WIRE ROPE AND METHOD OF MAKING SAME

Alfred F. Meger, Yardley, Pa., assignor to CF&I Steel Corporation, a corporation of Colorado
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This invention relates to the preparation of the end of a wire rope to aid in applying the rope to devices such as sheaves, pulleys etc., with which the rope is to be used. More particularly, the invention relates to arrangement of a loop, or the mounting and securing of a loop of smaller wire rope, usually referred to as a becket loop, on the end of a wire rope, usually of large size, to enable the rope to be "reeved," that is, pulled into position throughout a system of sheaves or the like in association with which the rope is to operate.

In reeving the rope it is manipulated or hauled by its end by a winch line, also referred to as a tag line, or other hauling cable. Insomuch as wire rope may be as large as 5" in diameter it will be understood that its weight per unit length is considerable and that a heavy pull is exerted on the hauling cable during the reeving operation. The purpose of a becket loop, or simply a becket, is to facilitate the connection of the haul line, or winch line, to the end of the wire rope, and it is understood that the becket loop and its connection to the wire rope must have sufficient strength for the handling and reeving of the rope, but are in no sense as strong as the rope itself, and usually do not form a part of the wire rope.

The invention relates both to the method of arranging or securing a becket loop on the end of the wire rope, and to the structural combination of the end portion of the wire rope and the becket loop. The becket loop may be made of the core of the wire rope but more often is made of a separate piece of small wire rope. Such becket loop includes a loop portion of some convenient size such as for example about 10 to 15 inches in length and 4 or 6 inches in width, in its natural unstressed state. To this loop portion a tail or shank portion is attached, which usually is about as long as the eye or loop portion. The becket loop, customarily is made of a single piece of wire rope of very much smaller diameter than the main wire rope which it is to handle.

A conventional becket loop would be made of wire rope which is some ½ inch or ¾ inch in diameter, depending upon the size of the rope to which it is to be attached and the diameter of the core of this rope. One end portion of a piece of small rope of the desired diameter is bent into loop form and the end of the loop connected to the tail portion of the becket in any suitable manner. A customary way of doing this is by means of a sleeve or collar of metal, which is placed around both the upper portion of the shank or tail of the becket and the end of the portion which forms the loop, and serves to clamp these firmly together. A collar or sleeve is also compressed about the lower end of the becket tail portion so as to form an enlargement at this location for a purpose which will appear later. The enlargement may also be formed in other ways, as for example by means of a weld button.

The wire rope to which the becket loop is to be applied is first opened up at its end by unwinding the rope strands in at least two groups so as to expose the core of the rope. Such unwinding will extend for a distance somewhat greater than the length of the becket tail portion. A portion of the core rope is then cut off at a point distant from the end of the rope slightly more than the length of the becket tail portion. The end of the cut-off core and these strands are rewound about the tail portion of the becket thereby positioning such tail portion in line with the core of the rope.

At least one, and preferably two metal, or other, sleeve members are then placed about the rope to enclose or surround both the rope strands and the becket tail portion somewhat nearer the rope end than the sleeve or other enlargement on the end of the tail portion, and these sleeves are compressed so that their outside diameter is approximately the same as the diameter of the wire rope.

It is very important that any end attachment used in reeving a rope shall not exceed the normal rope outside diameter, since this could easily prevent the rope from entering drum attachment holes or clamps or cause a rope to jump out of a sheave groove made for a specific diameter rope.

The presence of the enlargement or bulge at the end of the becket tail portion serves as an interference point greatly reducing the possibility of the becket assembly being separated from the rope. A becket assembly can only pull out of the rope end if all sleeves are removed.

The sleeve or sleeves which form a loose fit with respect to the wire rope before they are compressed, may be slipped over the rope before the becket is applied and then moved outwardly into position after the becket is applied as above described. Also if desired, such sleeve or sleeves may be slipped on to the end portion of the rope after the becket has been applied, by squeezing the sides of the becket loop in order to allow the sleeves to pass over it.

When the becket is made of the main rope core, a considerable length of the strands of the rope itself must be cut off and discarded, leaving exposed a sufficient length of core from which to form the becket loop. A sleeve is applied and compressed so as to evenly transfer the stress from the core to the rope strands.

