Dec. 8, 1942. O. V. PAYNE 2,304,194

HARNESS CORD FOR LOOMS

Original Filed July 8, 1940

FIG. 1

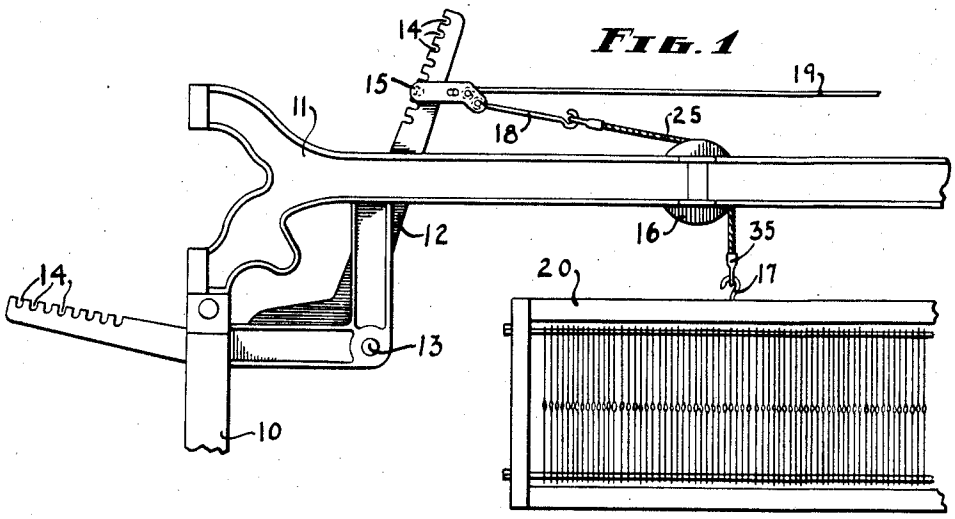


FIG. 2

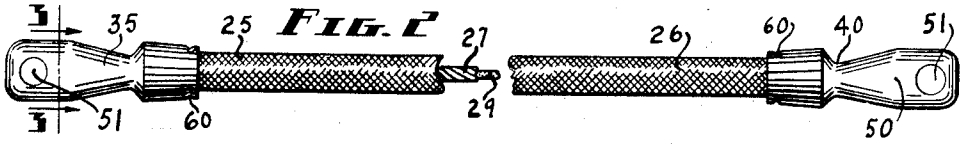


FIG. 3

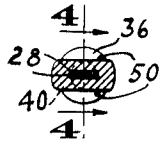


FIG. 4

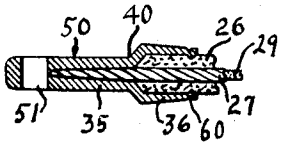


FIG. 5

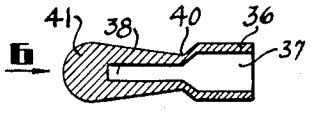


FIG. 6

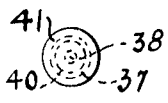


FIG. 7

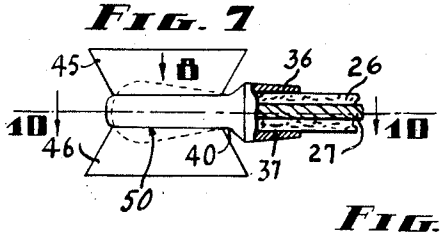


FIG. 8

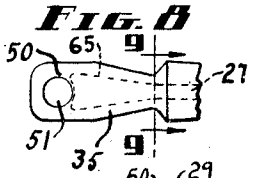


FIG. 9

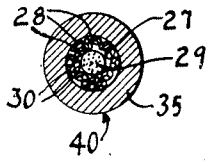


FIG. 10

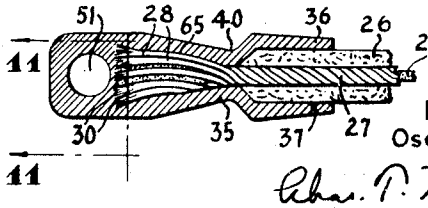
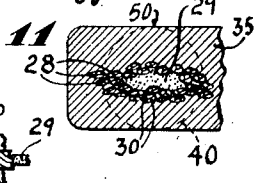


FIG. 11



INVENTOR
OSCAR V. PAYNE

Richard T. Hawley

ATTORNEY

Patented Dec. 8, 1942 2,304,194

UNITED STATES PATENT OFFICE

2,304,194

HARNESS CORD FOR LOOMS

Oscar V. Payne, Leicester, Mass., assignor to Crompton & Knowles Loom Works, Worcester, Mass., a corporation of Massachusetts

Original application July 8, 1940, Serial No. 344,311. Divided and this application November 29, 1940, Serial No. 367,695

7 Claims. (Cl. 24—123)

This is a division of my co-pending application Serial No. 344,311, filed July 8, 1940.

