June 23, 1942. R. M. SCOTT 2,287,200

BRAIDING MACHINE

Filed Aug. 13, 1941 2 Sheets-Sheet 1

FIG. 1

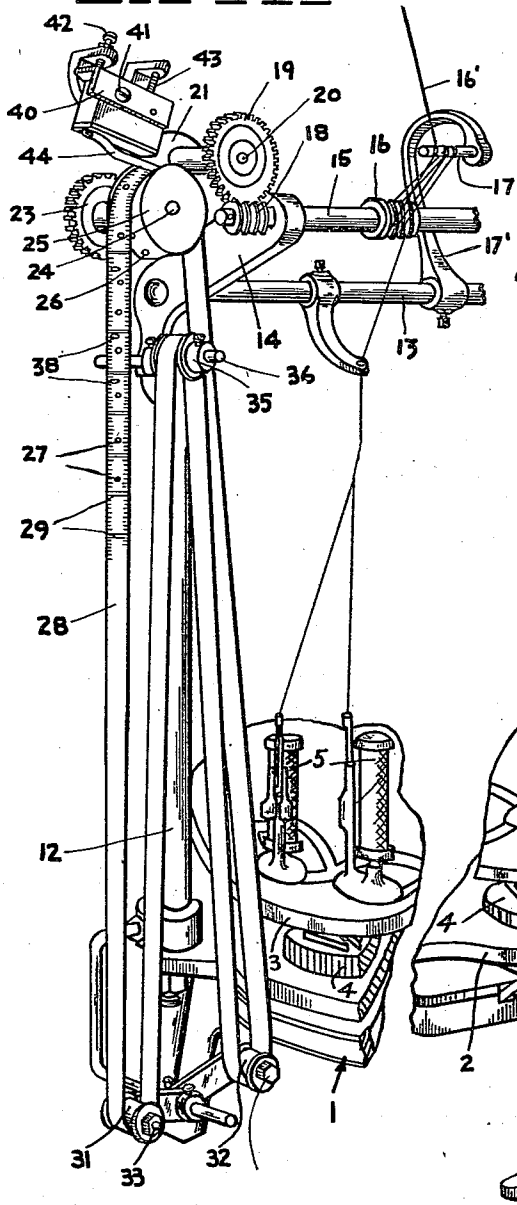
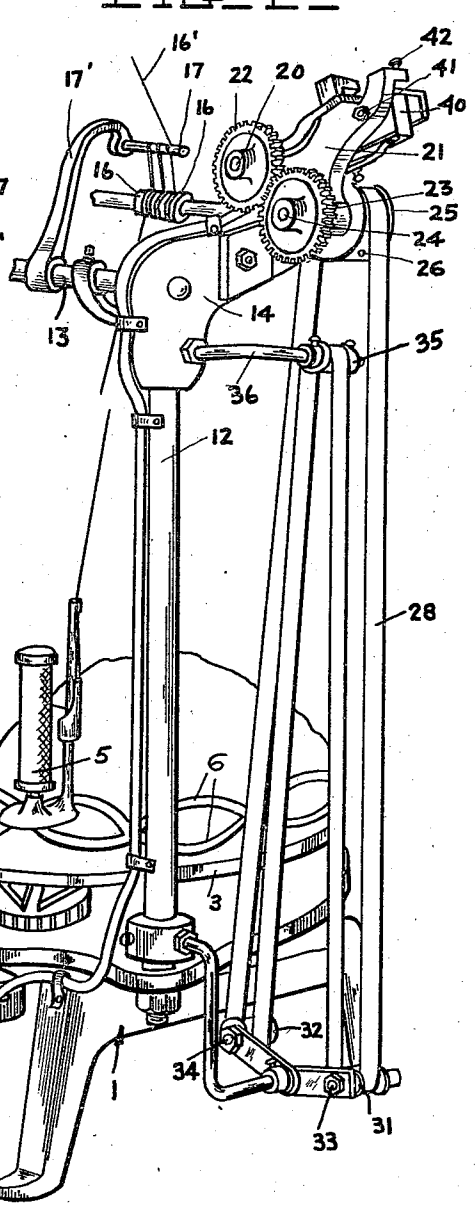


FIG. 2



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Filed Aug. 13, 1941 2 Sheets-Sheet 2

FIG. 3.

