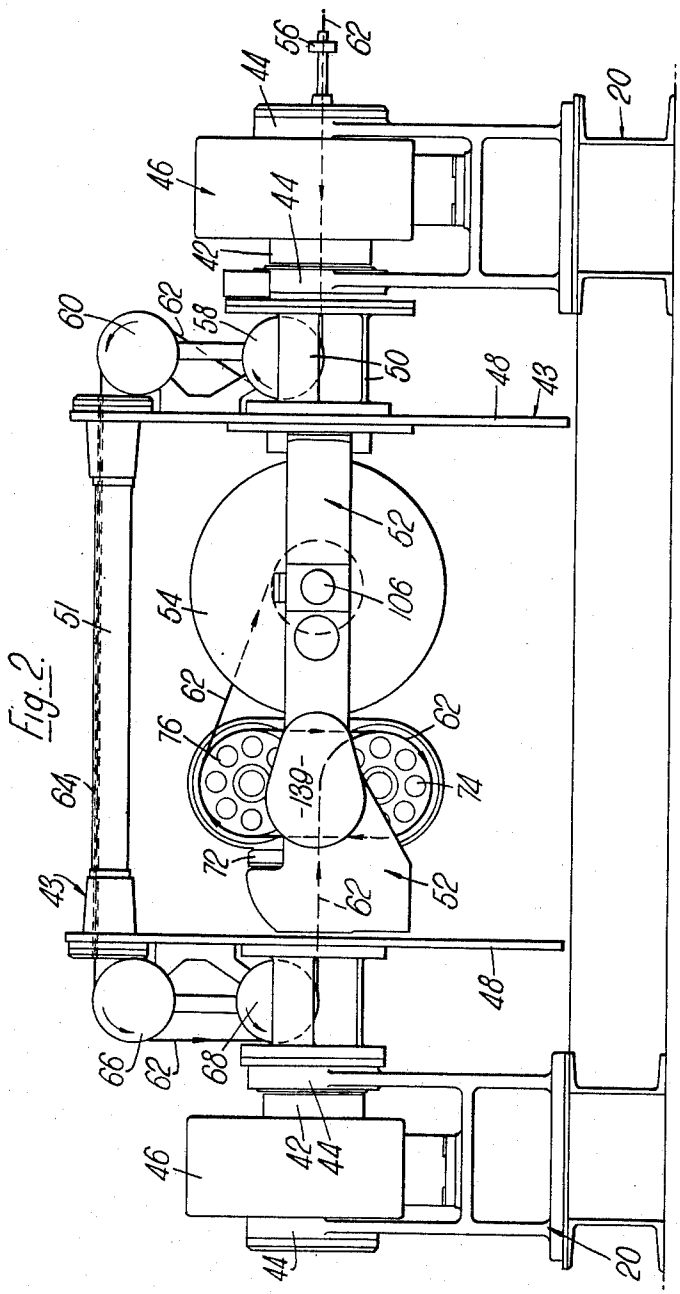

Fig. 2.

