Oct. 3, 1961 D. C. FRATE ET AL 3,002,779

GRAPPLES

Filed Aug. 25, 1958 2 Sheets-Sheet 1

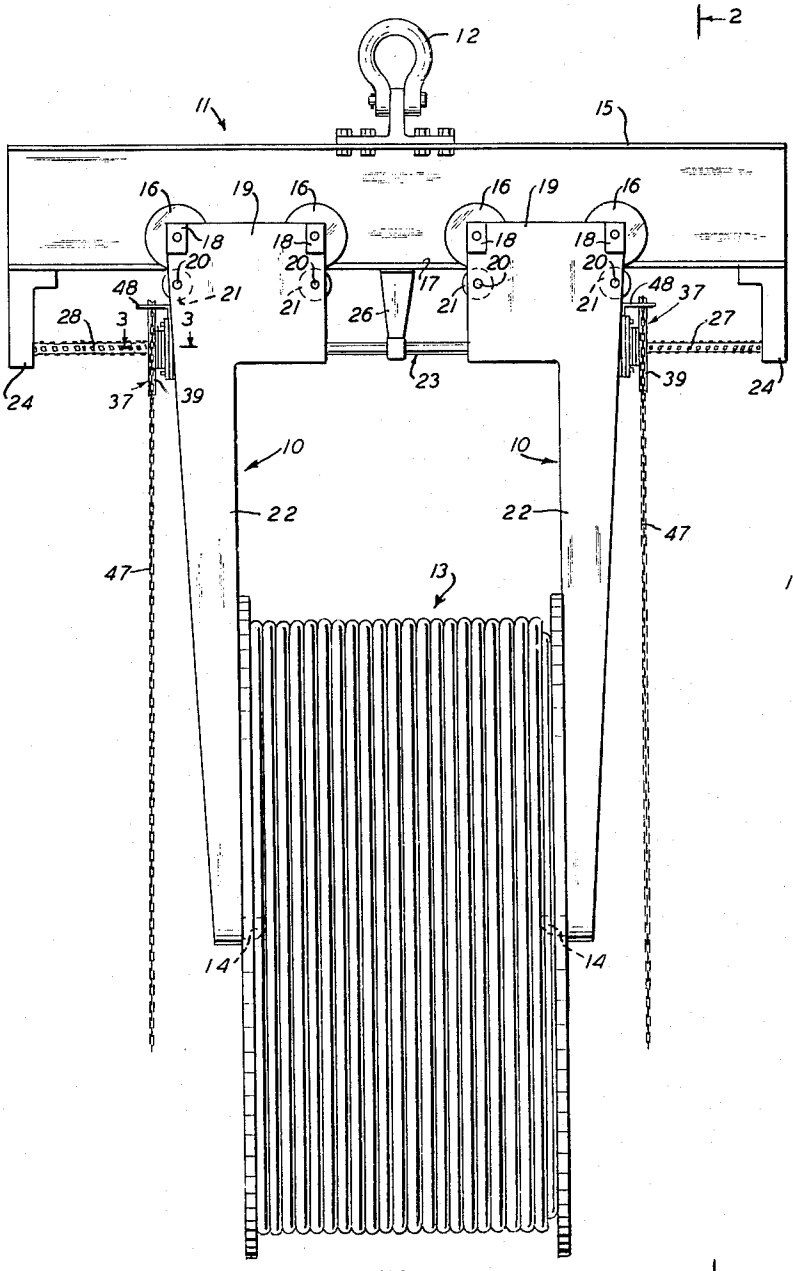

FIG. 1

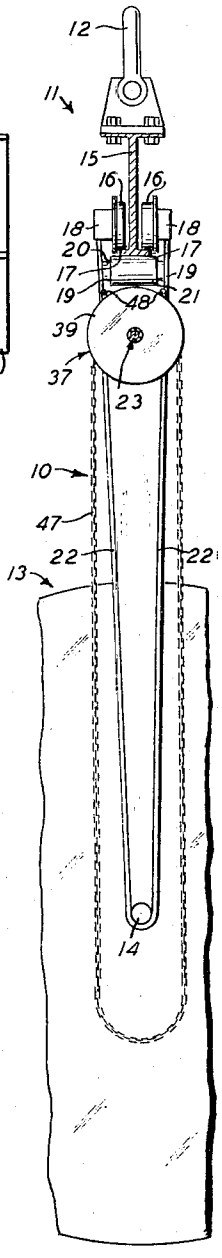

FIG. 2

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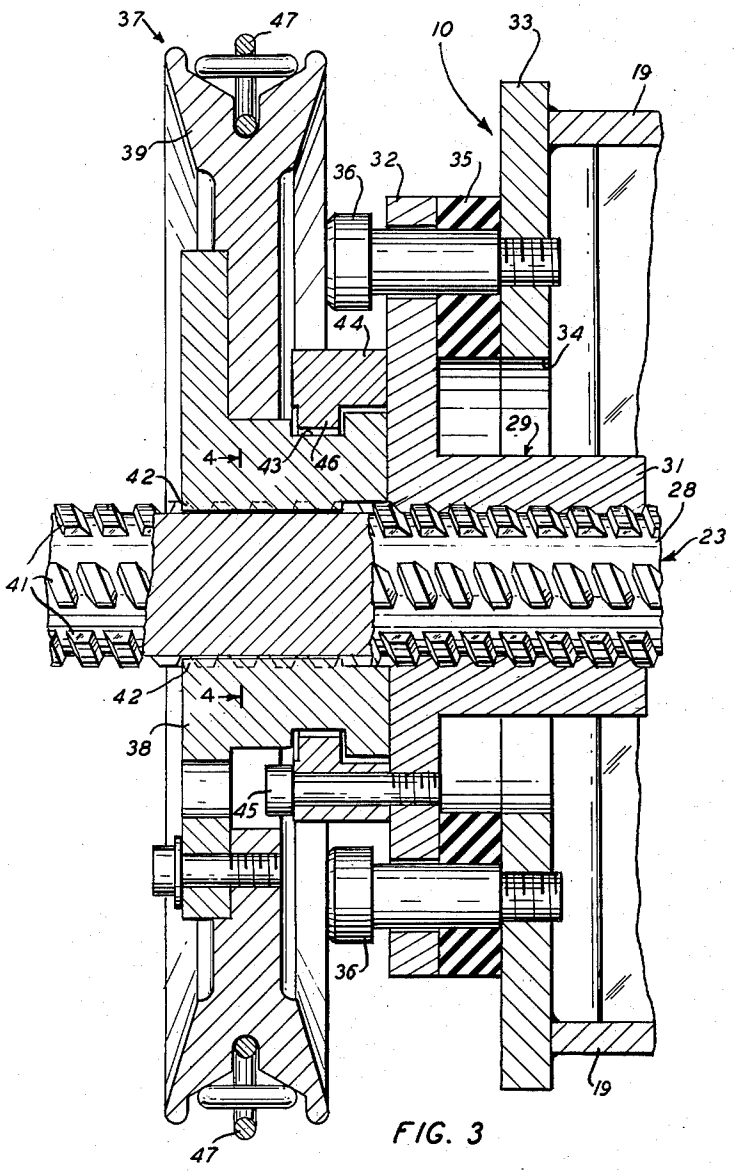

FIG. 3

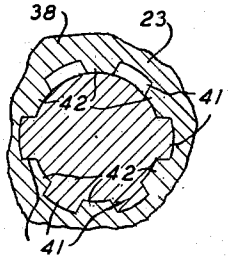

FIG. 4

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GRAPPLES

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2 Claims. (Cl. 294—67)

The present invention relates generally to grapples, and more particularly to grapples having opposing jaws for carrying an article wherein external forces applied to the jaws are substantially not transmitted to a mounting means for the jaws and to grapples having a pair of pulleys, either one of which may be employed for moving the jaws.

An object, therefore, of the present invention is to provide a new and improved grapple.

Another object of the invention is to provide a grapple having opposing jaws for carrying an article, wherein external forces applied to the jaws are substantially not transmitted to the mounting means for the jaws.

A further object of the invention is to provide an improved grapple wherein a pair of pulleys are provided, either one of which may be rotated to move the jaws.

A grapple, illustrating certain features of the invention, may include a rotatable shaft having oppositely threaded portions and a pair of nuts received on the oppositely threaded portions of the shaft. A pair of opposing jaws are provided having lower portions designed for engaging opposite sides of an article to be carried by the grapple. Resilient means are provided for mounting the jaws to the nuts near the upper ends of the jaws so that external forces applied to the jaws are substantially not transmitted to the nuts and shaft. Means are provided for rotating the shaft in order to move the jaws toward and away from each other to clamp and unclamp the article. The resilient mounting means may preferably comprise a pair of rubber-like washers positioned between a pair of flanges extending from the nuts and a pair of apertured plates formed near the top of the jaws.

