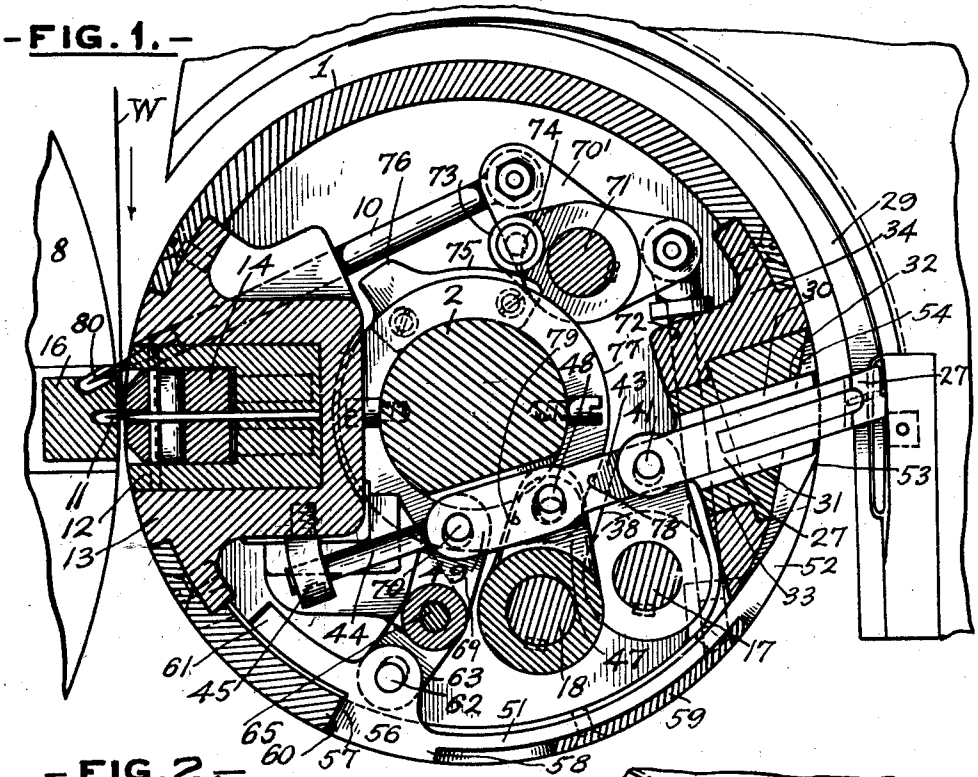
March 13, 1928. 1,662,442

E. P. SHELDON

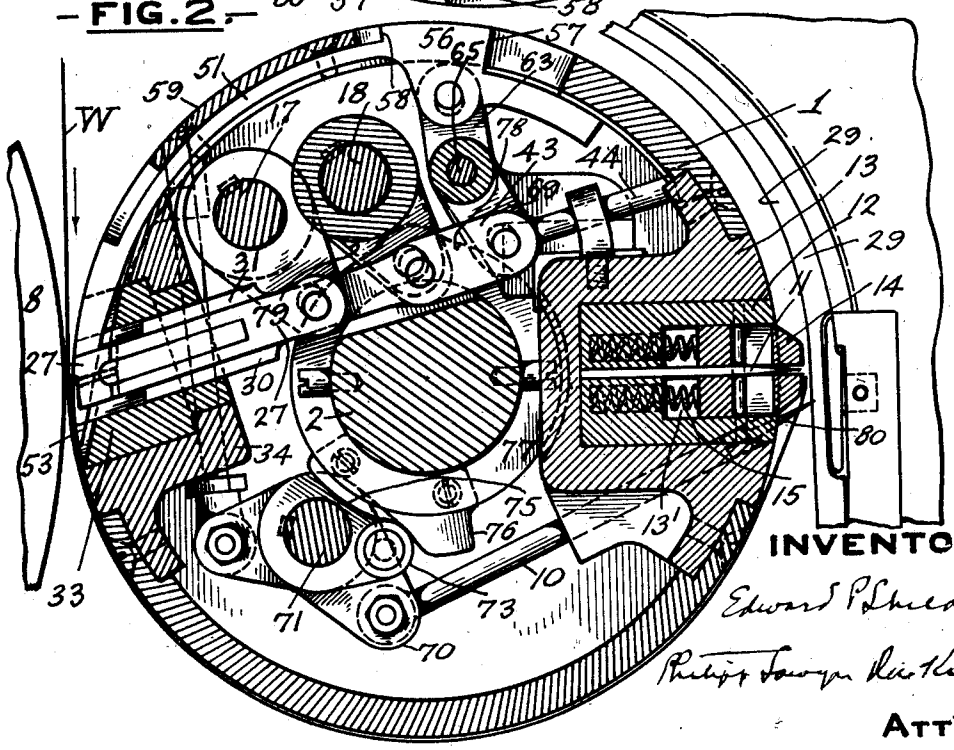
STAPLING MECHANISM

Filed Jan. 28, 1926 5 Sheets-Sheet 1

-FIG. 1.-



-FIG. 2.-