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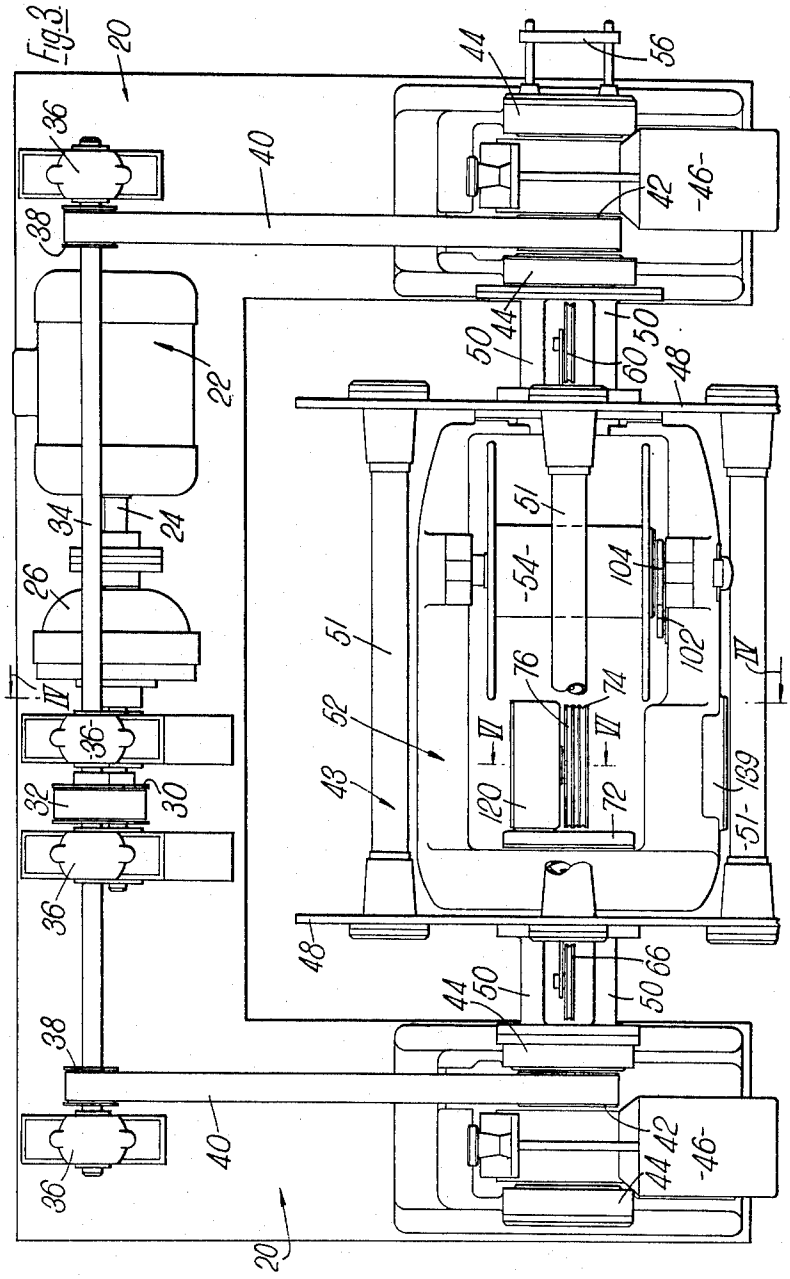
Fig. 3



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CABLE MAKING MACHINES

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Fig. 4.

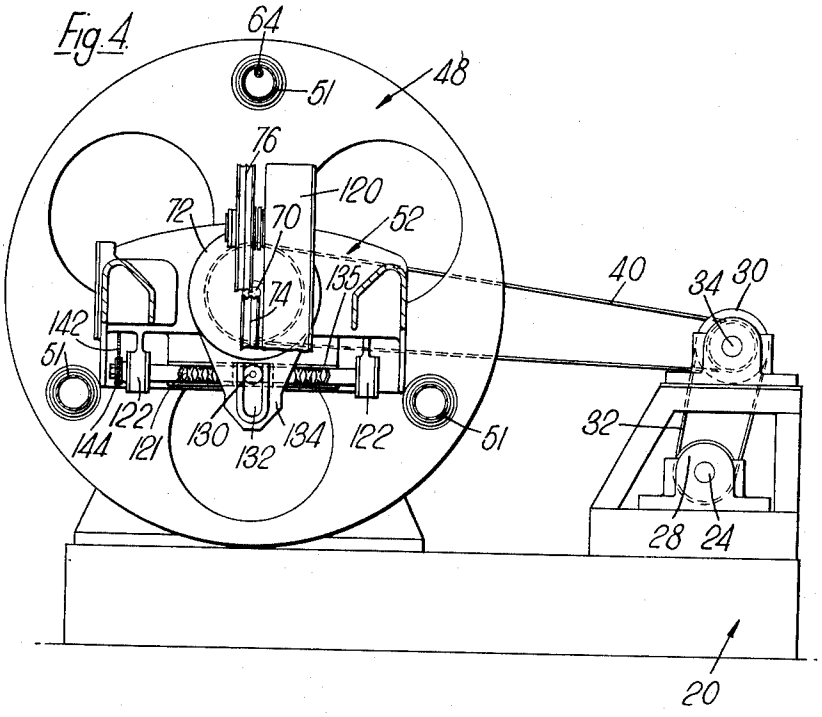

Fig. 7.