The rotating means may include a pair of rotatable pulleys mounted on the shaft and designed for rotating the shaft upon rotation of either one of the pulleys. Means may be provided for connecting each of the pulleys to a jaw adjacent thereto so that the pulleys travel along the shaft with the jaws during the rotation of the pulleys. The pulleys and shaft may be formed with meshing splines so that the shaft is rotated when one of the pulleys is rotated, yet the pulleys may slide along the shaft. A pair of bearing members are secured to the jaws, having portions which interlock with portions of the pulleys so that the pulleys are constrained to travel along the shaft with the jaws, yet may rotate with respect thereto.

Other objects and advantages of the invention will appear from the following detailed description of a specific embodiment thereof, when read in conjunction with the appended drawings, in which:

FIG. 1 is a front elevation of a grapple embodying the invention;

FIG. 2 is a right side elevation of the grapple illustrated in FIG. 1, partially in vertical section taken generally along the line 2—2 of FIG. 1;

FIG. 3 is an enlarged, fragmentary horizontal section, taken generally along the line 3—3 of FIG. 1 in the direction of the arrows, and

FIG. 4 is a vertical section, taken generally along the line 4—4 of FIG. 3 in the direction of the arrows.

Referring now in detail to the drawings, and in particular to FIGS. 1 and 2, the grapple includes a pair of opposing jaws, designated generally by the numerals 10—10, mounted for movement toward and away from each other on a supporting structure, designated generally by the numeral 11. The supporting structure 11 is provided with a shackle 12 at the top thereof, which may receive a hook (not shown) of a conventional overhead crane to allow travel of the entire grapple assembly consisting of the supporting structure 11 and the jaws 10—10, as well as any article carried between the jaws 10—10. The grapple is illustrated as carrying a cable reel, designated generally by the numeral 13.

The jaws 10—10 may be moved toward each other to clamping positions, illustrated in FIG. 1, wherein a pair of opposing lugs 14—14 formed at the lower extremities of the jaws 10—10 engage the hubs of the reel 13 (or other apertures in the article to be carried) so as to clamp the reel 13 between the jaws 10—10. The overhead crane is then operated in conventional fashion to elevate the clamped reel 13, transport the same to a desired location, and then lower the same to the ground or other support at the new location. The jaws 10—10 are next moved apart to unclamp the reel 13 and the grapple assembly consisting of the supporting structure 11 and the jaws 10—10 is elevated and transported to another location to engage another reel or similar article. The general type of grapple and overhead crane unit just described are well known and are described, for example, in the Durhan, Jr., Patent 1,615,115.

The supporting structure 11 includes an I-beam 15 having the shackle 12 mounted at the top thereof, and on which the jaws 10—10 are supported for horizontal movement therealong. Each of the jaws 10—10 is provided with two opposing pairs of rollers 16—16 mounted near the top thereof, which are designed to roll along the upper surface 17 of the lower portions of the I-beam 15, as best seen in FIG. 2. The rollers 16—16 are journalled, one each in a plurality of bearing blocks 18—18, which are secured near the top of two opposing pairs of plate members 19—19, each pair constituting the upper portions of one of the jaws 10—10.

A pair of shafts 20—20 are rotatably mounted between each pair of the opposing plates 19—19, each shaft 20 being provided with a roller 21 in rolling engagement with the under surface of the I-beam 15, as best seen in FIG. 2. The lower rollers 21—21 are mounted directly under the upper pairs of rollers 16—16, as illustrated in FIG. 1, and are effective to prevent the jaws 10—10 from moving upward, as viewed in FIG. 1, thus retaining the jaws 10—10 in a fixed vertical position with respect to the I-beam 15 but allowing relative horizontal movement of the jaws 10—10 with respect to the I-beam 15. As illustrated in FIGS. 1 and 2, the opposing plates 19—19 are formed with downwardly extending arms 22—22, which taper together toward the bottom of the figure and between which are secured the article-supporting lugs 14—14.

