Jan. 23, 1934. F. P. MANSBENDEL 1,944,251

SPLICING OR TYING OF ROPE OR THE LIKE

Filed May 28, 1932 2 Sheets-Sheet 1

Fig. 1.

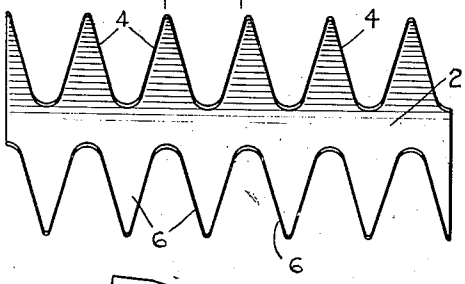


Fig. 2.

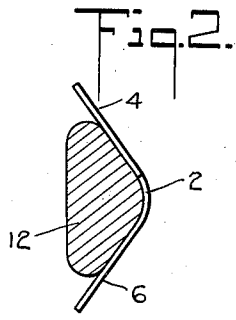


Fig. 3.

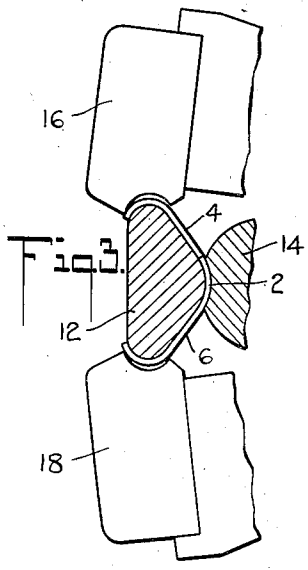


Fig. 4.

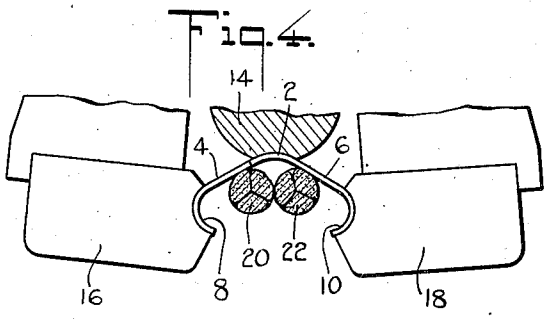


Fig. 5.

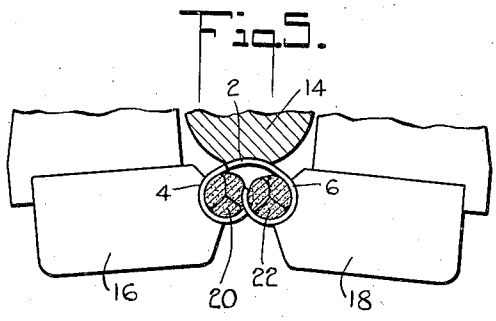


Fig. 6.

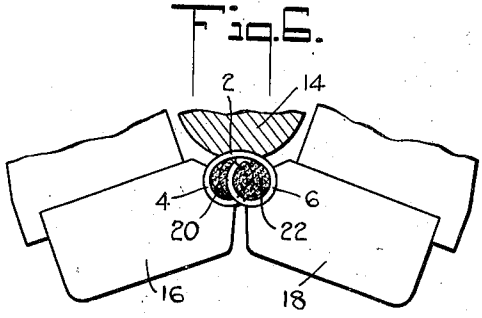
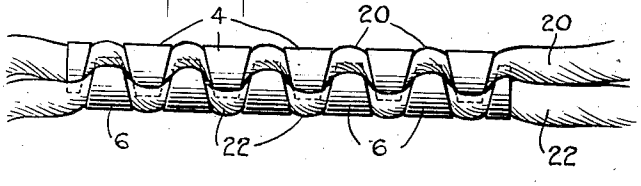


Fig. 7.



INVENTOR
Fritz P. Mansbendel
BY
James & Franklin
ATTORNEYS

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SPLICING OR TYING OF ROPE OR THE LIKE

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Fig.8.

