Aug. 3, 1965 A. I. ERICSSON ETAL 3,198,218

STRAPPING TOOL

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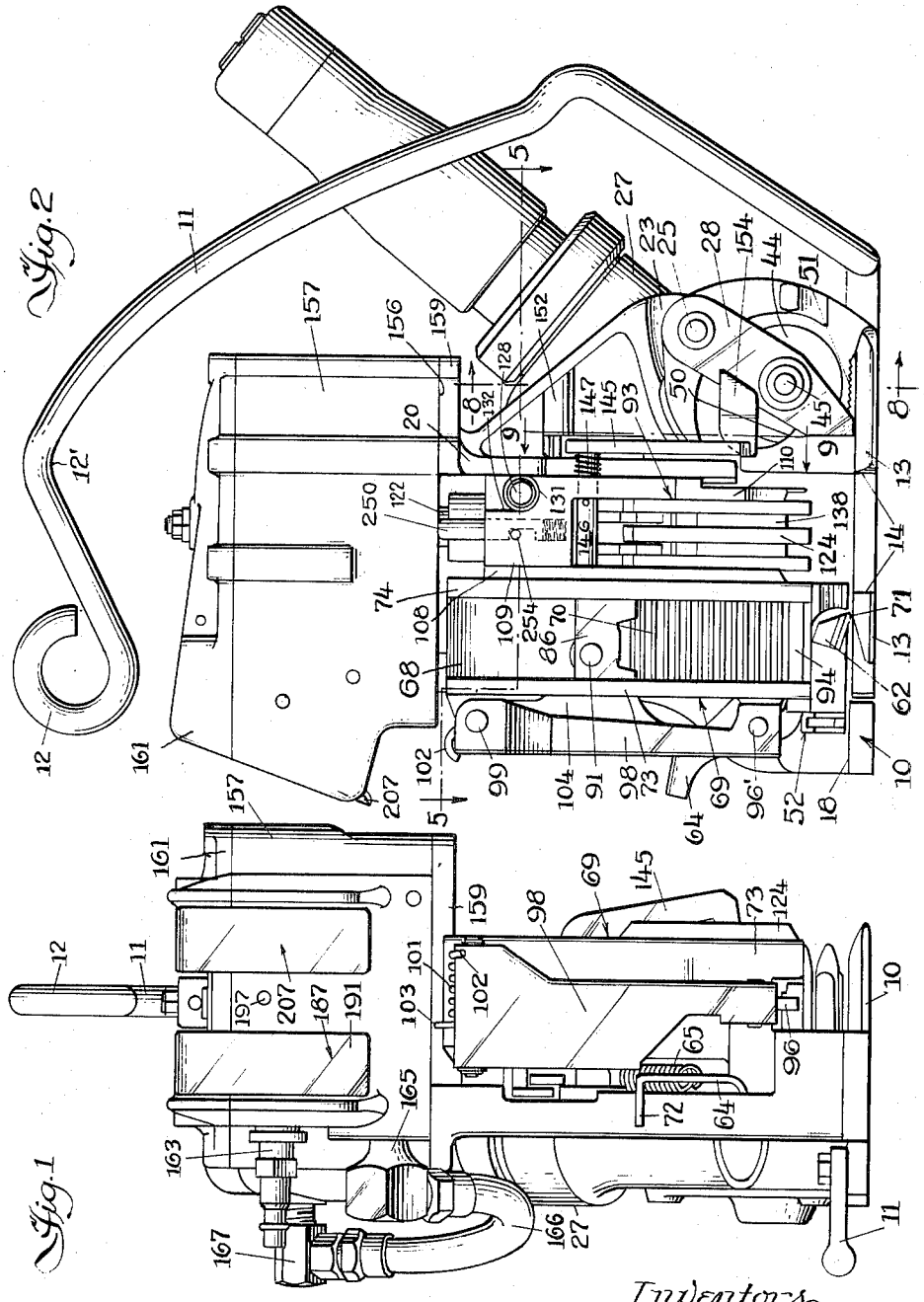

Fig. 2

Fig. 1

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Fig. 4

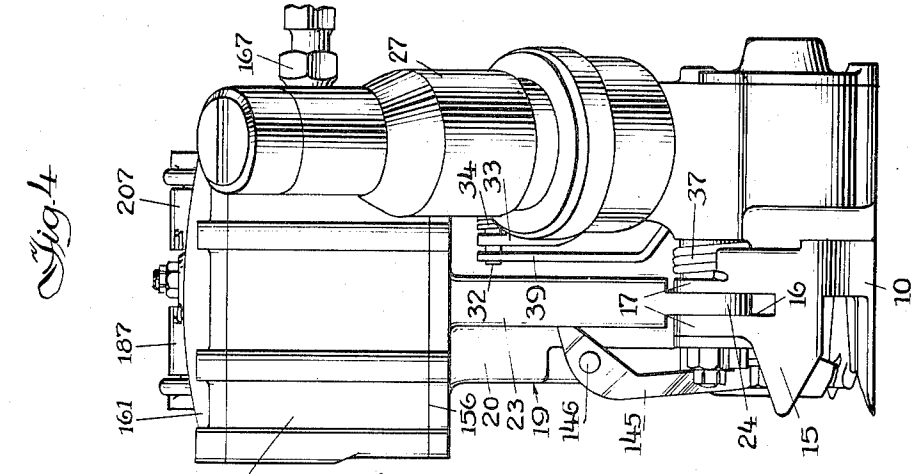
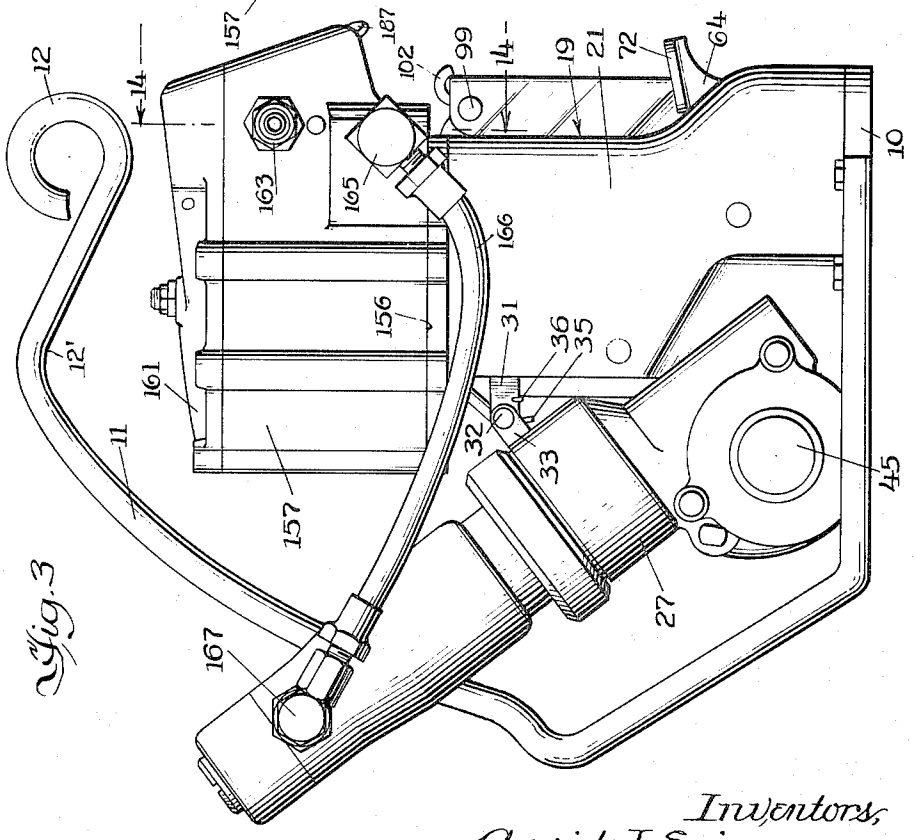


Fig. 3



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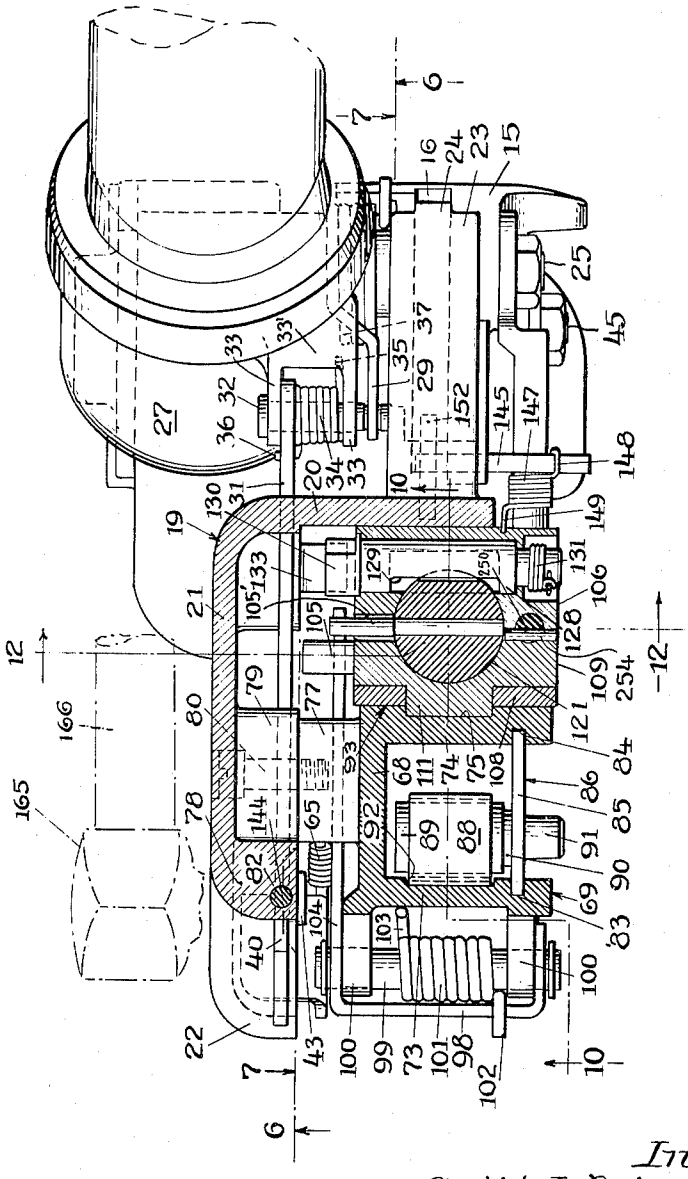