A rotatable shaft, designated generally by the numeral 23, is provided and is journalled at its ends in a pair of bearing brackets 24—24 and at its center in a bearing bracket 26. All of the bearing brackets 24—24 and 26 are secured to and depend from the bottom of the I-beam 15, so that the shaft 23 is rotatably mounted a fixed distance therebelow. The shaft 23 is formed with a left-hand threaded portion 21 to the right of the center bracket 26 and a right-hand threaded portion 28 to the left of the center bracket 26. The jaw 10 at the left of FIG. 1 is threadedly received on the right-hand threaded portion 28 and the jaw 10 at the right of FIG. 1 is threadedly received on the left-hand threaded portion 27, so that the two jaws 10—10 may move in opposite directions, toward each other to clamp the reel 13 when the common shaft 23 is rotated in one direction and

away from each other to unclamp the reel 13 when the shaft 23 is rotated in the opposite direction.

Referring now to FIG. 3, illustrating particularly the means for mounting the jaws 10—10 on the threaded shaft 23, only the structure associated with the left-hand jaw 10 is shown, it being understood that similar but reversely mounted structure is provided for a right-hand jaw 10. A nut, designated generally by the numeral 29, is provided having internal threads formed in a body portion 31 thereof meshing with the threads formed along the left-hand portion 28 of the shaft 23. Due to the threaded connection, the nuts 29—29 travel along the shaft 23 upon rotation thereof.

The nut 29 is provided with a circular flange 32 extending radially outward from the threaded body portion 31. A connecting plate 33 having a central aperture 34 is welded between the opposing plates 19—19 of the jaw 10 at the left ends thereof, as viewed in FIGS. 1 and 3. The aperture 34 is made larger in diameter than the body portion 31 of the nut 29 but sufficiently small to allow portions of the plate 33 to be aligned with portions of the nut flange 32 when the jaw 10 is positioned so that the aperture 34 is located coaxially around the body portion 31 of the nut 29, as illustrated in FIG. 3.

A washer 35 of a rubber-like material, such as neoprene, and having an inner diameter equal to that of the aperture 34 and an outer diameter equal to that of the flange 32, is inserted between the flange 32 and the plate 33 coaxially around the body portion 31 of the nut 29. A plurality of shoulder screws 36—36, two of which are shown in FIG. 3, are provided for fastening the flange 32, the washer 35 and the plate 33 together so that the plate 33 and thus the jaw 10 secured thereto are resiliently connected to the nut 29 for horizontal movement therewith. As illustrated in FIG. 3, a slight clearance is provided between the body portions of the screws 36—36 and the flange 32 to allow movement of the jaws 10—10 with respect to the nuts 29—29.

This resilient connection between the jaws 10—10 and the nuts 29—29 is provided so that external forces applied to the jaws 10—10 are substantially not transmitted to the nuts 29—29 and the shaft 23. Any forces or impacts which might be received by the jaw 10 are absorbed by the washer 35, rather than acting through the screws 36—36 and the nut 29 to damage the threaded portion 28 of the shaft 23. Such impacts are commonly received, for example, when the grapple is carrying a reel to a new location, and the lower portions of one of the jaws 10—10 strikes a solid object tending to pivot the lower end of the jaw 10 toward the center, as viewed in FIG. 1. With the resilient connection provided, such impacts or blows are absorbed by the washer 35 without damage to the grapple. The resilient mounting also prevents binding between the nut 29 and the threaded portion 28 of the shaft 23 and thereby facilitates the rotation of the shaft 23.

The means for rotating the shaft 23 in order to clamp and unclamp the reel 13 includes a pair of rotatable pulleys, designated generally by the numerals 37—37, which are mounted on the shaft 23, one adjacent to each of the jaws 10—10 and toward the outer end of the shaft 23 therefrom. The shaft 23 may be rotated to move the jaws 10—10 by rotating either one of the pulleys 37—37, and each of the pulleys 37—37 is connected to the jaw 10 adjacent thereto so that it travels along the shaft 23 with that jaw during the rotation thereof.

As illustrated in FIG. 3 (with respect to the pulley 37 at the left of FIG. 1), the pulley 37 may be formed in two parts, a central hub 38 and an outer, annular chain wheel 39 secured coaxially therearound. The shaft 23 is formed with a plurality of raised splines 41—41 running longitudinally therealong (conveniently six, as illustrated in FIG. 4) for that distance over which the pulley 37 is expected to travel and splitting the threaded portion 28, as illustrated in FIG. 3. The inner periphery of the hub 38 is formed with a plurality of mating splines 42—42 therealong in mesh with those of the shaft 23, as seen in FIG. 4. Utilizing such a splined connection, any rotation imparted to either one of the pulleys 37—37 is transmitted to the shaft 23 in order to cause travel of the opposing nuts 29—29 and thus the jaws 10—10 in opposite directions therealong, and the other one of the pulleys 37—37 is constrained to rotate with the shaft 23.

