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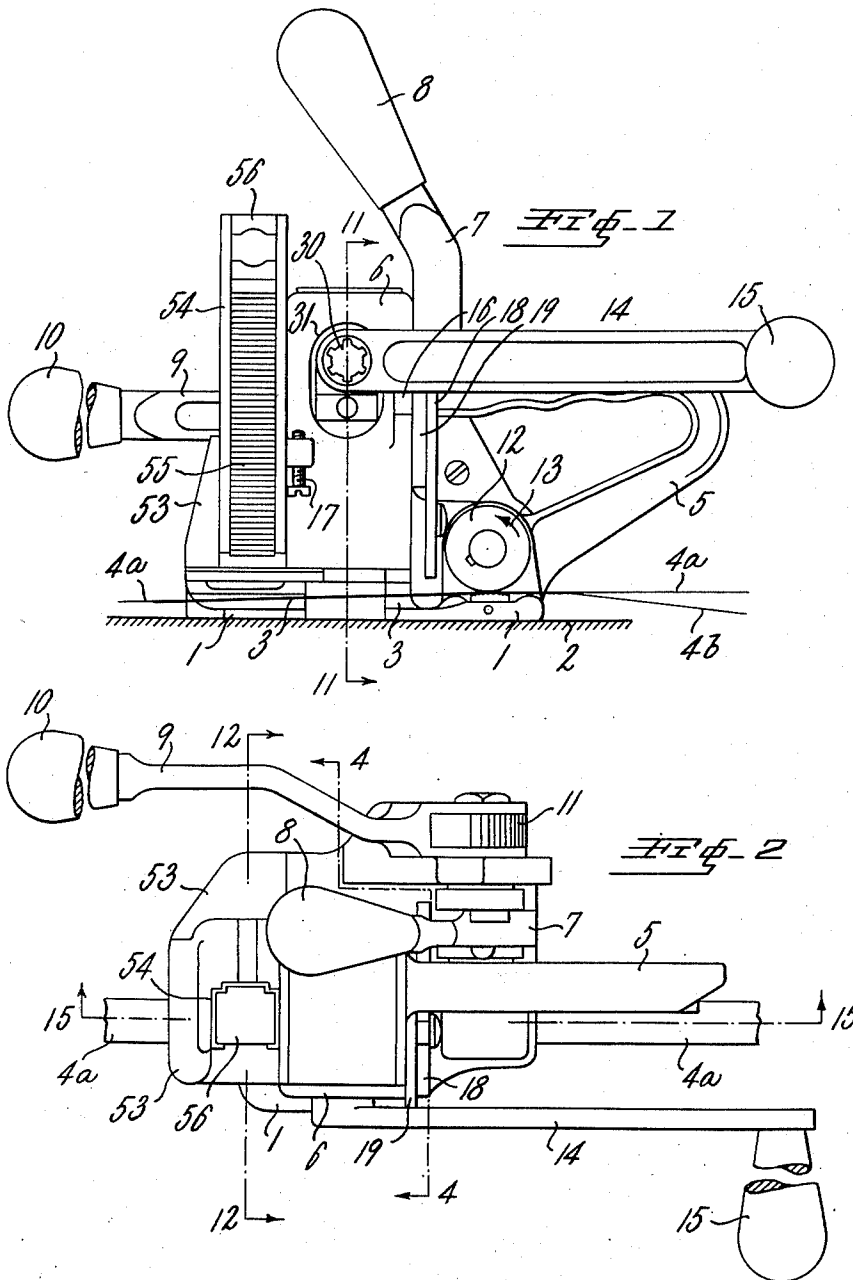
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HOOP IRON TIGHTENING AND CLAMPING DEVICE