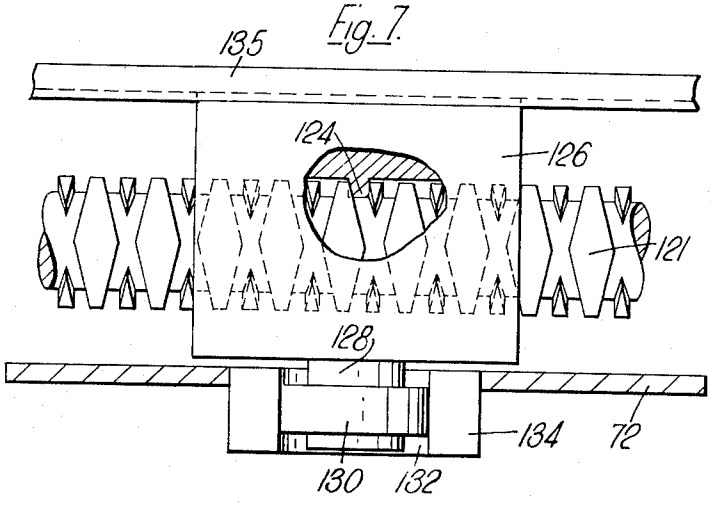

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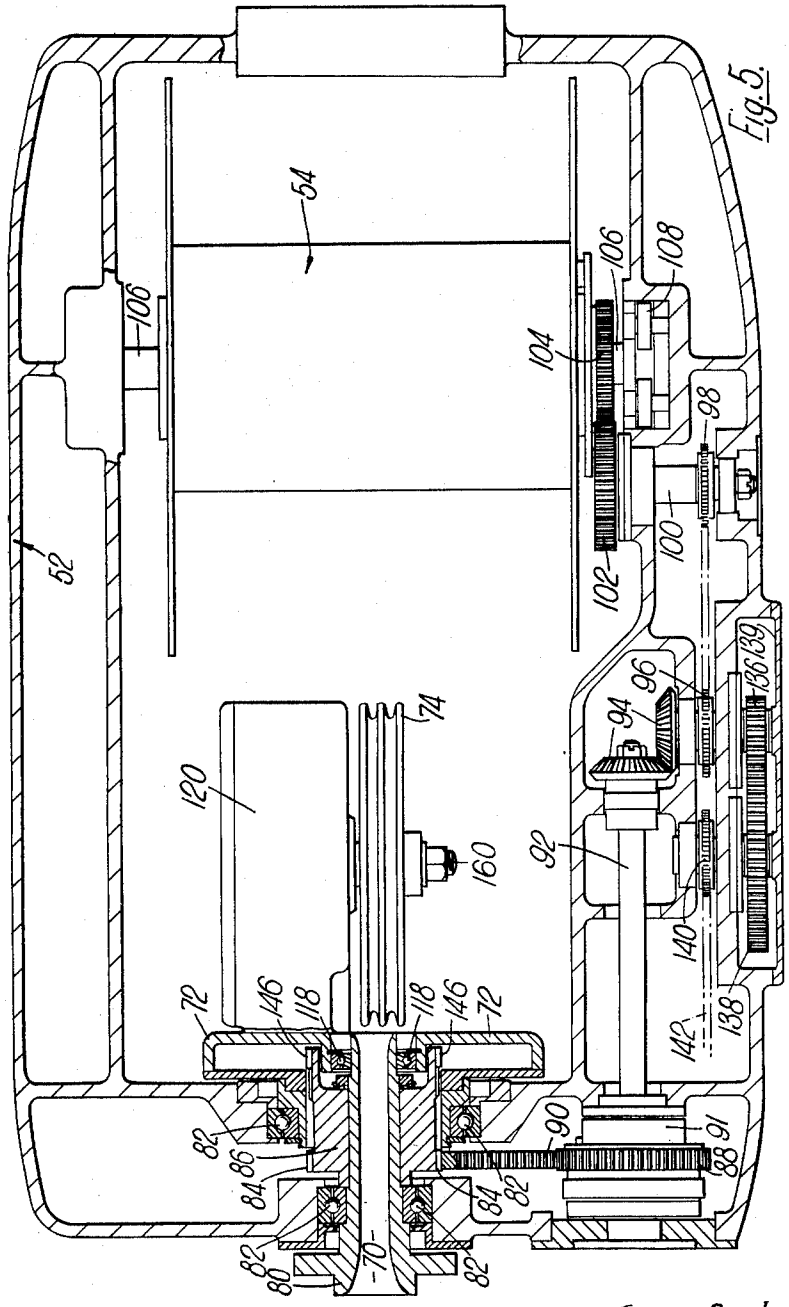
Fig. 5.



