Nov. 22, 1960 D. J. STEIDINGER 2,960,696

ROTARY STAPLER MECHANISM

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FIG. 1

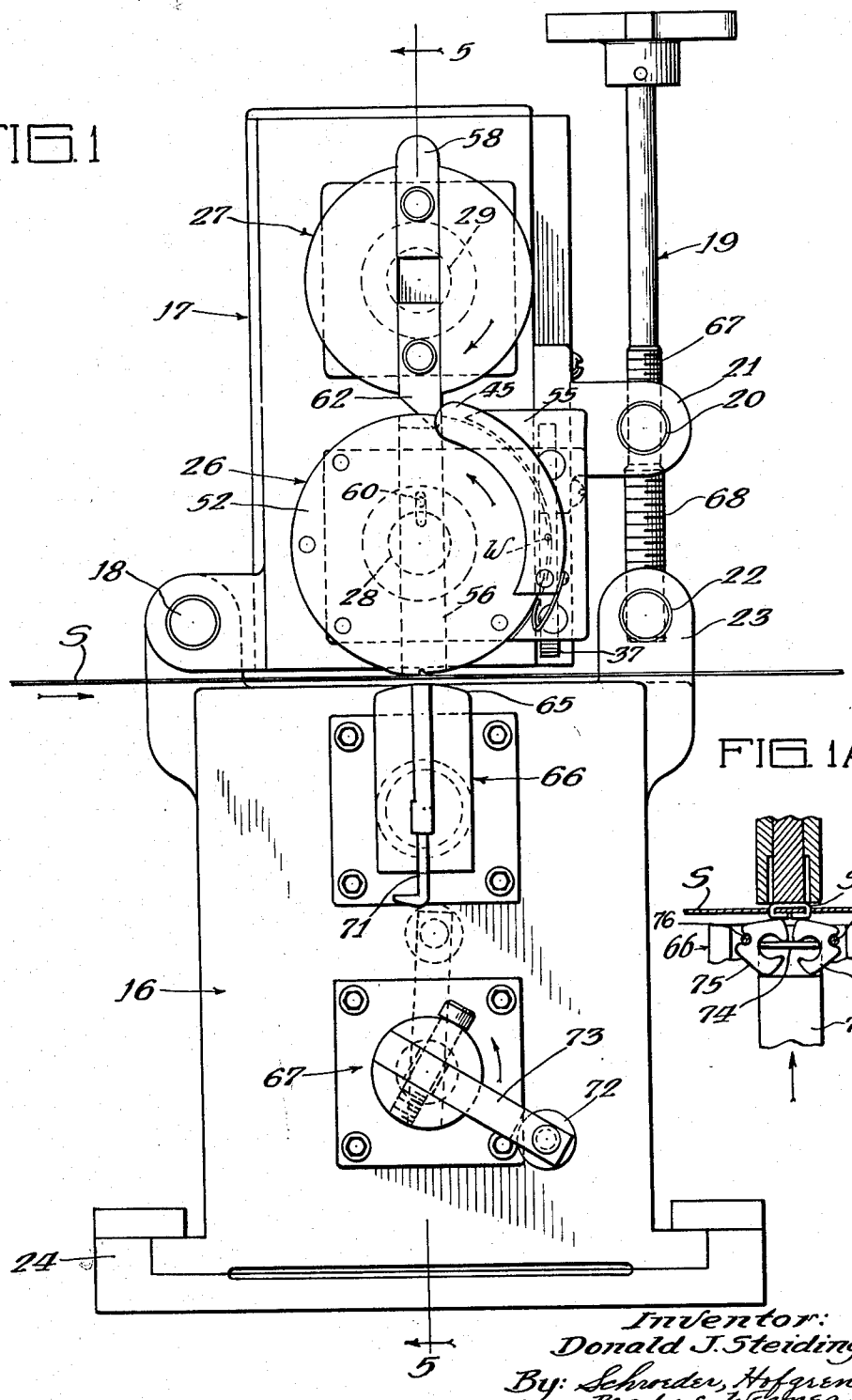


FIG. 1A