The invention will be further described in connection with the accompanying drawings. Referring to these drawings:

FIG. 1 shows the preferred form of wire rope and becket loop assembly;
FIGS. 2, 6, 7 and 8 show different forms of becket loops;
FIGS. 2, 3, 4 and 5 show the successive steps in making the assembly shown in FIG. 1;
FIGS. 9 and 10 show a variation of the becket loop;
FIG. 11 is a central longitudinal section of the lower portion of the assembly shown in FIG. 5 but drawn to an enlarged scale;
FIG. 12 is a section on line 12—12 of FIG. 11;
FIG. 13 is a view similar to FIG. 11 with the parts in their final positions; and
FIG. 14 is a section on line 14—14 of FIG. 13.

Referring to FIG. 1 the wire rope 1 has applied to its end portion a becket loop 2 (FIG. 2) which has an eye portion 3 and a tail portion 4. This form of becket is what is known as a Flemish eye in which the eye portion 3 is formed by separate strands of the wire rope from which the becket is made and which is very much smaller in size and strength than the wire rope 1. These strands are arranged in two groups and laid over each other to form the eye, and the ends of the groups are then carried beneath a metallic or other sleeve 5 which is compressed and thereby secures the ends of such strands to the upper end of tail portion 4. At the lower end of tail portion 4, a second and smaller sleeve 6 is applied by compression which forms the metal on the interior of the sleeve into the interstices of the tail portion 4 so that sleeve 6 is firmly secured thereto.

After providing the becket 2, the first step in mounting the becket on the end of the wire rope 1 is to place two sleeves 7 and 8 of metal or suitable plastic material loosely
over the wire rope and allow them to slide along the rope as shown in FIG. 2 to a position away from the end portion of FIG. 1. The next step is to separate the strands of rope 1 into groups, two such groups 9 and 10 being shown in FIG. 3. This exposes the core 11 of the rope, and a section is cut off as at a in FIG. 4. As shown in FIG. 4, tail portion 4 is now entwined with the strands of one of the strand groups 9 or 10, and with the lower end of tail portion 4 and sleeve 6 spaced somewhat from the end of core 11, sleeve 5 of the becket being placed close to the end of the strand groups 9 and 10.

The two sleeves 7 and 8 are now slid upwardly along the wire rope 1 from the positions shown in FIG. 2 to the positions shown in FIG. 5 and also in FIG. 1. As mentioned previously sleeves 7 and 8 may be slid over the eye 3 of the becket if desired. The upper sleeve 7 is positioned close to the end of wire rope 1 and sleeve 8 is spaced below it but with its lower edge somewhat above the end of core 11.

Sleeves 7 and 8 are now compressed and reduced in diameter as shown in FIG. 1 to the point where their outside diameters are approximately the same as that of the wire rope 1. This may be done by means of a hydraulic press, a rotary swaging apparatus or by means of an explosive charge, or in any other convenient manner. The use of a compression sleeve or sleeves near the end of the rope ties the main rope strands together as a unit. These sleeves or rings transfer any pulling load from the becket assembly to the main rope strands without unbalancing the rope. This is accomplished by pressure and friction, equally loading the main rope strands.

The reduction in diameter of the sleeves 7 and 8 is made possible by the squeezing together of the rope strands and the tail portion 4 of the becket loop, but principally by the deformation of the rope strands beneath the sleeves. This is illustrated in FIGS. 11-14. In FIGS. 11-12 the lower portion of lower or inner sleeve 8 is shown in its original diameter, and a certain amount of space is indicated between the surface of tail portion 4 and the interior of wire rope 1.

In FIG. 12, while the 6 strands 13 are in contact with one another, a considerable amount of space exists between the surfaces of these strands and the interior surface of sleeve 8. After compression however, as shown in FIG. 14 the strands 13 have each been deformed so that the outer sides are in engagement with one another over a considerable radial distance instead of merely being tangent to one another. The spaces between these strands and the interior surface of sleeve 8 has been very reduced.

In FIG. 13 it will be seen that the diameter of sleeve 8 is substantially the same as that of wire rope 1. This figure also shows how the metal of the various strands 13 is compressed over the upper end of becket sleeve 6 as indicated at 14. Hence the likelihood of the pull on becket tail portion 4 being sufficient to disable sleeve 6 is extremely remote.

In FIGS. 1, 2 and 5 it is shown that the lower end of becket sleeve 5 is tapered as indicated at 15. In compressing the upper sleeve 7 its upper end is advantageously forced upwardly and over the tapered portion 15 as shown in FIG. 1 producing a tapered portion 16 on the upper end of sleeve 7. Such tapering of the sleeve covering the nose of rope 1 is advantageous as the taper 16 serves to effect point against the becket sleeve 5 and reduces the possibility of damage of the becket assembly wires or strands by transferring side loads from the becket sleeve to the main rope sleeve 7. Such tapered portion also provides a smooth transition from the becket to the rope thereby reducing the possibility of the rope catching on a sharp corner when reeving.