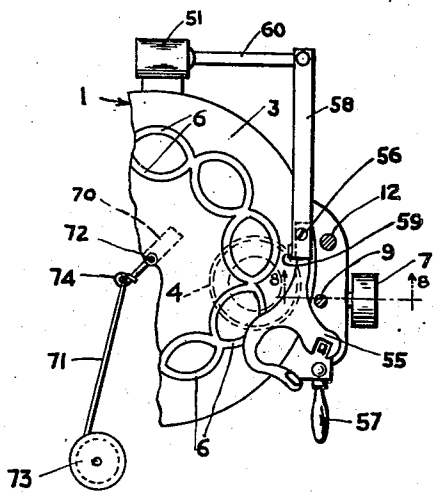


FIG. 4.

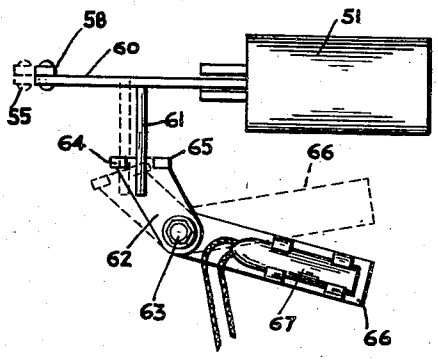


FIG. 5.

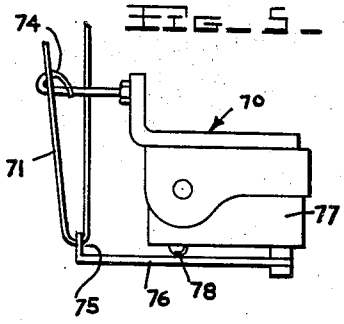


FIG. 5.

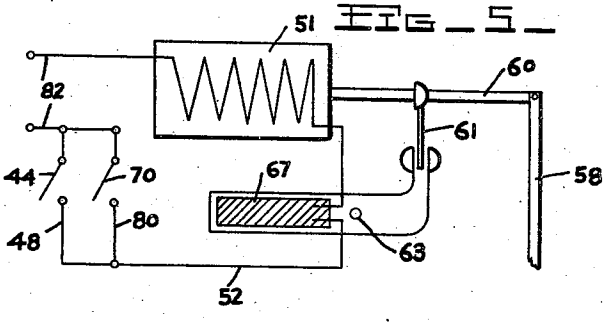


FIG. 7.

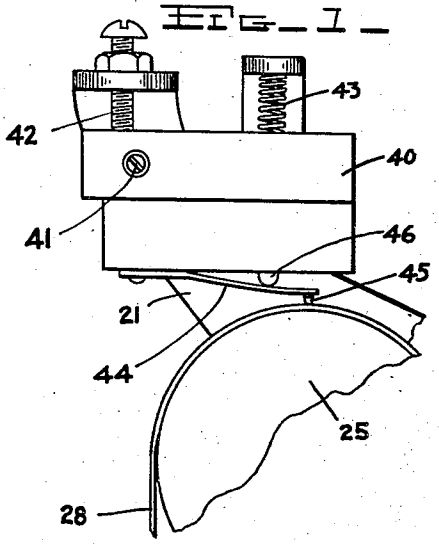
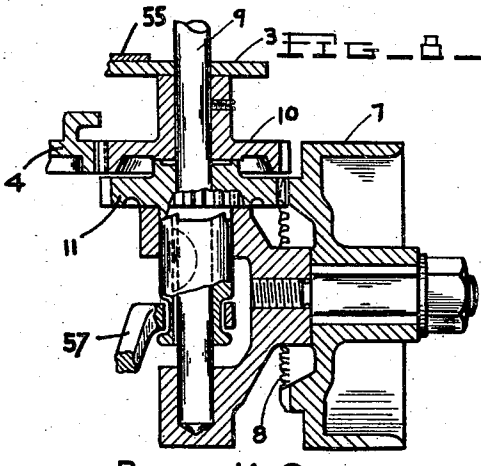


FIG. 8.