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FIG. 2

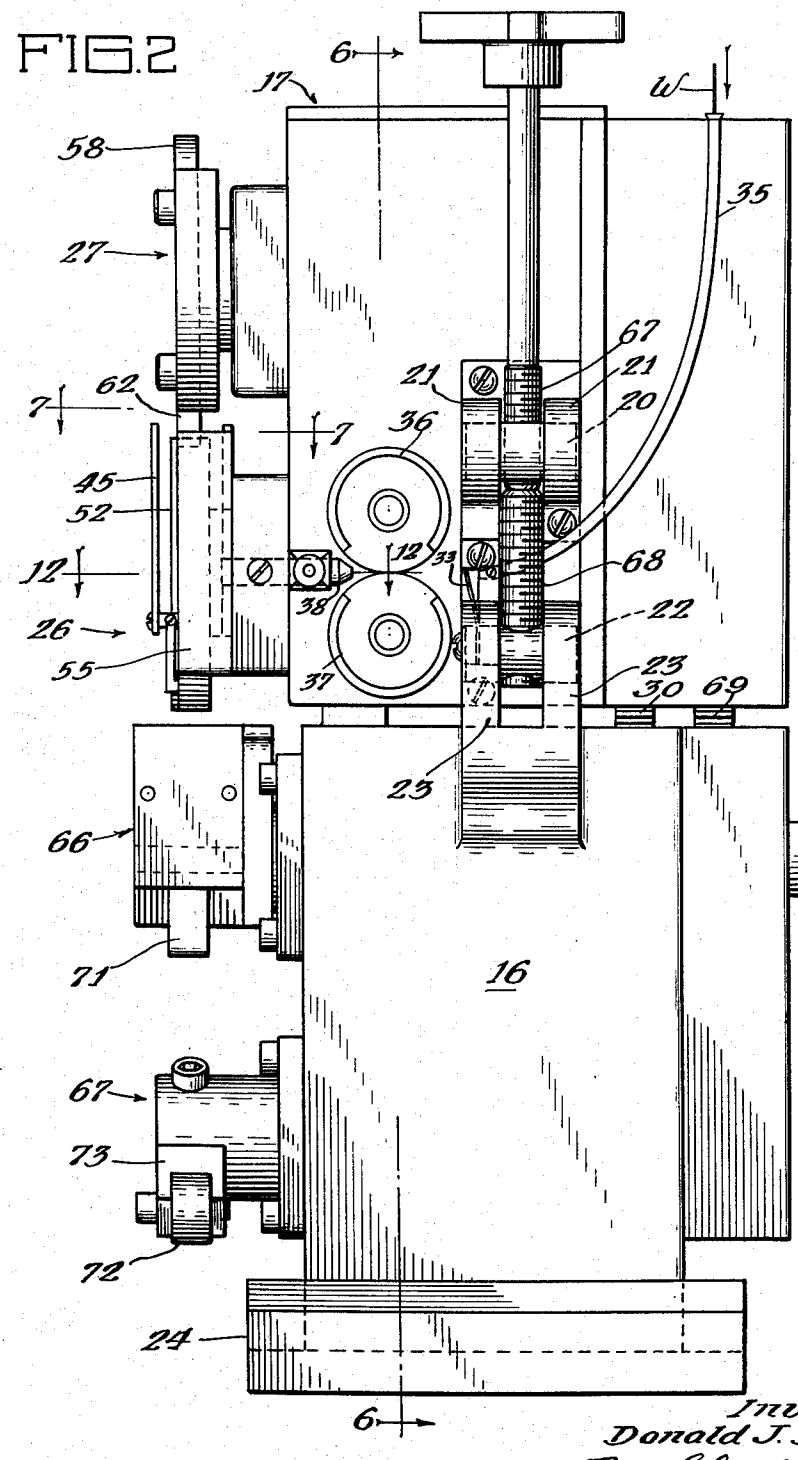


FIG. 3

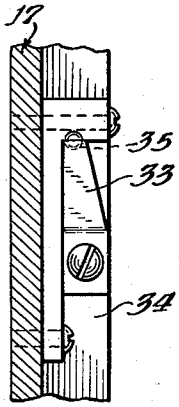
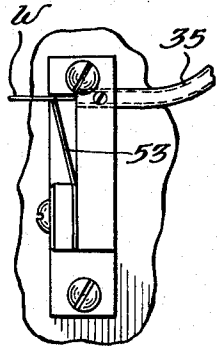