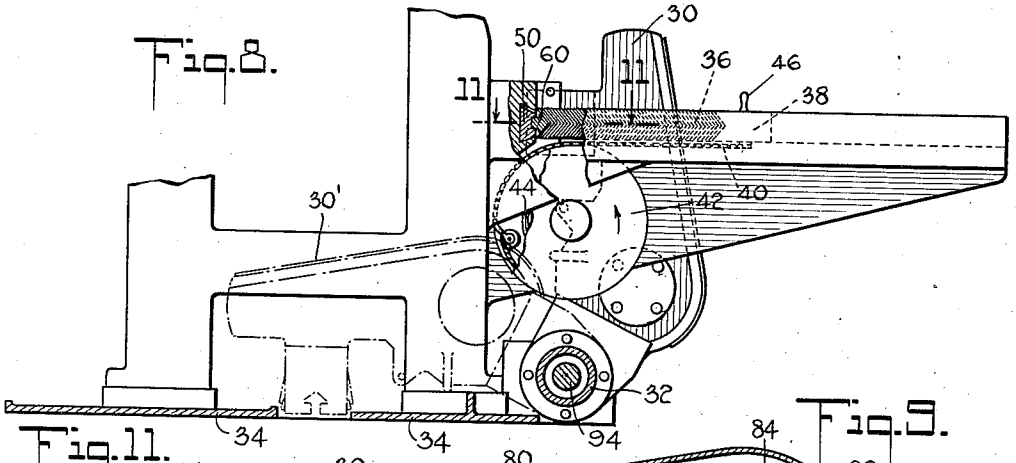


Fig.9.

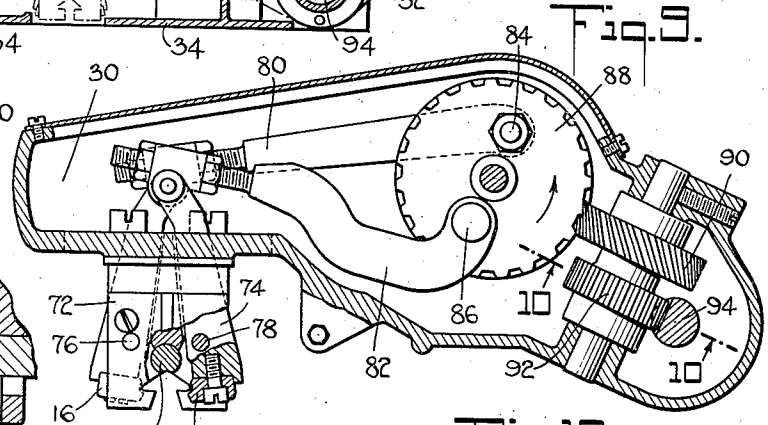


Fig.11.

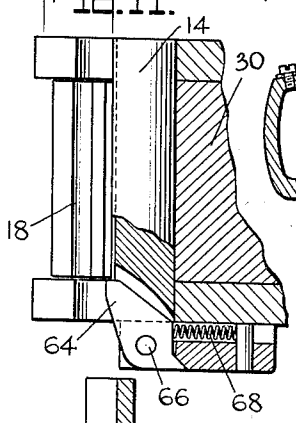
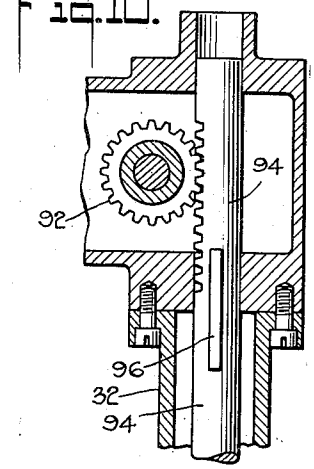


Fig.10.



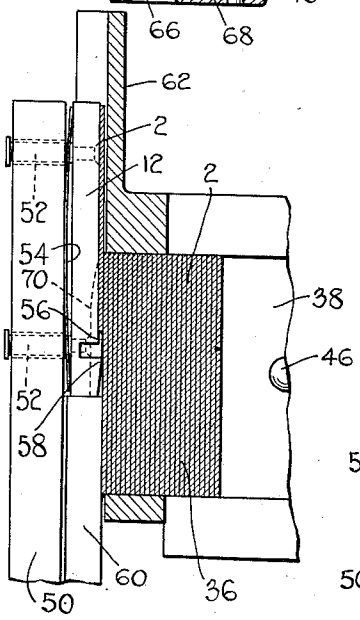
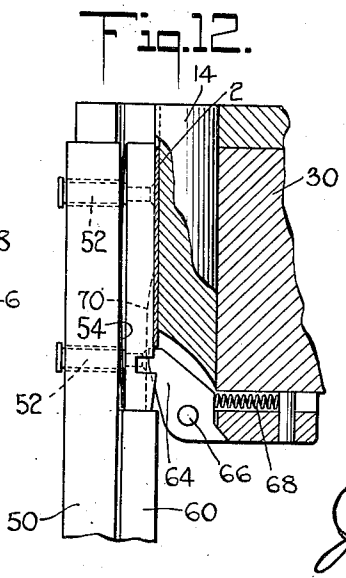


Fig.12.



INVENTOR
Fritz P. Mansbendel
BY
James & Franklin
ATTORNEYS

Patented Jan. 23, 1934 1,944,251

UNITED STATES PATENT OFFICE

1,944,251

SPLICING OR TYING OF ROPE OR THE LIKE

Fritz P. Mansbendel, New York, N. Y., assignor to Fred Goat Co. Inc., Brooklyn, N. Y., a corporation of New York

Application May 28, 1932. Serial No. 614,085

20 Claims. (Cl. 153—1)

This invention relates to a method of splicing or tying rope or the like, and to automatic bundling or tying apparatus for practicing the same.