The hub 38 of the pulley 37 is formed with a groove 43 running around the outer periphery thereof, and an annular bearing member 44 is provided, secured to the flange 32 of the nut 29 by screws 45 and having a circular rib 46 extending inwardly therefrom and received within the groove 43 to interlock the pulley 37 and the nut 29. The interlocking rib-and-groove connection allows rotation of the pulley 37 with respect to the bearing 44, and thus with respect to the nut 32 and the jaw 10, yet constrains the pulley 37 to travel longitudinally along the shaft 23 with the nut 32, which longitudinal movement is permitted by the splined construction described hereinbefore.

A pair of endless chains 47—47 are provided, which pass around the periphery of the chain wheels 39—39 so as to enable rotation of the pulleys 37—37 in well-known fashion by pulling on the chains 47—47. The chains 47—47 pass through a pair of guide members 48—48, which are secured to the jaws 10—10 and allow movement of the chains 47—47 in the direction of their lengths, while constraining them to travel along with the pulley 37, the nut 29 and the jaw 10. With this construction, the jaws 10—10 may be moved by pulling either one of the chains 47—47 to rotate a corresponding one of the pulleys 37—37. The provision of two chains 47—47, either one of which may be pulled to operate the apparatus, is highly desirable and allows operation in crowded places, wherein a single chain might be inaccessible or difficultly accessible but wherein the second chain provided herein might be clear and easy to manipulate. The provision of travelling chains, always adjacent to the jaws 10—10, facilitates the reel clamping and unclamping steps, since the operator pulling one of the chains 47—47 will be close to the reel 13 being worked on.

It will be manifest that this invention is not limited to the specific details described in connection with the above embodiment of the invention, but that various modifications may be made without departing from the spirit and scope thereof.

What is claimed is:

1. In combination with a grapple including a rotatable shaft having oppositely threaded portions on opposite sides of the center thereof and a pair of opposing jaws having lower portions designed for engaging opposite sides of an article to be carried by the grapple and having internally threaded apertures near the upper ends thereof received on the oppositely threaded portions of the shaft for longitudinal movement of the jaws toward and away from each other upon rotation of the shaft; the improvement which comprises a pair of rotatable pulleys mounted on the shaft, one adjacent to each of the jaws and toward the outer end of the shaft therefrom, said pulleys having splines formed around the inner periphery thereof, the threaded portions of the shaft being provided with longitudinal splines therealong which mesh with those of said pulleys so that either one of said pulleys may be rotated in order to move the jaws and so that said pulleys are also free to move longitudinally along the shaft, and a pair of bearing members secured to the upper portions of the jaws and having portions which interlock with portions of said pulleys so that both of said pulleys are constrained to travel along the shaft with the jaws during the rotation of either one of said pulleys, yet so that said pulleys are free to rotate with respect to the jaws.

2. In combination with a grapple including a rotatable

shaft having oppositely threaded portions on opposite sides of the center thereof, a pair of nuts having internally threaded body portions received on the oppositely threaded portions of the shaft for longitudinal movement upon rotation of the shaft, and a pair of opposing jaws having lower portions designed for engaging opposite sides of an article to be carried by the grapple and having upper portions connected to the nuts for movement therewith; the improvement which comprises a pair of apertured plates secured one to the upper end of each jaw with the aperture received loosely and coaxially around the body portion of an associated one of the nuts, a pair of flanges one extending radially outward from the body portion of each of the nuts and overlapping portions of an associated one of said plates, a pair of washers of rubber-like material positioned one between each flange and plate, means for fastening said flanges, said washers, and said plates together so that the jaws are connected to the nuts for movement therewith but so that external forces applied to the jaws are absorbed by said washers and are substantially not transmitted therethrough to the nuts and shaft, a pair of rotatable pulleys mounted on the shaft, one adjacent to each of the nuts and toward the outer end of the

shaft therefrom, said pulleys having splines formed around the inner periphery thereof, the threaded portions of the shaft being provided with longitudinal splines therealong which mesh with those of said pulleys so that either one of said pulleys may be rotated in order to move the jaws and so that said pulleys are also free to move longitudinally along the shaft, and a pair of bearing members secured to the nuts and having portions which interlock with portions of said pulleys so that both of said pulleys are constrained to travel along the shaft with the nuts during the rotation of either one of said pulleys, yet so that said pulleys are free to rotate with respect to the jaws.

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