FIG. 4



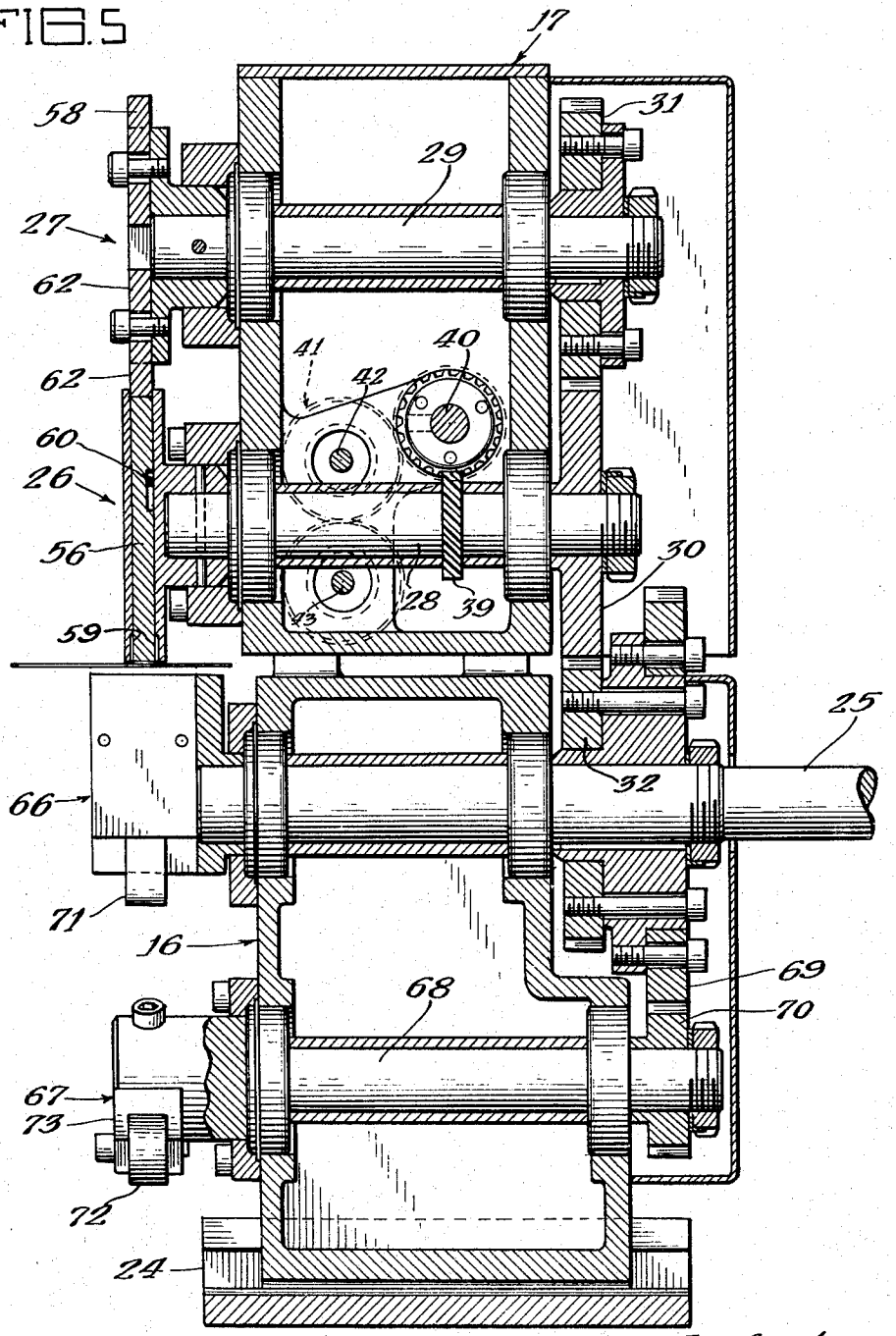
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FIG. 5