It is frequently necessary to tie rope or the like in overlapping end to end relation. One example is when splicing the ends of rope in order to obtain increased length. A more common example is for tying rope around bundles, packages, and so forth.

The primary and general object of the present invention resides in the provision of a new and improved method and apparatus for splicing rope or for tying bundles as aforesaid, in a quick and expeditious manner resulting in a tie or splice of great strength substantially equal to the tensile strength of the rope itself. More specifically, the present invention centers about the use of a sheet metal clip or fastener provided with oppositely directed spurs or fingers arranged in alternation; and in accordance with the present invention such a clip is placed over the overlapping ends of the rope to be spliced or tied, and the fingers are then crimped and curled so that the fingers at one side of the fastener curl around one of the ropes, while the fingers on the other side of the fastener curl around the other of the ropes. At this stage of the operation, the fingers may, if desired, be curled sufficiently tightly around each of the ropes as to provide a grip thereon, but this feature is entirely optional. After the fingers at each side of the clip have been curled around each of the ropes separately, the clip is then additionally crimped or compressed in order to bring the alternate curled fingers on each side thereof into interlaced or interlocked relation. This causes each of the ropes to assume a wavy or sinuous formation as it weaves in and out of the fingers of the clip or fastener, and results in the desired permanent and strong locking together of the ends of the rope. At the same time, by making the clip of relatively pliable metal, the resulting joint will not be rigid, but rather will be bendable, particularly in view of the fact that the central portion or backbone of the clip is relatively narrow. This yieldability of the fastener is exceedingly important when tying heavy bundles, because when the bundle is lifted by the rope, the clips tends to bend, and if this is not permitted the connection is either weakened or the rope cut by the metal fastener. The provision of such a desirable bendable connection constitutes another feature and object of my invention.

Considered in its apparatus aspect, a general object of the present invention resides in the provision of means for receiving, handling, and operating upon metallic clips, with a view to practicing the above described method. More specifically, some of the objects of my invention are to provide a magazine for receiving and stacking a considerable number of metallic clips or fasteners; to provide feed means for transferring the clips singly to an appropriate crimping or clamping head; to provide crimping means for preliminarily as well as finally bending the fingers of the clip, the preliminary crimping being such as to insure the desired subsequent curling operation of the fingers around the separate ropes to be spliced; to provide means permitting the clips to be in a relatively flat or sheet-like form when stored in the magazine, so that a large number may be stacked in a relatively small space; and to form integrally with the aforesaid feed means a member acting as a core or anvil for insuring exact bending of the fingers of the clip during the preliminary crimping operation.

Still further objects of my invention reside in the provision of crimping means acting in the nature of a three-point support, the body of the clip being supported by a fixed back bar, while the fingers of the clip are operated upon by oppositely movable jaws so related to the back bar as to cause the desired curling action while permitting the back bar to take the reaction of the jaw pressure; the provision of operating means for the crimper jaws in the form of one or more oscillatable cranks which approach dead-center as the crimping jaws are closed, in order to provide a maximum closing force or compression at the end of the operation, so as to make possible the desired interlock of the alternate fingers of the clip; the provision of crimper jaws and operating mechanism therefor on an oscillatable arm or head which may be oscillated between a loading position at the supply magazine, and a tying position at the top of the bundle to be tied; and the provision of operating mechanism for actuating the jaws independently of the position of oscillation of the head, said mechanism including means preferably in the form of a reciprocable rack extending concentrically through a hollow shaft carrying the oscillatable head.

To the accomplishment of the foregoing and such other objects as may hereinafter appear, my invention consists in apparatus for splicing or tying rope or the like and the elements thereof, as well as the method, and their relation one to the other, as hereinafter are more particularly described in the specification and sought to be

defined in the claims. The specification is accompanied by drawings, in which:

Fig. 1 shows a clip or fastener suitable for practicing the invention;

Fig. 2 is an end view of the same as borne against by the anvil of the feed mechanism;

Fig. 3 shows the same at the completion of a preliminary crimping operation around the anvil;

Fig. 4 illustrates how the still-open clip is placed over a pair of ropes to be spliced;

Fig. 5 shows the curling over of the fingers at each side of the clip around each of the ropes as the jaws are closed;

Fig. 6 illustrates a further stage in the practice of the invention;

Fig. 7 is a plan view of a joint, tie, or splice produced by my invention;

Fig. 8 is a partially sectioned elevation of a part of a bundling machine embodying features of my invention;

Fig. 9 is a vertical section through the oscillatable head of the machine;

Fig. 10 is a detail taken in the plane of the line 10—10 in Fig. 9;

Fig. 11 is a partially sectioned plan view of the feed mechanism and crimping mechanism in loading position; and

Fig. 12 is a similar view during retraction of the feed bar.