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BRAIDING MACHINE

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Application August 13, 1941, Serial No. 406,625

6 Claims. (Cl. 96—19)

This invention relates to braiding machines and more particularly to control means therefor adapted for use in connection with the braiding of harnesses for ignition circuits, radio, electric organs or other plural electric control devices as well as for tapered fish lines or other types of braid where predetermined stops are required either with or without the inclusion of a core element.

One object of the invention is the provision in a device of this character of a control means adapted for actuation in a definite relation with the driving mechanism for the take-up means whereby spaced points of actuation for the control means on a control element will bear a definite fixed relation to corresponding lengths of the formed braid.

Another object of the invention is the provision in a device of this character of an automatic positively operated mechanism for controlling the braider operation over a long or short cyclic period, as for stopping the braiding mechanism at regular or irregular intervals with certainty and in accordance with any desired predetermined lengths of braid or selected plan of operation.

A further object of the invention relates to the provision of improved control mechanism adapted for operative connection with the usual or any suitable type of manual or automatic control for stopping the braiding mechanism with certainty and according to any predetermined plan of operation.

Another object of the invention is the provision in a braiding machine of a core control which is adapted for operation in stopping the braiding mechanism upon any failure or deficiency in the feed of the core element which is of a character to impair the braid structure or effect adversely the operation of the mechanism.

A further object of the invention is the provision in a control mechanism of this character of operating means therefor capable of acting with certainty and speed to insure accuracy and certainty in any desired relation of the occurrence of stop intervals in the formation of the braided material.

Other objects and advantages of the invention relate to various improved details of construction and novel arrangements of the parts as will be more fully set forth in the detailed description to follow.

Referring to the drawings:

Fig. 1 is a side elevational view of a portion of a conventional braiding machine, certain parts thereof being broken away, showing the location and arrangement of parts of a control mechanism and a control strip therefor, wherein the control mechanism is adapted to interrupt the operation of the braiding machine at predetermined intervals,

Fig. 2 is a side elevational view of parts of the braiding machine mechanism and control mechanism shown in Fig. 1, as seen from the opposite side of the control mechanisms,

Fig. 3 is a top plan view of a portion of the braiding machine, taken looking down upon that portion of the top plate of the braiding machine upon the side thereof opposite to that shown in Figs. 1 and 2, with the thread carriers removed, and showing the location of the drive mechanism with relation to the stop motion arm and solenoid as well as the core element support and its relation to the core control means,

Fig. 4 is an enlarged side elevational view of the solenoid and mercury switch support in operative relation with the plunger,

Fig. 5 is an enlarged side elevational view of the core control means showing its relation to the core element,

Fig. 6 is a diagrammatic view, illustrating the control circuits and their relation with the solenoid, and solenoid circuit including the mercury switch,

Fig. 7 is an enlarged side elevational view of the braiding control switch block in its relation to the control strip, and,

Fig. 8 is a vertical sectional view, taken substantially along the line 8—8 of Fig. 3 and showing the relation of the driving and driven means for operating the braiding machine mechanism to the stop motion mechanism.

In the manufacture of certain forms of braid structures, such as particular types of braided fish lines and harnesses for electric circuits, it is necessary to stop the braiding machine at intervals in order to increase or decrease the cord ends in the braid or to remove or add core strands and it is highly desirable in making structures of this character that some means be provided for stopping the braiding mechanism with certainty and in accurate relation with the length of braid formed in order that the changes be made in substantially exact relation with the desired plan of construction of the braid material.

The present invention relates to mechanisms for the manufacture of a variable braid structure, that is, a braid in which the number of cord ends employed may vary throughout the length of the braid, or a braid structure having a variable

strand core in which the core element varies with respect to the number of strands contained therein throughout portions of its extent. As an example of the structure first described, reference has been made to a braided fish line in which the number of cord ends making up the braid are increased or decreased in portions of the length of the line. Structures of the class last described may be defined as braids containing a core element, which element varies with respect to the number of strands contained therein, as in the case of electric or other cable structures wherein certain of the strands making up the core element are withdrawn from the braided covering at separate points in the braid length.

