June 28, 1932. J. E. EVANS 1,865,362

DIE FOR COMPRESSING THE STRANDS OF WIRE ROPE

Filed Jan. 12, 1931 4 Sheets-Sheet 1

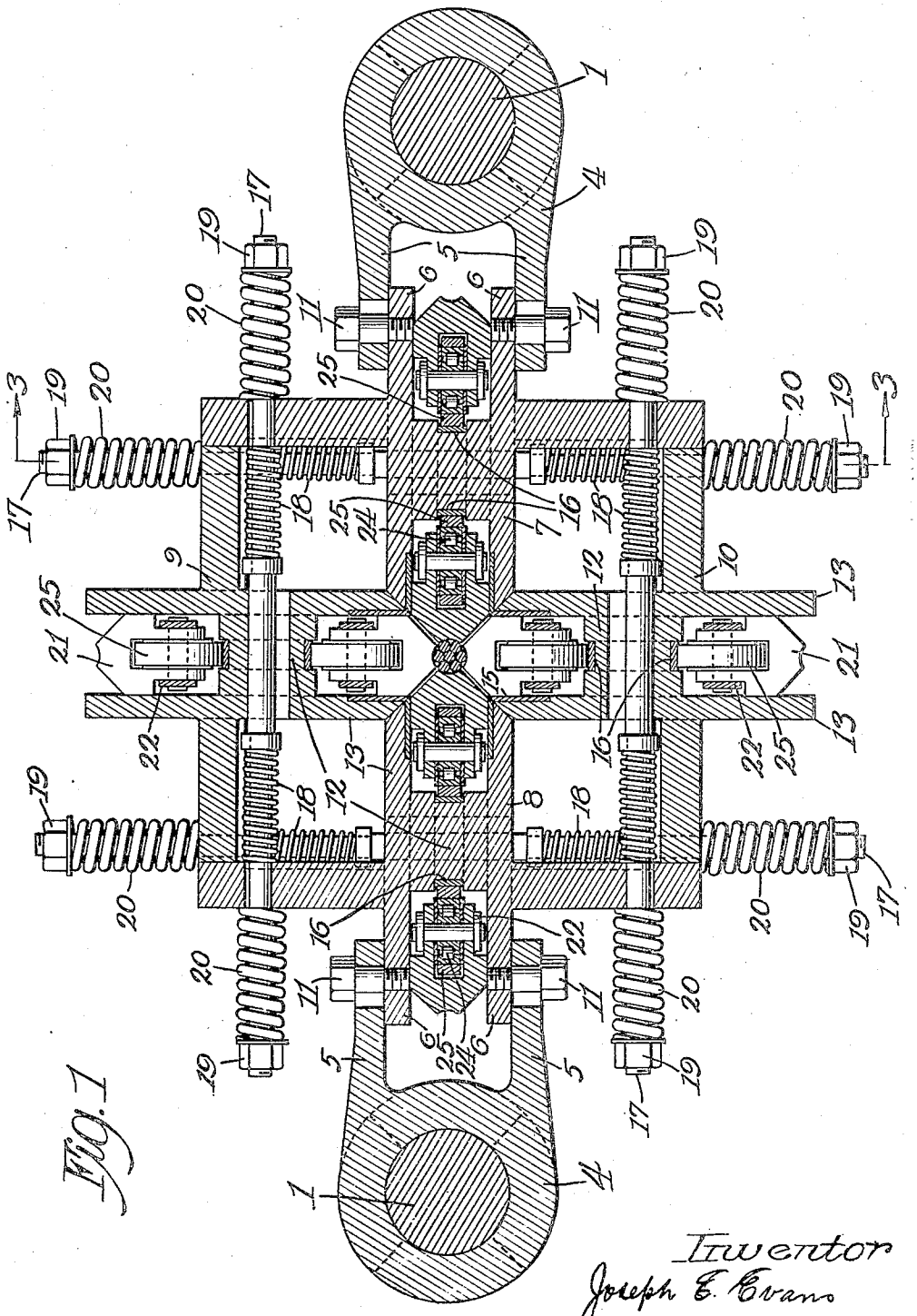


Fig. 1

Inventor
Joseph E. Evans
By Rector, Hibben, Davis & Macauley
Attys.