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4 Sheets-Sheet 1



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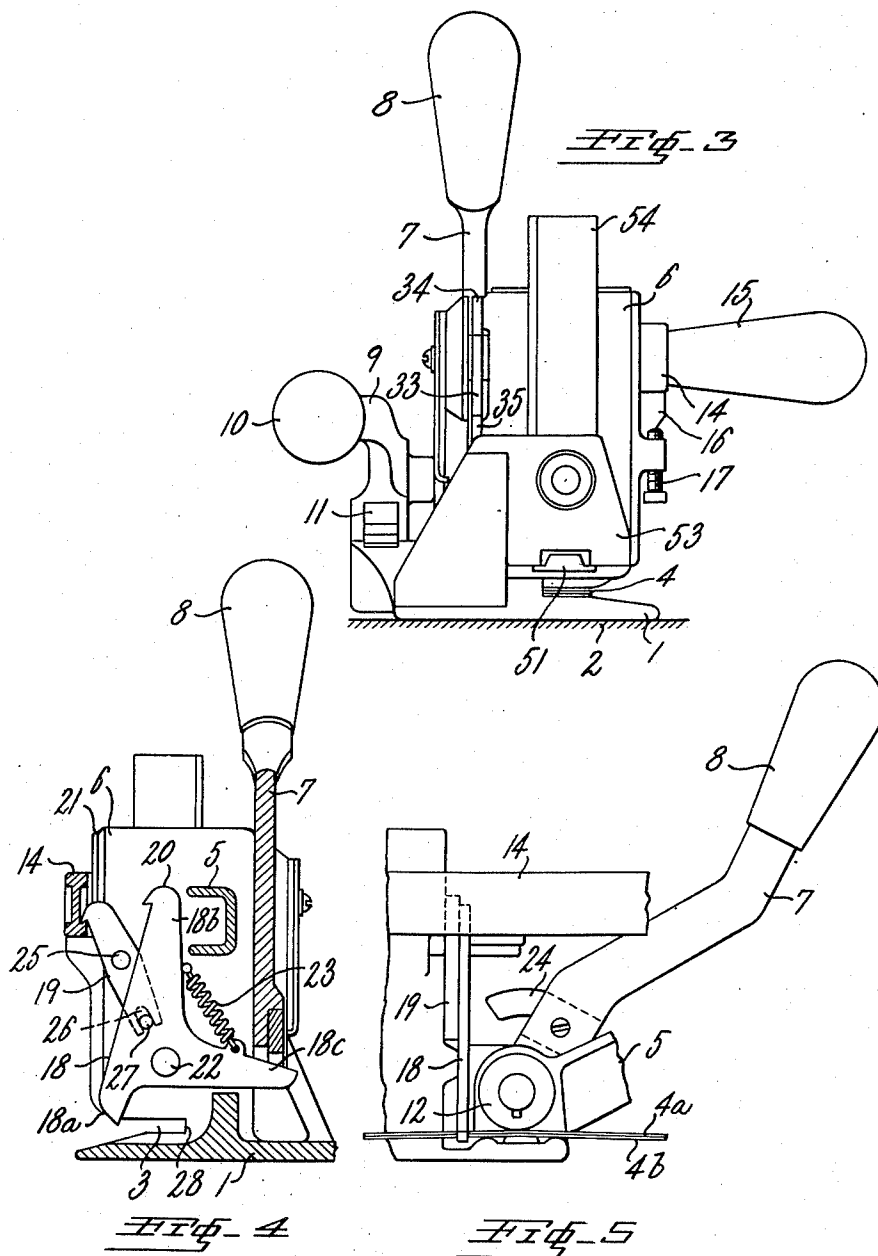
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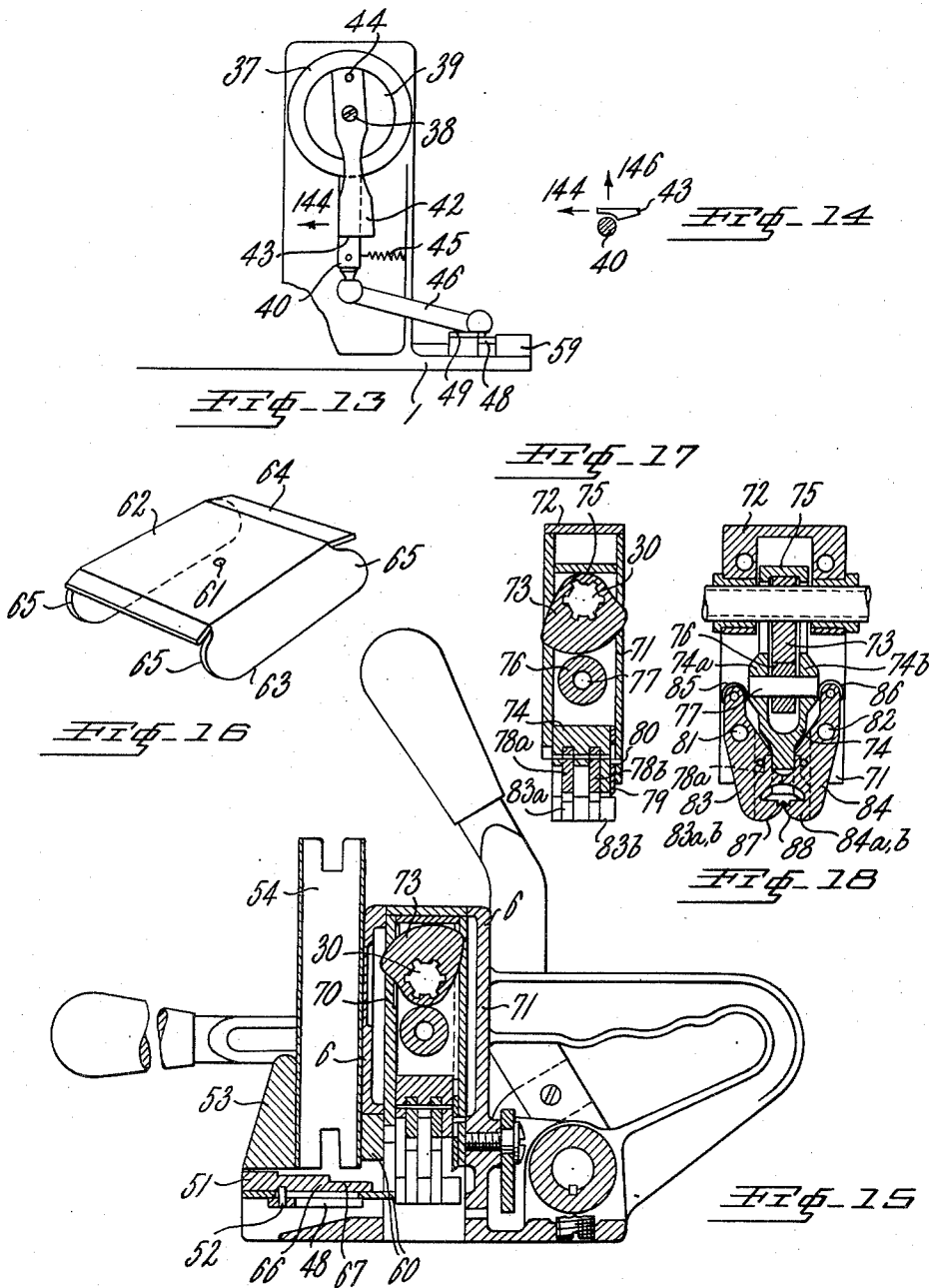
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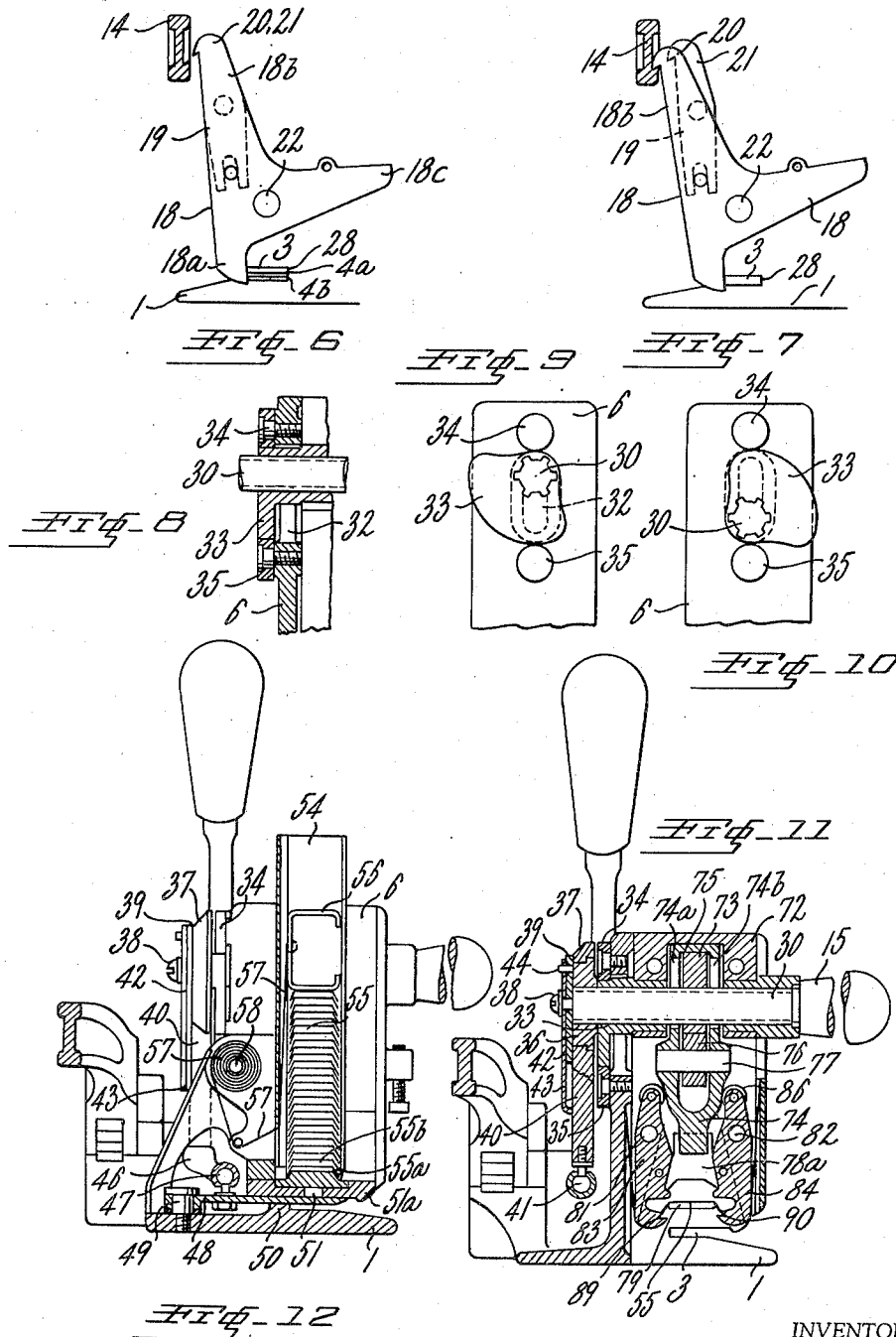
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HOOP IRON TIGHTENING AND CLAMPING DEVICE