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STAPLING MECHANISM

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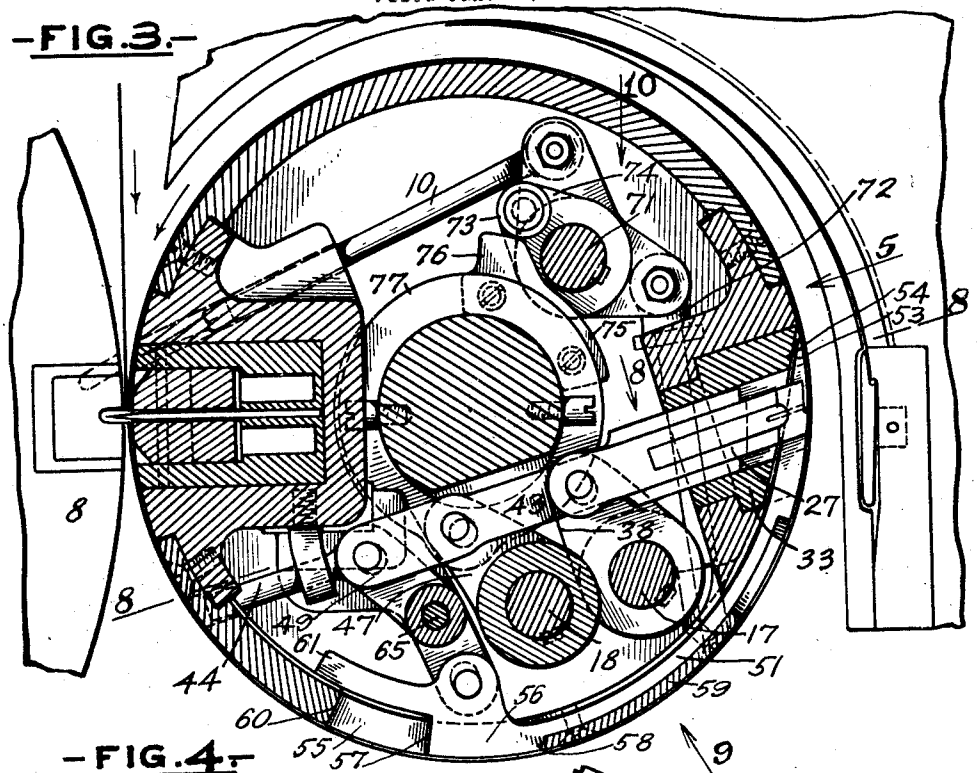
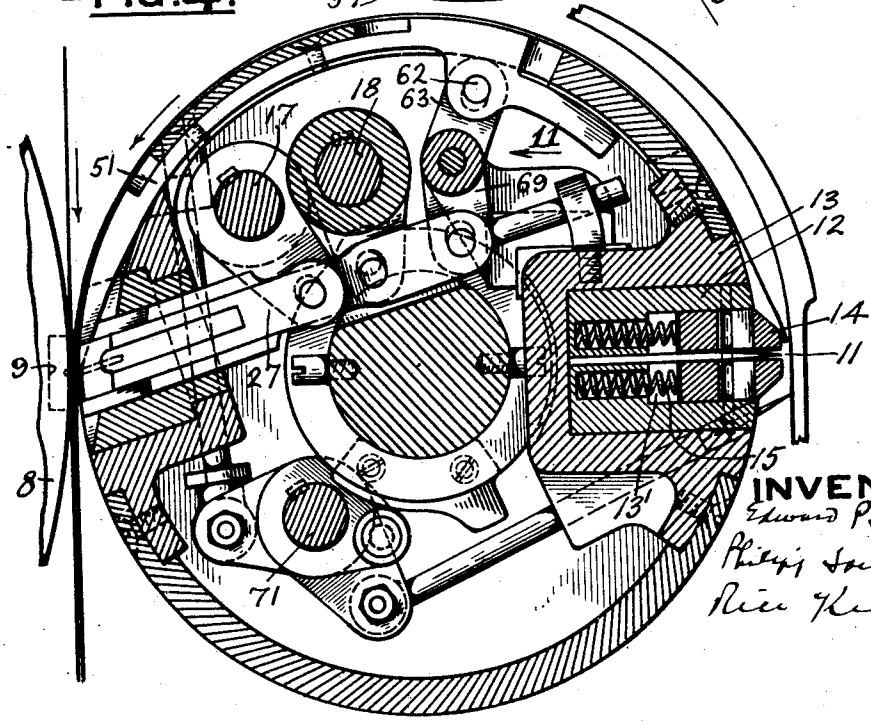
-FIG. 3.-