June 28, 1932. J. E. EVANS 1,865,362

DIE FOR COMPRESSING THE STRANDS OF WIRE ROPE

Filed Jan. 12, 1931 4 Sheets-Sheet 2

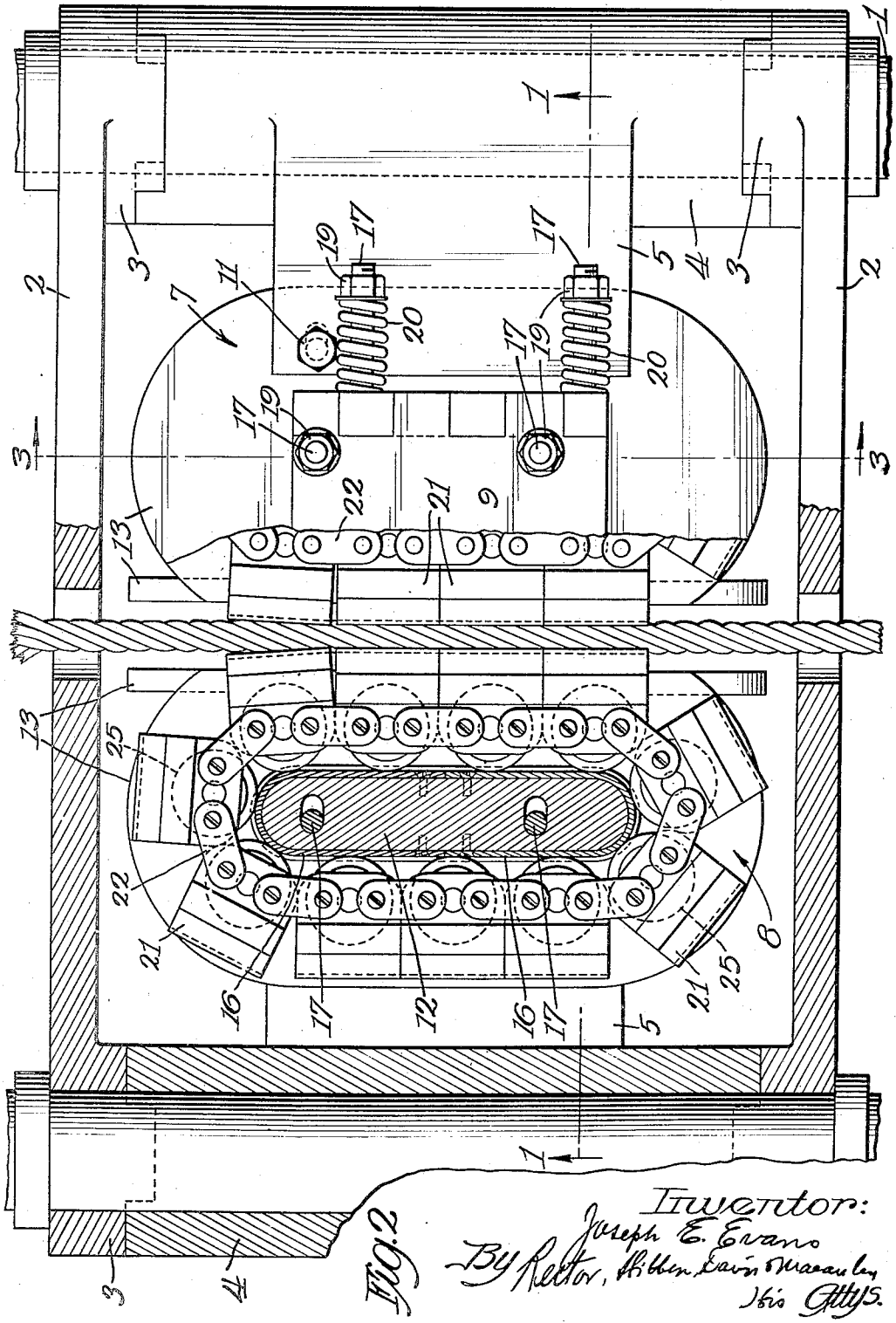


FIG. 2

Inventor:
Joseph E. Evans
By Rector, Hibben, Davis & Macauley
His Attys.