In the present application the terms "variable braid material" or "variable braided structure" are used to designate either a braid in which the number of braided cord ends may be increased or decreased throughout portions of the braid length by removing certain cord ends, or adding others as the case may be, or a braid structure containing a core which may include plural strands and in which the number of strands employed may be increased or decreased throughout portions of the braid length.

In the form of the invention illustrated herein, 1 designates a braiding machine, the general structure of which corresponds substantially with that of the conventional devices of this character, having the usual bottom plate 2 and top plate 3 with a plurality of horn gears 4 located therebetween for moving thread carriers 5 along tortuous runs 6 formed in the top plate 3 as is common in devices of this character. The horn gears 4 may be driven in any suitable manner to impart traversing movement to the thread carriers 5, as by means of a power operated pulley 7 provided with a driving gear 8 for driving the horn gears 4 and a vertical driven shaft 9 through a driven gear 10 carried by the shaft 9 and mounted in driving engagement with one of the horn gears 4. The driving gear 8 is adapted to drive the horn gears 4 and vertical shaft 9 through a clutch controlled gear 11 after the manner shown in Fig. 8 of the drawings.

The braiding machine may comprise oppositely positioned supporting standards 12 located upon opposite sides of the machine, as is common in devices of this character, for supporting a cross bar 13 through suitable brackets 14 carried by the standards 12. A cross shaft 15 is rotatably supported by the brackets 14 above and in substantial parallelism with the top plate 3, which shaft is adapted to be driven from the vertical driven shaft 9 by any suitable form of gearing, not shown, as is common in devices of this character, so that the cross shaft 15 may be rotated at various speeds, each bearing a proportionate relation to that of the remaining operating elements of the braider mechanism.

A take-up or braid haul-off means is shown as carried by the cross bar 13 and cross shaft 15 which may comprise a grooved pulley 16 mounted upon and driven by the cross shaft 15 and an idler pulley 17 rotatably supported by an arm 17' carried by the cross bar 13, which pulley is positioned in suitable relation with the grooved pulley 16 for drawing the formed braid 16' from the machine after its formation by the movement of the thread carriers. Any other suitable or desired form of take-up means may be employed for drawing the formed braid from the machine at a rate proportionate to the speed of the cross shaft 15, such as a capstan, or other desired and appropriate take-up mechanism.

The braid forming control mechanism in the embodiment of the invention shown herein is located in operative relation with and adapted to be driven from the cross shaft 15 through any suitable operating means, one form of which will now be more fully described. A worm 18 is secured to the cross shaft 15 and mounted in driving engagement with a worm gear 19 on a shaft 20 carried by an auxiliary frame 21, which frame is supported by one of the brackets 14 carried by the standards 12. In the form of the invention illustrated herein, the shaft 20 carries a gear 22 meshing with a gear 23 carried by a shaft 24 for rotating a control pulley 25 mounted on the shaft 24.

The intermeshing gears 22 and 23 are adapted for removal and replacement by gears having different diameters than those shown in order to change the operating ratios of the shafts 20 and 24 together with the speed of rotation of the control pulley 25 within such limits as may be permissible from the location of the shafts 20 and 24 relative to each other in accordance with any desired change in rate of speed to be imparted to the control pulley 25 within the limits of change reasonably necessary in a device of this character.

The pulley 25 is provided with a plurality of projecting teeth 26, which are uniformly spaced from each other and engage spaced openings 27 in a control strip 28 passed over the pulley 25 and mounted in driving engagement therewith. The control strip 28 is adapted to be passed over one or more idler pulleys, which may include idler pulleys 31 and 32 carried by arms 33 and 34 respectively, or either of them, and an idler pulley 35 carried by an arm 36, in order to provide an extended continuous pattern control means for the braiding machine. If desired, pattern control strips of various lengths may be used which may be considerably shorter or longer than the strip 28 shown herein, and they may be employed by being passed over the control pulley 25 and one or several idler pulleys, such as the idler pulleys 31, 32 or 35, shown herein, when the character of the braid to be formed is such as to permit or require the employment of a pattern control member of greater or less extent than that shown herein.