Fig. 5

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Fig. 7

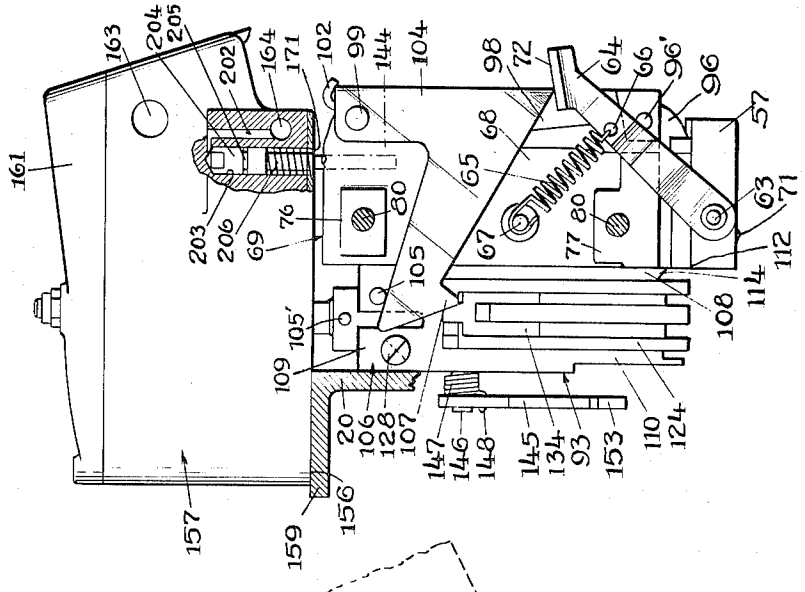

Fig. 6

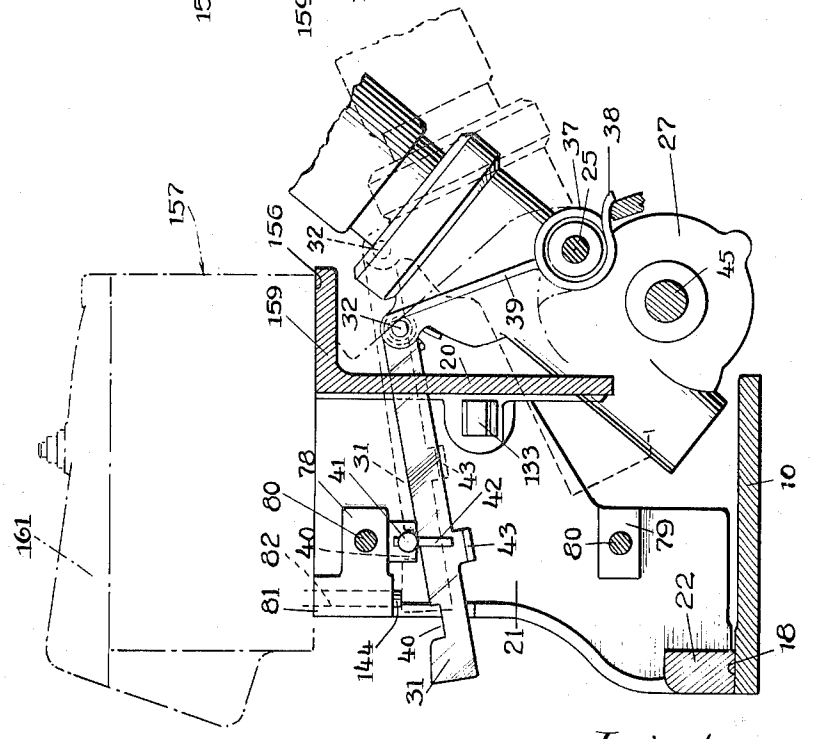

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Fig. 9

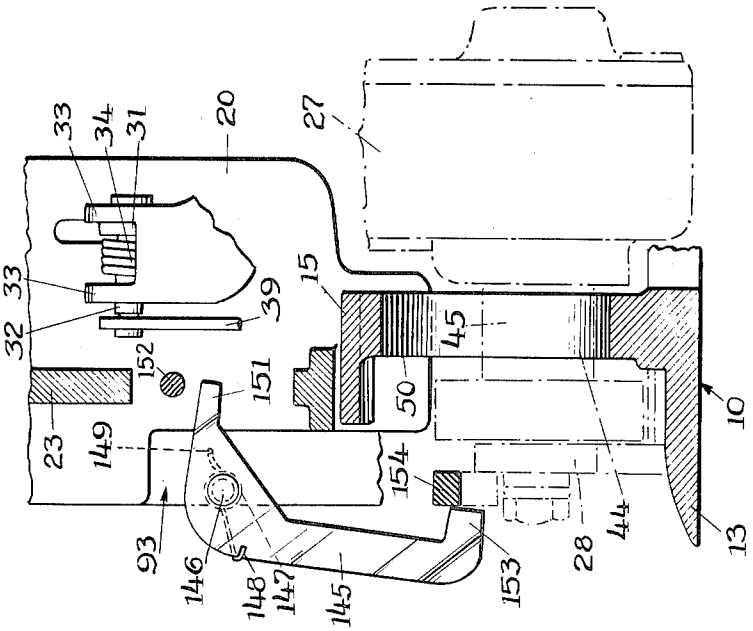

Fig. 8

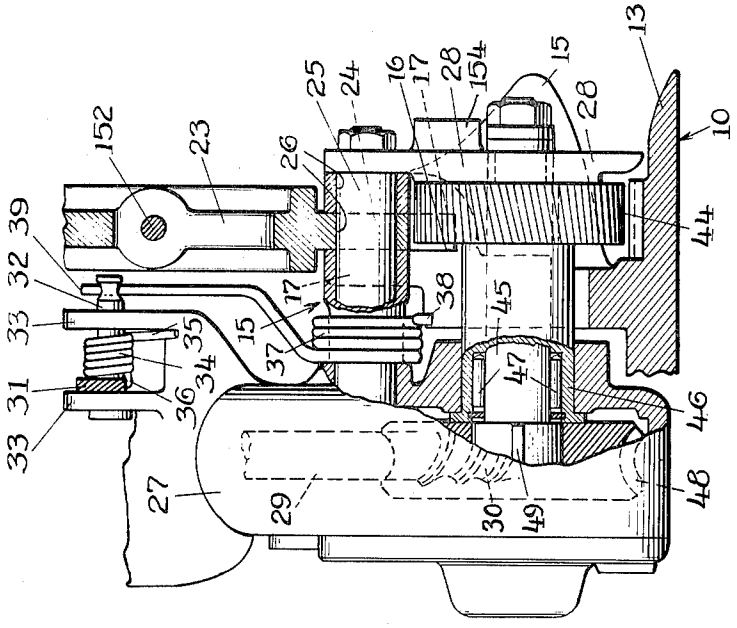

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Fig. 10

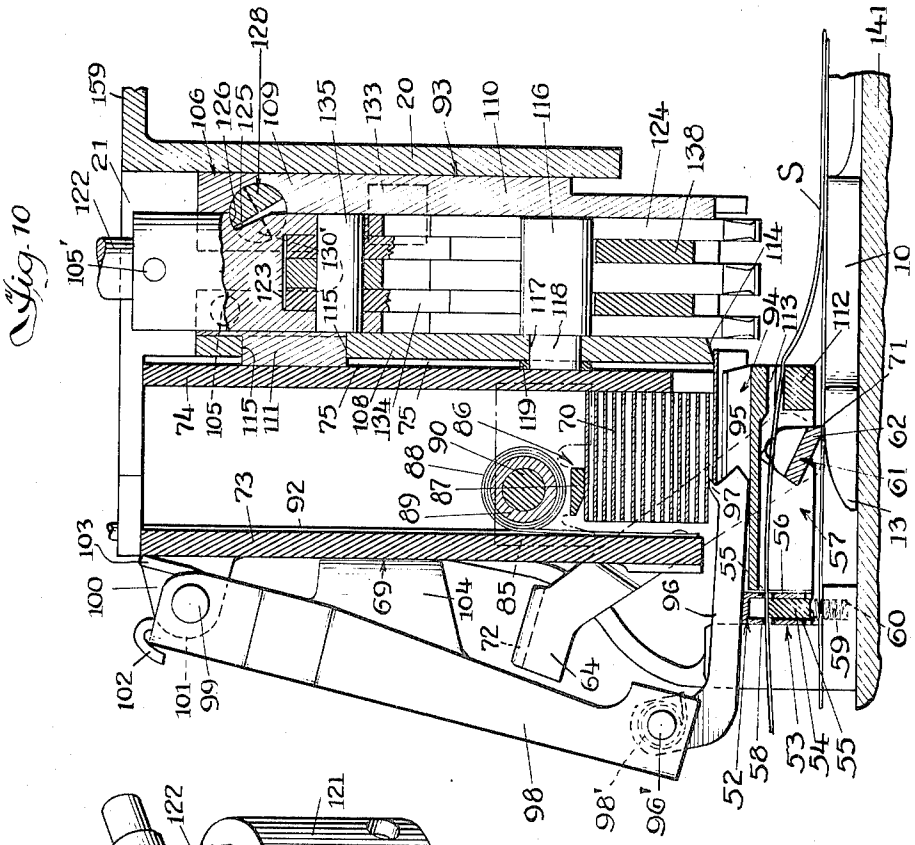

Fig. 11

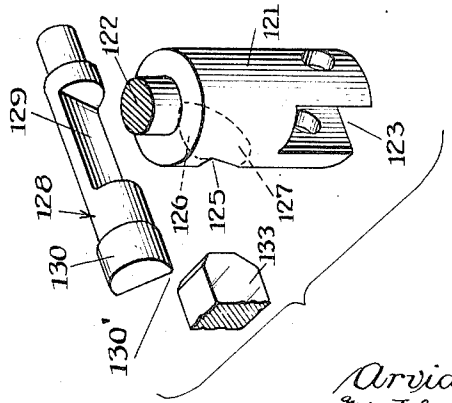

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Fig. 13

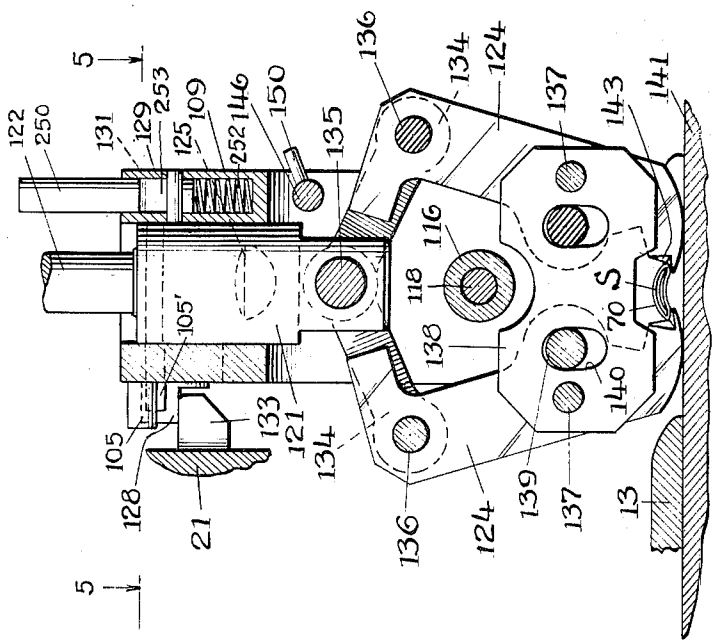

Fig. 12

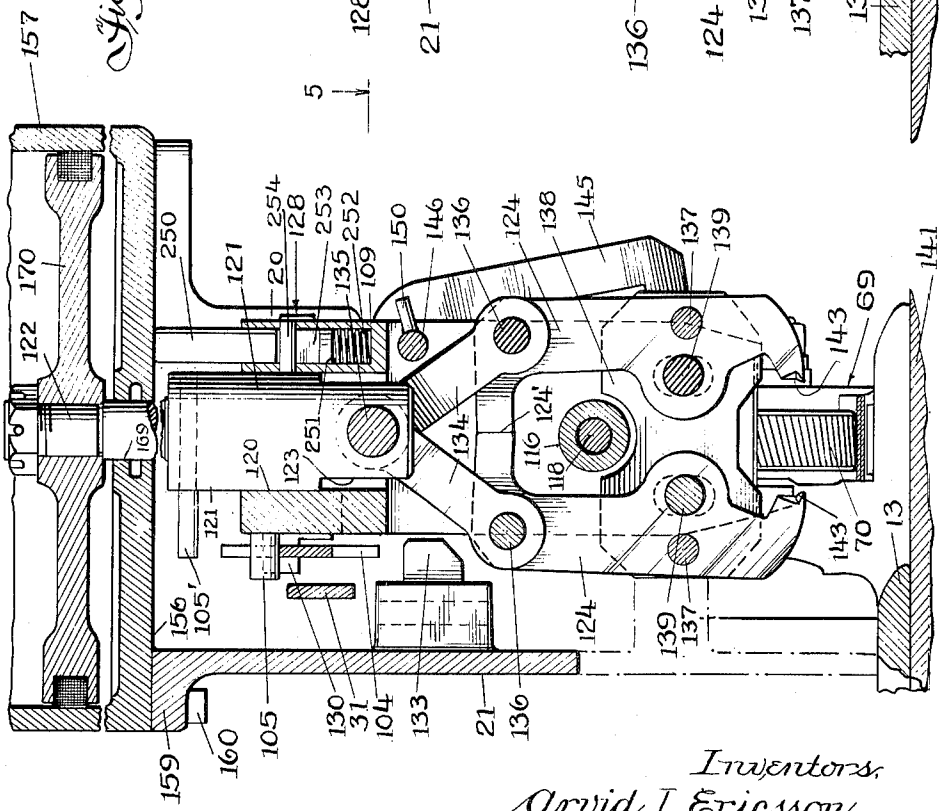

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Fig. 17

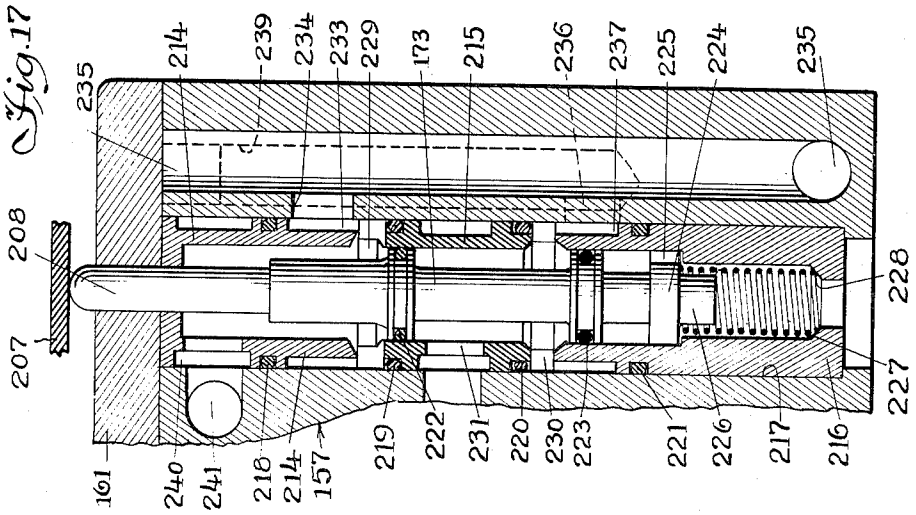


Fig. 15

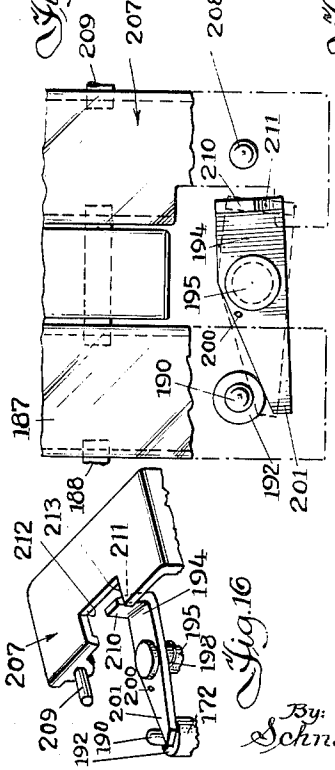
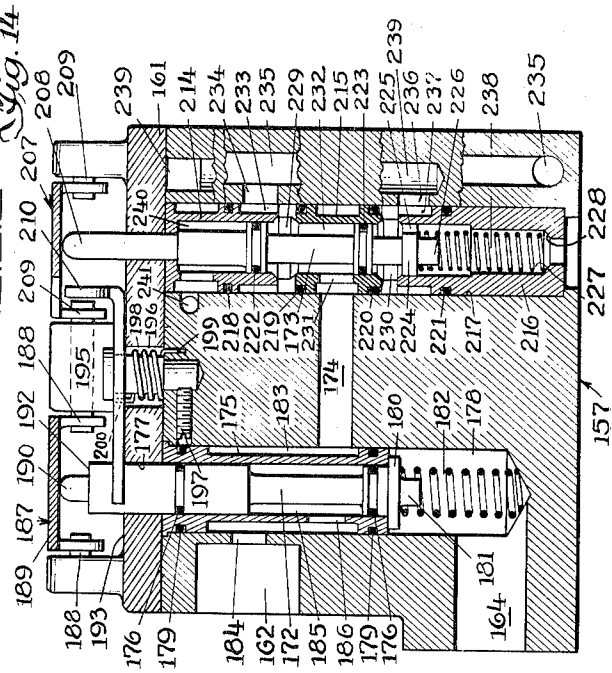