June 28, 1932. J. E. EVANS 1,865,362

DIE FOR COMPRESSING THE STRANDS OF WIRE ROPE

Filed Jan. 12, 1931 4 Sheets-Sheet 3

Fig. 3

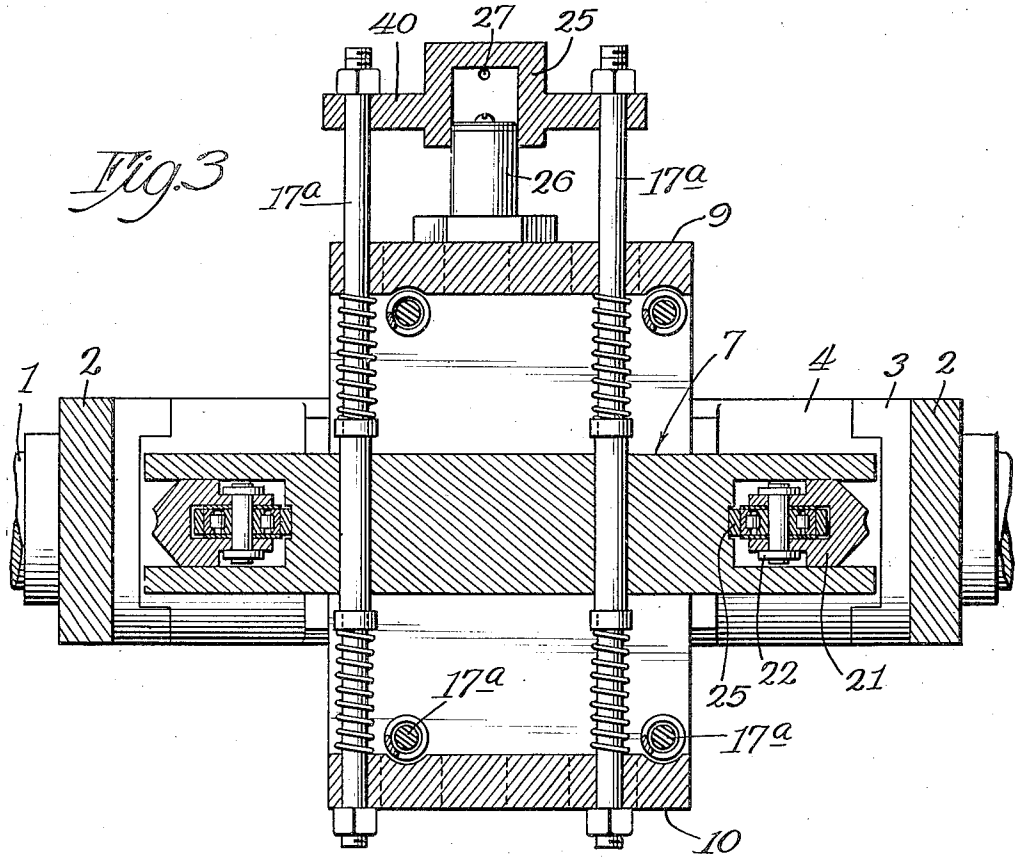
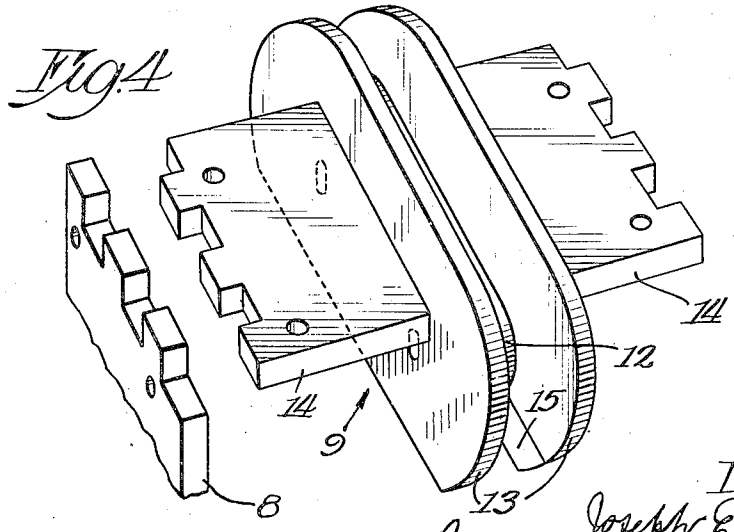


Fig. 4



Inventor
Joseph E. Evans
By Rector, Hibben, Davis & Macauley,
His Attys.