The control strip 28 may be formed of any suitable or desired material appropriate for the purpose, and in the form of the invention shown, is provided with a plurality of uniformly spaced centrally located openings 27 adapted to be engaged by teeth 26 carried by the pulley 25 to cause continuous travel of the control strip 28 over the pulley 25 during the operation of the braider mechanism. The control strip 28 is also provided with spaced openings 38, which may be located adjacent to one edge thereof, for actuating the control mechanism when the control element comes into registry therewith.

The control strip 28 may be provided with uniformly spaced transverse lines 29, which may indicate corresponding lengths of any desired extent on the formed braid, dependent upon the ratio existing between the speed of the cross shaft 15 and that of the pulley 25, thus serving as indicating means for the location of openings 38 in the control strip to correspond with any desired lengths of the formed braid. The spaced lines 29 may be so positioned as to correspond,

for example, in inches to lengths in feet on the formed braid.

The braid forming control mechanism as shown includes a switch block 40 which is pivotally supported by a pin 41 carried by the auxiliary frame 21 and is maintained in the desired position relative to the control strip 28 by an adjustable set screw 42 and pressure spring 43 carried by portions of the frame 21. The switch block 40 is provided with a resilient contact arm 44 having a free end 45 normally held in resilient sliding engagement with the face of the control strip 28 as it passes over the control pulley 25, but which is adapted to move into any one of the openings 38 as they are brought into registration therewith by travel of the control strip 28 over the pulley 25, thereby causing movement of the control arm away from the switch block 40 to close an electric circuit through the switch block 40 by movement of the contact arm out of engagement with a contact 46. An electric circuit 48 connected through the switch block 40 provides means for energizing a solenoid coil 51 through a solenoid circuit 52.

A stop motion means is provided which includes a stop motion arm 55 pivotally mounted, as at 56, on the top plate 3 of the braiding machine, and adapted, upon pivotal movement in one direction about its pivot 56 through an impulse communicated thereto by the slidable weight mounted on one of the carriers 5, when induced by thread failure or otherwise, to release a gravity operated shift lever 57 and disconnect the drive gear 8 from operative connection with the driven gear 10.

A supplemental arm 58 is pivotally connected to the stop motion arm 55, as at the point 56, and extends rearwardly therefrom, having a lug 59 carried thereby adapted to engage one side of the stop motion arm 55, whereby when the supplemental arm 58 is moved about its point of pivotal connection to the stop motion arm under the influence of the solenoid plunger 60 when the solenoid coil is energized, the lug 59 strikes the stop motion arm 55 to move the same outwardly radially of the top plate 3 and release the gravity operated shift lever 57 to disconnect the driving and driven means for operating the braider mechanism.

A pin 61 extends downwardly from the plunger 60 for engagement with a rocker arm 62, which is pivotally mounted as at 63, having spaced lugs 64 and 65 engageable by the pin 61 for moving the rocker arm about its pivot to change the angular position of an extension 66 which supports a mercury switch 67. The mercury switch 67 is connected into the solenoid circuit 52 and acts through movement of the rocker arm 62 to close the circuit through the solenoid when the plunger 60 is out of operative engagement with the solenoid, and to open the circuit through the solenoid 51 when the plunger 60 is drawn inwardly to substantially the full extent of its movement relative to the solenoid 51.

A core control means 70 serves to provide a control responsive to the tension on a core element 71, which may consist of a single strand or a plurality of strands. This control means may be supported by a portion of the braider or by the base upon which the braider rests and is preferably positioned at or closely adjacent to the core opening 72 formed in the bottom and top plates of the braider. The core element 71 may be carried by a support 73 and passed through a stationary guide eye 74 to a guide eye 75 carried by a resilient contact arm 76 forming a part of the control means 70 and mounted upon a switch block 77, which switch block is preferably so positioned that the guide eye 75 is engaged by the core element 71 adjacent to the point of its upward travel for incorporation into the braid.

An electric circuit 80 connects the switch block 77 with the solenoid 51 through the solenoid circuit 52, and any undue decrease in tension on the core element, such as may indicate exhaustion or near exhaustion of the core element, permits movement of the resilient contact arm 76 outwardly from the switch block 77 against the decreased tension exerted by the core element to move the arm 76 out of engagement with a contact point 78 carried by the switch block and close the circuit 80 through the switch block and solenoid 51.