-FIG. 4.-



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STAPLING MECHANISM

Filed Jan. 28, 1926 5 Sheets-Sheet 3

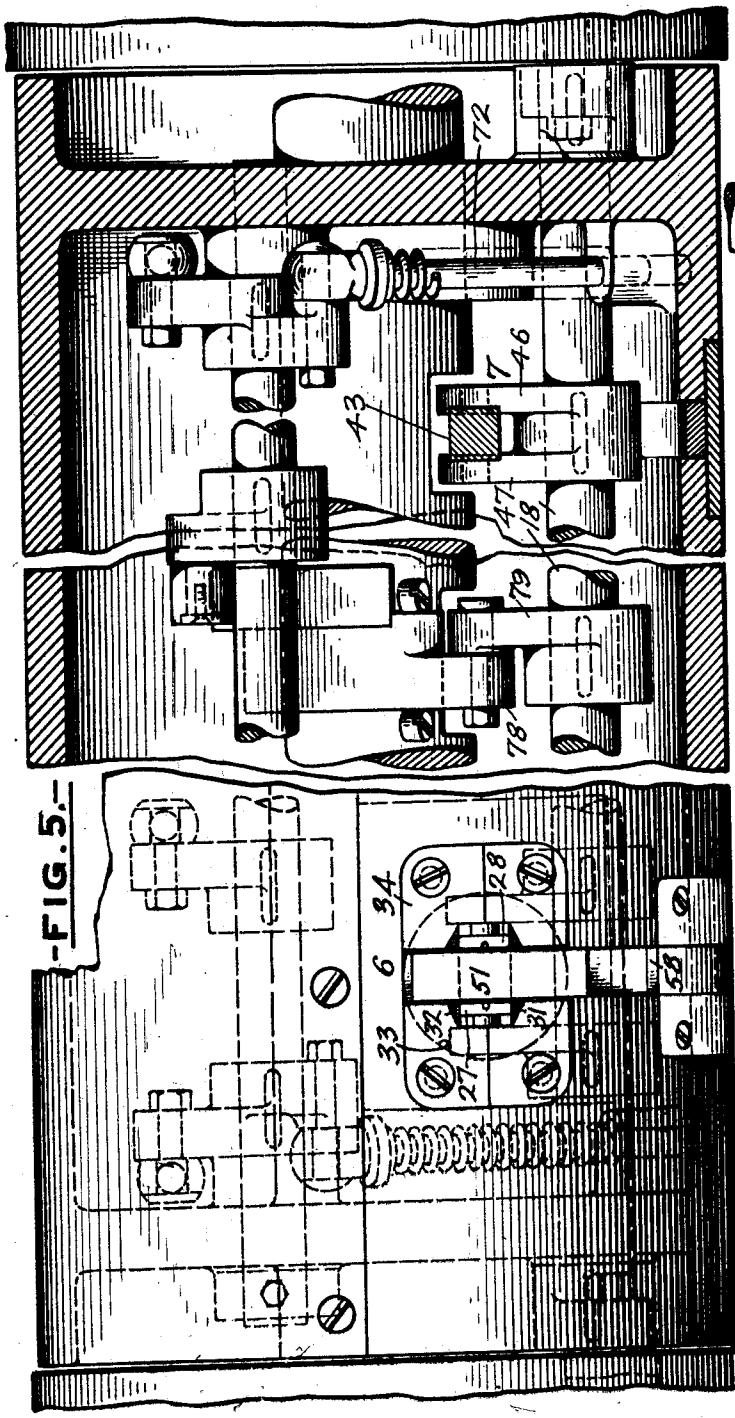

FIG. 5.

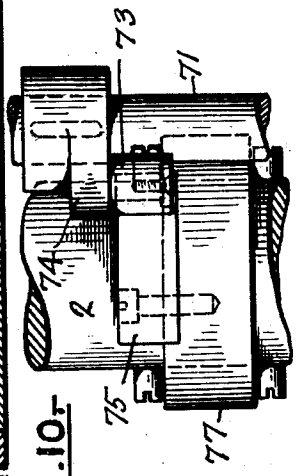

FIG. 10.

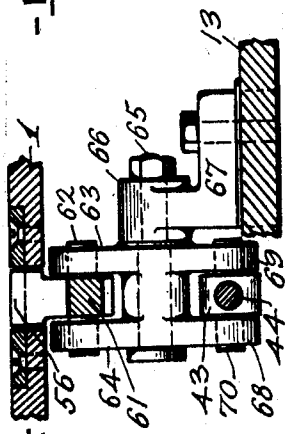

FIG. 11.