Fig. 16

Fig. 14



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United States Patent Office 3,198,218 Patented Aug. 3, 1965

3,198,218

STRAPPING TOOL

Arvid I. Ericsson, Chicago, and Ilmar J. Vilcins, Oak Park, Ill., assignors to Signode Corporation, a corporation of Delaware

Filed Dec. 5, 1960, Ser. No. 73,885
37 Claims. (Cl. 140—93.4)

The present invention relates to a power-operated strapping tool adapted to engage an object, such as a package or box, to hold overlapped portions of a flat metal strap looped around said object, to tension the strap, shear the upper overlapped strap portion, and crimp a metal seal and the overlapped portions of the strap together.

Tools embodying the present invention have general utility in the metal strapping field and are adaptable to enumerable types of strapping machines. The principles of this invention may be incorporated, for example, in large automatic package handling equipment as well as in portable tools. Hereinafter, there is described an illustrative embodiment of this invention which is in the form of a portable tool adapted to be placed on the object to be strapped. The description of this illustrative embodiment, while specific to the embodiment, is in no way intended to be restrictive, but is intended to be descriptive of an exemplary mechanism which incorporates the principles of this invention.

The exemplary portable tool hereinafter described in detail includes a base, a frame secured to the base, a gripper for holding the free end of the strap, tensioning means for moving the overlapped portion of the strap relative to the free end, a motor for operating the tensioning means, a magazine for holding a stack of metal seals, a plurality of coacting jaws for applying a seal around the edges of the overlapped portions of the strap and crimping the same, an ejector finger for feeding the metal seals individually to the jaws, a piston ram for operating the jaws, a cutter blade for shearing the upper overlapped strap portion, and a valve mechanism for operating the tensioning motor and the piston ram.

The tool may be suspended from a suitable support above the object to be strapped, and the various parts of the tool are at rest when the tool is positioned on the object. A metal strap, looped loosely around the object, is manually threaded into position in the tool, with the free end of the strap overlapped by a portion of the strap extending from any suitable reel, if a pre-cut length of such strap is not used.

The complete strapping operation is controlled by a pair of operating levers that are manually actuated in sequence. The first operating lever is latched in operative position automatically when it is depressed, and remains in its operative position until the second operating lever is depressed. The first operating lever causes a pin to release a latch holding the tensioning motor in inoperative position. The tensioning motor is spring biased to operative position, and a valve controlled by the first operating lever operates the motor to tension the strap immediately after the first operating lever is depressed. The second operating lever is depressed when the strap has been tensioned to the desired extent, and is manually held in its operative position until the metal seal and the overlapped strap portions are crimped. When the metal seal has been crimped about the overlapped portions of the strap, the second operating lever is released, and the mechanisms are returned to their original rest positions by air directed in the desired flow path by the valve mechanism.

The base of the tool is short, and its efficiency is increased because the amount of slack in the metal strap is less than the amount of slack ordinarily present when a tool having a longer base is used for the strapping operation. The shorter base also makes the tool more compact, easier to handle, and more versatile.

The gripper for holding the free end of the strap extends substantially parallel to the base of the tool and is pivotally mounted adjacent said base. The gripper is rigidly secured to the lower end of a pivoted lever. A tension spring tends to pull the lever to move the gripper into holding position. The lever is considerably longer than levers previously used, and the gripper bar is tipped about its axis in a plane closely adjacent the upper surface of the base of the tool. The increased leverage, coupled with the slight pivotal movement of the gripper bar, increases the holding force of the gripper to a substantial extent.

The shear and sealer units are arranged for coordinated movement and operation, moving together during a portion of the stroke but with the sealer unit moving during a portion of the stroke in which the shear unit is held in a fixed position. The latching and releasing means may be in the form of separate elements. In the embodiment of the invention described herein, however, a cam rod and stop therefor perform both functions.

The sealer unit comprises a plurality of pairs of coacting jaws secured to the lower end of a pneumatically operated vertically reciprocable piston ram. The jaws are adapted to hold a metal seal and to crimp it with the overlapped portions of the strap. The shear unit comprises a vertically reciprocable cutter blade adapted to cooperate with a fixed cutter to shear the upper portion of overlapped strap portions. The movable cutter blade is mounted on a jaw support that reciprocates with the piston ram through part of its stroke. A cam rod, comprising a rotatable rod having a cam face, holds the shear and sealer units together as they are moved downwardly by the piston ram. As the sealer and shear units move downwardly, the cutter blade engages the upper strap portion that is positioned on top of the fixed cutter, and cooperates with the fixed cutter to shear it adjacent to but forwardly of the area in which the seal is later applied. After the upper portion of the overlapped strap portions is sheared, the cam rod engages a lug fixed to the frame and is rotated to release the ram from its engagement with the shear unit. The ram continues its downward movement while the shear unit and jaw support remain stationary. A separate stop member independent of the release device may be provided for limiting the downward movement of the shear unit.

The continued movement of the ram initiates the crimping operation of the sealer unit. The jaws are in open position and hold a metal seal between them as they are being moved downwardly. When the downward movement of the jaws is stopped by engagement of cam rod with a lug fixed to the frame, the piston ram continues its downward movement for a short additional distance. Two pins that are fixed relative to the shear unit project through apertures in the jaws of the sealer unit. These pins cooperate with the piston ram during the downward movement of the ram after the jaws are in down position and while the shear unit and jaw holder are stationary, to impart a toggle action to the jaws. The toggle action moves the lower portions of the jaws toward closed position to crimp the metal seal around the edges of the overlapped portions of the strap. The inward movement of the lower portions of the jaws moves the notcher bars downwardly whereby the notcher cooperates with the jaws to control the cross sectional configuration of the crimped metal seal and the strap portions held therein. The seal is crimped adjacent the end of the upper portion of the strap that has been previously sheared by the cutter blade and the fixed cutter. The piston ram then moves upwardly to open the jaws and

move the shear unit, the jaw holder and the jaws upwardly in one continuous movement.

A tool of the present invention needs no adjustable parts for proper operation and has only a few parts that require machining to close tolerances. The few closely dimensioned parts provide for accurate alignment of the cutter blade with the fixed cutter. The dimensions of the notcher and the jaws are not critical because they do not affect the position of the cutter blade relative to the fixed cutter.

The magazine, comprising a three-sided vertical channel for carrying a stack of metal seals, is open at one side to permit easy loading of the seals into the channel of the magazine. The channel is provided with a spring-biased hold-down pad so that another seal is moved into position for ejection every time the ejector finger moves to retracted position after ejecting the lowermost seal of the stack. The spring that urges the hold-down pad downwardly is a coiled strap, constant tension spring having one end fixed in a groove in one side wall of the magazine channel while the other end is coiled about a pin on the pad. The spring unwinds as the hold-down pad is lifted to permit loading of the magazine, and rewinds as the pad moves downwardly. The positioning of the spring in the groove at one side of the channel permits maximum loading in the magazine.

The ejector finger is pivotally secured to the lower edge portion of a spring-pressed ejector lever. A lever extending at right angles to the ejector lever and integral therewith is successively engaged by two pins, one of which projects laterally from the jaw support, and the other of which projects laterally from the ram during the downward movement of the sealer unit. The downward movement of said pins retracts the ejector finger against the force of a biasing spring so that the spring-pressed hold-down pad can move the lowermost seal of the stack into the path of travel of the ejector finger. As the sealer unit moves upwardly, the pins release the lever and the ejector finger moves under spring pressure transversely across the lower portion of the magazine channel to push another seal against the shear plate. When the sealer and shear units reach their upper position, the ejector finger moves the seal into position between the jaws, and the tool is ready for another operation.

An illustrative embodiment of the invention and a structure by means of which the above noted and other advantages of the invention are attained is described in detail in the following specification, taken in conjunction with the accompanying drawings which form a part of this specification and in which:

FIGURE 1 is a front elevational view of a strapping tool embodying the invention;

FIG. 2 is a side elevational view showing the right hand side of FIG. 1;

FIG. 3 is a side elevational view showing the left hand side of FIG. 1;

FIG. 4 is a rear elevational view of the tool, with the handle removed to facilitate the illustration;

FIG. 5 is a plan sectional view, taken along the line 5—5 of FIG. 2;

FIG. 6 is a vertical sectional view, taken along the line 6—6 of FIG. 5;

FIG. 7 is a vertical sectional view, taken along the line 7—7 of FIG. 5;

FIG. 8 is a vertical sectional view, taken along the line 8—8 of FIG. 2;

FIG. 9 is a vertical sectional view, taken along the line 9—9 of FIG. 2;

FIG. 10 is a vertical sectional view, taken along the line 10—10 of FIG. 5;

FIG. 11 is a detail, exploded, perspective view of the jaw holder and the cam rod and lug for connecting it to and disengaging it from the jaw support as the jaw holder is reciprocated;

FIG. 12 is a vertical sectional view, taken along the line 12—12 of FIG. 5, showing the jaws in open position;

FIG. 13 is a fragmentary vertical sectional view, similar to FIG. 12, showing the jaws in sealing position;

FIG. 14 is a broken vertical sectional view, taken generally along the line 14—14 of FIG. 3, showing the valve mechanism for operating the tensioning motor and the piston ram;

FIG. 15 is a fragmentary plan view, showing the pivoted lever interengaging the operating levers;

FIG. 16 is a detail perspective view of the latch structure of FIG. 15; and

FIG. 17 is a broken plan sectional view, similar to FIG. 14, showing the valve for operating the piston ram in its lowermost position.

The strapping tool shown in the drawings includes a base 10 to which a handle 11 is secured. As shown in FIG. 3, the handle extends upwardly and forwardly from the rear end of the tool, and terminates in a handling convenience loop 12 located above the top of the operating mechanism. A bend 12' in the upper portion of the handle is located above the center of gravity of the machine and forms the suspension point on the handle when the tool is suspended from an overhead cable or chain.

The base has a pair of spaced feet 13 extending laterally from one side thereof. The feet are spaced longitudinally of the base to provide a gap 14 long enough to permit the entry therein of a sealer unit adapted to crimp the opposite longitudinal edges of overlapped portions of a flat metal strap and to secure a metal seal thereabout.

The base has an integral vertical support member 15 projecting upwardly from ts rear end. The upper edge of support member 15 is bifurcated, as indicated at 16, to provide a pair of integral upstanding ears 17. The top surface of the front end portion of base 10 is machined to provide a flat support 18 (FIG. 6) for the front end of an upstanding frame member 19. The frame member 19 is shown as a casting, preferably aluminum, having a rear wall 20, a side wall 21, and a lug 22 projecting parallel to the rear wall 20 at the front end of the frame member. The bottom of lug 22 is machined to provide a smooth surface for engagement with the upper surface of the flat support 18. The front end of the base 10 is bolted to lug 22.

An integral flange 23 extending rearwardly from the rear wall 20 has a lower portion 24 extending into the bifurcation 16 between the ears 17. A shaft 25 is rotatably mounted in transversely aligned apertures 26 (FIG. 8) provided in each of the ears 17 and in the lower portion 24 of flange 23. A motor housing 27 is secured to the shaft 25 at one side of the vertical support member 15 for pivotal movement with said shaft. A flat side guide plate 28 is rigidly secured to said shaft at the opposite side thereof. The tensioning motor does not constitute part of the present invention and is not shown, except for its shaft 29 and a worm gear 30 secured thereto, as shown in FIG. 8.