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4 Sheets-Sheet 4



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HOOP IRON TIGHTENING AND CLAMPING DEVICE

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11 Claims. (Cl. 81—9.1)

The present invention relates to a tightening and clamping device for flexible metal hoops for use in hooping parcels and cases.

Several designs of devices for hooping by means of flexible bands are already known, in particular a construction in which a seal is manually slipped on the hoop ends to be permanently connected. In order to eliminate the undesirable manual slipping of the seals on the hoop ends, devices have been proposed which are equipped with an integral seal magazine of which use is made in the present invention.

The known tightening and clamping devices equipped with seal magazines of this type are intricate machines of which the operations is complicated and which tend to break down in regular use and through unavoidable faulty operation so that undesirable losses of time are caused. The device according to this invention obviates these and other disadvantages by a novel distribution of the functions to be performed in the tightening and clamping process.

Accordingly the present invention relates to a tightening and clamping device for hoop iron having lever operated locking and tightening mechanisms for the hoop and a lever operated mechanism for connection of two overlapping hoop ends by means of a seal supplied from a magazine. The invention is characterized by the fact that the operating lever for the connecting mechanism performs three functions in one operative stroke, i. e. conveying a seal from the magazine into the connecting mechanism comprising bending pliers and embossing die, lowering the bending pliers together with the seal over the overlapping hoop ends and bending together the seal tongues around the said ends, and thirdly, lowering the embossing die relative to the bending pliers still embracing the bent-over seal for the purpose of permanently connecting the said seal with the hoop ends by means of impressed crimps. When being returned to the idle or inoperative position, the lever withdraws the embossing seal from the bending pliers, then opens the said pliers and raises them back into inoperative position.

An embodiment of the present invention is described by way of example in conjunction with Figs. 1-18, of which:

Fig. 1 is a side elevation of the device made according to the invention shown in idle position with the hoop inserted;

Fig. 2 is a top plan view of the device according to Fig. 1;

Fig. 3 is a side view of the device according to Fig. 1 seen in the direction of the seal magazine;

Fig. 4 is a side view as seen in the direction of line 4—4 in Fig. 2 with the locking mechanism in idle position;

Fig. 5 is a portion of an elevation view similar to Fig. 1 with the clamping lever in operative position;

Figs. 6 and 7 are views of the locking mechanism according to Fig. 4 in two operative positions;

Figs. 8 to 10 are a longitudinal section and two rear

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views, respectively, seen in the direction of the principal axis of the operating lever with the raising and lowering device for the clamping mechanism;

Fig. 11 is a cross section of the device taken along line 11—11 in Fig. 1;

Fig. 12 is a cross section of the device taken along line 12—12 in Fig. 2;

Fig. 13 is a rear view of the device seen in the direction of the coupling unit for the seal feed linkage;

Fig. 14 shows part of the automatically releasing coupling unit according to Fig. 13;

Fig. 15 is an elevation view similar to Fig. 1, shown in section taken along 15—15 in Fig. 2;

Fig. 16 is a perspective and enlarged view of the seal;

Fig. 17 is a lateral view of the clamping device in section, and

Fig. 18 is a front view of the clamping device in section.

Figs. 1 to 3 show general views of an embodiment of the present invention. The tightening and clamping device here comprises a one-piece casting supported by means of a plate 1 on the base 2, i. e. the object to be provided with the hoop iron. In the base plate 1 is provided a hoop channel 3 accommodating the overlapping hoop ends 4a, 4b. The same casting carries the handle 5 and a slide housing 6 as well as journals and attachment eyelets for the members to be described below.

As usual in such apparatus, the device is provided with three levers for the performance of the functions required in tightening and clamping, which levers are all shown in idle position in Figs. 1 to 3. The locking lever 7 with the handle 8 is designed to lock the hoop 4 in the channel 3 and to release a locking mechanism which will be described in detail below. The tightening lever 9 with handle 10 is designed to tighten the hoop 4. This lever operates the toothed tightening roller 12 in the direction of arrow 13 via a ratchet member 11 in the known manner. The clamping of the hoop ends 4a, 4b tightened against one another is performed by a clamping mechanism housed in the slide housing 6 and controlled by means of the operating lever 14 having a handle 15, which rests on a stop 16 in idle position, which stop is arranged on the housing 6. This clamping operation—which will be described in greater detail further below—is performed by swinging the operating lever 14 in anti-clockwise direction through about 180° until it abuts the set screw 17.