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March 13, 1928. 1,662,442

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STAPLING MECHANISM

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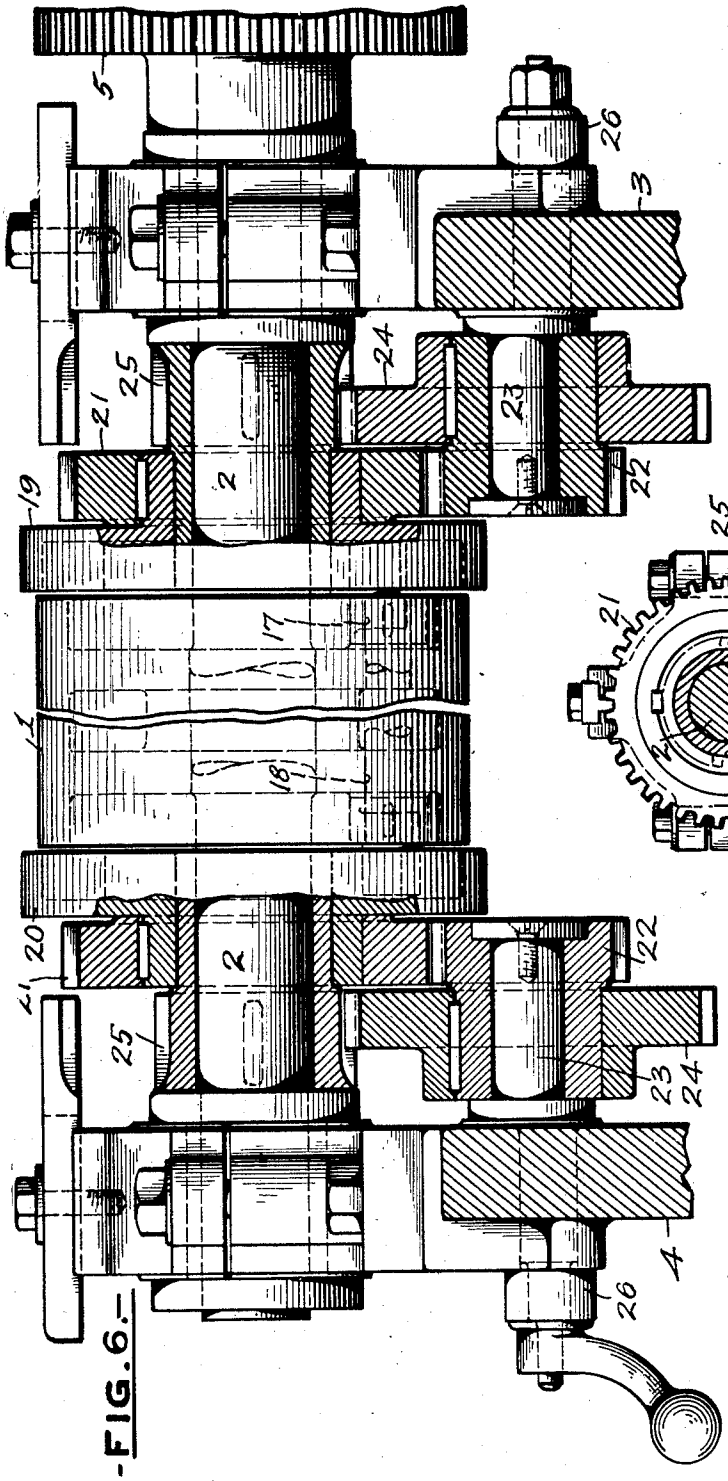

FIG. 6.

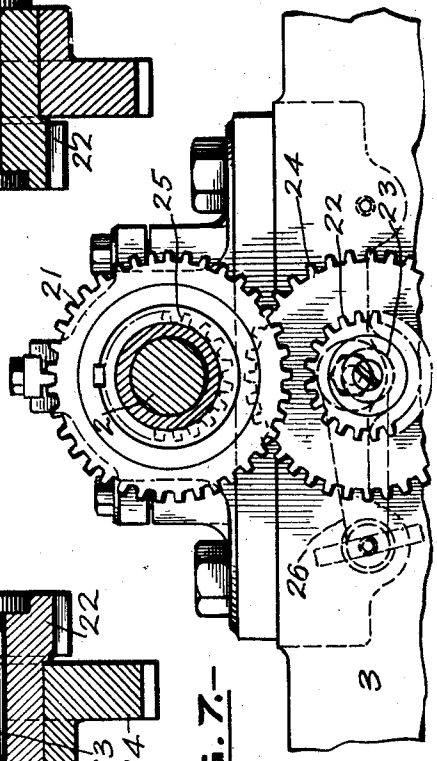

FIG. 7.

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FIG. 8.

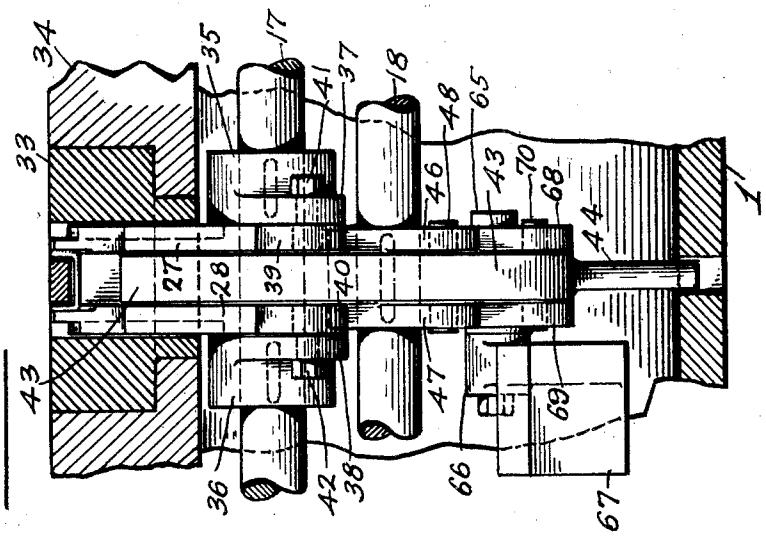
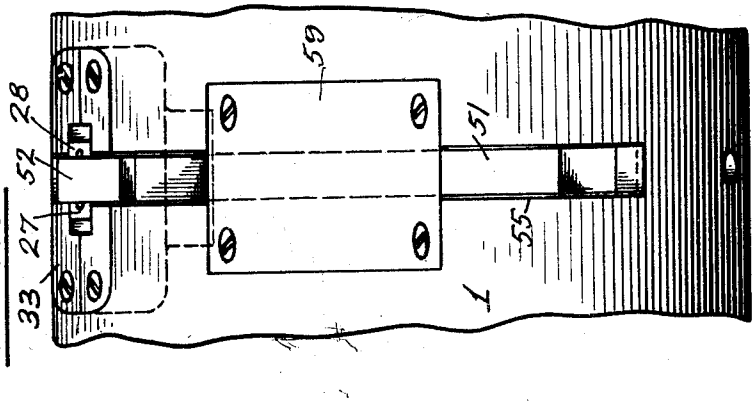