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CABLE MAKING MACHINES

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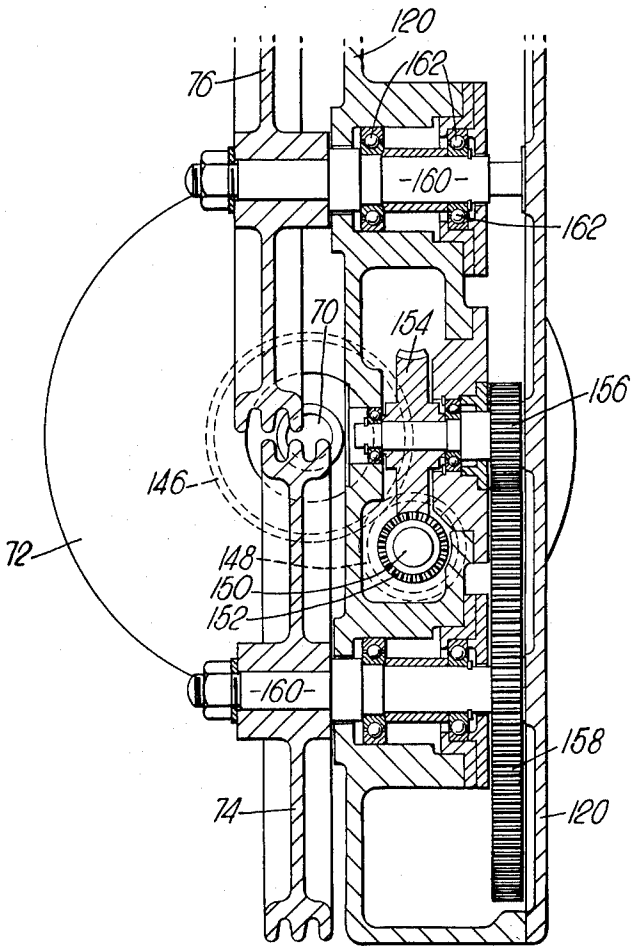
Fig. 6.



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United States Patent Office 3,093,956 Patented June 18, 1963

3,093,956

CABLE MAKING MACHINES

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Filed Nov. 20, 1961, Ser. No. 153,583
Claims priority, application Great Britain Nov. 22, 1960
9 Claims. (Cl. 57—58.65)

The invention relates to a cable making machine of the type in which a number of strands are twisted together to form a cable.

Such machines normally include a cage having a number of hollow spider arms which are arranged to be rotated about a central cradle carrying a bobbin onto which the cable is wound. The strands are led through one hollow arm of the cage and, when the cage is rotating, are given one twist at their point of entry into the spider arm and another at their point of exit. The twisted strands or cable then passes over a "haul-off" pulley through a traversing device mounted on the cradle to the bobbin on which it is wound. The traversing device ensures that the cable is laid on the bobbin in a uniform fashion along the whole length of the bobbin drum.