It is an essential feature of the present invention that a locking mechanism is provided for the operating lever 14 of the clamping mechanism in order to prevent faulty operation. This locking mechanism co-operates with the locking lever 7 and is released only when a hoop 4 within the predetermined width range has been inserted in the hoop channel 3, and when the said hoop 4 is held in the hoop channel by means of said locking lever 7. The design of this locking mechanism is described in greater detail in the embodiment according to Figs. 4 to 7.

As shown in Fig. 4, which is a side view of a section taken along the line 4—4 in Fig. 2, two flat levers 18 and 19 are provided to operate as locking levers for the operating lever 14, for which purpose they are equipped at their upper end with hook-type locking projections 20 and 21, respectively, which may engage the lower longitudinal rib of the operating lever 14. The first flat lever 18 is roughly in the shape of a horizontal T and swivelly arranged on pivot 22 adjacent the point of convergence. The shorter arm 18a of this first flat lever extends downward and forms the feeler for the hoop 4 in the channel 3, while the longer arm 18b carries the hook-shaped locking projection 20. The lateral arm 18c of this first flat lever

is biased in anti-clockwise direction on pivot 22 by means of spring 23, so that the locking hook 20 moves towards the operating lever 14 as soon as the first flat lever is released. In idle position as shown in Fig. 4, the first flat lever 18 is prevented from rotating around pivot 22 by the action of a projection 24 (Fig. 5) of the clamping lever 7 which forces the lateral arm 18c of the first flat lever downwards against the action of spring 23. The projection 24 is shaped in such a manner that it will engage behind the depressed lateral arm 18c when the clamping lever 7 is in idle position, thus causing the clamping lever 7 to be locked in idle position. In this idle position the arm 18a, which is designed as a feeler, of the first flat lever is swung upward far enough for a hoop 4 to be freely inserted in the hoop channel 3. The locking hook 20 does not engage the operating lever 14 when the members are in the idle position shown in Fig. 4.

The second flat lever 19 consists of two arms of approximately the same length and is pivoted on pivot 25. The lower arm is coupled with the arm 18b of the first flat lever through a slot 26 and the dog 27, while the upper arm bears the locking hook 21. Pivot 25 and dog 27 are arranged in such a manner relatively to one another that with the first flat lever 18 in the idle position the locking hook 21 of the second flat lever 19 is in engagement with the lower longitudinal rib of the operating lever 14 thus preventing an upward movement of the said lever.

If the clamping lever 7 is moved into its operative position (Fig. 5) from the idle position shown in Fig. 4, thus lowering the toothed tightening roller 12 upon the overlapping hoop ends 4a, 4b, in known manner, the projection 24 will release the first flat lever 18 so that it will swing in anti-clockwise direction under the action of spring 23. This causes the feeler arm 18a to move towards the hoop channel 3 and its locking hook 20 towards the operating lever 14. This rotation of the first flat lever 18 also causes a clockwise swinging motion of the second flat lever 19 on its pivot 25 via the dog 27 and the fork slot 26, so that its locking hook 21 will be withdrawn from the operating lever 14. If two hoop ends 4a, 4b of predetermined width have been inserted in the hoop channel 3 in approximately the correct position as shown in Fig. 6, the said two ends 4a, 4b are pushed towards the rear wall of the hoop channel 3 by the front edge of the feeler 18a, and the rotary movement of the first flat lever 18 is completed. If the hoop 4 is of the correct width, the locking hook 20 of the first flat lever will not yet engage the operating lever 14 with the said flat lever in this position, but the rotary movement of the first flat lever 18 to this position suffices to swing the coupled flat lever 19 in the opposite direction sufficiently to cause the locking action it exercises upon the operating lever 14 to be eliminated. As shown in Fig. 6, the locking hooks 20, 21 of the two flat levers 18 and 19 respectively, in this normal operating position, are approximately in alignment with each other and both out of engagement with the operating lever 14 so that the latter is free to perform the clamping operation.

If, however, the hoop ends 4 inserted in the hoop channel 3 are too wide or at least not approximately in the correct position, arm 18a completes the swinging movement of the first flat lever 18 before the lock of operating lever 14 by means of the locking hook 21 of the second flat lever 19 is rendered completely ineffective so that the operating lever 14 remains locked. If no hoop is inserted in the hoop channel 3 or if the hoop 4 is too narrow, the first flat lever 18 will swing beyond the position shown in Fig. 6 into the position shown in Fig. 7, and thus establish engagement, by means of its locking hook 20, with the operating lever 14, thereby locking the same.

It is evident that the locking mechanism according to the present invention prevents any faulty operation of the operating lever 14 of the clamping mechanism. It is only when a hoop in correct position has been inserted in the hoop channel and clamped by the clamping lever and when

the said hoop is within the predetermined width tolerances, that the operating lever 14 can be released.