FIG. 9.



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UNITED STATES PATENT OFFICE.

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STAPLING MECHANISM.

Application filed January 28, 1926. Serial No. 84,264.

This invention relates to certain improvements in wire stapling mechanisms.

In wire stapling mechanisms as now generally constructed, the staple forming mechanism takes a piece of wire and forms it into a staple, generally of U shape, having a back and legs. This staple is driven through the product by a staple inserting mechanism which acts to force the legs of a staple through the product, these legs being clenched against a suitable cooperating anvil. In operating the mechanisms, particularly when a thick product is to be stapled, difficulty has been experienced in properly inserting the staples, due to the tendency of the back of the staple to bend or buckle, so that the staple is not driven through the product and an imperfect product results.

It is the principal object of the present invention to produce a staple inserting mechanism in which the back and legs of the staple are directly supported after the staple is formed and during the staple inserting operation, so that this tendency of the staple to buckle or bend is overcome and perfect stapling may be effected with any thickness of product.

It is a further object of the invention to produce an improved stapling mechanism embodying this feature in which the parts are compactly arranged so that a small stapling cylinder or other carrier for the stapling mechanism may be used.

A further object of the invention is to provide a stapling mechanism which may be simply and readily adjusted for stapling either collected or uncollected products.

With these and other objects not specifically referred to, the invention consists in certain novel parts, arrangements and combinations which will be described in connection with the accompanying drawings, in which—

Figure 1 is a cross sectional view, partly broken away, through the carrier by which the stapling mechanism is supported, showing the parts arranged for stapling a collected product, the parts being shown in the position they occupy the first half revolution of the carrier;

Figure 2 is a similar view showing the parts in the position they occupy the second half revolution of the carrier;

Figure 3 is a similar view showing the parts in the position they occupy during the third half revolution of the carrier;

Figure 4 is a similar view showing the position of the parts during the fourth half revolution of the carrier;

Figure 5 is a side view, partly in section, of the carrier, part of the wall of the carrier being broken away to more clearly show the construction, the view being taken in the direction of the arrow 5 of Fig. 3;

Figure 6 is a sectional side view, partly broken away, of the carrier showing the driving mechanism therefor, and the operating mechanism for driving the staple forming and inserting devices for collected and uncollected products;

Figure 7 is a face view of part of the gearing shown in Fig. 6 showing adjustment of the gears when an uncollected product is to be stapled;

Figure 8 is a detail, partly sectional, view taken on the line 8—8 of Fig. 3 in the direction of arrow 8 of that figure;

Figure 9 is a face view, partly broken away, of certain of the parts, the view being taken in the direction of arrow 9 of Fig. 3;

Figure 10 is a detail of the cam mechanism for operating the pins, the view being taken looking in the direction of arrow 10 of Fig. 3, and

Figure 11 is a detail, partly sectional, view taken inside the cylinder looking in the direction of arrow 11 of Fig. 4.

Referring now to these drawings, the mechanism chosen to illustrate the invention is capacitated to operate with either collected or uncollected products, means being shown for cutting sheets from a web, collecting these cut sheets, and stapling the collected product. In the construction illustrated, these parts are carried by a carrier shown in the form of a cylinder 1. It will be understood, however, that as to certain features the invention is not to be restricted to a construction employing collecting and cutting mechanism, and that any suitable type of carrier may be employed.

The stapling cylinder is mounted on a shaft 2 suitably journalled in side frames 3, 4, of any usual configuration, this shaft

2 being provided with a driving gear 5 by which it may be driven from any suitable source of power, not illustrated. The machine shown is capacitated to insert a line of staples in the product, two such mechanisms being shown, illustrated generally by the numerals 6, 7 in Fig. 5. It will be understood, of course, that the mechanisms may be duplicated to insert as many staples in the product as may be desired. These stapling mechanisms cooperate with a suitable abutment, shown in the form of a cylinder 8, which is provided with anvils 9 against which the stapling is effected.

In the particular construction shown, the cylinder 1 is a collecting and cutting cylinder, being provided with sheet taking devices in the form of pins 10 and a cutting knife 11 supported in a holder 12 mounted in a block 13 secured in the cylinder wall. The holder 12 is recessed, as indicated at 13′ in Figs. 2 and 4, to receive the cheeks 14 which are spring seated on springs 15. The cutting knife 11 cooperates with the usual cutting wood 16 on the cylinder 8.