In machines used at present the traversing device comprises two upstanding rollers positioned close to each other between the haul-off pulley and the bobbin. The rollers are reciprocated together parallel to the axis of the bobbin so that the cable which is led between the rollers is laid along the whole length of the bobbin. As the traversing rollers are reciprocated the cable is flexed both at its point of leaving the haul-off pulley and its point of entry between the rollers of the traversing device. This bending or flexing of the cable tends to damage the cover or insulation of the strands and it may cause work hardening of the wires with a consequent increase in their resistance to the passage of electric current. The degree of bending can be lessened by increasing the distance between the haul-off pulley and the traverser but the increase necessary to reduce the flexing of the cable to such a degree that it would not be damaged would lead to machines of uneconomic length and the speed of rotation of the cage, which would also be increased in length, would necessarily be lowered. In practice machines have to be designed to compromise between the degree of bending of the cable and an economic length of the machine.

In a cable making machine of the type described, in accordance with the invention the cable is traversed along the bobbin drum by a relative rocking movement between a pulley incorporated in a traversing device or in a capstan unit and the bobbin, the movement being such that the cable is led straight off the pulley groove and onto the bobbin drum without flexing throughout the whole traverse of the drum.

Preferably the pulley forms part of the traversing device and is rocked in a plane substantially parallel to the bobbin drum, while the bobbin is not rocked. The rocking movement of the pulley is normally in an arc centered on a point which lies on the line connecting the point at which the cable enters the traversing device and the centre of the bobbin so that the cable is led directly onto the pulley groove without bending throughout the traversing movement.

Alternatively the bobbin can be rocked about a central axis perpendicular to the drum face while the pulley remains stationary or both the bobbin and the pulley may be rocked so that at any moment one is moving in an opposite direction relatively to the other so that the cable is traversed along the drum.

The pulley on the traversing device can be located very near to the bobbin in fact as near as desired provided that no fouling occurs during the rocking movement. The machine can therefore be shortened considerably as compared with normal machines and will occupy less floor space in a factory. The shortening of the machine results in a shortening of the length of the rotating cage so that a higher speed of the rotation of this cage becomes practicable with a consequent increase in the output of the machine. Indeed the cage may be rotated at speeds in excess of 1500 r.p.m., as compared with only about 1000 r.p.m. in a conventional machine.

The pulley forming part of the traversing device is preferably the haul-off pulley which draws the cable through the machine but it may be a guide pulley. The pulley is conveniently rotatably mounted on a rocker plate together with a measuring pulley also mounted on the plate and around which the cable passes so that the length of cable passing through the machine can be recorded. When two pulleys are mounted on the traversing device they will preferably be located, one above, and one below the point about which the device is rocked with their circumferences very close to this point.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a diagram illustrating the principles of the invention,

FIGURE 2 is an elevation of one embodiment of a machine in accordance with the invention,

FIGURE 3 is a plan view of the machine shown in FIGURE 2,

FIGURE 4 is a section on the line IV—IV of FIGURE 3,

FIGURE 5 is a sectional plan view of the cradle of the machine to a larger scale,

FIGURE 6 is a part sectional view on the line VI—VI of FIGURE 3, and

FIGURE 7 is a detailed view of the traversing screw and block.

The traversing device illustrated in its essentials in FIGURE 1, comprises a rocker plate **2**, which is mounted on a cradle (not shown in FIGURE 1), for rocking movement on an arc centered on a line X—X which connects the centre of a hole **4** in the plate **2** through which the twisted strands (or cable) pass to the traversing device, and the central point of a bobbin generally indicated at **6**, onto which the twisted strands are to be wound. The rocking movement takes place in a plane parallel to the bobbin axis Y—Y.

A haul-off pulley **8** and a measuring pulley **10** are mounted for rotation about axes perpendicular to the line X—X. The cable passes around the pulley **8** and around the measuring pulley **10** onto the drum of the bobbin **6**, the pulleys **8** and **10** being in line one on each side of the line X—X. The circumference of both the pulleys **8** and **10** lies very close to the line X—X so that the cable can be laid directly into the grooves of the pulley.

The rocking plate **2** has a tongue **11** having a slot **12**, in which a roller **14** is mounted. The roller **14** is carried by a traversing block (not shown in FIGURE 1) which engages in the thread of a traverse screw **16**. As the screw **16** is rotated the block reciprocates from one end of the screw to the other, the plate **2** being caused to rock or oscillate about the line X—X to lay the cable smoothly over the whole length of the drum of the bobbin **6**.