This invention relates to loom harness cords and the method of their manufacture and it is the general object of the invention to provide a simple durable connection between the harness cord proper and the part to which it is connected, such as the loom shedding mechanism of the harness frames.

Looms customarily employ a plurality of vertically reciprocating harness frames provided with heddles through which groups of warp threads pass to permit the formation of successive sheds. The harnesses are controlled by some form of shedding mechanism, such for instance as a dobby, having levers movable back and forth between extreme positions under control of a pattern mechanism. Each harness frame customarily corresponds to one of the levers and is connected to it by flexible cables or so-called harness cords which pass over sheaves supported in the arches of the loom.

It is an important object of my present invention to provide a harness cord having a steel cable core to the ends of which are attached heads or terminals which during the course of manufacture are subjected to a pressure which causes the metal of the heads to flow around the individual strands of the cable core.

It is a further object of my present invention to provide a cord terminal into which the cable extends to have increasingly tight holding engagement with the head the farther it projects thereinto. The purpose of this feature of my invention is to avoid subjecting one point of the core to all the stress imposed on the strands and distribute the stress over a considerable length of the strands.

It is a further object of my present invention to provide a harness cord terminal which in its original form is conical and provided with a central cylindrical bore into which the core is extended. During the compressing operation the wide part of the cone is subjected to considerable deformation to insure close contact with the strands, but the parts of the head of lesser diameter are subjected to relatively slight pressure so that their engagement with the strands is sufficiently loose to permit a limited motion of the strands with respect to the head adjacent the point where the cable enters the head. In the process of compressing the terminal the bore remains substantially cylindrical at one end where the core enters it, but the outer end of the bore is flattened into a fan-shaped recess of oblong cross-section in which the ends of the strands are spread out to provide close frictional contact between the metal of the terminal and all, or almost all, of the strands.

It is a further object of my present invention to provide a harness cord having a cable core through the center of which extends a flexible cord of textile fabric. In the spreading operation I find that the textile cord serves as a cushion which prevents breakage of the several strands.

With these and other objects in view which will appear as the description proceeds, my invention resides in the combination and arrangement of parts hereinafter described and set forth.

In the accompanying drawing, wherein a convenient embodiment of my invention is set forth,

Fig. 1 is a front elevation of part of a loom having a harness cord made according to my present invention,

Fig. 2 is an enlarged elevation of a cord made according to my present invention,

Fig. 3 is a vertical section on line 3—3 of Fig. 2,

Fig. 4 is a vertical section on line 4—4 of Fig. 3,

Fig. 5 is a longitudinal section through a cable terminal before attachment to the harness cord,

Fig. 6 is an end view taken in the direction of arrow 6, Fig. 5,

Fig. 7 is a diagrammatic view showing the method by which the cable is secured to the head,

Fig. 8 is a plan view of the terminal as formed in Fig. 7, looking in the direction of arrow 8, Fig. 7,

Fig. 9 is an enlarged vertical section on line 9—9, Fig. 8,

Fig. 10 is an enlarged longitudinal section on line 10—10, Fig. 7, and

Fig. 11 is a transverse section on line 11—11, Fig. 10, on an enlarged scale.

Referring to the drawing, particularly Fig. 1, the loom frame 10 supports arches 11 having a series of harness jacks 12, one being shown, movable about a pivot 13 carried by the arches. Each lever is provided with notches 14 into one of which is fitted a connector 15. The arch supports a series of sheaves 16 and wires 18 and 19 lead from the connector toward the center of the loom to be connected to harness frames 20, one of which is shown. It is to be understood that there will be a jack, a sheave and a harness frame for each group of warp threads to be controlled in the loom and that pattern mechanism not shown determines the order in which the

several levers or jacks 12 are rocked on the pivot 13. The matter thus far described is of common construction and of itself forms no part of my present invention.