The tensioning motor and the side guide plate 28 are pivotally movable in vertical planes about the axis of the shaft 25 to a predetermined extent, limited in a manner hereinafter described. The tensioning motor is held in either of two angular positions, designated, for convenience, as its upper and lower positions. The upper position of the motor is its operative position, and the lower position is its inoperative position. A latch 31 is pivotally connected to the motor by a pin 32 that extends transversely between two ears 33 projecting from a plate 33' rigidly secured to the motor housing 27. A coiled spring 34 encircling the pin 32 has one end 35 bearing against the plate 33' and its other end 36 bearing against the underside of the latch 31 to bias the latch upwardly.

The tensioning motor is biased upwardly by a coiled spring 37 encircling the shaft 25 and having its ends 38 and 39 bearing respectively against the vertical support member 15 and the pin 32. The motor is held in its lower position against the action of spring 37 by the interengagement of a notch 40 (FIG. 6) and a stud 41 that projects inwardly from the side wall 21. The latch 31 is held against lateral movement by pins 42 depending from stud 41 on opposite sides of the latch. The means for releasing the latch to permit the spring 37 to move the tensioning motor into its upper position, and the means for moving the tensioning motor from its upper position to its lower position against the action of the spring 37 are both hereinafter described in detail. The latch 31 is provided with an integral lip 43 that projects inwardly from its lower edge. The lip 43 cooperates with means, hereinafter described, to release the latch 31 before the sealing operation, and thereby prevent jamming of the tool, in the event that the latch is not previously released in the normal manner, hereinafter described.

A tensioning wheel 44, having a knurled peripheral surface, is fixed to a shaft 45 that extends parallel to the shaft 25. The shaft 45 is rotatably mounted in a sleeve 46 (FIG. 8) extending between the motor housing and the knurled wheel. The sleeve 46 is provided with needle bearings 47 adjacent one end. A worm wheel 48 is fixed to one end of the shaft 45 by a spline 49. The worm wheel 48 meshes with the worm gear 30 and rotation of the shaft 29 rotates the knurled wheel 44 as long as the motor remains in its upper position. The tensioning motor is preferably pneumatic, and its operation is controlled by a valve mechanism which is arranged to keep the motor in operation whenever the valve is depressed. The other end of the shaft 45 projects through the guide plate 28. The side guide plate 28 acts as a rigid link with reference to the shaft 45, and moves it pivotally about the axis of the shaft 25 whenever the tensioning motor is moved pivotally between its upper and lower positions.

The vertical support member 15 is provided with an opening 50 (FIG. 2) through which the shaft 45 extends. The opening 50 is elongated to permit arcuate movement of the shaft 45 pivotally about the axis of the shaft 25. The abutment of the shaft 45 against the upper end of the elongated opening 50 may limit the downward pivotal movement of the tensioning motor. The cooperation of the latch 31 and the stud 41, however, normally provide a stop and catch in advance of such abutment, and do not permit the same to occur. The free end of guide plate 28 abuts against the upper surface of base 10 to limit the upward pivotal movement of the motor if there is no strap disposed under the wheel 44. The knurled peripheral surface of the wheel 44 is substantially tangential to the upper surface of base 10 when the tensioning motor is in its upper, or operative, position. The base 10 has a knurled pad 51 that may be formed by knurling the upper surface of a boss on the base or it may be a separate plug that is secured in an aperture in the base plate. The knurled surface 51 is adapted to cooperate with the knurled surface of wheel 44 to grip both the upper and lower portions of the strap S and to permit the upper portion of the strap to be moved longitudinally relative to the lower portion thereof as the wheel 44 is rotated, to tension the strap about the object encircled by it.

The free end of guide plate 28 abuts the outer longitudinal edge of the strap to serve as a lateral guide for it as it is being tensioned. The guide plate is positioned close to the sealing area, and thus insures proper vertical registration of the edges of the overlapped portions of the strap during the sealing operation. Another guide member 52 is provided for the strap adjacent the front end of the tool.

The guide member 52 (FIG. 10) comprises a channel member 53 open at its bottom and having a transversely extending pin (not shown) pivotally securing a bar 54 within the channel. One side wall 55 of the channel member is positioned adjacent the inner surface of the lug 22, and the other side wall 56 is positioned adjacent one side of a block 57, hereinafter described. The pivot pin extends into a recess (not shown) in the side of block 57 to position the guide member 52 laterally with respect to the base. Side walls 55 and 56 are slotted longitudinally of the channel member 53, as indicated at 58, through the portion of the channel member 53 that projects beyond the inner edge of lug 22. The upper portion of strap S is positioned to extend through the slots 58.

A coiled spring 59, seated in a recess 60 provided therefor in base 10, engages the bottom edge of bar 54 and urges it upwardly against the underside of the portion of the strap S extending through the slots 58. The outer end of bar 54 has an upwardly extending projection (not shown) that traverses slots 58 and serves as a lateral guide for the portion of strap S that extends through said slots. The projection prevents accidental lateral displacement of the strap. The free end of the strap S passes under the guide member 52.

The free end of the strap also passes under a gripper 61 that holds it against longitudinal movement as the strap is being threaded into the machine and until the strap is tensioned. The gripper comprises a bar 62 extending transversely of the block 57 and has a stud 63 (FIG. 7) projecting through an aperture in the block 57. The stud 63 may be formed as a separate member rigidly secured to the bar 62, or it may be integral therewith. The axis of the stud 63 is parallel to and adjacent the plane of the top of the base of the tool. The gripper bar 62 is merely tipped about its axis to move it into holding relationship with the strap.

A lever 64, rigidly secured to the stud 63, is biased toward gripping position by a coiled tension spring 65. One end of the spring is secured to the lever 64, as indicated at 66. The other end of the spring is secured to a stud 67 projecting from the back wall 68 of a magazine 69. The lower edge of the gripper bar 62, urged into holding engagement with the strap S by the tension spring 65, is preferably provided with teeth, indicated at 71 (FIG. 2), to increase the firmness of the gripping action. The gripping edge of the bar 62 extends slightly below the bottom of the block 57 when it is in gripping position. The free end of the lever 64 is provided with a lateral flange 72 to facilitate pivotal movement of the bar 62, against the action of the spring 65, to permit raising the gripping bar for insertion of the strap into the machine.

The magazine 69 for holding a stack of seals is preferably an aluminum casting, but may be made in any suitable manner. In addition to the back wall 68, it has a pair of side walls 73 and 74 that extend forwardly from the back wall to form a three-sided vertical channel member. The side wall 74 is provided with a machined vertical groove 75 on its outer surface 74 which is also machined to provide a smooth surface.

One side of the magazine is open to facilitate insertion of the metal seals into the magazine. The opening at the side of the magazine is wider than the metal seal. All that is necessary to load the magazine is to lift a spring-pressed hold-down pad, hold the pad upwardly against the action of the spring, and manually insert the metal seals into the channel of the magazine 69 through the open side thereof. As soon as a stack of seals is inserted into the channel under the hold-down pad, the hold-down pad is released, and the spring pulls the hold-down pad downwardly against the top of the stack.

A pair of lugs 76 and 77 extend rearwardly from the upper and lower edge portions, respectively, of the back wall 68, as shown in FIGS. 5 and 7. The vertical spacing of the lugs 76 and 77 coincides with the vertical spacing of similar lugs 78 and 79 (FIG. 6) projecting inwardly

from the side wall 21 of the upstanding frame member 19. The meeting surfaces of these lugs are machined, and the magazine 69 is secured to the frame member 19 by means of bolts 80 extending through the lugs as shown in FIG. 5. The smooth surfaces of the lugs permit accurate alignment of the magazine 69 with other parts of the tool. The upper lug 73 is extended upwardly, as shown at 81, so that a portion thereof is flush with the upper edge of the frame member 19. The extension 81 is provided with a vertical bore 82, for a purpose hereinafter described.

The inner surfaces of the side walls 73 and 74 are provided with aligned vertical grooves 83 and 84, respectively, for sliding engagement with the opposite sides of a plate 85 forming part of a spring-pressed hold-down pad 86. The hold-down pad also has an arm 87, seating on the uppermost seal 70 of a stack of metal seals positioned in the magazine 69, and a coiled strap constant tension spring 88 urging the pad down against the top of the stack of seals. The arm 87 is preferably integral with the plate 85 and extends therefrom at substantially right angles. The arm 87 may be formed separately and secured to the plate 85 in any suitable manner.

The spring 88 has one end rigidly secured to the wall 73 of the magazine 69. The other end of the spring 88 is secured to a core 89 that is rotatably mounted on a stud 90 that is pressed into the front side of the plate 85. A finger piece 91 projecting from the stud 90 is easily accessible between the side walls 73 and 74 to facilitate movement of the hold-down pad 86 upwardly against the action of the spring 88. The hold-down pad must be held up above the stack of seals whenever it is desired to replenish the stock of metal seals in the magazine.

The wall 73, to which one end of the spring 88 is secured, is provided with a flat shallow groove 92 that extends vertically of the wall. The end of the spring that is secured to the wall 73 is fitted into the groove 92, and the intermediate portion of the spring is confined within the groove so that the spring does not take up any of the space within the magazine intended for stacking the metal seals 70. The location of the intermediate portion of the spring 88 in the groove 92 keeps the spring out of the way of the metal seals during the loading operation, thereby making it easier to load the magazine. The groove 92 also increases the life of the spring 88 because there is no rubbing wear on the spring by contact with the metal seals. The spacing of the intermediate portion of the spring 88 from the adjacent edge of the metal seals also prevents deformation of the metal seals by rubbing action of the spring against the metal seals.

The coiled portion of the spring 88 does not take up any of the space intended for the seals because it is positioned above the arm 87 that engages the uppermost seal. This arrangement permits the tool to have less height than tools of the same capacity previously known, because substantially all of the space in the magazine channel between the bottom of the channel and the underside of the hold-down pad is available for stacking seals therein.

The spring 88 is arranged to unwind as the hold-down pad is pushed upwardly, and winds itself on the core 89 as the seals are ejected from the magazine, or whenever the hold-down pad is released in spaced relationship to the top of the stack of seals in the channel of the magazine. The tension of the spring 88 is sufficient to hold the lowermost seal 70 against the upper surface of the block 57, which serves as the bottom of the magazine 69. The tension of the spring 88 also insures substantially instantaneous movement of the next lowest metal seal into engagement with the top surface of the block 57 as soon as the lowermost seal is moved out of the magazine. The metal seals are fed individually from the magazine into a sealer unit 93, hereinafter described, for crimping them into engagement with the longitudinal edges of overlapping portions of a metal strap.

As shown in FIG. 10, the top portion 94 of the block 57 comprises an integral extension projecting upwardly from the block and provided with a centrally disposed transverse groove 95 in which an ejector finger 96 is slidably mounted. The ejector finger has a projection 97 extending upwardly and outwardly from its free end to engage one edge of the lowermost metal seal 70 and push it rearwardly of the tool. The seal is moved from the bottom of the stack of seals in the magazine into the sealer unit. A pin 96' pivotally secures the other end of the ejector finger to the lower end of an ejector lever 98 operable to move the ejector finger back and forth through the groove 95. A spring 98' coiled around the pin 96' urges the ejector finger downwardly against the bottom of the groove 95.

The upper end of the ejector lever 98 is pivotally secured to a pin 99 extending through apertures in a pair of spaced ears 100 projecting from the wall 73 of the magazine 69. A coiled spring 101 encircling the pin 99 has one end 102 bearing against the ejector lever and its other end 103 bearing against the wall 73 to urge the lower end of the ejector lever toward the magazine 69. A lever 104, integral with the ejector lever 98, is positioned between the back wall 68 of the magazine and the side wall 21 of the frame member 19. The lever 104 extends at substantially right angles to the ejector lever, and is adapted to move the ejector finger 96 into its retracted position when the tool begins operation.

The lever 104 is engaged, near its outer end, by a pin 105 that projects outwardly from a jaw support 106. The jaw support 106 is reciprocated vertically, in a manner hereinafter described. Downward movement of said jaw support causes the pin 105 to engage the upper edge of the lever 104 adjacent its outer end to move the lever pivotally downwardly. The downward movement of the lever 104 moves the lower end of the ejector lever 98 outwardly against the action of the spring 101.

Another pin 105' projects laterally from a ram, hereinafter described, in a direction parallel to the pin 105 and supplements the action of the pin 105 on the lever 104. After the jaw support 106 reaches its lowermost position, the ram continues to move downwardly, and the pin 105' engages the ejector lever to move it farther in the same direction as it was previously moved by the pin 105. The outward movement of the lower end of the ejector lever caused by downward movement of the pin 105' retracts the ejector finger 96 far enough to allow the spring 88 to move the stack of metal seals 70 downwardly in the channel of the magazine 69, and thereby move another seal into position on the top surface of the block 57. The pin 105' is rigidly secured to the ram and does not release the ejector mechanism until the ram starts to move upwardly after the sealing operation which occurs during downward movement of the ram. The crimping jaws, however, do not open sufficiently far to receive another seal until the jaw support and shear units start upward movement. The ejector, therefore, feeds the seal against the shear unit until it has raised a sufficient extent to permit a seal to enter the jaws. The pin 105 is secured to the jaw support and therefore rises with the jaw support so as to permit unhibited seal feeding.