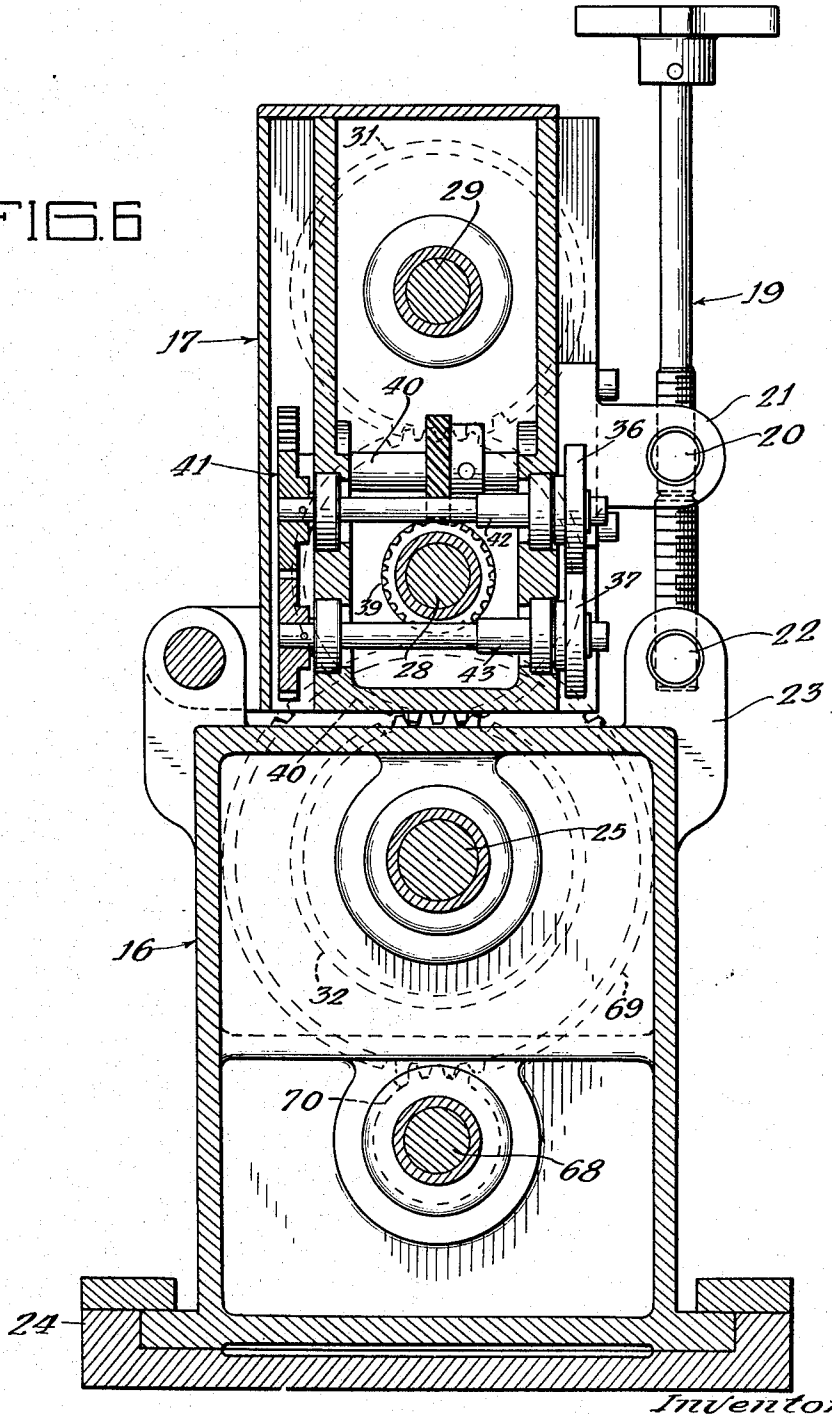
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FIG. 6