Referring to the drawings and particularly Fig. 1 thereof the present invention is preferably practiced by utilizing a clip or fastener such as is there shown, said clip or fastener being made of a somewhat pliable sheet metal and comprising a central strip or backbone section 2 bearing on each side thereof outwardly or oppositely directed spurs or fingers 4 and 6, the fingers 4 on one side of the clip being arranged in alternation with the fingers 6 on the opposite side of the clip, that is, each of the fingers 6 is located opposite the spaces between the fingers 4, and, conversely, each of the fingers 4 is located opposite the spaces between the fingers 6, all as is readily evident from an inspection of the drawings.

Viewed in side elevation, the clip is preferably in the form of a relatively flat or open V, as is clearly evident from an inspection of Fig. 2 of the drawings. This shape, or, even more preferably, a wholly flat shape for the clip, is preferred in order to permit the same to be arranged in closely stacked relation, as is indicated, for example, in Fig. 8 of the drawings.

From the standpoint of the actual method of the invention as applied directly to a pair of ropes to be spliced, the clip more preferably takes the form shown in Fig. 4, in which the ends of the fingers 4 and 6 are preliminarily curled, as is indicated at 8 and 10. For this purpose the relatively flat V-shaped clip shown in Fig. 2 is preliminarily crimped or bent around an anvil such as the anvil 12 shown in Figs. 2 and 3. Thus, in Fig. 3, the clip 2 is preferably supported between the anvil 12 and a reaction bar or back bar 14, while the ends of the fingers 4 and 6 are bent around the curved upper and lower edges of the anvil 12 by a pair of oppositely movable clamping or crimping jaws 16 and 18. This preliminary bend of the fingers 4 and 6 is so designed with relation to the movement of the jaws 16 and 18, that continued bending and curling over of the fingers may thereafter be obtained without the use of any intermediate or supporting member such as the anvil 12. Consequently, anvil 12 may be removed, as by sliding the same longitudinally from the clip, and the latter, under the continued three-point support of back bar 14 and jaws 16 and 18, may be moved as desired and, for example, may be placed over rope ends 20 and 22 arranged in parallel juxtaposition, as is shown in Fig. 4 of the drawings.

Continued movement or squeezing together of the jaws 16 and 18 causes the preliminarily curled ends 8 and 10 to continue to roll over upon themselves and around each of the ropes 20 and 22, as is shown in Fig. 5 of the drawings. At this point, it may be mentioned that the length of the fingers of the clip is preferably determined by and in relation to the periphery of the ropes 20 and 22, so that when the clip is finally fully compressed, the fingers each extend entirely around each of the ropes. It may further be mentioned that the curvature of the fingers in relation to the size of the rope may be so chosen that each of the ropes is gripped by the curled finger even when the ropes are still left in side by side position as shown in Fig. 5. This feature, however, is optional and is relatively unimportant, for the true grip upon and locking together of the ropes is obtained as next described in connection with Figs. 6 and 7.

Continued compression or squeezing together of the fastener 2 by the jaws 16 and 18 causes the sides of the fastener to move toward one another in interlacing or interlocking relation in a manner best shown in Figs. 6 and 7, Fig. 6 showing the position of the jaws and back bar substantially at the end of the crimping operation, and Fig. 7 showing the resulting joint or tie. It will be observed from inspection of Fig. 7 that the rope 20 is surrounded and clamped by the fingers 4; that the rope 22 is surrounded and clamped by the fingers 6; and that the fingers 4 and 6 have been forced into interlocking relationship so that the fingers 4 jam or wedge the rope 22 outwardly, while the fingers 6 jam or wedge the rope 20 outwardly. The ropes 20 and 22 are each waved or corrugated so that they weave through and around the alternate succeeding fingers of the metallic clip. The compression of the clip may be carried to the point where the clip becomes substantially cylindrical and only slightly greater in diameter than either of the ropes which are spliced together. The interlocking connection obtained may be made fully equal in tensile strength to the tensile strength of the rope itself. At the same time, it should be noted that inasmuch as the metallic splice is made up of many small or severed metallic elements interconnected only at the relatively narrow strip or backbone portion 2 of the clip, the resulting splice is yieldable or bendable, which is of the utmost importance for many purposes.

A preferred form of apparatus embodying features of my invention is shown in greater detail in Figs. 8 through 12 of the drawings. The three-point support crimping mechanism already described in preferably carried at the end of an oscillatable head 30 oscillatable between a substantially vertical loading position shown in full lines in Fig. 8, and a substantially horizontal tying position shown in broken lines in Fig. 8. The head 30 oscillates about the axis of and is oscillated by a hollow shaft 32. The complete bundling machine is not disclosed herein, but by way of explanation it may be briefly pointed out that the plate 34 is stationary and is at the top of the mechanism for handling the bundle itself which may, for example, be a bundle of newspapers.