The sequence of feeding the meal seals into the sealer unitis as follows. When the tool is at rest, a metal seal is in position in the sealer unit, and the ejector finger is in the transverse groove 95 extending across the bottom of the magazine. The downward movement of the jaw support 106 moves the pin 105 into engagement with the upper edge of the lever 104, thereby moving the lower end of the ejector lever 98 away from the magazine. After the jaw support is in its lowermost position, the pin 105' is moved downwardly by the ram to complete the retraction of the ejector finger 96. In the retracted position, the free end of the ejector finger is in the groove 95 but is under the wall 73 so that it is clear of the channel of the magazine 69. The spring 88 then moves the stack

of metal seals downwardly in the magazine, thereby moving the lowermost seal into position for subsequent ejection. As the jaw support 106 moves upwardly, the pin 105 moves upwardly, and the spring 101 moves the lower end of the ejector lever 98 inwardly toward the magazine. The ejector lever moves the ejector finger through the groove 95 to move the lowermost seal against the shear plate. As the jaw support is moved upwardly the cutter blade moves upwardly, and when its lower edge clears the top of the lowermost seal 70 the seal is moved into the sealer unit for the next sealing operation.

As the ejector finger 96 moves the seal into the sealer unit, the projection 97 extends slightly beyond the outer surface of the magazine wall adjacent the sealer unit so as to properly seat the seal within the crimping jaws. If the finger did not project far enough to so seat the seal, the seal would either interfere with the shearing operation or be cut off thereby. The pin 105 is so located, relative to the cutter blade, hereinafter described, as to insure retraction of the projection 97 far enough to clear the vertical plane of the cutter blade before the cutter blade reaches the horizontal plane of said projection.

The shear and sealer units are so interrelated that some of the structure hereinafter described is common to both units. The shear unit comprises the jaw support 106 and a cutter blade 108. Both of these members also cooperate with the jaws of the sealer unit, hereinafter described, to support them and to enable them to produce the toggle action necessary to crimp the metal seal around the longitudinal edges of the overlapped portions of the strap. The jaw support comprises a block 109 having an integral side plate 110 depending from one side of the block. The block 109 has an integral extension 111 projecting laterally from one side of the block. The extension is slidably mounted in the groove 75 that extends vertically in the side wall 74 of the magazine 69. In addition to helping guide the vertical movement of the shear and sealer units, the extension 111 helps to locate the cutter blade 108 properly with respect to a fixed cutter 112. The fixed cutter constitutes part of the block 57.

The fixed cutter is formed on one edge of the block 57. Said edge portion of the block is machined to provide for close, accurate surface contact with the side of the cutter blade. This edge portion of the block is notched, as indicated at 113 (FIG. 10), to provide a V-shaped opening through which the upper portion of the strap S is extended. The upper portion of the strap also passes above the gripper bar 62, which is adjacent the notch, so that it may be free to move longitudinally relative to the lower portion of the strap that is held against movement by the gripper. The lower edge of the cutter blade 108 is inclined slightly, as indicated at 114, to provide a sharp cutting action between the cutter blade and the fixed cutter. In order to provide a close enough fit between the cutter blade and the fixed cutter to attain the sharp cutting action desired, it is necessary to accurately dimension the thickness of the block 109 and the thickness of the cutter blade 108.

The cutter blade 108 is provided with a rectangular opening 115 adapted to fit snugly over the extension 111. Although the extension 111 and opening 115 are of rectangular surface area in this embodiment, it is obvious that these members may be of any desired configuration. A sleeve 116 fits over a stud 118 to act as a spacer between cutter blade 108 and plate 110. The cutter blade 108 and plate 110 abut opposite ends of spacer 116, but the cutter blade has an aperture 117 through which the stud 118 extends. A washer 119 fitting on the stud 118 has an outer diameter substantially equal to the width of the vertical groove 75 and fits therein to help guide the vertical movement of the shear and sealer units. The spacer 116 may be integral with the stud 118, if desired, with a portion of reduced diameter extending through the aperture 117.

The length of the spacer 116 is accurately dimensioned to equal the lateral distance between the inner surface of the side plate 110 and the outer surface of the block 109 from which the extension 111 projects. The spacer and said outer surface of the block 109 provide two vertically spaced areas of support for the inner surface of the cutter blade to insure accurate alignment of the cutter blade with the outer surface of the fixed cutter 112. The flat surface-to-surface contact between the lugs 76 and 78, and between the lugs 77 and 79 insures accurate vertical alignment of the magazine wall 74. The outer surface of the cutter blade 108 has a smooth, sliding contact with the outer surface of the magazine wall 74 on both sides of the vertical groove 75. In addition to the sharp cutting action attained by the accurate alignment of the cutter blade with the fixed cutter, the accurate alignment of these parts insures accurate positioning of the metal seals in the jaws as they are ejected from the magazine by the ejector finger 96.

The jaw support 106 has a vertically extending bore 120, through which the ram 122 extends. The ram has a portion 121 of enlarged diameter that has a sliding fit in the bore 120. The lower end of the ram is recessed, as indicated at 123 (FIGS. 10 and 11) to support a plurality of crimping jaws 124 in a manner hereinafter described. The ram is also provided with a transversely extending notch 125 having a substantially horizontal face 126 and an inclined face 127. A cam rod 128 is rotatably mounted in the block 109 of the jaw support 106 (FIG. 5) for cooperation with the ram whereby the ram may be moved vertically with the jaw support or independently thereof to effect the crimping action of the jaws 124.

The cam rod 128 is recessed longitudinally along its center portion, as indicated at 129 (FIG. 11), and has one end 130 of semi-cylindrical cross-section projecting outwardly beyond the outer surface of the block 109. The flat surfaces of the portions 129 and 130 of the rod, both of which act as cams, are angularly disposed relative to each other. A spring 131 (FIG. 5) urges the cam rod into the position shown in FIG. 10, in which it engages the notch 125 of the ram so that the ram and the jaw support 106 will move downwardly together with the downward vertical movement of the ram until the cam rod is disengaged from the notch 125. The block 109 is recessed, as indicated at 132, (FIG. 2), to provide space for the spring 131 within the confines of the block.

A hold-down plunger 250 is slidably mounted in a recess 251 in the block 109. The plunger extends vertically above the top of the block to limit the upward movement of the jaw support in the event that the cam gets disengaged from the notch 125. A spring 252 seated in the recess urges the plunger upwardly. One edge of the plunger is notched, as indicated at 253, and a pin 254 traverses the notch to limit the vertical movement of the plunger.

A lug 133 projects inwardly from the side wall 21 of the frame member 19 in such position that it will be engaged by the end 130 of the cam rod as the shear and sealer units are moved downwardly. The flat surface of the end of the cam rod projecting from the block 109 engages the lug 133 adjacent the edge 130' as the piston ram moves the shear and sealer units downwardly together. The lug causes the cam rod to rotate against the action of the spring 131 in a clockwise direction, as viewed in FIG. 10, far enough to move the flat surface of the portion 129 into parallel relationship to the vertical axis of the ram. In this position the face 126 of the notch 125 is clear of the cam rod, and the ram moves the jaws with a toggle action while the jaw support and the cutter blade remain stationary.

The lug 133 is spaced vertically from the lower edge of the side wall 21 at such a distance that it is engaged by the cam rod after the shearing action of the cutter

blade with the upper overlapped portion of the strap. This upper portion of the overlapped strap is spaced from the lower portion in the vertical shearing plane, as shown in FIG. 10, so that the upper portion of the strap may be completely sheared without cutting into the lower portion of the strap. The vertical shearing plane is adjacent the forward end of the sealing area. The location of the shearing action prevents waste of the strap and results in a neater package. The upper portion of the strap is sheared just before the seal is crimped around the longitudinal edges of both overlapped portions of the strap.

As shown in FIGS. 12 and 13, the sealer unit includes a plurality of toggle links 134 that are pivotally mounted on a pin 135. The pin 135 is secured to the ram and extends transversely of the recess 123. The lower ends of the toggle links are pivotally connected to the coacting jaws 124 by means of pins 136. The jaws are arranged in pairs, with each jaw facing an oppositely disposed jaw in the same plane. The lower ends of the jaws are pivotally secured adjacent opposite sides of the sealer unit by pins 139 that have their ends fixed snugly in apertures in the cutter blade and side plate 110 to hold the lower ends of the jaws against vertical movement relative to the cutter blade and the side plate 110. Notcher bars 138, positioned between adjacent jaws, extend transversely of the jaw holder, and each notcher bar is secured to the jaws 124 by pins 137.

Each of the pins 139 extends through apertures 140 in the notcher bars. The apertures 140 are slightly elongated in the vertical direction. This vertical elongation of the apertures 140 permits the notcher bars to move downwardly during the crimping action of the jaws. The jaws move pivotally about the pins 139 to move the pins 137 and the notcher bars downwardly.

The inner edges of the jaws 124 are each notched adjacent the bottom of the jaw, as indicated at 143. The notches 143 facilitate positioning the metal seals 70 between oppositely disposed jaws when the seals are moved into the sealer unit by the ejector finger 96, and also guide the outer edges of the metal seal during the crimping operation.

The overlapped portions of the strap are tensioned before the seal is applied to them. The means for moving the tensioning motor pivotally about the axis of shaft 25 between its upper and lower positions includes a pin 144 and a latch 145. The latch 145 is pivotally mounted adjacent its upper end on one wall of the sealer unit 93 by a stud 146, as shown in FIG. 9. A spring 147 having one end 148 engaging the latch 145 and its other end 149 engaging an aperture or recess in the sealer unit 93, urges the lower end of the latch inwardly into its operative position. A pin 150 (FIG. 12) projects laterally from the stud 146 and engages the lower edge of the block 109 to limit the outward movement of the lower end of the latch. The upper end 151 of the latch 145 extends inwardly so that it can engage a pin 152 (FIG. 9) projecting rearwardly from the rear wall 20 of the frame member 19. The lower end 153 of the latch 145 extends inwardly so that it can engage a lug 154 projecting forwardly from the guide plate 28. The lug 154 is preferably cast in one piece with the guide plate.

As the sealer unit is moved downwardly, the lower end 153 of the latch 145 moves inwardly, as urged by the spring 147, so that it underlies the lug 154. As the sealer unit is moved upwardly, the lower end 153 of the latch 145 engages the underside of the lug 154 and lifts it upwardly. The upward movement of the lug 154 moves the guide plate 28 and the lower end of the tensioning motor pivotally upwardly about the axis of the shaft 25, thereby moving the motor to its lower position. This pivotal movement of the tensioning motor pulls the motor latch 31 rearwardly, and the spring 34 moves the motor latch upwardly to cause the notch 40 to move into holding engagement with the stud 41, whereby the motor is held in its lower position.

As the sealer unit is moved upwardly, the upper end 151 of the latch 145 engages the pin 152. The pin 152 holds the upper end 151 from further upward movement, and rocks the lower end of the latch outwardly to disengage it from the lug 154. This disengagement of the latch 145 from the lug 154 does not affect the position of the tensioning motor, because the motor is then held in its lower position by the interengagement of the pin 41 with the notch 40 of the motor latch 31.

The pin 144 is moved downwardly through the bore 82, by pneumatic means hereinafter described, into engagement with the upper edge of the motor latch 31 to move the motor latch pivotally downwardly to disengage the notch 40 from the pin 41. As soon as the notch 40 is clear of the pin 41, the spring 37 moves the tensioning motor pivotally into its upper position. The spring 37 holds the tensioning motor in its upper position until the lower end of the latch 145 again engages the lug 154 and lifts it, thereby moving the lower end of the motor pivotally upwardly to move the motor into its lower position. Although the motor latch is ordinarily released by the downward pressure of the pin 144 on its upper edge, it is preferred, as a safety feature, to provide additional means, hereinafter described, for releasing the motor latch in the event that the shear and sealer units are moved downwardly without first actuating the pin 144. The shear and sealer units are reciprocated vertically by the same pneumatic means that moves the pin 144 downwardly.

The housing 157, which encloses the valve mechanism hereinafter described, is seated on a flange 159 extending laterally from the upper edge of the frame member 19 and is secured thereto by bolts 160. The bottom 156 is preferably integral with the housing 157. A top cover 161 is bolted to the upper edge of the housing. The housing has an air inlet 162 provided with a fitting 163 adapted to be connected to a source of air under pressure, and an air outlet 164 provided with a fitting 165, as shown in FIGS. 1, 3 and 14. A conduit 166 connects the fitting 165 to a fitting 167 secured in an air inlet in the motor housing and leading to the tensioning motor.