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ROTARY STAPLER MECHANISM

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FIG. 7

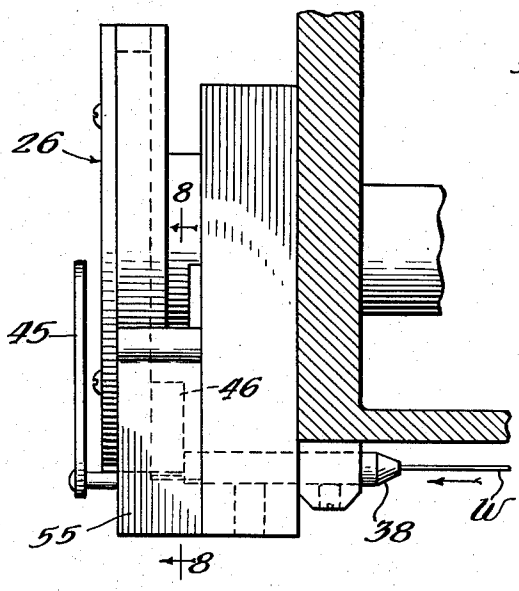


FIG. 8

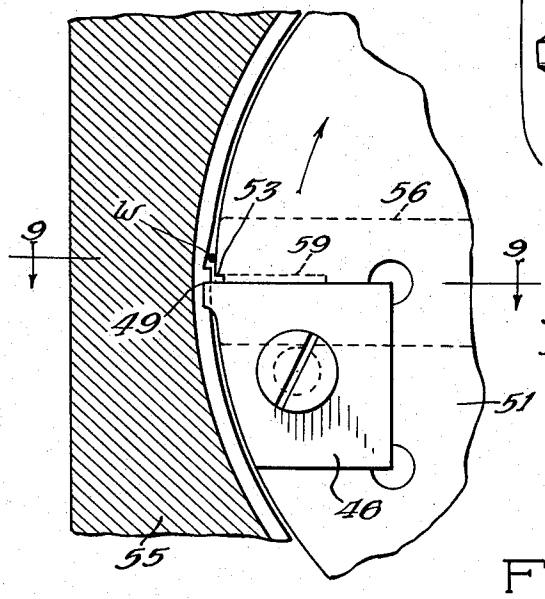


FIG. 10

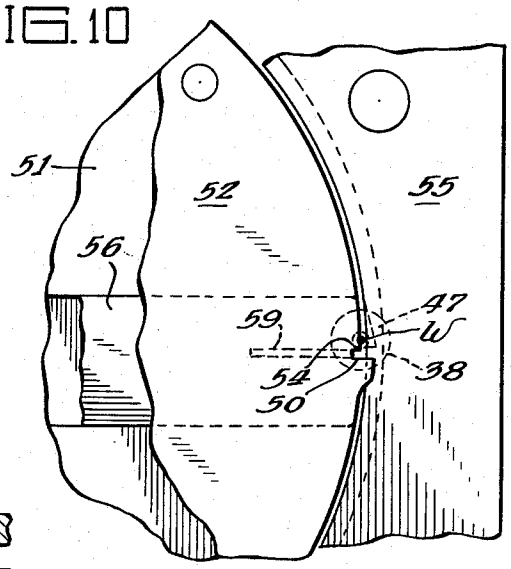
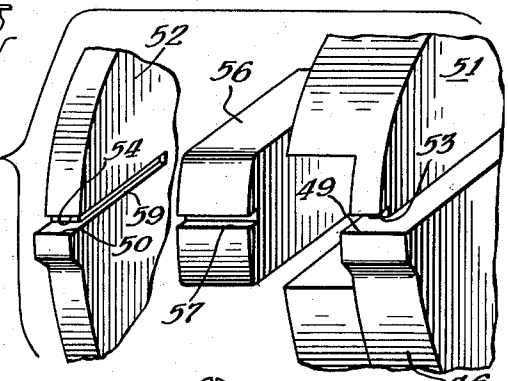