The stapling mechanisms 6, 7 are identical in construction and a description of one will suffice for both. While the specific construction of this mechanism may be of various characters, as illustrated, the staple forming mechanism is operated from a shaft 17 suitably supported in the cylinder, and the staple driving mechanism is operated from a second cross shaft 18 suitably supported in the cylinder. The operation of these mechanisms is controlled by a pair of cams 19, 20, which are loosely journalled on the driving shaft 2, before referred to. In accordance with the invention, means are provided whereby these cams may be operated to insert a staple at every revolution of the carrier or at every other revolution. While this may be effected in various ways, the operating cams 19, 20 are arranged so that they may be stationary with respect to the cylinder, which arrangement is used where a product is to be stapled at each revolution, or they may be given a movement with the cylinder but at half the speed thereof, so as to effect the stapling and collecting function in the particular machine shown at every other revolution of the cylinder, the collecting pins being likewise operated. As the same construction is preferably employed for each of the cams, but one such construction will be described. As shown, see Figs. 6, 7, the cam 20 carries a gear 21, which meshes with a gear 22 on an eccentric shaft 23. This eccentric shaft 23 carries a gear 24, which is arranged to be thrown into mesh with a gear 25 fast on the shaft 2 of the cylinder. In the construction shown, the parts are in the position they occupy when a product is being collected and stapled at every other revolution of the carrier. In Fig. 7, the eccentric shaft is shown rocked to throw the gears 22 and 24 out of mesh with gears 21 and 25, in which position the stapler is operated to staple a product at every revolution of the cylinder. This eccentric shaft may be manipulated by means of a handle 26, indicated by dotted lines in Fig. 7.

The staple forming mechanism is of the usual type, comprising a pair of staple carrying members 27, 28, which take a wire length cut off by a suitable mechanism, not shown, these members cooperating with the staple forming horn 29, eccentric to the carrier, which bends up the wire length to form the legs of the staple. These staple carrying members are each provided with a pair of side projections 30, 31, best shown in Figs. 1 and 2, which work in a guideway 32 (Fig. 5) formed in a plug 33 in a recess in a block 34 secured in the cylinder walls. These staple carrying members are operated in any suitable manner. In the particular construction shown, they are operated, as before stated, from the shaft 17. While the specific means for giving these staple forming members a reciprocating movement may be varied, in the particular construction illustrated, see particularly Figs. 1 and 8, the shaft 17 has keyed thereto a pair of hubs 35, 36 provided with arms 37, 38. These staple carrying members are provided at their inner ends with slotted ears 39, 40, these ears being secured to the arms 37, 38 by pins 41, 42, these pins having a slight play in the slot, as indicated by dotted lines in Fig. 1.

The cam 19 is formed so as to operate the shaft 17 to drive the staple forming members beyond the periphery of the cylinder, as shown in Fig. 1, during the first half revolution of the cylinder, the cam roll engaging the groove in the cam 19, being shown in dotted lines at the right-hand side of Figure 5, the cam roll being connected with the shaft 17 in any suitable manner. The staple members are then retracted within the cylinder during the next three half revolutions, as shown in Figs. 2, 3 and 4, these members carrying the staple between them, as shown in Fig. 8, the staple being held by the spring of the wire.

The staple is driven into the product and clenched by a suitable driving plunger, best shown in Figs. 5 and 8, marked 43. This plunger is, as shown in Fig. 8, in the form of a bar which operates between the staple forming members 27, 28. This plunger at its inner end is formed with an extension 44 which works through a guide piece 45 (Fig. 1) secured to the cutting knife carrying block 13, before referred to. Means are provided for reciprocating this plunger to drive the staple and in the particular construction

illustrated, this plunger is operated from the cam 20 through the rock shaft 18, before referred to. While this may be accomplished in various ways, in the particular construction illustrated, the rock shaft 18 has keyed thereon a pair of lever arms 46, 47 (Fig. 8) to which, by means of pins 48, is secured an ear 49 on the plunger, the pins having a lost motion connection in the ear, as shown in Fig. 1. By the operation of the cam 20, this plunger is operated to drive the formed staple into the product.

In accordance with the invention, means are provided for supporting the staple between the product and the plunger, these means being arranged to lie between the legs of the staple and to provide a rigid support for the staple back so that the back cannot bend or crimp while it is being driven into the product, and the construction and operation of these means may be varied within wide limits. In the best construction, however, these means will be of such a character and so operated that they will come into position after the staple is formed and will remain in position during the time the staple is being driven, so that during the staple forming and driving operations any liability of the staple to bend or crimp is effectually prevented.