The bundle is surrounded with a rope by appropriate mechanism, and is held upwardly against the plate 34. The head 30 in the meantime is in its loading position where it receives a clip from a magazine 36. The clip also preferably undergoes the preliminary crimping operation described in connection with Fig. 3 of the drawings. Head 30 carrying with it the preliminarily crimped clip then oscillates downwardly to the position 30' where the ends of the rope surrounding the bundle are surrounded by the clip and locked together by completion of the crimping or compression of the clip, as was described in connection with Figs. 4 through 7. The rope end may then be severed, the jaws released, and the head 30 oscillated upwardly to be again loaded with a new clip.

The magazine 36 comprises appropriate bottom and side guide walls or rails for receiving and supporting a complete stack of clips 2, as will be evident from an inspection of Figs. 8 and 11 of the drawings. The upper wall of the magazine may be left open inasmuch as the magazine is arranged horizontally, and this facilitates the insertion of a fresh supply or stack of clips. The stack of clips is slidable within the magazine and is urged toward the forward or feed end thereof by an end block or pusher block 38 which is itself slidable in the magazine and is urged toward the feed end thereof by a draw chain 40 secured to and wound upon a rotatable drum 42 carrying within it a coiled spring 44 which tends to rotate the drum in a direction indicated by the arrow. A handle 46 on the block 38 facilitates drawing the block backwardly when a new supply of clips is to be placed in the magazine. At its opposite or feed end, the stack of clips bears against a horizontally reciprocable feed bar 50 shown in section in Fig. 8 and in plan in Figs. 11 and 12.

Referring to Fig. 11, the feed bar 50 is shown at the beginning of a feed operation, that is, after it has reciprocated toward the head 30 for a part of its stroke. It will be observed that the feed bar is preferably provided with a yieldable member 12 for bearing against the clip. This member is preferably the anvil member 12 already referred to in connection with Fig. 3 of the drawings. It is held on the main feed bar 50 by a pair of pins 52, but these permit a limited self-adjusting movement of the anvil 12. A flat leaf spring 54 is positioned between the main feed bar 50 and anvil 12 in order to urge the same in the direction of the clip being moved. The rear portion of anvil 12 is provided with appropriate means in the form of lugs 56 and 58 for bearing against the end or trailing edge of the clip and sliding the same out of the magazine 36. The lugs 56 and 58 are in staggered relation, as shown, because one is designed to bear against one of the fingers 4, while the other is designed to bear against one of the fingers 6, and this requires a relative displacement, as will be evident from an inspection of Fig. 1 of the drawings. As feed bar 50 reciprocates outwardly, (or upwardly as viewed in the drawings), the endmost clip is carried with it on the anvil member 12, while the remaining clips are supported by the trailing portion 60 of feed bar 50. Any space between the magazine 36 and the head 30 is bridged by a guide rail or support 62.

It has already been explained in connection with Figs. 3 through 6 that the crimping mechanism preferably includes a stationary back bar 14 and oppositely movable jaws 16 and 18. These elements are carried at the movable end of head 30 and are clearly shown in Fig. 9 of the drawings. Referring to Fig. 11 which is a horizontal section taken in the plane of the line 11—11 in Fig. 8, the back bar is also indicated at 14, while the lower jaw is indicated at 18, the upper jaw 16 not being visible because of the section.

It will be evident that the clip 2 carried by the feed bar 50 and anvil 12 is moved into and received by the head 30, the back surface of the clip being supported by the back bar 14 after it leaves the intermediate guide 62. The anvil 12 bearing yieldably against the clip, seats the same properly in the V-shaped surface of the back bar. The timing of the machine is such that at this point a preliminary movement of crimping jaws 16 and 18 takes place, thus bending the ends of the clip around the anvil 12.

It should be noted that back bar 14 is provided with a retaining finger 64 pivoted at 66 and urged outwardly or into the path of the clip by a compression spring 68. As the clip 2 is fed into the head 30, finger 64 is displaced out of its path. However, after the clip has been moved completely into place, retaining finger 64 springs outwardly beyond the end of the clip. This is best shown in Fig. 12, and at this point it may be observed that anvil 12 is provided with a groove 70 into which retaining finger 64 may move. It will now be evident that upon retraction of the feed bar 50, the clip 2 is left in place in head 30, despite any tendency to frictionally hold to the anvil because of it having been bent therearound.

The head 30 is then provided with a preliminarily bent clip and is free to be oscillated downwardly to the position 30' where continued closing of the jaws takes place.