Throughout the whole of the traversing movement the cable passes directly into the pulleys **8** and **10**, and directly out from them onto the bobbin drum without flexure.

Referring now to FIGURES 2 and 3, the machine comprises a base frame generally indicated at **20** onto which a motor **22** is fastened. The motor shaft **24** passes through a fluid-coupling device **26** to drive a pulley **28** (see FIG-

URE 4). The pulley **28** is connected to an upper pulley **30** by a belt **32**, the upper pulley **30** being fastened to an upper lay shaft **34**, extending along the length of the machine and mounted in bearing **36**. The lay shaft **34** carries drive pulleys **38** at each end from which a drive is transmitted by belts **40** to driven pulleys **42** at each end of the machine, the belts, which are not shown in FIGURE 2 for the sake of clarity, are toothed, giving a power grip so that no slipping can occur.

Each of the pulleys **42** are connected to a short drive shaft for the rotating cage **43** of the machine, the drive shaft being carried in bearings **44**. An electro-magnetic brake generally indicated at **46** is provided for each of the drive shafts between the bearings **44** at each end. Each drive shaft is connected to one of the discs **48** of the cage through connecting struts **50**, the two discs being connected together near their periphery by three spider tubes **51** (only one of which is shown in FIGURE 2).

An approximately U-shaped cradle generally indicated at **52** is freely mounted between the cage discs within the tubes **51**, independently of the cage so that when the cage is rotating at high speed the cradle remains relatively stationary, but is free to rock slightly if necessary. A bobbin **54** onto which the cable is to be wound extends across the arms of the cradle and is carried by them.

Strands of the cable are fed into the machine through a lay plate **56** at one end of the machine, under a lower guide pulley **58** carried by one of the cage discs **48** and over a corresponding guide pulley **60**, the strands of cable being shown at **62** in FIGURE 2. The strands pass through a tube **64** indicated by dash lines in FIGURE 2 and mounted within one of the tubes **51** connecting the two discs. After emerging from the other end of tube **64** the strands pass over guide pulleys **66**, **68** carried by the other disc **48** and through a central hole in the disc **48** along the axis of the cage through a corresponding hole **70** in the base of the U-shaped cradle through a traversing device comprising a rocker plate **72** mounted on the cradle, a driven haul-off pulley **74** and a measuring pulley **76**, both pulleys being carried by the plate **72**.

When the machine is running, the cage is rotated at high speed and the strands of the cable are given one twist at their point of entry to the cage and another on leaving the cage, the length of the strands passing through the tube **64** being rotated about the bobbin **54**. The twisted strands or cable is then fed onto the bobbin drum by the traversing device.

The cradle generally indicated at **52** is carried at its base by a member **80** providing the inlet hole **70**, and secured to the cage of the machine, through bearings **82**. Thus the cradle can remain stationary despite the rotation of the member **80**.

The drive for the take-up bobbin **54** is taken from the cage **43** and the gear train and is illustrated in FIGURE 5. A gear **84** formed on a member **86** secured to the member **80** and rotated therewith, drives a driven gear wheel **88** through an idler gear **90**. The driven gear **88** drives shaft **92** through an electro-magnetic slipping clutch **91** which in turn drives one of two meshing bevel gears **94**, the driven one of which is connected to a chain sprocket **96** driving a corresponding sprocket **98** mounted on a shaft **100**. The other end of the shaft has a drive gear **102** mounted on it which drives a corresponding gear **104** on the bobbin shaft **106**.

Each end of the bobbin shaft is mounted in bearings provided by two freely rotatable rollers **108** for quick removal.

The traversing device rocker plate **76** is mounted, independently of the cradle, about the member **80** through bearings **118**. Attached to the rocker plate is a gearbox **120** carrying the haul-off pulley **74** and measuring pulley **76** each of which is formed with two grooves around its periphery.