The operating lever 14 designed to perform the clamping process is arranged on the main shaft 30 (Fig. 1), which belongs to the clamping mechanism in the slide housing 6 and projects from the two opposite end walls of housing 6 through openings 31 and 32 respectively. The horizontal main shaft 30 can be vertically raised and lowered, together with the clamping mechanism designed as a slide—which will later be described in greater detail—in the housing 6. This vertical movement is positively coupled to the rotation of the main shaft by a predetermined angular distance within the operating stroke of its operating lever 14 between 0° and 180°. As shown in Figs. 8 to 10, a sector-type cam 33 is provided on the end of the main shaft 30 projecting from the housing 6 which is not connected with the operating lever 14 to effect the said positive coupling. The front edge of the said cam 33 is designed as a sliding surface and engages the roller 34 above the longitudinal slot 32 in the housing 6 and the roller 35 below the said slot respectively. The two rollers 34, 35 determine the position of the cam 33 and thereby of the main shaft 30 in vertical direction relatively to the housing 6. The main shaft 30 cannot move in a lateral direction, since it is supported within the slide housing 6 in the clamping mechanism, which slide is displaceable vertically but not horizontally. The position of the cam 33 in the idle position of the operating lever 14 is shown in Fig. 9, which reveals the main shaft 30 in its extreme raised position in the housing 6. When the operating lever 14 performs an operating stroke, the main shaft, together with the cam 33, is rotated in clockwise direction as shown in Fig. 9, the upper extreme position of the said main shaft 30 being maintained at the beginning of the rotation—roughly within the angular range between 0° and 30°—then rapidly lowered to its lower extreme position in the housing 6—roughly in the angular range between 30° and 75°—and remaining in this lower extreme position during the rest of the operating stroke—i. e. in the range between approximately 75° and 180° since the sector-type outer and inner peripheries of the cam 33 engage the rollers 34 and 35 respectively. The lower extreme position of the main shaft 30 is shown in Fig. 10, which illustrates the position of the cam 33 at the end of the operating stroke of the operating lever 14, i. e. after being rotated from its idle position by about 180°. The cam 33 is designed so that its front edge always engages the two rollers 34 and 35 so that there will be no undesirable play of the main shaft 30 and of the clamping mechanism in a vertical direction relative to the housing 6 and thereby relative to the casting with the base plate 1. The rollers 34 and 35 themselves may be formed as hardened sleeves rotatable on pivots attached to the housing 6.

As shown in the section of the device along the main shaft 30 in Fig. 11 and in the side and rear views in Figs. 12 and 13 respectively, the end of the main shaft 30 carrying the cam 33 of the raising and lowering mechanism just described further carries a rigidly attached concentric disc 36 on the peripheral surface of which a ring 37 is rotatably arranged. An end plate 39 attached to the main shaft 30 by means of screw 38 prevents the ring 37 from laterally slipping off the peripheral surface of disc 36. The ring 37, which is rotatable around the main shaft 30, carries a downwardly extending control arm 40 having a ball-and-socket joint 41 at its lower extremity. This arm forms part of a lever linkage through which the seal feed from the seal magazine into the clamping mechanism is actuated. The seal feed being effected during the first phase of the operating stroke of the operating lever 14 of the clamping mechanism, as provided by the present invention, a mechanical coupling between the main shaft 30 driven by the operating lever 14 and the control arm 40 movable in concentric relation to the main shaft 30 on ring 37 is provided. This cou-

pling is designed in such a manner that it is automatically released when the lever linkage encounters a resistance in excess of the normal value, which will occur if the seal feed is operated although a seal has already been conveyed to the clamping mechanism. This automatically released coupling for the seal feed eliminates trouble in this mechanism and its time-consuming correction, which constitutes an essential advantage of the device according to this invention.

The automatic release of the coupling between the main shaft 30 and the control arm 40 of the seal feed is effected via a rigid leaf spring 42 extending downward from the main shaft 30 and carrying a nose 43 bent backward, which engages behind the control arm 40 when the operating lever 14 is in idle position. The leaf spring 42 is attached to the main shaft 30 by means of screw 38 and secured against rotary movement by a pin 44 arranged on disc 36 and projecting through bores in the end plate 39 and the upper portion of the leaf spring 42. Fig. 14 shows the nose 43 of leaf spring 42 seen from below in order to illustrate the releasing process. When the main shaft is moved from idle position by means of operating lever 14, the leaf spring 42 is twisted in the direction of arrow 144 carrying with it in the same direction the control arm 40 against the action of tension spring 45 owing to the configuration of its nose 43. As soon as the resistance acting against a further movement of the control arm 40 exceeds a certain magnitude, the nose 43 slides past the control arm 40 and bends the leaf spring 42 in the direction of arrow 146, thus releasing the arm 40, which is then returned to its idle position by tension spring 45. The timing of the automatic release of the leaf spring 42 depends solely on the resistance which the feed linkage exercises against a further movement. Normally, release occurs after completion of the seal feed by the lever linkage, to which end the main shaft 30 must be rotated by about 30° from its idle position. If seal feed is impossible for some reason, e. g. because a seal has already been conveyed to the clamping mechanism, release is effected earlier and all damage to the feed mechanism or the seals is obviated.

The control arm 40 is connected to a transverse arm 46 by means of the ball-and-socket joint 41, which latter arm is attached to the feed lever 48 through a further ball-and-socket joint 47. This flat feed lever is horizontally swivelled on the base plate 1 of the device by means of pivot 49, and its free end engages a rib 50 of base plate 1 and extends below a stepped sliding member 51 to which it is connected by a pin 52. This stepped slide member 51 constitutes the feed member for the seals and is reciprocated parallel to the base plate 1 of the device in a slide guide to be described later, as soon as the control arm 40 swivels the feed lever 48 via the transverse arm 46. Provision of the ball-and-socket joints 41 and 47 respectively in the feed linkage on the one hand ensures a reliable coupling of the linkage with the main shaft 30 and the leaf spring 42 respectively, and on the other hand the main shaft 30 remains vertically movable for the performance of the raising and lowering movement controlled by the cam 33.

The stepped slide 51 slides in a guide 51a (Figs. 12 and 15) with which it forms the lower end of the unit constituting the seal magazine. This unit comprises the one-piece casting of the base 53. Extending upwardly from this base 53 is a magazine shaft of rectangular cross-section adapted to hold the seals 55. The stacked seals 55 are lightly pressed downward by a plunger 56 which is attached to a spiral screw 57 mounted on pin 58, which pulls the plunger 56 downward. The entire magazine unit is mounted on suitable attachment holes 59 (Fig. 13) of the base plate 1 at the end of the housing 6 opposite the locking levers 18, 19. A lateral projection 60 of the magazine unit extends into the interior of the housing 6 and is provided with a mouth for the stepped slide 51 longitudinally displaceable in the slide bed 52. When

the feed linkage is actuated by control arm 40 in the manner illustrated in Figs. 13, 14 the feed lever 48 pushes the stepped slide 51 into the interior of housing 6 from its rearward idle position until the front edge of the seal resting on the slide and carried thereby is positioned in the bending pliers to be described later. Abutment causes the release of the coupling between control arm 40 and leaf spring 42 so that the control arm 40 and, via the feed linkage, the stepped slide 51 are returned to idle position by spring 45. If the stepped slide 51 or the seal it carries abut anywhere before reaching the stop in the bending pliers, the control arm of the feed linkage is immediately released as described above.