The wires 18 and 19 are connected to their respective harness frames by so-called harness cords which are trained over the sheaves 16. My present invention relates to the harness cords, and more especially to the terminals thereof which afford means for attaching the wires 18 and 19 to the harness frames.

In carrying my invention into effect I provide a cord 25 which includes a braided external sheath 26 of textile fibers, surrounding a steel cable 27 formed of a series of individual strands 28 within which is inclosed a flexible core 29 made preferably of textile fibers. If preferred, each of the strands 28 may in turn be formed of a series of filaments 30 twisted together. While I have described the textile core 29 I do not wish necessarily to be limited to a steel cable containing such a core, but as will be pointed out hereinafter the core 29 possesses advantages.

Both ends of the harness cord will be substantially the same and will be attached to a terminal designated generally at 35. In preparing the terminal I provide the same with a contour as indicated in Figs. 5 and 6. In its blank or original form the terminal has a shell 36 with a cavity 37 of sufficient diameter to receive the braided sheath 26. Leading inwardly from the cavity 37 is a bore 38 preferably cylindrical throughout its length and of a diameter to establish a snug fit with the core 29. The blank is formed with a neck 40 from which the blank tapers with increasing diameter to the left as viewed in Fig. 5 to provide a rounded end 41 the diameter of which is considerably greater than the diameter of neck 40. The blanks destined to form the terminals 35 can conveniently be made as machine screw products and are formed of a steel chosen for its ductility and strength. The blank will preferably be substantially circular in all sections at right angles to its axis.

When attaching the terminal to the cable I remove a portion of the sheath 26 from the cable 27 and project the extended bare end of the cable into the bore 38, at the same time fitting the braided sheath 26 into the cavity 37. That part of the cable projecting beyond its braided sheath will be of substantially the same length as the bore 38. The terminal blank is then subjected to pressure by a hammer 45 which exerts a downward force on the blank while resting on an anvil 46. During the pressing operation the rounded end 41 is flattened to the form shown in Figs. 3 and 4, changing from the original shape indicated in dotted lines in Fig. 7 to that shown in full lines in that figure. The hammer 45 will ordinarily be stopped in its descent when it is above the anvil 46 by a distance substantially equal to the diameter of the neck 40, hence the neck will not be deformed appreciably. Since the blank is of conical form the degree of deformation is variable and increases with the diameter of the blank, that part of the metal adjacent to the left end of the cable 27 as viewed in Fig. 7 being forced into close and intimate contact with the strands 28 and filaments 30, while the cable passes loosely through the neck 40. By this relationship the contact between the terminal and the cable 27 is built up gradually so that there is no pinching or subjugation of the cable to a high compressive force at that point in its length which is adjacent the right end of the bore 28 as viewed in Fig. 5. The shell 36 can then be crimped as at 60 to establish holding relation with the braided sheath 26 either at the time of flapping the head or at a subsequent operation.

The operation as already described provides the terminal with flat surfaces 50 which are broader than the maximum diameter of the original blank. A hole 51 may be drilled through the flattened terminal for the reception of the hooked ends of the wire 18 or hook 17 on top of the harness frame.

When the cable is formed with the core 29 the latter has a cushioning effect and serves to spare the strands undue shock during the compressing operation. The textile cord 29 also serves to make the harness cord as a whole more flexible as it bends around the sheave 16.

By cutting off a part of the flattened end of the terminal I have been able to determine the effect of the compressing operation on the several strands of the cable. It is found that the cable takes the general fan-shaped form indicated at 65 in dotted lines in Fig. 8. The strands in their original form are of helical form and the general helical curvature preserved, although modified as shown in Fig. 10. At a point adjacent to the neck 40 the diameter of each helix is approximately that of the cable 27, but in the flattening consequent on the application of pressure certain of the strands spread out to have a helical curvature of greater diameter while other strands, particularly those near the axial center of the terminal, have a very much reduced helical diameter. The metal of the terminal is found to be compressed between adjacent strands, and indeed in many instances between filaments. Those strands which lie at the ends of the oblong sections shown for instance in Fig. 3, are found to lie in between curved ridges formed by flowing of the metal of which the terminal is formed around said strands. These curved ridges offer considerable resistance to endwise movement of the strands out of the terminal. Under tests for tensile strength it is found that the strands ultimately break at a point between the neck 40 and the widest part of the fan, showing that there has been no objectionable pinching at the neck and that the contact between the terminal metal and the ends of the strands is so tight as to cause breakage of the latter before the strands can be pulled out of the terminal.