In the particular construction illustrated, these means include a support or abutment which is given a reciprocating movement to and from the staple, the support being so shaped that as it is withdrawn during the staple forming operation it decreases in thickness proportionately as the staple is driven into the product, so that as the staple is driven space is provided for the passage of the staple legs into the product. In the particular construction illustrated, this support or abutment is in the form of a slide 51, see Figs. 1 to 4, this slide having an operating end 52 substantially the width of a staple inside the staple legs. Referring to Figs. 1 and 4, it will be observed that the operating end 52 of this slide has an outer surface of the same curvature as the periphery of the cylinder and an inner surface which is bevelled from a thin outer point 53. The outer wall of the plug 33, before referred to, is also correspondingly bevelled, as indicated at 54 in Fig. 3, the amount of this bevel and the bevel on the slide 51 being substantially the depth of a staple leg at the point of insertion of a staple. It will be observed, referring to Figs. 2 and 3, that as the staple is formed and is brought to the stapling point the slide is reciprocated to lie between the staple legs. As the staple operation proceeds, the slide is gradually withdrawn and, owing to the bevel on the inner face of the slide, the slide will act as a support for the staple during the entire stapling operation, the slide being withdrawn entirely from the staple after the latter has been inserted in the product, as shown in Fig. 4.

With this construction therefore the staple is supported, after it has been formed and during the entire staple inserting operation, so that no crimping of the back of the staple can take place, and thus a perfect stapling of the product is assured.

This slide operates in a groove, indicated at 55 in Figs. 1 to 4, in the cylinder wall, the slide being guided by the walls of the groove. In the best construction, means are provided for stopping the slide accurately in either its forward or operating position, or in its withdrawn position. While various means may be provided for effecting this, in the particular construction illustrated, the slide is provided with a projection 56 having a rear shoulder 57 and a front shoulder 58. In the forward position of the slide, the shoulder 58 abuts against a stop plate 59, and in the rear position of the slide the shoulder 57 abuts against the end wall 60 of the groove. If desired, the slide may be provided with a tail 61, which rides on the inner surface of the cylinder wall and acts as a steadying means for guiding and steadying the slide in its reciprocating movements.

This slide may be operated in any suitable or desired manner. In the best constructions, to obtain accuracy in the position of the slide, it is operated from and timed with the driving plunger 43, before referred to, so that as the driving plunger goes forward to insert the staple the slide is gradually withdrawn so that a staple can be driven. In the particular construction illustrated, the slide is operated by a pin 62 between two arms 63, 64 of a bell crank lever pivoted on a stud 65 secured in a bracket arm 66 supported from a bracket 67 secured to the block 13, before referred to. The other arms 68, 69 of the bell crank have secured between them, by a pin 70, the plunger 43, before referred to. As this plunger is forced forward by its operating mechanism, the slide is operated in a reverse direction to retract the slide from between the staple legs and vice versa.

When collecting, as in the machine illustrated, the sheet taking pins 10 are normally projected beyond the periphery of the cylinder to take a sheet, and are withdrawn to release the sheet, so that the collected product may be forwarded and stapled. While various mechanisms may be employed for so operating these pins, in the particular construction shown they are operated by the cam 20, before referred to, through the rock shaft 18 in the following way, the construction being the same for all the pins. As shown, each pin is carried on a lever arm 70′ on a rock shaft 71 suitably journalled

in the cylinder ends. The other arm of this lever is backed up by a spring rod construction 72, which normally rocks the shaft 71 to project the pins, as shown in Figs. 1 and 3. The pins are retracted by means of a roll 73 on an arm 74 fast on the rock shaft 71. This roll is controlled by a cam 75 having an operating nose 76. This cam 75 is carried on a cam ring 77 loosely mounted on the shaft 2, before referred to. This ring, see Fig. 5, has an arm 78 to which is pinned a lever arm 79 fast on the shaft 18, before referred to, see Figs. 1 and 3. As the cylinder reaches the stapling point, the shaft 18 is rocked by the cam 20 to operate the cam ring 77 to bring the operating nose 76 of the cam into the path of the roll 73, as shown in Fig. 3, which operates the rock shaft 71 to withdraw the pins so that the collected product has been released at the stapling point and the stapling is then effected.

The pin rods will be operated at every revolution of the carrier and, when no collecting is to be done, the pin points 80 may be removed so as to keep them out of the way of the sheets.

The operation of the machine may be briefly described as follows when collecting: With reference to Figs. 1 to 4, on the first quarter turn of the cylinder the pin points 80 are projected and take the leading end of the web W. In this position of the carrier, the staple forming members 27, 28 have been projected through the shaft 17 beyond the carrier wall to take a wire length. The abutment slide at this point is in its rear position. As the carrier makes its second half revolution it has taken a sheet around the carrier and its staple forming members have been retracted, carrying the formed staple with them within the cylinder wall, and the abutment slide is moving into operative position, the position of the parts at this point being shown in Fig. 2. On the third half turn of the carrier, or the beginning of the second revolution, the pin points 80 have been withdrawn beyond the periphery of the cylinder and the cutting mechanism is operated to sever the first sheet from the web, this severed sheet being associated with the next incoming sheet. The abutment slide has moved to its complete operative position between the legs of the staple, the position of the parts at this point being shown in Fig. 3. On the next half turn of the carrier, the staple has been brought to stapling position, and the plunger is operated to insert the staple in the collected product, and the slide 51 has partially completed its backward movement so that the staple can be inserted in the sheet, the pins in the meantime have been operated so that they again project beyond the periphery of the cylinder to take the next sheet.