When idle, the stepped slide 51 is approximately in the position relatively to the seal shaft 54 shown in Fig. 15. The seal shaft 54, which was shown empty, is now filled with a stack of seals 55 of the type shown in Fig. 16, which stack consists of a predetermined number of seals, such as fifty individual seals, which are strung on a thin wire passed through their holes 61. This holding wire is sharply bent behind the last seal, it projects from the top of the seal stack and is there formed into a finger loop. The seal stack on the wire is inserted in the shaft 54 of which the cross section is adapted to the shape of the seals thereby preventing insertion in incorrect position. The holding wire is then pulled out by its loop so that all individual seals 55 are now freely stacked in the shaft. The side surfaces 63 bent obliquely downwards from the flat top surface 62 of the seal engage in such a manner when the seals are stacked that the flat top surfaces 62 do not engage but are spaced at a predetermined distance. The front and rear of the flat top surface of each seal is provided with an edge bent downwards by less than 45°. The front and rear edges 63 of the side surfaces 63 are rounded and project beyond the front and rear edges 64 respectively. After insertion of the seal stack in the shaft 54 and removal of the holding wire, the lowest seal 55a then straddles the upper step 66 of the stepped slide 51 while its lower step 67 is as yet empty. The second last seal 55b already projects into the interior of the shaft 54. When the stepped slide is moved into the direction of the clamping mechanism accommodated in housing 6, the lowest seal 55a is held by the friction exercised by the adjacent seal 55b until the rear edge of the step 66 engages the front edge 64 of the lowest seal 55a, sliding it from the stack in the direction of housing 6. When the first seal is removed after refilling the seal magazine, the seal 55a, in contradistinction to normal operation with the filled magazine, does not reach the clamping mechanism in housing 6; the feed motion of the stepped slide 51 is terminated with approximately one-half of the full length of the seal 55a still remaining in the seal stack. When the stepped lever 51 returns into the idle position shown in Fig. 15 after this first feed stroke, the lowest seal 55a is prevented from moving backwards by the friction of the overlying seal 55b and thus remains in its position half projecting from the seal stack. This seal will then drop to straddle the lower step 67 of the stepped slide after the latter has reached its idle position. At the same time the following seal 55b rests its rear edge 64 on the upper step 66 of the stepped slide. This arrangement of the seals 55a and 55b is the normal starting position obtaining in normal operation when the magazine is filled and the machine in idle position. If the stepped slide 51 is now moved to feed, the seal 55a resting on the lower step 67 is conveyed into the clamping mechanism in the housing 6 and there held in a manner to be described later, while the rear edge of the upper step 66 slides the following seal 55b half out of the seal stack. When the stepped slide 51 has returned into its idle position, the prepared seal 55b drops onto the lower step 67, which is now empty, and the rear edge 64 of the third seal 55c then rests on the upper step 66 so that the starting position for the next seal feed is again reached. If the side edges 65 of the seal resting on step 67 contact

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the corresponding edges of a seal already inserted in the clamping mechanism when the stepped slide performs a feed movement, the lever arm 40 causing the seal feed will be released as already described and snap back under the action of spring 45 so that the stepped slide 51 can be returned to its idle position.

As stated above, the main shaft 30, which is rotated between approximately 0° and 180° by the operating lever 14, is part of the clamping mechanism which will be described in detail below in conjunction with Figs. 11 and 15 to 18. Besides the main shaft 30 and the raising and lowering mechanism described in connection with Figs. 8 to 10 above, the clamping device comprises the clamping unit proper within the slide housing 6.

The clamping unit is an approximately rectangular unit with two plane-parallel plates 70 and 71 forming the wide ends, between the upper ends of which a solid double bearing 72 for the main shaft 30, closing pliers and an embossing plunger are arranged. The clamping unit shown as a separate structure in Figs. 17 and 18, forms a slide vertically movable in slide guides within the housing 6. This movement is effected by the raising and lowering mechanism actuated by the main shaft 30, which has already been described in connection with Figs. 8 to 10. The main shaft 30 rotatable in the double bearing 72 carries a cam 73 in the space between the two bearing points, which cam forms the coupling member between the main shaft 30 and an embossing plunger 74 of which the upper portion forks into the two flat plunger side walls 74a and 74b. The upper ends of these two side walls 74a, 74b are equipped with a transverse connection 75 so that the upper portion of the embossing plunger assumes a frame-type shape, which frame surrounds the cam 73 and possesses longitudinal slots for the main shaft 30 in the plunger side walls 74a, 74b so that the plunger 74 is vertically displaceable within the clamping unit relatively to the main shaft 30. This displacement of the embossing plunger 74 is caused by the cam 73 of which the peripheral surface formed as a sliding surface engages a roller 76 in the lower part of the fork-type plunger extension, which roller is rotatable on an axis 77 connecting the plunger side walls 74a, 74b. At the same time the peripheral surface of the cam 73 engages the transverse connection 75 of the plunger side walls 74a, 74b on the opposite side so that the frame-type upper portion of the embossing plunger 74 is guided by the cam 73 between the transverse connection 75 and the roller 76 with a limited play. By suitable configuration of the cam 73 a lowering and raising motion of the embossing plunger 74 can be performed with every rotation of the main shaft 30. An embossing die 78 is attached to the lower end of the embossing plunger, which die consists of two flat tongues 78a and 78b the shape of which is indicated by broken lines in Fig. 18.

Furthermore, a flat cutter 79 is provided which is vertically reciprocable between the embossing plunger 74 and the wall 71 of the clamping unit, guided by a longitudinal slot by a pin 80 mounted on the wall 71 and continually forced downwards by a pressure spring. This causes the cutting edge of the cutter 79 to project downwards while it can resiliently withdraw in the event of an upward pressure being exerted on the edge. The outer surfaces of the plunger side walls 74a, 74b are formed as slide faces and shaped to form a certain contour which will be described below.

Arranged at the lower end of the clamping device are two jaws 83 and 84 respectively of bending pliers which are swivellable on pivots 81 and 82 connecting the walls 70 and 71. These jaws project downwardly from the clamping device. The symmetrically designed jaws 83, 84 are formed as levers having a shorter arm projecting upwards, which engages the outer surface of a plunger side wall 74a, 74b by means of a roller 85 and 86 respectively, and a longer arm downwardly projecting from the clamping device and forming the opening of the bending pliers.