The manner in which the jaws are operated is best explained in Fig. 9, referring to which it will be observed that the jaws 16 and 18 are carried at the ends of arms 72 and 74 pivoted respectively at 76 and 78. The opposite or inner ends of the arms 72 and 74 are respectively connected to the ends of connecting rods 80 and 82. The arms 72 and 74 extend generally transversely of the head 30, while the connecting rods 80 and 82 extend generally longitudinally of the head 30. The opposite ends of the connecting rods are connected to crank pins 84 and 86 which are preferably diametrically oppositely located on a helical gear 88. The location of crank pins 84 and 86 and the direction of rotation of the crank are so selected that the jaws reach their fully closed or minimum spacing as the cranks come into dead-center, so that a maximum leverage or beneficial toggle action results, thereby providing the necessary extreme pressure needed to interlock the ropes in the manner indicated in Fig. 7. Specifically, crank pin 84 moves toward the left; crank pin 86 moves toward the right; and the jaws reach their most nearly closed position as the crank pins 84 and 86 arrive at the extremities of an approximately horizontal diameter.

The helical gear 88 meshes with a helical gear 90 which in turn is fixed to a spur gear 92. The latter meshes with a longitudinally reciprocable rack 94 preferably cut on one side of a rod or shaft. This rod or shaft is arranged concentrically with and is reciprocable through the hollow shaft 32 on which the head 30 is mounted and which causes rotation of the head 30. It will thus be evident from an inspection of Figs. 9 and 10 that upon reciprocation of the outwardly projecting end of rack 94, the pinion 92 is rotated and consequently the gears 90 and 88, thus causing closing or opening of the jaws 16 and 18.

This movement of the rack is, of course, arranged in two stages one of which takes place at the loading positon for the preliminary crimping operation, and the remainder of which takes place at the tying position. The movement of the head between these positions does not change the position of the crimping jaws because there is no resulting rotation of the gear system. In fact, the rack 94 may, if desired, be provided with a key 96 which insures oscillation of the rack with the head 30.

The specific drive mechanism for oscillating the head 30 and for reciprocating the feed bar 50 and rack 94 have not been shown, for these may be of any conventional known satisfactory type. As is common in most automatic machines, there may be provided a single main timing or drive shaft which rotates once for each complete bundling operation, which timing or drive shaft, among other things, may include three cams, one for operating the feed bar 50, one for reciprocating the rack 94, and one for oscillating the head 30, all in proper amounts and proper time sequence for the desired operation.

It is believed that the mode of operation and the many advantages of my invention will be apparent from the foregoing detailed description thereof. In operation, the first of a series of clips in the magazine 36 is fed horizontally by a horizontally reciprocable feed bar 50 into the head 30. While the feed bar 50 and anvil 12 are still within head 30, the rack bar 94 is reciprocated slightly in order to provide the desired preliminary crimping operation. The feed bar 50 is then retracted from the head. The head with the preliminarily crimped clip is then oscillated downwardly to the tying position, at which time the rack bar 94 is reciprocated for the remainder of its stroke, thereby locking the ropes together, as was described.

It will be recognized that this tying or splicing operation may be performed with extreme rapidity, and results in a strong joint or union substantially equal to the tensile strength of the rope itself. The method is applicable for splicing of two pieces of rope or for tying of a single piece of rope around a bundle. The tie or splice obtained is neat and compact and but little greater in diameter than the rope itself. The shape of the metal clip is such that it is yieldable with the rope, rather than rigid. The rope is woven through and around the successive fingers of the clip in a sinuous manner which insures a tight grip, and yet is not cut or permanently weakened by the clip. Despite the complexity of the final union obtained between the two ropes, the apparatus for performing the locking operation is relatively simple. The clips may be supplied and stacked in substantially flat condition, any necessary or desirable preliminary bending of the ends of the fingers being taken care of by the crimping jaws after the originally relatively flat clip is fed thereto.

I may point out that the length of the clip may be varied in accordance with the strength of splice necessary, the machine indicated being capable of handling shorter clips than that shown. A clip of given size is capable of securely locking together ropes which vary somewhat in diameter, and this is a very important feature of the present invention because a cheap grade of rope, such as is used for tying newspaper bundles, is not absolutely uniform in diameter, but varies somewhat from point to point. With my arrangement, inasmuch as the grip of the individual fingers around the rope is relatively unimportant compared to the grip provided by the subsequent interlocking or interlacing of the fingers, the precise relation between the size of the clip and the diameter of the rope is not at all critical. This also makes it possible to use a given size of clip for a reasonable range of sizes of rope. However, in case of a large change in size of rope, it is desirable to change the size of the clip, and such a change may be accommodated by changing the jaw blocks 16 and 18 which, as is best shown in Fig. 9, are detachably mounted on the arms 72 and 74.