June 28, 1932. J. E. EVANS 1,865,362

DIE FOR COMPRESSING THE STRANDS OF WIRE ROPE

Filed Jan. 12, 1931 4 Sheets-Sheet 4

Fig. 5

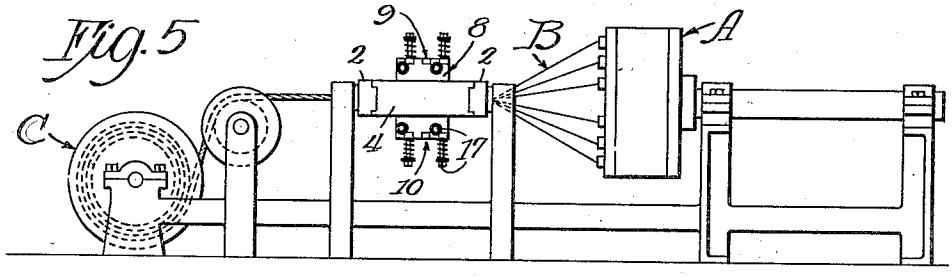


Fig. 6

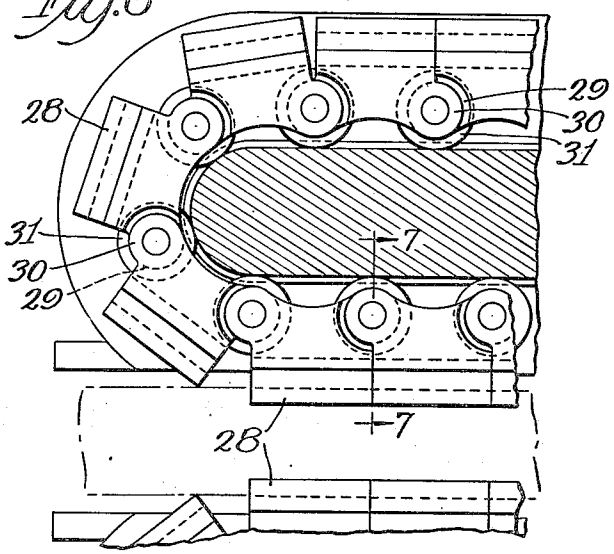


Fig. 7

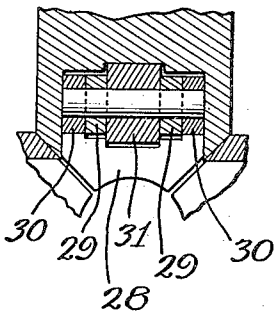


Fig. 8

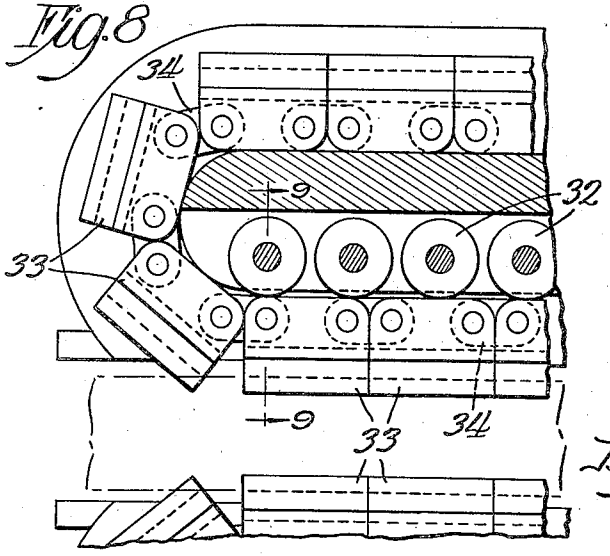
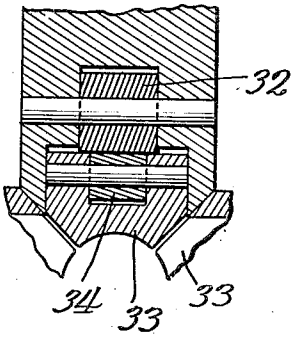


Fig. 9



Inventor
Joseph E. Evans
By Rector, Hibben, Davis & Macauley
His Attys.

Patented June 28, 1932 1,865,362

UNITED STATES PATENT OFFICE

JOSEPH E. EVANS, OF BEDFORD, INDIANA

DIE FOR COMPRESSING THE STRANDS OF WIRE ROPE

Application filed January 12, 1931. Serial No. 508,891.

My invention relates to a device for compressing and sizing the twisted group of strands of a wire cable as it is in process of manufacture and the twisted group passes to and is acted upon by the sectional multiple die elements of the device after leaving the rotating head which lays the separate strands together to form the cable. My present device may be regarded as a modification and improvement in certain respects of the multiple die compressing and sizing device described in Patent No. 1,759,105 granted to me on May 20, 1930, and certain objects of my present invention relate to the provision of means for quick and convenient shifting of the die elements radially away from the axis of the rope passageway and means for a ready centering of the elements when they are shifted back to working position in order that the strands of a cable may be easily threaded through the cable passageway of the device at the beginning of each operation of forming a cable. These objects I attain by means of a novel construction and arrangement of the frame and die-carrying members of the device, in connection with associated bolt and spring elements connected with them. Other objects relate to the provision of new and useful modifications in the form and arrangement of the sectional die elements of the device,—all as will be apparent from the description of the device hereinafter given. In the appended claims I have particularly pointed out the essential elements of my invention, it being understood however, that my invention is susceptible of embodiment in forms varying from those specifically described, and that I desire my claims construed to include formal modifications and variations in the way of substitution of equivalent elements which may come within the spirit and scope of my invention.