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Along the inside of the two jaws 83, 84 are provided two channels 83a, 83b and 84a, 84b respectively beginning at the front surfaces 87 and 88 respectively, which channels extend over the entirety of the lower arm and are adapted in position and width to the two flat tongues 78a, 78b of the embossing die, and which are equipped with a rounded front extension with which they glide along the base of channels 83a, b and 84a, b respectively. The jaw 83 is therefore guided in the channels 83a, b between the outer side of the plunger side wall 74a and the die tongues 78a, b. The jaw 84 is accordingly guided in the channels 84a, b between the outer side of the plunger side wall 74b and the die tongues 78a, b. This guide of the jaws 83, 84 is, however, formed in such a manner that the arms forming the mouth of the bending pliers have a play totalling approx. 1 mm. around their respective pivots 81, 82. The arms of jaws 83, 84 are slightly compressed by suitable leaf springs within the housing 6, and the lateral play enables them to be expanded against the spring bias. The inner sides of the jaw front sides 87, 88 opposite the die tongues 78a, b form the embossing matrix for the embossing die 78a, b attached to the embossing plunger 74 which is displaceable relatively to the two jaws 83, 84.

When the operating lever 14 of the clamping mechanism is in idle position, the main shaft 30 including the cam 73 is in the position shown in Fig. 11, and the embossing plunger in its extreme upper position. When the main shaft 30 is rotated from its idle position by about 75°, the embossing plunger remains in its extreme upper position owing to the circular periphery of the cam 73 in this angular range. When the main shaft 30 is rotated beyond the 75°, the cam 73 causes a relatively rapid downward displacement of the embossing plunger 74 relatively to the jaws 83, 84 via the roller 76, the rollers 85, 86 running on the outer sides of the plunger side surfaces 74a, b reaching the widening portion of the plunger side walls at the level of the pivot 77. This causes the mouth of the bending pliers to close as shown in Fig. 18. From this angular position of the main shaft 30 to its extreme position at 180° the embossing plunger 74 is moved forward in the same direction at a relatively small rate, while the rollers 85, 86 then run on the parallel portion of the plunger side walls 74a, b, while the two die tongues 78a, b are further advanced in the die channels 83a, ba and 84a, b respectively into the inner mouth sides of the jaws 83, 84 forming the die. When the main shaft 30 is returned from its extreme position into the original position, the cam 73 engaging the transverse connection 75 will first cause the embossing plunger 74 to be withdrawn from the matrix while the bending plier mouth is closed, then cause the mouth to open and finally the embossing plunger 74 and both jaws 83, 84 to be returned to their extreme upper position.

When the operating lever 14 is in idle position, the clamping device is in the position shown in Figs. 11 and 15 within the housing 6. The opened mouth of the bending pliers is ready to accommodate a seal 55 which can be slid into the mouth in the proper position shown in Fig. 11 by the stepped slide while straddling the step 67. The inner longitudinal edges of the jaw front sides 87 and 88 are equipped with grooves 89 and 90 respectively which form a guide for the lower edges of the bent side surfaces 63 of the seal 55. However, the mouth opening is somewhat smaller in idle position than the width of the seal 55 so that it somewhat spreads the jaws 83, 84 on insertion in the mouth which, as described above, is possible against a slight spring bias. Insertion of the seal 55 into the mouth is facilitated by the fact that the lateral limits of the said mouth are rounded, and the slight angular deformation of the seal fronts 64 assists the said insertion. The spring action of the jaws 83, 84 holds the seal inserted in the mouth in position. Since the seal feed is completed after rotation of the main shaft by about 30° from idle position of the operating

lever 14, as described, and the cam 33 controlling the lowering movement of the clamping unit becomes operative only after approximately 30°, the bending pliers remain in their extreme upper position during the entire seal feed. As stated above, the control arm 40 actuating the seal feed is released when the seal 55 abuts a stop on the lower step 67 of the stepped slide 51. This stop is formed by the flat cutter 78 in idle position of the clamping device according to Fig. 11 which cutter projects into the mouth opening at the rear of the jaws 83, 84 sufficiently for the inserted seal 55 to engage it with its front edge 64. Since the seal 55 will then have assumed the proper position in the mouth of the bending pliers, the release of the control arm 40 for the seal feed under the action of the engagement with cutter 79 will ensure that the seals 55 are properly inserted in the bending pliers of the clamping unit.

Continuation of the operating stroke of the operating lever 14 and the rotation of the main shaft from about 30° to 75° causes the clamping unit to be lowered so that the opened mouth of the bending pliers together with the seal will drop over the overlapping hoop ends 4 in the hoop channel 3. During this lowering movement, the embossing plunger 74 of the clamping device remains in idle position and only the cutter 79 is returned into the clamping device against its spring bias when the seal 55 is applied to the hoop ends 4. Only a further rotation of the main shaft beyond approximately 75° will cause the embossing plunger 74 to be moved forward and the mouth of the bending pliers to be closed in the manner described, so that the bent side surfaces 63 of the seal are forced together and inserted under the hoop ends 4. When the bending pliers are closed, the embossing plunger 74 together with the embossing die is forced upon the seal, which surrounds the hoop ends and lies in the closed mouth, during the last portion of the movement which takes place at a low feed rate. The two die tongues 78a, b then cause corresponding deformation of the seal which results in a permanent connection of the seal with the hoop ends. Very shortly before the extreme lower position is reached, a lateral projection of the embossing plunger 74 engages the cutter 79 already placed immediately behind the seal on the upper surface of the hoop and causes the top hoop to be crimped immediately behind the seal in the last portion of the operating stroke of the operating lever 14, which completes the clamping operation.

When the operating lever 14 is now returned into its idle position, the main shaft 30 first causes the embossing die to be withdrawn from the matrix by means of the cam 73, and the bending pliers to be opened, whereupon the clamping unit together with the main shaft 30 is raised into its idle position in the housing 6 by means of the cam 33. Shortly before reaching its idle position, the operating lever 14 causes the leaf spring 42 to re-engage control lever 40 of the seal feed and the device is then ready for performing the next clamping operation.