From the foregoing it will be seen that I have provided a simple form of terminal for loom harness cord wherein the stranded cable in the center of the cord extends into the terminal and is spread fan-shaped to have close contact with parts of the terminal which are forced around it under pressure. It will also be seen that the blank from which the terminal was formed is of conical shape with the greater diameter of the cone spaced from the point of entry of the cable into the bore 38, thereby permitting the strands and terminal to come gradually into close contact with each other as the cable projects into the terminal. It will also be seen that the pressing operation does not materially effect the neck 40 and that the thickness of the flattened terminal is substantially the same as the diameter of the neck. It will further be understood that the cord 29 acts as a cushion to prevent objectionable abrupt engagement between adjacent strands of the cable during the pressing operation. Furthermore, I have provided a simple process for forming the terminals which in-

cludes in its steps the formation of a conical blank and subsequent pressing to spread the cable strands and at the same time provide flat parallel sides without injury to the cable at its point of entry into bore 38.

Having thus described my invention it will be seen that changes and modifications may be made therein by those skilled in the art without departing from the spirit and scope of the invention and I do not wish to be limited to the details herein disclosed, but what I claim is:

1. In a flexible cable having a metallic terminal at one end thereof, said cable comprising a plurality of metallic wire strands extending loosely into the terminal at one end thereof and having an engagement with the interior of the terminal which becomes progressively tighter in a direction extending away from the point of entry of the cable into the terminal toward the opposite end of the terminal.

2. In a flexible cable having a terminal made of steel, said cable comprising a plurality of steel wire strands which project into the terminal at one end thereof, the strands being held to the interior of the terminal in varying degrees of tightness which increases progressively in a direction from that end of the terminal which the cable enters toward the opposite end of the cable.

3. In a flexible cable having a metallic terminal, said cable comprising a plurality of metallic wire strands which project loosely into the terminal at one end thereof, portions of the interior of the terminal extending into close fitting contact with the circumferential peripheries of the strands in varying degrees, the degrees of lesser engagement being nearer said one end of the terminal and the degrees of greater engagement existing at points along the strands farther from said one end.

4. In a flexible cable having a metallic terminal, said cable comprising a plurality of metallic wire strands which project loosely into the terminal at one end thereof, the cable at the point of entry into the terminal being substantially circular in cross section and the strands being spread apart as they progress into the terminal to have a collective width greater than the diameter of the cable, the interior parts of the terminal having engagement with the strands, the degree of closeness of engagement between the interior of the terminal and the strands increasing as the collective width increases.

5. In a flexible cable having a terminal at one end thereof, the cable extending into the terminal and comprising a plurality of textile fibers extending centrally of the cable, the strands entering the terminal loosely at one end thereof and having a variable degree of closeness of engagement with the interior of the terminal which increases in a direction away from the point of entry of the cable into the terminal, said strands within the terminal lying in a plurality of layers and the textile fibers lying between certain of said layers within the terminal, said textile fibers contributing to the flexibility of the cable at the point of entry thereof into the terminal.

6. In a flexible cable having a terminal at one end thereof, the cable projecting into the terminal and comprising a plurality of wire strands which surround a core of textile fibers extending centrally of the cable, the cable being substantially circular in cross section at the point of entry into one end of the terminal and progressing toward the other end of the terminal in directions such that the cross section of the space occupied collectively by the strands at a point adjacent to the other end of said terminal is wider than the diameter of the cable and of less thickness than the diameter of the cable, the strands being arranged in a plurality of layers and the textile fibers extending between the strands of different layers, and the strands having holding engagement with the interior of the terminal, said textile fibers contributing to the flexibility of the cable at the point of entry thereof into the terminal.

7. A flexible cable having a metallic terminal at one end thereof, said cable including a plurality of metallic wire strands which enter the terminal at one end thereof, the cable at the point of entry into said one end of the terminal being substantially circular in cross section and entering the terminal freely and the strands progressing into the cable away from said one end in directions such that a cross section of the space occupied collectively by the strands at a point remote from said one end of the terminal is of greater width than the diameter of the cable and of less height than the diameter of the cable at the point of entry into the terminal, the interior of the terminal having engagement with the strands which become progressively closer and closer measured in a direction away from said one end of the terminal.

OSCAR V. PAYNE.