In the drawings, Figure 1 is a transverse, vertical section of my novel multiple-die compression device, the plane of the section being indicated by the dotted line 1—1 of Fig. 2.

Fig. 2 is a top plan view, partly broken away to show portions of the chains of connected die-blocks forming the rope passageway and parts of the frame members being shown in horizontal section;

Fig. 3 is a vertical section of a modified form of my invention, in a plane corresponding to that indicated by the dotted line 3—3 of Figs. 1 and 2;

Fig. 4 is a perspective of one of the die-carrying members of the device, detached, showing also a detached fragmentary portion of an interlocking similar member;

Fig. 5 is a simplified semi-diagrammatic view on a small scale showing the relation of the device to other parts of a cable-making machine;

Fig. 6 is a fragmentary side view of a modified form of connected die-blocks;

Fig. 7 is a transverse section of such modified form in a plane indicated by the dotted line 7—7 of Fig. 6;

Fig. 8 is a fragmentary side view corresponding to Fig. 6, but showing a different arrangement of parts for sustaining the stress upon a different form of connected die-blocks; and

Fig. 9 is a transverse view of the parts shown in Fig. 8 in a plane indicated by the dotted line 9—9 of said Fig. 8.

Like reference characters indicate like parts in all the figures of the drawings.

It will be understood that the particular construction of the wire rope-making machine is not material to my present invention excepting that it shall contain a suitable form of rotating head, marked A, in Fig. 5, carrying reels of wire from which the group strands B which enter into the rope are laid down spirally as they enter the multiple-die compressing device to which the present invention relates, the completed cable being

wound upon a drum or reel C which ordinarily is power-driven and serves to draw the strands and cable in process of being formed through the compression device.

My improved die is supported, in the present instance, upon two heavy horizontal frame bars 1—1 (see Figs. 1 and 2) which are stationarily supported by base frame members of any suitable construction. These bars 1 are connected by end plates or bars 2—2 formed adjacent their ends with side bosses 3 which are cut away to form segmental projections arranged to interlock with complementary projections formed on the tubular outer portions of a pair of supporting brackets 4, one at each side of the device, which engage the frame bars 1 intermediate the end bars 2. Each bracket 4 is formed with a pair of spaced horizontal inwardly-extending engaging portions 5—5 between which are arranged the outwardly-extending portions 6—6 of each of two horizontally opposite die-carrying frame members 7 and 8 of the device, these two frame members serving to support the device as a whole and having an interlocked yielding connection with a similar upper die-carrying member 9 and a lower die-carrying member 10.

As illustrated (see Figs. 1 and 2) the bolt holes which are formed in the engaging portions 5 of the supporting brackets to receive headed guide bolts 11 carried by the parts 6 of the die-carrying frame 7 and 8 are elongated to permit tensioned movement of such die-carrying members away from and back toward the axis of the device.

The four die-carrying members 7, 8, 9 and 10 (see Fig. 4,—also Figs. 1 and 2) are of similar construction and each has a central track portion 12, a pair of guide flanges 13—13, one on each side of the track portion, and a pair of opposite interlocking portions 14—14 extending outwardly from the flanges and at right angles to them. The outer edges of the portions 14 are mortised so that the tenons of the four members can be interlocked to form a generally rectangular frame structure yieldingly held together by springs and bolts in a manner later to be described. The inner edges of the guide flanges 13 are beveled or formed with inclined faces which in normal innermost position meet at joints extending radially of the rope passageway lying centrally between the four die-carrying members, and preferably, as shown, the inner face of the inner portion of each flange is provided with a wear plate 15 of hardened steel. The central or bearing portion of the portion 12 of the die-carrying members, which engages the rollers of the die members hereinafter described and is slightly depressed below the level of the portions on each side, may consist of separately-formed meeting track pieces 16 of specially hardened steel which abut against each other centrally and are secured by screws to the body of the portion 12, as shown in Fig. 2, or the track or bearing face of the portion 12 may be heat treated to impart wear-resisting qualities which will fit it to endure the severe service to which it is subjected.

The four members 7, 8, 9 and 10 are connected by bolts 17, arranged in four pairs, the members of each pair being spaced in such manner as to avoid interference with other pairs and passing through the interlocking portions 14 of two opposite die-carrying members,—the members 7 and 9, or 8 and 10,—near and just inside of the interlocking joints between two adjacent members, and also passing about centrally through the track portion 12 of the die-carrying member which lies between the particular portions 14 engaged by such pair of bolts. The orifices in the track portions 12 of the different die-carrying members formed to receive the bolts are elongated sufficiently to permit a limited degree of outward or radial movement of such members, and the bolt holes in the portions 14 have an easy sliding fit to permit freedom of movement.