It will therefore be apparent that while I have shown and described my invention in preferred form, many changes and modifications may be made in the method and structure disclosed, without departing from the spirit of the invention, defined in the following claims.

I claim:

1. Apparatus for splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, said apparatus comprising oppositely movable clamping jaws having arcuate working surfaces properly shaped to so curl or crimp the fingers of the fastener that the fingers at each side of the fastener curl into separate closed loops, and means to support the intermediate portion of the fastener against reaction caused by the pressure of the clamping jaws as they roll the fingers into loops.

2. Apparatus for splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, said apparatus comprising means to move the fastener to a position over collaterally disposed rope ends to be spliced or tied, oppositely movable clamping jaws, and operating means for clamping the same, said jaws having arcuate working surfaces curved on a relatively small radius and properly shaped to so curl or crimp the fingers of the fastener that the fingers at each side of the fastener curl into separate closed loops, the fingers at one side of the fastener curling around one of the ropes while the fingers at the other side of the fastener curl around the other of the ropes, said operating means being adapted to additionally clamp the jaws in order to crimp or compress the fastener so as to bring the alternate curled fingers into interlaced or interlocked relation.

3. Apparatus for splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, said apparatus comprising oppositely movable clamping jaws and intermediate anvil means cooperating to preliminarily crimp or bend the ends of the fingers of the fastener, operating means to clamp said jaws, and means to move the fastener and clamping jaws over collaterally disposed rope ends to be spliced or tied, said clamping jaws having surfaces properly shaped to so curl or crimp the preliminarily bent fingers of the fastener that the fingers at each side of the fastener curl into separate closed loops, the fingers at one side of the fastener curling around one of the ropes while the fingers at the other side of the fastener curl around the other of the ropes, said operating means being adapted to further clamp the jaws in order to additionally crimp or compress the fastener in order to bring the alternate curled fingers into interlaced or interlocked relation..

4. In apparatus of the class described, a

crimper head, a magazine for clips, feed mechanism for feeding the clips from the magazine to the crimper head, said feed mechanism including a reciprocable feed bar including an anvil portion, said crimper head including a pair of oppositely movable clamping or crimping jaws for bearing against the ends of the clip and bending the same around the anvil portion.

5. In apparatus of the class described, a crimper head, a magazine for clips, feed mechanism for feeding the clips from the magazine to the crimper head, said feed mechanism including a reciprocable feed bar, and an anvil yieldably mounted on said feed bar for engaging the forward face of the clip, said crimper head including a back bar for receiving and supporting the rear surface of the clip, and a pair of oppositely movable clamping or crimping jaws for bearing against the ends of the clip and bending the same around the anvil.

6. In apparatus of the class described, a crimper head, a magazine for clips, feed mechanism for feeding the clips from the magazine to the crimper head, said feed mechanism including a reciprocable feed bar, an anvil, and means for engaging and forcing the clip out of the magazine and into the crimper head, said crimper head including a back bar for receiving and supporting the rear surface of the clip, a pair of oppositely movable clamping or crimping jaws for bearing against the ends of the clip and bending the same around the anvil and means for holding the preliminarily crimped clip against return movement upon return movement of the feed bar and anvil.

7. In apparatus of the class described, a crimper head movable between a loading position and a tying position, a magazine located near the loading position, feed machanism for feeding the clips from the magazine to the crimper head, said feed mechanism including a reciprocable feed bar, and means for engaging and forcing the clip out of the magazine and into the crimper head, said crimper head including means for receiving and supporting the clip, a pair of oppositely movable clamping or crimping jaws for bearing against the ends of the clip and bending the same, and means for holding the preliminarily crimped clip against return movement upon return movement of the feed bar.

8. In apparatus of the class described, a crimper head movable between a loading position and a tying position, a magazine located near the loading position, feed mechanism for feeding the foremost clip from the magazine to the crimper head, said feed mechanism including a reciprocable feed bar, an anvil yieldably mounted on said feed bar for engaging the forward face of the clip, and means for engaging the trailing edge of the clip in order to slide the same out of the magazine and into the crimper head, said crimper head including a back bar for receiving and supporting the rear surface of the clip, a pair of oppositely movable clamping or crimping jaws for bearing against the ends of the clip and bending the same around the anvil, and a retaining finger for holding the preliminarily crimped clip against return movement upon return movement of the feed bar and anvil.

9. In apparatus of the class described for tying rope on bundles or the like, a bundle tying station, an elevated feed magazine for clips, a movable crimper head movable between an elevated loading position at the feed magazine and a lowered tying position at the bundle tying station, said crimper head including clamping jaws for bending a clip, and feed means for transferring the clips from the magazine to the crimper head, said magazine comprising guide means for receiving a stack of clips, and resilient means for constantly urging the stack of clips in the magazine toward the feed means.