A traverse screw **121**, provided to rock the rocker plate **76** is suspended in bearings **122** from the cradle and its screw thread is engaged by a tongue **124** of the traverse block **126** (see FIGURE 7). The block has a shaft **128** projecting from one side to carry a roller **130** which engages in a slot **132** in the tail portion **134** of the rocker plate (see FIGURE 4). The block is free to slide along a slide **135** on the cradle as it is moved along the screw thread by the inter-engagement of its tongue **124** in the thread as the screw is rotated, the thread being doubled so that the block is reciprocated from end to end.

Thus, as the traverse screw is rotated and the traverse block **126** reciprocated along the screw, the plate **76** is oscillated or rocked in an arc about its axis which coincides with the hole in the member **80**. As the rocker plate carries the pulleys **72**, **74** these also are rocked so as to traverse the cable fed from the pulley **74** along the length of the drum of the bobbin **54** and lay the cable correctly onto that drum.

The thread cut into the traverse screw is such that its pitch varies so as to cause a faster movement of the block **126** at each end of the screw thread than at the centre point. This ensures that the cable is laid onto the bobbin evenly. Alternatively, the pitch of the screw could be maintained constant, but its speed of rotation varied. The screw thread is also arranged to have a slight dwell at each end so that the cable is laid correctly against the flanges of the bobbin. The variation of the screw thread depends on the size of the bobbin. For example with a take-up bobbin having 16″ diameter x 9⅜″ traverse, the pitch of the traverse screw will vary from ¾″ at one end to ⅜″ at the centre, to 0.9″ at the other end. The pitch is not equal at the ends because part of the take-off from the pulley **76** is off centre.

The drive for the traverse screw is directly connected to the drive for the bobbin so that the rotation of the bobbin and the oscillation of the pulleys of the traversing device are always maintained in correct time with each other.

As can be seen in FIGURE 5, the driven bevel gear **94** drives in addition to the chain sprocket **96**, a change gear wheel **136** meshing with a second change gear wheel **138** mounted on a shaft carrying a chain sprocket **140**. The sprocket **140** is connected by a chain **142** to a corresponding sprocket **144** on one end of the traverse screw **121**. The speed of rotation of the screw can be varied by changing the size of the change wheels **136**, **138** which are covered by a removable cover **139**.

As can be seen in FIGURE 2, the twisted strands or cable are laid directly into one of the grooves in the circumference of the pulley **74** from the hole in the member **80**, without flexure whatever the angular position of the pulley **74** may be. This is because the pulleys are rocked about an arc centered on the axis of the hole **70** of the member **80** and because the circumference of the groove in the pulley **74** is in line with the hole **70**. The cable passes from the first groove in the pulley **74** into the corresponding groove in the measuring pulley **76** around the second groove in the haul-off pulley **74**, over the second groove in the measuring pulley to the bobbin drum.

The haul-off pulley is driven and acts to drag the cable through the lay plate **56** and the cage.

The drive to the haul-off pulley is as follows. The member **86** which is rotating with the cage carries a second drive gear **146** around its circumference (see FIGURE 5). This gear drives a driven gear **148** (see FIGURE 6) fixed to a shaft **150** carrying a worm **152** which drives a worm wheel **154**. The worm wheel is mounted for rotation in the gearbox **120** and carries a driven change wheel **156** meshing with a second change wheel **158** keyed on the shaft of the haul-off pulley **74**. The size of the gears **156**, **158** can be varied to vary the speed of rotation of the haul-off pulley.

The measuring pulley **76** has a shaft **160** which is mounted freely in bearings **162** in the gearbox so that the pulley is rotated as the cable passes over it. This measur-

ing pulley is connected up to a counting device (not shown) so that the length of cable passing through the machine can be recorded.

The pulleys **74, 76** will be seen to be as close to the flange of the take-up bobbin as is possible without fouling so that the machine has as short a length as possible. This enables the rotating cage, also to have as short a length as possible so that its speed of rotation and hence the output of the machine is high.

In order to adjust the length of traverse for different widths of bobbins provision may be made to adjust the height of the traverse screw and hence the position of the roller **130** in the slot **132**. Alternatively the length of traverse may be varied by providing haul-off pulleys having different diameters. It will be appreciated that in the latter case and if the diameter is reduced, the circumference of the groove may not be on the centre line of the cradle and a guide wheel has to be provided to ensure that the cable does not rub on the edge of the hole **70**.