The bolts 17, as illustrated—see Fig. 1,—are formed with a collar on each side of the track portion 12 of the die-carrying member centrally engaged by it, and between these two collars and the two interlocking portions 14 of the die carrying members on either side are arranged springs 18. On the opposite ends of each bolt 17, between the particular interlocking portion 14 and a nut 19 carried by the adjacent end of the bolt, are springs 20 which are much heavier and stronger than the springs 18. When the nuts 19 are turned up to normal position their stress is sufficient to overcome that of the springs 18 compressing the latter, and to yieldingly constrain the die-carrying members inwardly to an innermost position in which the beveled inner edges of the flanges 13 of such members will come into contact and the inner faces of the die member shortly to be described will form a rope passageway of a standard size. When the nuts 19 are unscrewed and pressure through the springs 20 released, it is obvious that the springs 18 will act to automatically spread the die-carrying members away from the axis of the device, to open up the rope passageway and permit the introduction of the strands of a new cable.

While I have illustrated and described above two springs 20 at each end of each bolt 17, it is manifest that but a single spring, if of adequate strength, may be employed, arranged at either end of the bolt, since in either case the effect is to stress the two connected die-carrying members towards each other. It is further evident that the members of each pair of bolts have a joint effect, and that this might be produced by a single bolt and

spring, or a pair of bolts and a single spring acting on both bolts.

The die members of the device (see Figs. 3 and 1) consist of four chains of die blocks 21, linked together by pairs of links 22. The die blocks have working faces cylindrically curved through an arc of almost 90°, from the edges of which the faces of the block are inclined upon faces which are closely adjacent radial planes passing through the axis of the rope passageway between the working faces of the blocks, as shown in Fig. 1. The rear side of each block is cut away centrally to provide space for the roller 23, and also at each side to provide space for the two pairs of links by which the block is pivotally connected to the adjacent blocks of the chain. Preferably, and as illustrated, the rollers are mounted upon roller bearings 24 though ordinary pivot bearings may be used if desired.

It will be understood that when the die-carrying members are in contact in innermost position, as illustrated in Fig. 1, the working faces of the die-blocks define a minimum rope passageway which will be the standard measurement for the rope being manufactured, but since it is usually desired by manufacturers that the rope shall vary, if at all, only in being a little oversize and the gauge of the wire used is such as to produce this result, it may occur that the die-carrying members will be slightly separated during most, or even all, of the time.

In Fig. 3, I have illustrated a modified form of my invention in which the elastic pressure means by which the die-carrying members are constrained to inner position consists of a cross-head 40 in which is formed a fluid pressure cylinder 25, and a piston 26 in said cylinder. The cross-head is connected to the end of each pair of connecting bolts, marked 17^a, at at least one end of the pair, and the piston is secured to the interlocking portion of the die-carrying member to which the particular cross-head member is adjacent. The cylinder communicates through a port 27 and a suitable pipe connection (not shown) with a source of liquid, such as oil or other suitable liquid, under pressure sufficient to exert the required stress, suitable control means being of course provided for releasing and admitting the pressure to the cylinders. It will be understood that the oil pressure line is intended to include a sufficient body of air, at the top of the piston or a high point in the line, or wherever convenient, to provide the required degree of elasticity in the pressure exerted: or if desired, compressed air may be employed to exert the required stress. Preferably and as illustrated, but one liquid pressure device is used for each pair of bolts 17^a, as for instance, the pairs corresponding to the two top pairs of bolts 17 and the upper and lower right-hand pair of bolts 17 shown in Fig. 1, the other ends of the pairs of bolts being equipped with nuts. Thus, with this arrangement but four cross-heads and associated cylinders and pistons will be required. It is of course obvious that a cylinder and piston can be used at each end of the several pairs of bolts, or more than one cylinder and piston employed acting on one cross-head, if desired.

In Figs. 6 and 7 of the drawings I have shown a chain of die-blocks of different construction than those hereinbefore described. These blocks, marked 28, are formed with pairs of registering bearing lugs 29 and 30 at the rear corner portions of each block, engaged by pivot pins by which they are directly pivoted together, the rollers 31 being also pivoted on said pin between the inner lugs. If desired the rollers may be mounted on roller bearings, as in the form of die members before described. As shown, the rear faces of the die blocks are cut away to provide clearance as the die-blocks pass around the ends of the track members.

I have also illustrated in Figs. 8 and 9, a still different arrangement of parts for sustaining the stress of the die-blocks on the rope. In this arrangement the die-carrying member of the device is provided on the side adjacent the rope passageway with a row of inset rollers 32 forming a track section upon which the inside or rear faces of the chain of connected die-blocks 33 and links 34 may ride during their traverse along the rope passageway, such faces sliding on the continuous face of the track between the rollers 32 and recessed portion of the track member.