The bottom of the housing has a vertical bore 169 through which a reduced diameter upper portion of the ram attached to the piston 170 extends. The bottom 156 has another opening 171 through which the pin 144 depends. As shown in FIG. 5, the pin 144 is aligned vertically with the vertical bore 82 that extends through the lug 78 integral with the frame member 19. The vertical bore 82 is in vertical alignment with the upper edge of the motor latch 31.

The valve mechanism (FIG. 14) comprises a two-way valve 172 for operating the pin 144 and the tensioning motor, and a four-way valve 173 for operating the cutter and sealer mechanism through the ram 122. Both valves are operated through the same air supply and are interconnected by an air passageway 174.

The valve 172 is slidably mounted in a tubular valve sleeve 175, and is provided with a sealing ring 176 adjacent each end of the valve sleeve to prevent air leakage between the valve 172 and the valve sleeve 175. The upper end of the valve sleeve abuts the underside of the top cover 161. The upper end of the valve 172 extends upwardly through the upper end of the valve sleeve 175 and through an opening 177 extending through the top cover in vertical alignment therewith. The valve sleeve 175 is fitted in a vertical bore 178 in the housing 157, and is provided with a sealing ring 179 adjacent each end to prevent air leakage between the valve sleeve and the vertical bore.

The lower end of the valve 172 is of larger diameter than the inside diameter of the valve sleeve 175, as indicated at 180, and is in engagement with the bottom of the valve sleeve when the valve is in its uppermost posi-

tion to provide a stop for the valve stem. The bottom of the valve 172 has a centrally disposed tit 181 depending therefrom. A coiled spring 182, seated in the lower end of the vertical bore 178, has its upper end encircling the tit 181. The spring 182 bears against the bottom of the valve 172 to urge it upwardly.

The outer cylindrical surface of the valve sleeve 175 is recessed to provide an annular space 183 intermediate its length. An opening 184 provides an air passageway between the air inlet 162 and the annular space 183. The valve 172 is also recessed to provide an annular space 185, and an opening 186 in the valve sleeve provides an air passageway between the annular spaces 183 and 185.

An operating lever 187 is pivotally mounted on the top cover 161, as indicated at 188. This lever has a portion 189 approximately parallel to the top surface of the cover 161 in engagement with the top portion 190 of the valve 172, and a portion 191 (FIG. 1) extending downwardly adjacent the front end of the housing 157 for convenience of operation. The lever 187 is on the left, as viewed in FIGS. 1 and 14, and is designated as the first operating lever. The portion 191 of the lever 187 is pressed inwardly to depress the valve 172, and the pressure is immediately released.

The upper end of the valve 172 is cut away to provide an annular external shoulder 192. When the valve 172 is depressed it is moved downwardly far enough to align the shoulder 192 horizontally with the upper surface of the top cover 161 which has been recessed in the area adjacent the operating lever, as indicated at 193 in FIG. 14. The downward movement of the valve 172 moves the recessed portion 185 in the bore 178 below the lower end of the valve sleeve 175, but not below the opening 186.

When the first operating lever 187 is depressed, it is held in its down position by a transverse latch 194, shown in detail in FIGS. 15 and 16. The latch 194 is pivotally mounted on a vertically disposed stud 195 that extends through an opening 196 in the top cover 161 and is held in place by a set screw 197 in the housing 157. A coiled spring 198, seated in the opening 196, encircles the stud 195 and has its ends 199 and 200 fixed respectively to the housing 157 and the latch 194, to urge one end 201 of the latch toward the valve 172. When the valve 172 is depressed, the spring 198 moves the end 201 of the latch 194 into engagement with the side of the top portion 190 of the valve so that the latch seats on the shoulder 192 to hold the valve in its down position.

When the valve is in its down position, air under pressure flows from the air inlet 162, through the air outlet 164, to the upper side of the pin 144 and to the tensioning motor. The passageway for the air between the inlet 162 and the outlet 164 includes the opening 184, the annular space 183, the opening 186, the annular space 185, the gap between the lower end of the valve sleeve 175 and the valve 172, and the vertical bore 178. A small proportion of the air flowing through the outlet 164 passes through a narrow passageway 202 (FIG. 7) to the upper end of a vertical bore 203 in which a piston 204 is slidably mounted. The piston 204 is provided with a sealing ring 205 to prevent leakage of air through the bottom of the vertical bore 203.

The pin 144 depends from the bottom of the piston 204 through the vertical bore 82 to engage the top edge of the motor latch 31. In its down position, the pin 144 moves the front end of the motor latch 31 pivotally downwardly far enough to release the notch 40 from its engagement with the pin 41. The spring 37 then automatically moves the tensioning motor into its upper position.

Since the sealing ring 205 prevents any of the air from leaking from the vertical bore 203, the flow of air into the passageway 202 stops when the piston 204 and the pin 144 are in their lowermost positions. When the flow

of air into the passageway 202 stops, all of the air flows through the conduit 166 to operate the tensioning motor which is then in its upper position.

The tensioning motor rotates the knurled wheel 44 to move the upper overlapped portion of the strap S toward the supply roll, while the free end of the strap is held against movement to tension the strap. The free end of the strap is held against the knurled pad 51 by the pressure of the tensioning wheel and the overlapped portion of the strap. The air operating the tensioning motor is exhausted through the motor and, therefore, no separate exhaust is needed for the valve 172. When the strap is tensioned sufficiently, the tensioning motor will stall.

The tensioning operation is stopped by depressing a second operating lever 207 to start the shearing and sealing operations and to simultaneously move the valve 172 to its uppermost position. When the valve 172 is moved upwardly by means hereinafter described, after the overlapped strap portions have been properly tensioned, the air passage from the annular space 185 around the lower edge of the valve sleeve 175 to the air outlet 164 is closed. Stopping the flow of air through the fitting 165 reduces the air pressure aginst the top of the piston 204 to atmospheric pressure. A spring 206 encircles the pin 144 between the bottom 156 of the housing 157 and the bottom of the piston 204. When the air pressure against the piston 204 is reduced by moving the valve 172 upwardly, the spring 206 moves the piston 204 upwardly to retract the pin 144.

The valve 173 has an end 208 projecting upwardly through the top cover 161 into engagement with the underside of the lever 207 which is pivoted to the top cover, as indicated at 209. The latch 194 has one end extending under the lever 207 and provided with an upstanding flange 210 having an inclined edge 211. An edge portion of the operating lever 207 is cut away, as indicated at 212, to provide an edge 213 adapted to engage the inclined edge 211. When the second operating lever 207 is depressed, it depresses the valve 173 and simultaneously moves the latch 194 pivotally against the action of the spring 198 by downward pressure of the edge 213 against the inclined edge 211 which acts as a cam. The pivotal movement of the latch 194 moves its end 201 off the shoulder 192, and the spring 182 automatically moves the valve 172 upwardly into its upper, or rest, position. It is impossible, therefore, for the valve 172 to remain in its down position when the lever 207 is depressed. Accordingly, when the lower end of the tensioning motor is moved pivotally upwardly by the latch 145, the pin 144 cannot interfere with the movement of the motor to its down position or with the interengagement of the notch 40 and the pin 41 to hold it in said down position.

The valve 173 has a top valve sleeve 214, a middle valve sleeve 215 and a bottom valve sleeve 216, all mounted in a vertical bore 217 in the housing 157. The sleeve 214 has a sealing ring 218 between it and the cylindrical wall surface of the bore 217. The sleeve 215 has two sealing rings 219 and 220 on opposite sides of the air passageway 174 that connects the bore 217 with the bore 178 in which the valve 172 is mounted. The sleeve 216 has a sealing ring 221. The valve 173 has a sealing ring 222 sealing the space between it and the sleeve 214 and a sealing ring 223 sealing the space between it and the sleeve 215. An annular flange 224 on the portion of the valve seated in the sleeve 216 has a notch 225. A tit 226 depending from the valve 173 below the flange 224 is encircled by a coiled spring 227 that has its other end bearing against a shoulder 228 adjacent the bottom of the sleeve 216. Both ends of the sleeve 215 are counterbored, as indicated at 229 and 230.

The air connection to the fitting 163 remains open whenever the strapping tool is being used, and the air flows constantly from the inlet 162 through the opening

184 and the annular space 183 surrounding the valve sleeve 175 into the air passageway 174 regardless of the position of the valve 172.

When the second operating lever 207 is pressed inwardly it depresses the valve 173, as shown in FIG. 17. The air from the passageway 174 flows through the notch 231 and sleeve bore 232, through the groove 237 and aperture 236 into a conduit 239 to the top of the piston 170, thereby moving the piston 170 and the ram 122 downwardly. At the same time, the air is exhausted from the bottom of the piston by flowing from the conduit 235 through the aperture 234, the notch 233, the sleeve bore 240 and through the exhaust 241. The second operating lever 207 is held down manually until the piston 170 reaches its lowermost position, and is then released.

When the lever 207 is released, the spring 227 moves the valve 173 upwardly, thereby changing the air flow pattern. The air from the passageway 174 then flows through a notch 231 in the sleeve 215, the sleeve bore 232, a notch 233 in the sleeve 214, and through an aperture 234 in the housing to a conduit 235 leading to the bottom of the piston 170, thereby moving the piston 170 upwardly. While the piston 170 is moving upwardly, air is exhausted from the top of the piston by flowing through an aperture 236 in the housing, a groove 237 in the sleeve 216, the notch 225 in the flange 224, and the bore 238 of the sleeve 216.

When the piston 170 and the valve 173 are both in their uppermost position, the air in the passageway 174 will be substantially static, and the air pressure will retain them in said uppermost positions.

The operation of the strapping tool may be summarized as follows: A flat metal strap S is pulled forwardly from a supply roll, or other suitable source, and looped around a package or box with the free end of the strap underneath the portion of the strap extending from the supply roll. The tool is then positioned adjacent the overlapped portions of the strap. The free end of the strap is moved longitudinally into the front end of the tool and passed under the guide 52 and under the gripper bar 62 that is held upwardly by thumb pressure on the flange 72. The free end of the strap is pushed forwardly to a position over the knurled pad 51 and the thumb is released from the flange 72 to allow the spring-pressed gripper to move pivotally downwardly to hold the free end of the strap against movement.

The overlapped portion of the strap is then moved laterally past the vertical plane of the side guide plate 28, over the top of the gripper bar 62, through the notch 113 of the fixed cutter 112, and into the slot 58 of the guide 52. In this position, the overlapped portion of the strap passes between the free end of the strap and the knurled wheel 44.

The first operating lever 187 is then pressed inwardly and released. The spring-pressed latch 194 moves on to the shoulder 192 of the valve 172 to hold the valve 172 down. The air pressure moves the pin 144 downwardly to release the motor latch 31, and the spring 37 moves the tensioning motor pivotally into its upper, or operative, position. The side guide plate 28 and the knurled wheel 44 are moved downwardly with the lower end of the motor as the motor is moved into its operative position. The motor rotates the knurled wheel 44 in contact with the upper portion of the strap which is held tightly between the wheel 44 and free end of the strap S. The rotation of the wheel 44 moves the upper portion of the strap longitudinally toward the supply roll while the free end of the strap is held stationary on knurled surface 51, thereby tensioning the strap. When the strap has been tensioned to the desired extent, as evidenced by stalling of the tensioning motor, the second operating lever 207 is pressed inwardly and manually held in its down position.

Pressure on the lever 207 moves the latch 194 from the shoulder 192 and depresses the valve 173. In its down position, the valve 173 directs the air to move the piston 170 and the ram 122 downwardly. The valve 173 is held down until the piston 170 and ram 122 reach their lowermost positions. In its downward movement the ram 122 carries the shear and sealer units downwardly with it. The sealer unit has a metal seal 70 held between the jaws 124 in position for the next sealing operation.

The pin 105, projecting from the block 109, passes close to the motor latch 31 as the block is moved downwardly by the piston ram. If the motor latch 31 has not been previously released, the pin 105 engages the lip 43 of the latch to release the latch and engages the upper edge of the lever 104 to retract the ejector finger as the sealer unit is moved downwardly. After the sealer unit is in its lowermost position, the pin 105' engages the upper edge of the lever 104 and continues the retracting movement of the ejector finger as the ram continues its downward movement to provide clearance for the cutter blade 108 and for the metal seals 70 so that the seals can be moved downwardly in the magazine by spring pressure. The cutter blade 108 then cooperates with the fixed cutter to shear the upper portion of the strap, and the cam rod 128 engages the lug 133 to disengage the shear unit from the ram. The jaws carry the metal seal into engagement with the overlapped strap portions and crimp it around the edges of said strap portions. At this point the second operating lever 207 is released, and the spring 227 moves the valve 173 upwardly to again change the air flow pattern to move the piston 170 and the ram 122 upwardly.

The upward movement of the ram pulls the pivot pin 135 upwardly and the toggle links 134 move the jaws pivotally about the pins 139 with the upper ends of the jaws moving toward each other and the lower ends moving apart. This pivotal movement of the jaws also raises the notcher bar to its upper position. The pivotal movement of the jaws in this direction is limited by the abutment of the surfaces 124' of the upper ends of the jaw, as shown in FIG. 12. When the surfaces 124' of the jaws move into abutting engagement, the notch 125 of the ram also moves into registration with the cam rod 128, and the spring 131 moves the cam surface 129 into engagement with the notch. The abutment of the surfaces 124' also causes the jaws to move upwardly with the ram. Since the pins 139 engage the cutter blade 108 and the side plate 110, these members also move upwardly with the ram.