In the operation of the mechanism above described, the braider mechanism generally operates in the usual manner, thread carriers 5 being driven by horn gears 4 through the usual or any suitable form of gearing 9 from the drive pulley 7 or other source of power, to cause the thread carriers 5 to travel over the top plate 3, and along the carrier runs 6, as is common in devices of this character.

The braid forming control means is adapted to be driven from the conventional driven cross shaft 15, since it is desired to correlate the operation of the control means directly with lengths of the formed braid in order that definite spacings of the openings 38 on the control strip, or other pattern means employed, may correspond with or possess a definite relation to lengths of the formed braid as passed through the take-up mechanism driven by the cross shaft 15. The particular form of means employed for actuating the control means from the shaft 15 may be of any suitable character other than that shown which may be adapted for the purpose.

The braid forming control means as driven from the conventional cross shaft 15 may be actuated by the pattern strip 28 or other suitable form of pattern determining means driven from the cross shaft 15.

In the present form of the invention, the pattern strip 28 may be driven at a greater or less speed with reference to the speed of rotation of the cross shaft 15 by changing the diameters of the gears 22 and 23 to increase or decrease the speed of the shaft 24 relative to that of the shaft 20 while maintaining a definite relation between the speed of the shaft 24 and that of the cross shaft 15, and the relative locations of the control openings 38 formed in the strip 28 may be positioned to regulate the stop intervals so that they may occur regularly or irregularly and in accordance with any desired plan of operation. By regulating the rate of travel of the control strip 28 with particular reference to the speed of the shaft 15 or the rate of the formed braid, definite distances on the control strip 28 may be made to correspond with definite braid lengths, whereby the locations of the control openings may be positioned to correspond with any desired locations of changes in the braid structure. These changes in the braid structure to be made upon interruption of the braider operation by the braiding control means may consist either of changes in the number or character of braid ends employed or in the number of core strands to be included within or removed from the core element.

Each engagement of the free end 45 of the resilient contact arm 44 with one of the spaced openings 38 of the control strip causes movement of the arm 44 out of engagement with the contact 46 and serves to close the circuit 48 through the solenoid circuit 52 and the solenoid coil 51. The closing of the circuit through the solenoid 51 draws the plunger 60 inwardly toward the solenoid thereby engaging the lug 59 carried by the arm 58 with the stop motion arm 55 to move the stop motion arm outwardly radially of the top plate 3 and release the gravity operated shift lever 57 to disengage the driving and driven means for stopping the braider mechanism. As the plunger 60 is drawn inwardly by the energizing of the solenoid 51, the pin 61 strikes the lug 65 carried by the rocker arm 62 and moves the rocker arm about its pivot 63 to turn the extension 66 into downwardly inclined position, as shown in full lines on Fig. 4 of the drawings, thereby tilting the mercury switch 67 to open the circuit through the solenoid 51. It results that upon actuation of the control means the closing of the circuit through the solenoid 51 is only for a period sufficient to draw the plunger 60 into its solenoid engaged position, when the current through the solenoid circuit is again opened in order that current may not be permitted to flow through the solenoid for any substantial length of time.

Current for the control circuits 48 and 80 may be furnished from any suitable source of electric energy, as through a main line circuit 82, into which the circuits 48 and 80 may be connected in parallel, as shown in Fig. 6 of the drawings.

When the operator has made the braid change necessary or desirable at the point indicated by the stoppage of the braiding mechanism, he raises the shift lever 57 to engage operatively the driving means with the driven means of the braider. This movement of the shift lever causes radially inward movement of the stop motion arm 55 about its pivot 56 and engagement of the arm 55 with the lug 59 carried by the arm 58 to move the plunger 60 outwardly from the solenoid 51. Upon outward movement of the plunger 60 the pin 61 carried thereby engages the lug 64 of the rocker arm 62 to move the rocker arm about its pivot 63 and raise the extension 66 into its dotted line position, as shown in Fig. 4 of the drawings, and thus close the solenoid circuit through the mercury switch, placing the parts in position to be again operated by engagement of the free end 45 of the resilient arm 44 with one of the openings 38 in the control strip.