It will be understood that my invention is applicable to the manufacture of cables from strands each consisting of a group of spirally coiled wires, and my invention relates equally to the formation of the cable strands from a group of wires, and the formation of a cable from a group of strands.

I claim:

1. In a wire rope making machine, a stationary die-supporting frame, a pair of horizontally spaced die-carrying members supported by said frame, upper and lower die-carrying members each interlocked with said first mentioned die-carrying members and having limited vertical movement with respect thereto, four endless chains of connected die elements mounted severally in said die-carrying members, said die elements being formed with cylindrically segmental working faces arranged to engage the rope and together form a rope passageway, elastic pressure means arranged to stress said pair of first-mentioned die-carrying members towards each other, and other elastic pressure means arranged to stress said upper and lower die-carrying members towards each other.

2. In a wire rope making machine, a sta-

tionary die-supporting frame, a pair of horizontally spaced die-carrying members supported by said frame, upper and lower die-carrying members each interlocked with said first mentioned die-carrying members said die-carrying members having a limited radial movement, four endless chains of connected die elements mounted severally in said die-carrying members, said die elements being formed with cylindrically segmental working faces arranged to engage the rope and together form a rope passageway, releasable elastic pressure means arranged to stress said pair of first-mentioned die-carrying members towards each other, weaker elastic pressure means tending to separate said pair of first-mentioned die-carrying members, other releasable elastic pressure means arranged to stress said upper and lower die-carrying towards each other, and other weaker elastic pressure means tending to separate said upper and lower die-carrying members; whereby when said releasable pressure means are operative said die-carrying members and dies will be constrained to innermost position and when said releasable pressure means are released said weaker elastic pressure means will automatically spread said die-carrying members and dies outwardly.

3. In a wire rope making machine, a stationary die-supporting frame, a pair of horizontally spaced die-carrying members supported by said frame, upper and lower die-carrying members each interlocked with said first mentioned die-carrying members and having limited vertical movement with respect thereto, four endless chains of connected die-elements mounted severally in said die-carrying members, said die-elements being formed with cylindrically segmental working faces arranged to engage the rope and together form a rope passageway, horizontal bolts engaging said pair of first-mentioned die-carrying members and springs connected with the outer ends of said bolts arranged to stress such die-members towards each other, weaker springs connected with inner portions of said bolts tending to separate such pair of die-carrying members, vertical bolts engaging said upper and lower die-carrying members and springs connected with the outer ends of said bolts arranged to stress said last mentioned die-carrying members towards each other, and other weaker springs connected with the inner portions of said bolts tending to separate such last mentioned die-carrying members.

4. A multiple-die compression device for a wire rope making machine according to claim 1 in which said die-carrying members each comprises a central track portion, and a pair of guide flanges, one on each side of the track portion, and a pair of interlocking portions disposed severally at right angles to said guide flanges, the outer ends of said interlocking portions being formed with complementary tenons and mortises.

5. In a wire rope making machine, a stationary die-supporting frame, a pair of horizontally-spaced die-carrying members supported by said frame and upper and lower die-carrying members connected with said horizontally spaced members, said die-carrying members each including a central track portion and a pair of guide flanges and a pair of interlocking portions formed with complementary tenons and mortises, upper and lower horizontal bolts respectively engaging upper and lower interlocking portions of said pair of horizontally-spaced die-carrying members, and also severally making slotted engagement with said upper and lower die carrying members, springs connected with the outer ends of said bolts arranged to stress said pair of horizontally-spaced die-carrying members towards each other, weaker springs tending to separate such die-carrying members, a pair of vertical bolts respectively engaging the interlocking portions of said upper and lower die-carrying members and also severally making slotted engagement with said pair of horizontal die-carrying members, springs connected with the outer ends of said vertical bolts arranged to stress said upper and lower die-carrying members towards each other, and other weaker springs tending to separate such last mentioned die-carrying members; said slotted engagement of bolts and die-carrying members being arranged to permit relative movement of the die-carrying members without disengagement of the mortise and tenon connection between them.

6. A multiple-die compression device for a wire rope making machine according to claim 3 in which the springs connected with the outer ends of the bolts are compression springs confined between terminal nuts on said bolts and portions of adjacent die-carrying members and the weaker springs are compression springs confined between abutments on said bolt and said portions of the adjacent die-carrying members.