The upward movement of the pins 105 and 105' releases the latch 104 and the spring 101 moves the ejector lever, causing the ejector finger 96 to move a metal seal from the magazine between the jaws in position for the next sealing operation. The latch 145 engages the lug 154 to lift it pivotally upwardly and thereby moves the tensioning motor pivotally to its lower, or inoperative, position. The knurled wheel 44 and the side guide plate 28 are both lifted to inoperative position along with the lower end of the motor. The motor latch 31 engages the pin 41 to hold the motor in its inoperative position, and the latch 145 engages the pin 152 which disengages it from the lug 154. The recessed portion 129 of cam rod 128 engages the notch 125 of the ram during the upward movement of the ram, which then carries the shear unit upwardly with the sealer unit to their uppermost position in one continuous movement. The tool is then in its rest position for the next operation.

Although we have described a preferred embodiment of the invention in considerable detail, it will be understood that the description thereof is intended to be illustrative, rather than restrictive, as many details may be modified or changed without departing from the spirit or scope of the invention.

We claim:

1. In a strapping tool, a frame member, a vertically reciprocable sealer unit supported on said frame member, a shear unit adjacent said sealer unit, means on said

shear unit engageable with said sealer unit during the downward movement of said sealer unit to prevent relative vertical movement between said sealer unit and said shear unit in the downward direction, and a lug projecting from said frame, said lug being engageable with said means to disengage it from said sealer unit at the lower limit of travel of said shear unit.

2. In a strapping tool, a shear unit having a vertical bore, a sealer unit having an upper end slidably mounted in said bore, a piston ram connected to said sealer unit for vertically reciprocating the same, said sealer unit having a notch, means mounted in said shear unit and engageable with said notch to prevent relative vertical movement between said sealer and shear units, a spring urging said means into engagement with said notch, and a lug engageable with said means to move it from said notch against the action of said spring at a predetermined point in the vertical downward movement of said sealer unit to permit relative movement between said sealer and shear units.

3. In a strapping tool, a frame member, a housing mounted on said frame member, a ram depending from said housing, means in said housing for reciprocating said ram, a sealer unit secured to said ram for vertical movement therewith, and a spring-pressed plunger projecting upwardly from said sealer unit, said plunger being engageable with said housing to limit the upward movement of said ram and sealer unit.

4. In a strapping tool, a frame member, a housing mounted on said frame member, said housing having a bottom wall provided with an aperture, a piston ram depending through said aperture, means in said housing for reciprocating said ram vertically, a sealer unit secured to said ram for vertical movement therewith, and a spring-pressed plunger projecting upwardly from said sealer unit, said plunger being engageable with the bottom wall of said housing to limit the upward movement of said sealer unit and to cushion said upward movement as said sealer unit approaches the limit of its upward movement.

5. In a strapping tool, a frame member, a housing mounted on said frame member, a ram depending from said housing, means for vertically reciprocating said ram, a sealer unit secured to said ram, a shear unit positioned adjacent said sealer unit, means mounted in said shear unit and engageable with said ram in a predetermined vertical position of said sealer unit as said sealer unit is being moved downwardly by said ram, whereby relative vertical movement between said sealer and shear units is prevented, and a lug projecting from said frame member, said lug being adapted to disengage said last mentioned means from said shear unit in a predetermined vertical position of said shear unit to permit relative movement between said sealer and shear units.

6. In a strapping tool, a frame member, a housing mounted on said frame member, a ram depending from said housing, means for vertically reciprocating said ram, a sealer unit secured to said ram, a shear unit positioned adjacent said sealer unit, means mounted in said shear unit and engageable with said ram to prevent relative vertical movement between said sealer and shear units, a spring effective to move said last mentioned means into engagement with said ram in a predetermined vertical position of said sealer unit as said sealer unit is being moved downwardly by said ram, and a lug projecting from said frame member, said lug being engageable with said last mentioned means at a predetermined vertical position of said sealer unit to move said last mentioned means against the action of said spring to disengage said last mentioned means from said sealer unit, whereby said sealer unit may be moved relative to said shear unit.

7. In a strapping tool, a shear unit having a centrally disposed vertical bore, a sealer unit having an upper end slidably mounted in said bore, means for vertically reciprocating said sealer unit, a cam rod rotatably mounted in said shear unit transversely of said bore, said sealer unit having a transversely extending notch engageable with said cam rod, means urging said cam rod into position for engagement with said notch, whereby said shear unit is secured to said sealer unit, and means engaging said cam rod at a predetermined point in the vertical downward movement of said sealer unit to move it out of engagement with said notch.

8. In a strapping tool, a fixed cutter, a shear unit including a cutter blade in vertical alignment with said fixed cutter, a cam rod rotatably mounted in said shear unit, a sealer unit slidably associated with said shear unit, said sealer unit having a notch extending parallel to said cam rod, means for vertically reciprocating said sealer unit, a spring on said cam rod urging it into position for engagement with said notch whereby said shear unit is secured to said sealer unit as said notch is moved into registration with said cam rod, said shear unit being movable with said sealer unit to move said cutter blade into cutting engagement with said fixed cutter, and means engageable with said cam rod to disengage said shear unit from said sealer unit as said cutter blade engages said fixed cutter.

9. In a strapping tool, a frame member, a housing mounted on said frame member, a ram depending from said housing, means for vertically reciprocating said ram, a sealer unit secured to said ram, a shear unit positioned adjacent said sealer unit, a transversely extending cam rod rotatably mounted in said shear unit, said ram having a transverse notch engageable with said cam rod, a spring mounted on said cam rod urging it into a rotational position in which it is adapted to engage said notch to hold said shear and sealer units together for movement with said ram, and a lug projecting from said frame member, said lug being adapted to engage said cam rod and rotate it to disengage said shear unit from said sealer unit during the downward movement of said ram.

10. In a strapping tool, a frame member, a housing mounted on said frame member, a ram depending from said housing, means in said housing for vertically reciprocating said ram, a sealer unit secured to said ram, a shear unit associated with said sealer unit, a cam rod rotatably mounted in said shear unit, said cam rod being engageable with said ram in one rotational position to secure said shear unit to said sealer unit, whereby said shear unit moves vertically with said sealer unit, and means projecting from said frame member for engagement with said cam rod during the downward vertical travel of said shear unit to disengage said shear unit from said sealer unit to permit relative movement between said sealer and shear units.

11. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, pneumatic means in said housing for vertically reciprocating said piston ram, said pneumatic means comprising a valve, a spring urging said valve in one direction, and a manually operated lever for moving said valve in the opposite direction, a sealer unit secured to said piston ram, a shear unit associated with said sealer unit, a cam rod rotatably mounted in said shear unit, said cam rod being engageable with said ram in one rotational position to secure said shear unit to said sealer unit, whereby said shear unit moves vertically with said sealer unit, and means projecting from said frame member for engagement with said cam rod to disengage said shear unit from said sealer unit to permit relative movement between said sealer and shear units.

12. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, means in said housing for vertically reciprocating said piston ram, a sealer unit secured to said ram, said sealer unit including a plurality of pairs of coacting jaws, a shear unit associated with said sealer unit, said shear unit including a cutter blade, a fixed cutter adapted to cooperate with said cutter blade to shear the upper strap portion of overlapped strap portions posi-

tioned in said tool, a cam rod rotatably mounted in said shear unit, said cam rod being engageable with said ram to secure said shear unit to said sealer unit, a lug projecting from said frame member for engagement with said cam rod simultaneously with the engagement of said cutter blade with said fixed cutter during the downward travel of said sealer unit, said lug being adapted to rotate said cam rod to disengage said shear unit from said sealer unit, and a plurality of fixed pins projecting from said shear unit, said coacting jaws being pivotally connected to said pins, whereby the downward movement of said piston ram after disengagement of said sealer unit from said shear unit causes the lower ends of said coacting jaws to move inwardly relative to each other to crimp a metal seal around the edges of said overlapped strap portions.

13. In a strapping tool, a frame member, a ram, means for reciprocating said ram vertically on said frame member, a sealer unit secured to said ram, a shear unit adjacent said sealer unit, a plurality of pins fixed to said shear unit, said sealer unit including a plurality of coacting jaws suspended from said ram and pivotally secured to said pins, means on said shear unit engageable with said ram at a predetermined point in the downward movement of said sealer unit to prevent relative vertical movement between said sealer and shear units, a lug projecting from said frame member, said lug being engageable with said second mentioned means to disengage it from said ram and to prevent further downward movement of said shear unit, whereby said jaws are moved pivotally by the continued downward movement of said ram to crimp a metal seal around the edges of overlapped strap portions positioned in said tool, and means for positioning a metal seal between said coacting jaws as said sealer unit is moved upwardly.

14. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, means in said housing for vertically reciprocating said piston ram, a sealer unit secured to said ram, said sealer unit including a plurality of pairs of coacting jaws, a shear unit associated with said sealer unit, means mounted in said shear unit for engagement with said ram to prevent relative vertical movement between said shear and sealer units, a spring urging said last mentioned means into engagement with said ram, a lug projecting from said frame member for engagement with said last mentioned means to move it out of engagement with said ram to permit relative movement between said shear and sealer units, a pair of pins fixed relative to said shear unit, said coacting jaws being pivotally mounted on said pins, whereby the lower ends of said coacting jaws are moved pivotally toward each other by the downward movement of said piston ram while said shear unit is stationary to crimp a metal seal around the edges of overlapped strap portions positioned in said tool, and means for positioning a metal seal between said coacting jaws as said sealer unit is being moved upwardly.

15. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, means in said housing for vertically reciprocating said piston ram, a sealer unit secured to said ram, said sealer unit including a plurality of pairs of coacting jaws, a shear unit associated with said sealer unit, a cam rod rotatably mounted in said shear unit, said cam rod being engageable with said ram to secure said shear unit to said sealer unit, a lug projecting from said frame member for engagement with said cam rod to disengage said shear unit from said sealer unit, a pair of pins fixed relative to said shear unit, said coacting jaws being pivotally mounted on said pins, whereby the lower ends of said coacting jaws are moved pivotally toward each other by the downward movement of said piston ram while said shear unit is stationary to crimp a metal seal around the edges of overlapped strap portions positioned in said tool, and means for positioning a metal seal between said coacting jaws as said sealer unit is being moved upwardly.

16. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, means in said housing for vertically reciprocating said piston ram, a sealer unit secured to said ram, said sealer unit including a plurality of pairs of coacting jaws, a shear unit associated with said sealer unit, a cam rod rotatably mounted in said shear unit, said cam rod being engageable with said ram to secure said shear unit to said sealer unit, a lug projecting from said frame member for engagement with said cam rod to disengage said shear unit from said sealer unit, a pair of pins fixed relative to said shear unit, said coacting jaws being pivotally mounted on said pins, whereby the lower ends of said coacting jaws are moved pivotally toward each other by the downward movement of said piston ram while the shear unit is stationary to crimp a metal seal around the edges of overlapped strap portions positioned in said tool, a magazine positioned adjacent said sealer unit for holding a plurality of metal seals, an ejector finger movable transversely of said magazine to move a metal seal between said coacting jaws, and means for actuating said ejector finger to position a metal seal between said coacting jaws as said sealer unit is being moved upwardly.

17. In a strapping tool, a frame member, a housing mounted on said frame member, a piston ram depending from said housing, means in said housing for vertically reciprocating said piston ram, a sealer unit secured to the piston ram, said sealer unit including a plurality of pairs of coacting jaws, a shear unit associated with said sealer unit for downward movement therewith, means for releasing said sealer unit from said shear unit at a predetermined point in the downward movement of said shear unit, a magazine mounted on said frame member adjacent said shear unit for holding a stack of metal seals, an ejector finger movable transversely of said magazine to position a metal seal in said sealer unit, an ejector lever pivotally secured at one end to said ejector finger, a pin projecting from said shear unit, said pin being adapted to engage said ejector lever to retract said ejector finger as said shear unit is moving downwardly, said pin releasing said ejector lever from engagement therewith during the upward movement of said shear unit, and spring means for moving said ejector finger to move a metal seal from said magazine to a position between said coacting jaws as said pin is moved upwardly out of engagement with said ejector lever during the upward movement of said shear unit.

18. In a strapping tool, a frame member, a shear unit, a sealer unit and a magazine secured to said frame member in side-by-side relationship, said magazine being adapted to hold a stack of metal seals in position for feeding them into said sealer unit, said magazine comprising a vertically disposed channel member having an opening at one side wider than said seals for facilitating insertion of said seals into said channel member, a pad positioned in said channel member above said seals, a spring urging said pad downwardly against the uppermost seal in said channel member, a bottom member having a groove extending transversely along its upper surface, an ejector finger movable along said groove, an ejector lever operable to move said ejector finger along said groove to eject the lowermost seal from said channel member into said sealer unit, a spring urging said ejector lever to move said ejector finger, and a pin projecting from said shear unit and engageable with said ejector lever to hold said ejector finger in retracted position against the action of said spring while one of said seals is in said sealer unit.

19. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, a magazine, a shear unit and a sealer unit mounted on said frame mem-

ber in accurately spaced relationship to each other, a spring-pressed ejector finger for feeding individual metal seals from said magazine to said sealer unit, and pneumatic means in said housing for releasing said motor from latched inoperative position and for operating said motor and said shear and sealer units.

20. In a strapping tool, a frame member, a transverse shaft rotatably mounted in said frame member, a tensioning motor mounted on said shaft for pivotal movement between an inoperative position and an operative position, a plate mounted on said shaft for pivotal movement with said motor, a lug projecting from said plate below the axis of said shaft, a spring urging said motor to its operative position, a pin projecting laterally inwardly from said frame member, a latch secured at one end to said motor and engageable with said pin to hold said motor in its inoperative position, a second pin aligned with said latch, and pneumatic means for moving said second pin into engagement with said latch to disengage it from said first pin, whereby said spring moves said motor into operative position.

21. In a strapping machine having a tensioning motor, a shear unit, a sealer unit and a vertically reciprocable piston ram for operating said shear and sealer units, a pneumatic system for operating said motor and said piston ram from a single air inlet, said pneumatic system comprising a valve for moving said motor into operative position and for operating said motor, and a second valve for reciprocating said piston ram after said first valve is moved to inoperative position.

22. In a strapping machine having a tensioning motor, a shear unit, a sealer unit and a vertically reciprocable piston ram for operating said shear and sealer units, a pneumatic system for operating said motor and said piston ram from a single air inlet, said pneumatic system comprising a valve for moving said motor into operative position and for operating said motor, a first operating lever for actuating said first valve, means automatically holding said first valve in operative position after actuation by said first operating lever, a second valve operable to reciprocate said piston ram, a second operating lever for actuating said second valve, means on said second operating lever adapted to automatically release said holding means upon actuation of said second valve, and a spring adapted to move said first valve to inoperative position upon release of said holding means.

23. In a strapping machine having a tensioning motor, a shear unit, a sealer unit and a vertically reciprocable piston ram for operating said shear and sealer units, a pneumatic system for operating said motor and said piston ram from a single air inlet, said pneumatic system comprising a valve for moving said motor into operative position and for operating said motor, a first operating lever for actuating said first valve, a pivotally mounted latch adjacent said first operating lever, a spring urging said latch into latching engagement with said first valve upon actuation of said first valve, a second valve operable to reciprocate said piston ram, and a second operating lever for actuating said second valve, said second operating lever being engageable with said latch to move it out of latching engagement with said first valve as said second operating lever is moved to actuate said second valve.

24. In a strapping machine, a frame, a housing mounted on said frame, a tensioning motor pivotally mounted on said frame for movement between an inoperative position and an operative position, a latch adapted to hold said motor in inoperative position, means urging said motor towards its operative position, a pin depending from said housing in alignment with said latch, a vertically reciprocable piston ram depending from said housing, a pair of valves in said housing, one of said valves being operable to move said pin into engagement with said latch to release said motor from its inoperative position and to operate said motor, the other of said valves being adapted to reciprocate said piston ram, a pair of operating levers for separately actuating said first and second valves, and means adapted to automatically move the operating lever for said first valve to inoperative position upon actuation of said second valve.

25. In a strapping tool, a frame member, a transverse shaft rotatably mounted in said frame member, a tensioning motor mounted on said shaft for pivotal movement between an inoperative position and an operative position, a plate mounted on said shaft for pivotal movement with said motor, a lug projecting from said plate below the axis of said shaft, a spring urging said motor to its operative position, a pin projecting laterally inwardly from said frame member, a latch secured at one end to said motor and engageable with said pin to hold said motor in its inoperative position, a second pin aligned with said latch, pneumatic means for moving said second pin into engagement with said latch to disengage it from said first pin, whereby said spring moves said motor into operative position, a vertically reciprocable shear unit operatively secured to said frame member, a second latch pivotally mounted on said shear unit to engage said lug during the upward movement of said shear unit to move the lower end of said motor pivotally upwardly into inoperative position, and means on said frame member engageable with said second latch during the upward movement of said shear unit to disengage said second latch from said lug after said first latch has engaged said first pin to hold said motor in inoperative position.

26. In a strapping tool, a frame member, a transverse shaft rotatably mounted in said frame member, a tensioning motor mounted on said shaft for pivotal movement between an inoperative position and an operative position, a plate mounted on said shaft for pivotal movement with said motor, a lug projecting from said plate below the axis of said shaft, a spring urging said motor to its operative position, a pin projecting laterally inwardly from said frame member, a latch secured at one end to said motor and engageable with said pin to hold said motor in its inoperative position, a vertically reciprocable shear unit operatively secured to said frame member, a second latch pivotally mounted on said shear unit to engage said lug during the upward movement of said shear unit to move the lower end of said motor pivotally upwardly into inoperative position, and means on said frame member engageable with said second latch during the upward movement of said shear unit to disengage said second latch from said lug after said first latch has engaged said pin to hold said motor in inoperative position.

27. In a strapping tool, a frame member, a transverse shaft rotatably mounted in said frame member, a tensioning motor mounted on said shaft for pivotal movement between an inoperative position and an operative position, a plate mounted on said shaft for pivotal movement with said motor, a lug projecting from said plate below the axis of said shaft, a spring urging said motor to its operative position, a pin projecting laterally inwardly from said frame member, a latch secured at one end to said motor and engageable with said pin to hold said motor in its inoperative position, a vertically reciprocable shear unit operatively secured to said frame member, a second latch pivotally mounted on said shear unit, said second latch having its upper and lower ends extending inwardly, the lower end of said latch engaging said lug during the upward movement of said shear unit to move the lower end of said motor pivotally upwardly into inoperative position, and a second pin on said frame member engageable with the upper end of said second latch to move said second latch pivotally to disengage it from said lug after said first latch has engaged said first mentioned pin to hold said motor in inoperative position.

28. In a strapping tool, a frame member, a housing mounted on said frame member, a transverse shaft rotatably mounted in said frame member, a tensioning motor mounted on said shaft for pivotal movement between

an inoperative position and an operative position, a plate mounted on said shaft for pivotal movement with said motor, a lug projecting from said plate below the axis of said shaft, a spring urging said motor to its operative position, a pin projecting laterally inwardly from said frame member, a latch secured at one end to said motor and engageable with said pin to hold said motor in its inoperative position, a vertically disposed pin projecting from said housing in alignment with said latch, a vertically reciprocable shear unit operatively secured to said frame member, a pneumatic system in said housing, said pneumatic system including two valves, one of said valves being operable to move said vertically disposed pin into engagement with said latch to disengage it from said first pin, whereby said spring moves said motor into operative position, said other valve being operable to reciprocate said shear unit, a second latch pivotally mounted on said shear unit, said second latch being adapted to engage said lug during the upward movement of said shear unit to move said motor pivotally into inoperative position, and means on said frame member engageable with said second latch during the upward movement of said shear unit to disengage it from said lug after said first latch has engaged said pin to hold said motor in inoperative position.

29. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, a magazine, a shear unit and a sealer unit mounted on said frame member in accurately spaced relationship to each other, a spring-pressed ejector finger for feeding individual metal seals from said magazine to said sealer unit, and pneumatic means in said housing for operating said motor and said shear and sealer units, said pneumatic means including a first valve for releasing said motor from latched inoperative position and for operating said motor to tension overlapped strap portions looped around an object, and a second valve for operating said shear and sealer units to shear one of said overlapped strap portions, to position a metal seal around the edges of said overlapped strap portions, and to crimp said metal seal against said edges of the overlapped strap portions.

30. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, a magazine, a shear unit and a sealer unit mounted on said frame member in accurately spaced relationship to each other, a spring-pressed ejector finger for feeding individual metal seals from said magazine to said sealer unit, pneumatic means in said housing for operating said motor and said shear and sealer units, said pneumatic means including a first valve for releasing said motor from latched inoperative position and for operating said motor to tension overlapped strap portions looped around an object, and a second valve for operating said shear and sealer units to shear one of said overlapped strap portions, to position a metal seal around the edges of said overlapped strap portions, and to crimp said metal seal against said edges of the overlapped strap portions, an operating lever for actuating said first valve, a latch for holding said operating lever in operative position, and a second operating lever for moving said first valve to inoperative position and actuating said second valve.

31. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, a spring adapted to move said motor to operative position upon release of said latch, a magazine, a shear unit and a sealer unit mounted on said frame member in accurately spaced relationship to each other, a spring-pressed ejector finger for feeding individual metal seals from said magazine to said sealer unit, and pneumatic means in said housing for operating said motor and said shear and sealer units, said pneumatic means including a first valve for releasing said motor from latched inoperative position and for operating said motor to tension overlapped strap portions looped around an object after said spring has moved said motor to operative position, and a second valve for operating said shear and sealer units to shear one of said overlapped strap portions, to position a metal seal around the edges of said overlapped strap portions, and to crimp said metal seal against said edges of the overlapped strap portions.

32. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in operative position, a shear unit and a sealer unit mounted on said frame member, pneumatic means in said housing for releasing said latch and for operating said motor and said shear and sealer units, and means on said shear unit for releasing said latch before the operation of said shear and sealer units in the event that said latch is not previously released by said pnuematic means.

33. In a strapping tool, a frame member, a housing mounted on said frame member, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, a magazine, a shear unit and a sealer unit mounted on said frame member in accurately spaced relationship to each other, a spring-pressed ejector finger for feeding individual metal seals from said magazine to said sealer unit, pneumatic means in said housing for operating said motor and said shear and sealer units, said pneumatic means including a first valve for releasing said motor from latched inoperative position and for operating said motor to tension overlapped strap portions looped around an object, and a second valve for operating said shear and sealer units to shear one of said overlapped strap portions, to position a metal seal around the edges of said overlapped strap portions, and to crimp said metal seal against said edges of the overlapped strap portions, and means on said shear unit for releasing said latch before the operation of said shear and sealer units in the event that said latch is not previously released by said first valve.

34. In a strapping tool, a frame member, a housing mounted on said frame member, a vertically reciprocable piston ram depending from said housing, a sealer unit secured to said ram, a magazine for holding a stack of metal seals, an ejector finger for individually feeding said metal seals to said sealer unit, a shear unit engageable with said sealer unit, means for accurately positioning said magazine and said shear unit relative to said sealer unit, a tensioning motor pivotally mounted on said frame member, means for moving said motor between an operative and an inoperative position, a latch for holding said motor in inoperative position, a pin depending from said housing in alignment with said latch, and pneumatic means for moving said pin to release said latch, for operating said motor, and for reciprocating said piston ram.

35. In a strapping tool, a frame member, a housing mounted on said frame member, a vertically reciprocable piston ram depending from said housing, a sealer unit secured to said ram, a magazine for holding a stack of metal seals, an ejector finger for individually feeding said metal seals to said sealer unit, means for accurately positioning said magazine relative to said sealer unit, a tensioning motor pivotally mounted on said frame member, means for moving said motor between an operative and an inoperative position, a latch for holding said motor in inoperative position, a pin depending from said housing in alignment with said latch, pneumatic means in said housing including a valve for moving said pin to release said latch and a second valve for reciprocating said piston ram, said pneumatic means including a pair of operating levers for moving said valves, and means for moving one of said levers to inoperative position upon actuation of said other lever.

36. In a strapping tool, a frame member, a housing

mounted on said frame member, a vertically reciprocable piston ram depending from said housing, a sealer unit secured to said ram, a magazine for holding a stack of metal seals, an ejector finger for individually feeding said metal seals to said sealer unit, a shear unit engageable with said sealer unit, means for accurately positioning said magazine and said shear unit relative to said sealer unit, a tensioning motor pivotally mounted on said frame member, means for moving said motor between an operative and an inoperative position, a latch for holding said motor in inoperative position, a pin depending from said housing in alignment with said latch, pneumatic means in said housing including a valve for releasing said latch and operating said motor and a second valve for reciprocating said piston ram, a first lever for operating said first valve, a second lever for operating said second valve, and means operable by actuation of said second lever to automatically move said first lever to inoperative position.

37. In a strapping tool, a frame member, a housing mounted on said frame member, a vertically reciprocable piston ram depending from said housing, a sealer unit secured to said ram, a magazine and a shear unit mounted on said frame member in accurately spaced relationship to said sealer unit, interengageable means on said shear and sealer units for securing said shear unit to said sealer unit and for disengaging it therefrom, whereby said shear and sealer units move together through a portion of the vertical movement of said piston ram and said sealer unit moves relative to said shear unit during a portion of said vertical movement of the piston ram, a spring-pressed ejector finger

for feeding individual metal seals from said magazine to said sealer unit, a tensioning motor pivotally mounted on said frame member, a latch for holding said motor in inoperative position, and pneumatic means in said housing for releasing said motor from latched inoperative position and for operating said motor and said shear and sealer units.

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