A particular feature of the tightening and clamping device described above is that the design disclosed in Figs. 1 to 18 may be manufactured in simple and inexpensive mass production. The parts requiring a higher degree of machining are formed as compact units, i. e. the clamping device and the magazine unit. Assembly of the entire device is then performed by mounting the said units and the operating levers on a one-piece casting. This casting is distinguished by the fact that only seven milling operations are required despite the variety of the mechanical parts described above and forming part of the device according to this invention. These operations concern milling the slide guide in the housing 6, the lower face of the base plate 1, the hoop channel 3, the mounting surface 59 and the sliding rib 50 for the magazine unit and the feed lever 48 respectively, the support and guide of the locking levers 18, 19, the support of the tightening roller 12. In addition, the bearing brackets

for levers 7 and 8 must be drilled and the various threaded holes provided. Assembly of the units, levers and other parts on the prepared one-piece casting can then be effected very rapidly.

The present invention has been described above in conjunction with a preferred embodiment. It is obvious that other mechanical designs of the locking mechanisms, the feed lever linkage, the raising and lowering mechanism and the magazine unit may be employed and that the invention is not limited to the particular designs described.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:

1. A device for tightening and clamping, by means of a seal, an iron hoop designed to embrace an object, comprising means for accurately locating a hoop in position on said object with the free ends of said hoop in overlapping relation, a seal containing magazine, means for feeding said seal from said magazine to an operative position adjacent said overlapping hoop ends, an embossing plunger reciprocally arranged for movement toward and away from said overlapping hoop ends and said seal when the latter is in said operative position, bending plier means engageable with opposite portions of said seal when the latter is in said operative position for bending said portions about said overlapping hoop ends, a first lever operatively connected to said seal feeding means and said plunger for operating both of the latter in timed relation with one another, means operatively interconnecting said plunger with said plier means for actuating the latter upon movement of said plunger toward said seal and said overlapping hoop ends, the arrangement being such that said first lever during its working stroke from a rest position first actuates said feeding means and then moves said plunger toward said seal to simultaneously actuate said plier means, whereby the latter bend said seal portions about said hoop ends while said plunger crimps said seal and said hoop ends to permanently interconnect the same, said first lever upon being returned to said rest position effecting movement of said plunger away from said seal and said hoop ends together with said plier means, locking means including a feeler for impeding operation of said first lever in response to sensing, by said feeler, of erroneous widths of said hoop ends or of inaccurate positioning of said hoop ends relative to said object and said plunger, a second lever operatively connected to said locking means and movable between two end locations in one of which it retains said locking means in continually effective condition and in the other of which it releases said locking means to enable the same to respond to the action of said feeler, said locking means being rendered ineffective only when said feeler senses hoop ends which are both accurately positioned and of a width lying within a predetermined tolerance range.

2. A device according to claim 1, said locking means comprising two locking arrangements, said feeler being operatively connected to both said locking arrangements to render the same effective, respectively, in response to hoop widths lying above and below said tolerance range.

3. A device according to claim 2, said locking arrangements comprising a pair of multi-armed locking levers provided with latch elements on respective first arms and rotatable toward and away from said first lever and in adjacent planes about spaced, parallel axes oriented substantially lengthwise of said first lever when the latter is in said rest position, a pin and slot connection between said first arm of one of said locking levers and a second arm of the other of said locking levers, said feeler constituting a second arm of said one locking lever, and spring means connected to a third arm of said one locking lever for biasing said feeler in a hoop-sensing direction and for biasing said one arm of said one locking lever

toward said first lever while simultaneously biasing said one arm of said other locking lever away from said first lever through the intermediary of said pin and slot connection, said second lever when in said one end location engaging said third arm of said one locking lever and opposing the biasing action of said spring means.

4. A device according to claim 1, further comprising rotatable shaft means supporting said first lever, and means operatively connected to said shaft means for limiting the rotary movement of said first lever to an angle of about 180°, said seal feeding means being actuated only during the initial movement of said lever from said rest position and through an angle of about 30°.

5. A device according to claim 1, further comprising rotatable shaft means supporting said first lever, cam means carried by said shaft means for rotation therewith, and abutment means operatively connected with said plunger and arranged for engagement by said cam means, whereby upon rotation of said shaft means through movement of said first lever from said rest position, said plunger is moved by said cam means toward said seal and said overlapping hoop ends.

6. A device according to claim 4, said seal feeding means comprising a stepped slide member arranged for linear displacement from a position beneath said magazine to a position adjacent said hoop ends and constructed to receive said seal from said magazine, arm means pivotally connected to said seal feeding means, leaf spring means operatively and releasably interconnecting said arm means and said first lever, whereby said slide member is normally displaced to feed said seal upon rotation of said first lever about the axis of said shaft means, said leaf spring means being released from said arm means to prevent further seal feeding whenever displacement of said slide member is opposed by a force greater than a predetermined maximum force, and resilient means connected to said arm means for returning the same with said slide member to their starting positions.

7. A device according to claim 6, said slide member being provided with three stepped portions with the lowest of said portions located nearest said operative position and serving to displace said seal to said operative position, the middle one of said stepped portions serving, during transfer of said seal, to receive a further seal from said magazine and to shift said further seal into a position enabling said lowest portion of said slide member to receive said further seal upon return to said starting

position, the highest of said stepped portions preventing removal of still another seal from said magazine during displacement of said slide member and subsequent to receipt of said further seal by said middle portion.

8. A device according to claim 5, said cam means comprising a cam plate shaped to permit said plunger to remain in its starting position during initial rotation of said shaft means with said first lever through an angle of about 30° and to effect movement of said plunger toward and into engagement with said seal and said hoop ends during further rotation of said shaft means with said first lever through an additional angle of about 30° to 45°, said cam plate retaining said plunger in its seal-crimping position during subsequent rotation of said shaft means until said first lever has been displaced through a total angle of about 180° from said rest position.

9. A device according to claim 8, said plier means comprising a pair of two-armed levers arranged on opposite sides of the path of movement of said plunger, for pivotal movement toward and away from one another, respectively, corresponding first arms of said levers abutting against the surface of said plunger, corresponding second arms of said levers being constructed as seal-engaging and bending jaws, said surface of said plunger being shaped to retain said second arms in their starting condition while said plunger is in its starting position and to spread said first arms while moving said second arms toward one another upon movement of said plunger toward said seal and said hoop ends due to rotation of said first lever from said rest position thereof.

10. A device according to claim 9, further comprising resilient means acting on said jaw-forming second arms of said levers to cause the latter to grip said seal upon transfer thereof to said operative position and prior to movement of said second arms toward one another upon movement of said plunger.

11. A device according to claim 10, further comprising means resiliently supported and extending into the space between said jaws of said plier means to thereby constitute a yielding stop for said seal upon arrival thereof at said plier means.

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