7. In a wire rope making machine, a multiple-die compression device including a frame comprising a plurality of interconnected die-carrying members, said die-carrying members being formed with interlocking portions arranged to restrain relative movement parallel with the hereinafter mentioned rope passageway and permit relative movement toward and from said rope passageway, means for supporting said frame, a plurality of endless chains of connected die blocks carried by said die-carrying members and mounted to travel with their inner flights extending parallel with each other adjacent the center of the device, said die blocks being formed with cylindrically segmental working faces arranged to engage the rope and to-

gether form a rope passageway, and elastic pressure means arranged to stress said die-carrying members toward the rope passageway.

8. In a wire rope making machine, a multiple-die compression device including a frame comprising a plurality of interconnected die-carrying members, said die-carrying members being formed with interlocking portions arranged to restrain relative movement parallel with the hereinafter mentioned rope passageway and permit relative movement toward and from said rope passageway, means for supporting said frame, a plurality of endless chains of connected die blocks carried by said die-carrying members and mounted to travel with their inner flights extending parallel with each other adjacent the center of the device, said die blocks being found with cylindrically segmental working faces arranged to engage the rope and together form a rope passageway, spring pressure means arranged to normally constrain said die-carrying members toward the rope passageway, means for releasing said pressure, and weaker spring pressure means normally overbalanced by said first mentioned spring pressure means and arranged to automatically shift said die-carrying members away from the rope passageway when the pressure of said first mentioned means is released.

9. In a wire rope making machine, a multiple die compression device of the character described and having a plurality of supporting track members and a plurality of endless chains of connected die blocks arranged to travel around said track members, said supporting track members being each provided with a row of inset bearing rollers arranged in line along the center of its bottom face and forming a track section projecting therebelow, and said die blocks having cylindrically segmental working faces and having flat rear faces arranged to ride on said rollers during the travel of the blocks adjacent said roller track section and slide upon the continuous face of the track members throughout the remaining portion of their travel.

10. In a wire rope making machine, a multiple die compression device of the character described and having a plurality of supporting track members and a plurality of endless chains of connected die blocks arranged to travel around said track members, said die blocks having cylindrically segmental working faces and being each connected by pivot joints at opposite sides of the longitudinal center of the block with adjacent die-blocks of the chain.

11. In a wire rope making machine, a multiple-die compression device including a supporting frame, a plurality of die-carrying members supported by said frame, a like plurality of endless chains of connected die-blocks in said die-carrying members, said die-blocks having cylindrically segmental working faces arranged to form together a rope passageway extending centrally through the device, elastic pressure means acting normally to constrain the die-carrying members and associated chains of die-blocks into inner working position, weaker elastic pressure means normally overcome by said first-mentioned pressure means and tending to shift said die-carrying members and associated chains of die-blocks outwardly away from working position, and means for releasing said first-mentioned elastic pressure means.

12. In a wire rope making machine, a stationary die-supporting frame, a pair of horizontally spaced die-carrying members supported by said frame, upper and lower die-carrying members having limited horizontal and vertical movement relative to said horizontally spaced die-carrying members, four endless chains of connected die-blocks mounted severally in said die-carrying members, said die-blocks having cylindrically segmental working faces arranged to form together a rope passageway extending centrally through the device, pairs of horizontal bolts connected to said pair of first-mentioned die-carrying members, each pair of bolts being connected at one end at least by a cross-head, a fluid pressure cylinder and piston interposed between each said cross-head and the adjacent die-carrying member, pairs of vertical bolts connected to said upper and lower die-carrying members, each pair of bolts being connected at one end at least by a cross-head, a fluid pressure cylinder and piston interposed between each said cross-head and the adjacent die-carrying member, and means for admitting a supply of fluid under pressure to all said cylinders.

13. In a wire rope making machine, a stationary die-supporting frame, a pair of horizontally spaced die-carrying members supported by said frame, upper and lower die-carrying members having limited horizontal and vertical movement relative to said horizontally spaced die-carrying members, four endless chains of connected die-blocks mounted severally in said die-carrying members, said die-blocks having cylindrically segmental working faces arranged to form together a rope passageway extending centrally through the device, pairs of horizontal bolts connected at one end to one member of said first-mentioned pair of die-carrying members, the opposite ends of each such pair of bolts being connected by a cross-head, a fluid pressure cylinder and piston interposed between each said cross-head and the adjacent die-carrying member, pairs of vertical bolts connected at one end to one of said upper and lower die-carrying members, the opposite ends of each such last-mentioned pair of bolts being connected by a cross-head,

a fluid pressure cylinder and piston interposed between each such last-mentioned cross-head and the adjacent die-carrying member, means for admitting a source of fluid under pressure to all said cylinders, and elastic pressure means tending, to shift said die-carrying members and die-blocks outwardly away from said rope passageway, the stress of said pressure means being less than that exerted through said piston and cylinder.

In testimony whereof, I have subscribed my name.

JOSEPH E. EVANS.