It will be appreciated that the desired rocking movement of the rocker plate can be achieved by any other suitable device, such as a heart-shaped cam.

In an alternative arrangement the bobbin may be rocked, the lead-off pulley either remaining stationary, in which case it no longer forms part of a traversing device but is incorporated rather in a stationary capstan unit, or alternatively both the pulley and the bobbin are rocked in opposite directions to achieve a relative rocking movement to traverse the cable.

In all traversing positions the cable is led directly from the traversing device perpendicularly onto the bobbin drum without flexure.

The machine described with reference to the drawings is very suitable for the "twinning" of plastic covered wire.

We claim:

1. A cable making machine comprising a bobbin cradle, a cage arranged to be rotated and to carry the strands of the cable around the bobbin cradle, a traversing device for laying cable onto the drum of a bobbin mounted in the bobbin cradle after the cable has passed through the said cage, a pulley forming part of the said traversing device, drive means to rock said pulley in a plane substantially parallel to the bobbin drum, and second drive means linked to the pulley drive, said second drive means being arranged to drive the bobbin to take up cable as the said pulley is being rocked to traverse cable across the drum of the bobbin.

2. A cable making machine as claimed in claim 1 in which the pulley is rocked along an arc centred on a point which lies on a line connecting the point at which the cable enters the traversing device to the centre of the bobbin.

3. A cable making machine as claimed in claim 1 in which the pulley forming part of the traversing device is driven to pull the cable through the cage from a supply bobbin.

4. A cable making machine comprising a bobbin cradle, a cage arranged to be rotated and to carry the strands of the cable around the bobbin cradle, a traversing device for laying cable onto the drum of a bobbin mounted in the bobbin cradle after the cable has passed through the said cage, a pulley forming part of the said traversing device, drive means to rock said pulley in a plane substantially parallel to the bobbin drum, second drive means linked to the pulley drive, said second drive means being arranged to drive the bobbin to take up cable as the said pulley is being rocked to traverse cable across the drum of the bobbin, and said pulley having its circumference arranged substantially tangential to a line connecting the centre of the bobbin drum to the point on which the cable enters the traversing device.

5. A cable making machine as claimed in claim 4 in which the pulley is an idler pulley arranged to measure the length of cable passing through the machine.

6. A cable making machine comprising a bobbin cradle, a cage arranged to be rotated and to carry the strands of the cable around the bobbin cradle, a traversing device for laying cable onto the drum of a bobbin mounted in the bobbin cradle after the cable has passed through the said cage, a pulley forming part of the said traversing device, drive means to rock said pulley in a plane substantially parallel to the bobbin drum, second drive means linked to the pulley drive, said second drive means being arranged to drive the bobbin to take up cable as the said pulley is being rocked to traverse cable across the drum of the bobbin, said traversing device including a rocker plate on which the said pulley is mounted, and a traverse screw adapted to rock the rocker plate, said traverse screw having a thread which is engaged by a traverse block connected to the rocker plate.

7. A cable making machine according to claim 6 in which the thread of the traverse screw is such that its pitch varies along its length in such a way that the rocker plate is moved faster at each end of the screw than at the centre of the screw.

8. A cable making machine comprising a bobbin cradle, a cage arranged to be rotated and to carry the strands of the cable around the bobbin cradle, a traversing device for laying cable onto the drum of a bobbin mounted in the bobbin cradle after the cable has passed through the said cage, a pulley forming part of the said traversing device, drive means to rock said pulley in a plane substantially parallel to the bobbin drum, second drive means linked to the pulley drive, said second drive means being arranged to drive the bobbin to take up cable as the said pulley is being rocked to traverse cable across the drum of the bobbin, said pulley being carried by a rocker plate having an aperture through which the cable passes to the pulley after leaving the said cage, and the circumference of the said pulley lying substantially tangential to the line connecting said aperture with the centre of the bobbin drum.

9. A cable making machine as claimed in claim 8 in which the rocker plate is driven by a traverse screw, the drive means for the screw being linked with the drive means for the bobbin.

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