While the invention has been shown and described in its preferred form, it will be understood that various constructions may be devised for securing the staple while it is being driven, and these devices may be operated in various ways. The invention is therefore not to be restricted to the precise form of abutment shown, or the means for operating it, and this abutment may be used in stapling mechanisms of widely varying characters without departing from the invention as defined in the appended claims.

What I claim is:

1. The combination of a rotary carrier, staple forming and inserting mechanisms carried thereby, means for operating the staple forming mechanism, means for operating the staple inserting mechanism, a support, and means controlled by the staple inserting mechanism for positioning the support between the product and the inserting mechanism while the staple is being inserted in a product.

2. The combination of a rotary carrier, staple forming and inserting mechanisms carried thereby, means for operating the staple forming mechanism, means for operating the staple inserting mechanism, a support, means for positioning the support between the product and the staple inserting mechanism while the staple is being inserted in the product, and means for effecting the stapling operation on every revolution of the carrier or on alternate revolutions.

3. The combination of a rotary carrier, staple forming and inserting mechanisms carried thereby, means for operating the staple forming mechanism, means for operating the staple inserting mechanism, a support, means controlled by the staple inserting mechanism for positioning the support between the product and the inserting mechanism while the staple is being inserted, and means for effecting the stapling operation on every revolution of the carrier or on alternate revolutions of the carrier.

4. The combination of a collecting cylinder, sheet taking devices carried thereby, staple forming and inserting mechanisms, means for operating the staple forming mechanism, means for operating the staple inserting mechanism, a support, means for positioning the support between the product and the inserting mechanism while the product is being stapled, and means for operating the sheet taking devices to take and release a sheet.

5. The combination of a collecting cylinder, sheet taking devices carried thereby, staple forming and inserting mechanisms, means for operating the staple forming mechanism, means for operating the staple inserting mechanism, a support, means for positioning the support between the product and the staple inserting mechanism while

the staple is being inserted, and means controlled by the staple inserting mechanism for operating the sheet taking devices to take and release a sheet.

6. The combination of a rotary carrier, staple forming mechanism, a shaft for operating the mechanism, a staple driver, a shaft for operating the staple driver, a support, and means operated by the staple driver for positioning the support between the product and the driver during the stapling operation.

7. The combination of a rotary carrier, staple forming mechanism, a shaft for operating the mechanism, a staple driver, a shaft for operating the driver, a slide, and connections from the staple driver for reciprocating the slide to move it into a position between the product and the driver and to gradually withdraw it as the stapling operation proceeds.

8. The combination of a rotary cylinder, sheet taking devices carried thereby, staple forming mechanism and means for operating it, a staple driver, a shaft for operating the driver, a support, connections from the driver for reciprocating the support into position to support the staple while being driven, and connections from the driver shaft for operating the sheet taking devices to take and release a sheet.

9. The combination of a rotary cylinder, staple forming mechanism carried thereby, a cam for operating the staple forming mechanism, a staple driver, a shaft therefor, a cam for operating the driver shaft, a slide, and connections from the driver for reciprocating the slide into and out of the path of the staple as it is being driven.

10. The combination of a rotary cylinder, staple forming mechanism carried thereby, a cam for operating the staple forming mechanism, a staple driver, a shaft therefor, a cam for operating the driver shaft, a slide, connections from the driver for reciprocating the slide into and out of the path of the staple as it is being driven, and means for stopping the slide in either position.

11. The combination of a rotary cylinder, staple forming mechanism carried thereby, means for operating the staple forming mechanism, a staple driver, means for operating the driver, a slide having a bevelled inner face, and means for operating the slide to position the bevelled face of the slide between the product and the staple driver.

12. The combination of a rotary cylinder, staple forming mechanism, a staple driver, means for operating the driver, a staple supporting slide movable about the periphery of the cylinder, and connections for operating the slide in a direction reverse to the movement of the driver.

13. The combination of a rotary cylinder, staple forming mechanism, a staple driver, means for operating the driver, a staple supporting slide movable about the periphery of the cylinder, and lever connections for operating the slide in a direction reverse to the movement of the driver.

14. The combination of a rotary cylinder, staple forming mechanism, a staple driver, a plug in which the driver works having a bevelled face, means for operating the driver, a slide having a bevelled face riding on the face of the plug and a curved opposite face, and means for reciprocating the slide.

15. The combination of a rotary cylinder, staple forming mechanism carried thereby, a cam for operating the staple forming mechanism, a staple driver, a shaft therefor, a cam for operating the driver shaft, a slide, connections from the driver for reciprocating the slide into and out of the path of the staple as it is being driven, and means for effecting the stapling operation on every revolution of the carrier or on alternate revolutions.

16. The combination of a collecting cylinder, sheet taking devices carried thereby, staple forming mechanism carried thereby, a cam for operating the staple forming mechanism, a staple driver, a shaft therefor, a cam for operating the driver shaft, a slide, connections from the driver for moving the slide into and out of the path of the staple as it is being driven, connections controlled by the staple driver for operating the sheet taking devices, and means for effecting the stapling operation on every revolution of the carrier or on alternate revolutions.

In testimony whereof, I have hereunto set my hand.

EDWARD P. SHELDON.