FIG. 6 illustrates a two-part becket 17 in which the shank or tail portion consists of two sections of the becket rope material secured together at the bottom of the loop by a binding 18 and at the bottom of the tail portion by a compressed sleeve 19.

FIGS. 7-8 show return loop becket 20 and 21 in which the becket eyes 22 are formed by bending the upper portion of the becket loop material into a loop and securing it to the tail portion 23 by means of a compressed collar 24. Becket 20 of FIG. 7 is provided with an enlargement at its lower end in the form of a weld button 25 which takes the place of sleeves 5 or 19. Weld button 25 is formed by folding together the strands of the lower end of the tail portion 23 and adding sufficient weld metal to produce the enlargement 25. Becket 21 of FIG. 8 has the usual sleeve 26 and is similar to sleeve 6 at its lower end.

It will be understood that any of these beckets or becket loops shown in FIGS. 6, 7 and 8 may be used in place of the Flemish eye becket shown in FIG. 1. Also any other desired form of becket may be used.

FIGS. 9 and 10 illustrate a becket loop which is formed from the core of the wire rope itself. FIG. 9 shows a step-in making this end formation and FIG. 10 shows the completed becket loop 27 which has been formed from a section of the core 28 of the wire rope 29 which has been left projecting from the end of the rope by severing therefrom the end portion of the strands 30 of the rope. The end of the loop has been brought to a point adjacent the end of the rope and secured thereto by means of a compressed sleeve 31. A sleeve 32 similar to sleeves 7 and 8 is placed over rope 29, and in FIG. 10 is shown as having been compressed to a diameter approximately the same as that of the rope. Also in compressing sleeve 32 its upper end portion has been extended to sleeve 31 in the form of a tapered portion 33.

Where wire ropes are provided with a core member of steel wire an adequate becket loop can be constructed as above described. This method of providing the becket loop however has the disadvantage that a considerable amount of the rop strands must be thrown away in order to expose a sufficient length of core to form the becket. Consequently this method of making a becket loop is more expensive than the method previously described in connection with FIGS. 1-8.

I claim:
1. The method of securing a becket loop to the end of a wire rope which comprises unwinding the end portion of the rope and with one hand to expose the end portion of the rope core for a length greater than the tail portion of the becket loop, removing a length of the exposed core which is somewhat longer than the becket loop tail portion, rewinding the rope strands about the tail portion with the tail portion in line with the core, positioning at least one sleeve member surrounding the rewound strands and tail portion, and compressing the sleeve member to approximately the same diameter as the wire rope.
2. The method as set forth in claim 1 which includes providing an enlargement on the inner end of the becket loop tail portion, and placing such enlargement beyond the inner end of the sleeve member.
3. In combination, a becket loop having a tail portion with an enlargement at the inner end thereof, and a wire rope the core of which extends to a point short of the end portion of the rope, the becket tail portion being disposed at the center of the wire rope end portion in line with the core, at least one sleeve member surrounding the wire rope and the becket tail portion, said tail portion having an enlargement located between the inner end of the sleeve member and the core end, and the sleeve member having approximately the same diameter as the wire rope.
4. The combination set forth in claim 3 in which the strands of the rope within the sleeve member occupy ap-
proximately the entire space between the becket tail portion and the inner surface of the sleeve.

5. The combination set forth in claim 3 in which the diameter of the becket tail portion is approximately the same as that of the core of the rope.

6. The combination set forth in claim 3 in which the becket loop has a sleeve joining the loop portion, and the adjacent sleeve on the wire rope has a tapering portion extending to the becket sleeve.

7. In combination, a wire rope having a becket loop projecting from its end, the connecting portion of said loop with the wire rope extending axially into the wire rope, centrally of the strands thereof, and a sleeve member surrounding the end portion of the wire rope, said sleeve member being compressed to approximately the same diameter as the wire rope thereby causing said connecting portion beneath the sleeve to be brought into close association with the strands of the rope so as to transfer the pull of the becket loop evenly to the rope strands.

8. The combination as set forth in claim 7 in which the connecting portion between the becket loop and the wire rope is a portion of the wire rope core.

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FRANK J. COHEN, Primary Examiner.
DONALD WATKINS, Examiner.