10. In apparatus of the class described, a stationary feed magazine for clips, an oscillatable crimper head movable between a loading position at the feed magazine and a tying position, said crimper head including clamping jaws for bending a clip, and feed means for transferring the endmost clip from the feed end of the magazine to the crimper head, said magazine comprising guide means for receiving a stack of clips, a movable end block slidable in said guide means, and a draw chain and spring operated drum for urging said end block and with it the clips toward the feed end of the magazine.

11. In apparatus of the class described for tying rope on bundles or the like, a crimping or clamping head movable between a loading position and a tying position, said movable head including a pair of oppositely movable crimper jaws, and an oscillatable crank for actuating said jaws, the crank being so arranged that it approaches dead-center as the clamping jaws are closed to the minimum desired value, and means for oscillating said crank, said means being unaffected by movement of the head.

12. In apparatus of the class described, a movable crimping or clamping head including a pair of oppositely movable crimper jaws, a pair of connecting rods connected to said jaws, and an oscillatable double crank for actuating the connecting rods, the crank arms extending in diametrically opposite relation and being so adjusted that they approach dead-center as the clamping jaws are closed to the minimum desired value.

13. In apparatus of the class described, an oscillatable crimping or clamping head including arms pivoted near the movable end of said head and extending generally transversely thereof, a pair of oppositely movable crimper jaws carried by said arms, a pair of connecting rods connected to the ends of the arms and extending generally longitudinally of said oscillatable head, and an oscillatable double crank for actuating the connecting rods, the crank arms extending in opposite directions.

14. In apparatus of the class described, an oscillatable head having fastener crimping mechanism mounted on the free end thereof, a hollow shaft extending transversely of and secured to said head, for oscillating the same about the axis of the shaft between a loading position and a rope tying position, and means extending through said hollow shaft for operating said crimping mechanism.

15. In apparatus of the class described, an oscillatable head having fastener crimping jaws mounted on the free end thereof, a hollow shaft extending transversely of and secured to said head for oscillating the same about the axis of the shaft between a loading position and a rope tying position, a rack extending through said shaft in concentric relation thereto, a pinion mounted in said head and meshing with said rack, and means for operating said crimping jaws upon rotation of said pinion by reciprocation of said rack, whereby the position of the crimping jaws is not altered during oscillation of the head.

16. In apparatus for splicing or tying rope by means of a sheet metal clip or fastener having oppositely directed fingers arranged in alterna-

tion, a crimping or clamping head movable into rope tying position and providing a three-point support for the metal clip to be crimped, the three-point support being provided by a fixed central back bar and two oppositely movable crimping jaws spaced from said back bar, means for moving the head into rope tying position and means for closing said jaws in order to crimp and curl the ends of the clip.

17. In apparatus for splicing or tying rope by means of a sheet metal clip or fastener having oppositely directed fingers arranged in alternation, a movable crimping or clamping head movable into rope tying position and providing a three-point support for the metal clip to be crimped, the three-point support being provided by a fixed central back bar or reaction bar and two oppositely movable crimping jaws spaced from said back bar in the form of an isosceles triangle, means for moving the head into rope tying position, and means for closing said jaws in order to crimp and curl the ends of the clip, the reaction of the bending force being taken by the aforesaid stationary back bar.

18. The method of splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, which includes disposing the rope ends to be spliced or tied in collateral relation, placing the fastener over the ends of the rope, then curling or crimping the fingers of the fastener so that the fingers at one side of the fasteners curl around one of the ropes while the fingers on the other side of the fastener curl around the other of the ropes, and finally additionally crimping or compressing the fastener in order to bring the alternate curled fingers into interlaced or interlocked relation.

19. The method of splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, which includes disposing the rope ends to be spliced or tied in collateral relation, preliminarily bending the fastener, placing the same over the ends of the rope, then curling or crimping the fingers of the fastener so that the fingers at one side of the fastener curl around one of the ropes while the fingers on the other side of the fastener curl around the other of the ropes, and finally additionally crimping or compressing the fastener in order to bring the alternate curled fingers into interlaced or interlocked relation.

20. The method of splicing or tying rope or the like by means of a sheet metal clip or fastener having relatively long oppositely directed fingers arranged in alternation, which includes disposing the rope ends to be spliced or tied in collateral relation, preliminarily bending the fastener, placing the same over the ends of the rope to be spliced or tied, then curling or crimping the fingers of the fastener so that the fingers at one side of the fastener curl around one of the ropes while the fingers on the other side of the fastener curl around the other of the ropes, each of the ropes being separately gripped by the surrounding fingers of the fastener, and finally additionally crimping or compressing the fastener in order to bring the alternate curled fingers into interlaced or interlocked relation.

FRITZ P. MANSBENDEL.