Actuation of the core control means 70 through lack of a suitable degree of tension on the core element 71 is effected by movement of the resilient arm 76 out of engagement with the contact 78 to close the circuit 80 through the solenoid 51 and thereby draw the plunger 60 into solenoid engaging position and at the same time move the stop motion arm to disconnect the driving and driven means. The operation of the mercury switch 67, in case of actuation by the control means 70, is similar in all respects to that above described with relation to the braiding control means. In each case, the mercury switch 67 is moved to open the circuit 52 through the solenoid when the plunger 60 is drawn inwardly substantially to the extent of its inward movement, and is moved into position to close the circuit through the solenoid 51 when the plunger is in its outward position away from the solenoid in order that either control means may then be free to operate the stop motion means through actuation of the switch means 44 or 76.

From the above description it will be understood that the stop motion arm 55 is capable at all times during the operation of the mechanism of responding to impulses communicated thereto by one of the carrier weights in the usual way for disconnecting the driving means from the operating mechanism of the braider in the usual manner and without moving the arm 58 or plunger 60 or interfering in any way with the operation of either of the control means described.

It will be apparent from the above that the braiding control means and core control means may be employed together in the formation of a variable braid structure of any character, which includes a core element, in order to provide means for stopping the operating mechanism at predetermined points in the braid formation for making any desired change in the number of character of braid elements employed, as well as to maintain such suitable tension on the core element as may be necessary or desirable in forming a product of the character specified. The controls above described may also be employed separately, as in forming a braid having no core element included therein, or in forming a braided cover over a single or plural strand core element which is substantially uniform in character and construction throughout the extent of the formed braid structure.

What I claim is.

1. The combination with a braiding machine for braiding cord ends over cord strands having driving and driven means and stop motion means including a stop motion arm for disconnecting the driving and driven means, of a stop motion actuating means independently of the movement of said thread carriers including a stop motion arm engaging member, a solenoid coil, solenoid coil operated means for actuating said stop motion arm engaging member, and means actuable at predetermined points in the braid formation and in response to changes in the tension on the cord strands for energizing said solenoid coil to operate said stop motion means through said stop motion arm engaging member.

2. In a braiding machine, a control mechanism comprising a stop motion means and actuating means therefor including a shaft rotatable in timed relation with the rate of braid formation, a pattern strip, means for driving said pattern strip in timed relation with said shaft, a member resiliently engageable with said pattern strip and displaceable relative thereto at predetermined intervals in the braid formation, a solenoid coil, and means actuated by displacement of said pattern strip engaging member for energizing said solenoid coil to operate said stop motion means.

3. In a braiding machine having driving and driven means and stop motion means for disconnecting the driving and driven means including a stop motion arm, a solenoid coil and a solenoid operated stop motion actuating means including a stop motion arm engaging member movable upon the energizing of said solenoid coil to displace said stop motion arm and actuate the stop motion means, control means for energizing the solenoid coil to operate said stop motion means through said arm engaging member, and means operated by movement of said arm engaging member for deenergizing said coil immediately

following the actuation of said stop motion means.

4. The combination with a braiding machine having driving and driven means and a stop motion means for disconnecting the driving and driven means including a stop motion arm, of a stop motion arm actuating means comprising a perforated pattern strip movable in timed relation with the rate of braid formation, means mounted for movement into and out of engagement with the perforations in said pattern strip, and solenoid means for operating said stop motion actuating arm to displace said stop motion arm and operate said stop motion means in response to perforation engaging movements of said perforation engaging means.

5. The combination with a braiding machine having driving and driven means, and stop motion means for disconnecting the driving and driven means, of a solenoid coil and a solenoid operated stop motion actuating means, means for energizing the solenoid coil to operate said stop motion actuating means, and means operated by movement of said stop motion actuating means in one direction for deenergizing said solenoid coil.

6. The combination with a braiding machine having driving and driven means and stop motion means including a stop motion arm for disconnecting the driving and driven means, of a stop motion actuating means including a stop motion arm engaging member, a solenoid coil, solenoid coil operated means for actuating said stop motion arm engaging member, and control means operable to energize said solenoid coil and operate said stop motion means through said stop motion arm engaging member.

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