FIG. 11



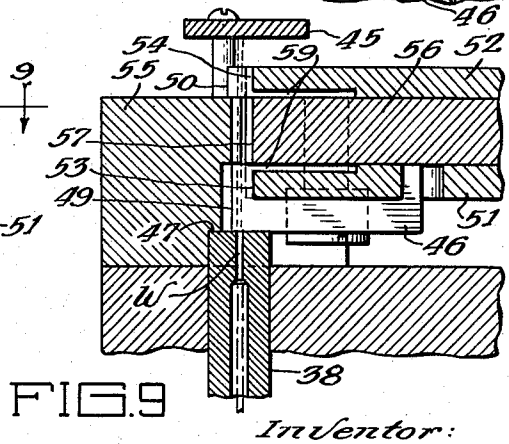


FIG. 9

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FIG. 12

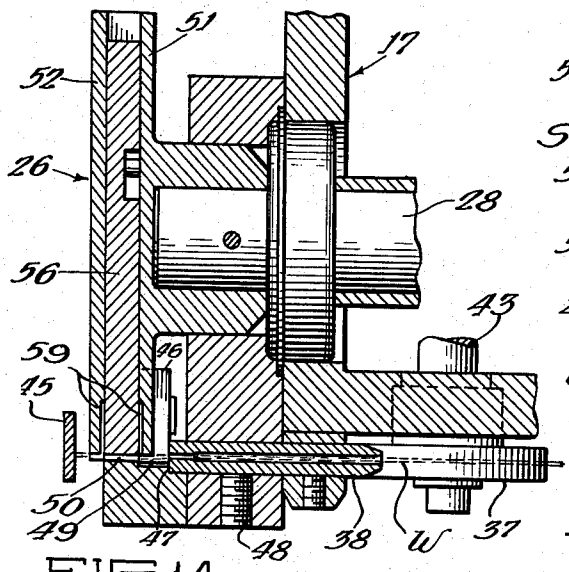


FIG. 13

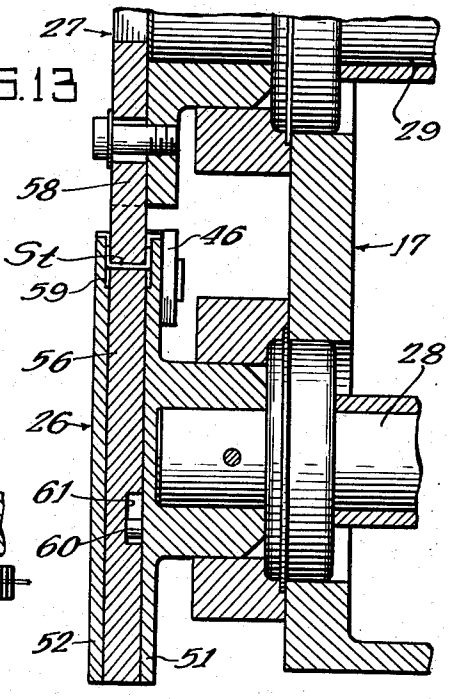


FIG. 14

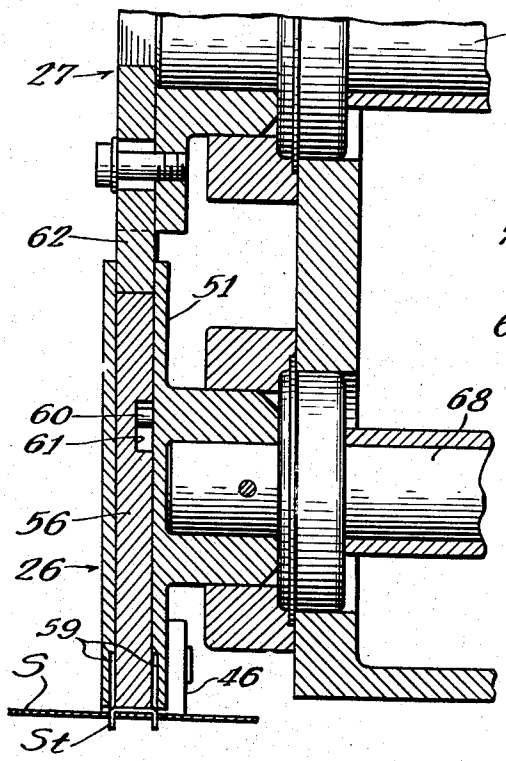
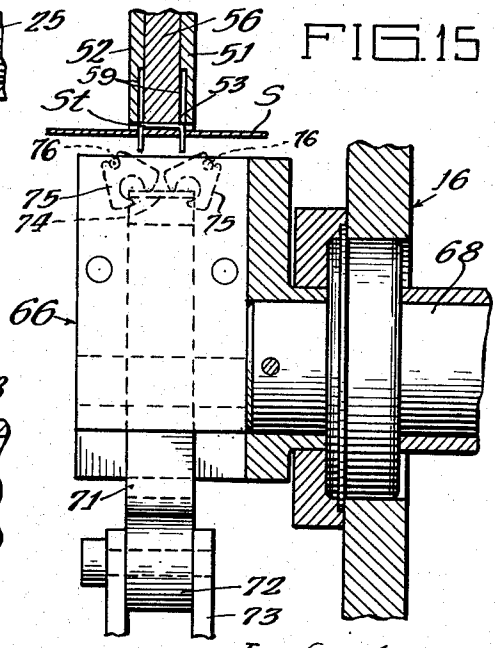


FIG. 15



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2,960,696

ROTARY STAPLER MECHANISM

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Filed Oct. 27, 1958, Ser. No. 769,834

4 Claims. (Cl. 1—7)

This invention relates to a rotary stapler mechanism and more particularly to a stapling device for placing staples accurately in moving strips or webs of superposed stationery.

Heretofore, some stapling has been done in stationery by intermittently stopping the stationery strips to receive the staple. The stationery was advanced rapidly past a stapling mechanism and stopped long enough to receive the staple. This type of mechanism is not readily adaptable to interleaving or collating apparatus for assembling the previously printed strips with transfer material.

There has been also some additional work in rotary stapler mechanisms primarily in the book binding trade where the location of the staples need not be accurate since the binding would eventually cover any visible evidence of the location of the staples.

The principal object of the present invention is to provide a new and improved stapling mechanism for placing staples accurately in moving strips or webs of superposed stationery.

Another object is to provide such a stapling mechanism which may be run in connection with a collating or an interleaving operation.

A further object is to provide a mechanism capable of placing an accurately formed staple in a precise location in moving strips or superposed stationery at selected variable spaced intervals.

A still further object is to provide such a stapler mechanism having separate staple driving and clinching operations permitting accurate location of the staples in a moving stationery strip assembly.

Further objects, features and advantages of the present invention will be apparent from the following description of a preferred embodiment illustrated in the drawings in which:

Figure 1 is a front elevational view of the apparatus embodying the invention;

Figure 1*a* is a fragmentary sectional view of the clinching mechanism;

Figure 2 is a front elevational view of the mechanism;

Figure 3 is an enlarged fragmentary front view of a portion of the wire feed;

Figure 4 is a fragmentary side view of the apparatus shown in Figure 3;

Figure 5 is a vertical sectional view through the mechanism taken substantially along line **5—5** in Figure 1;

Figure 6 is a view similar to Figure 5 taken substantially along line **6—6** in Figure 2;

Figure 7 is a horizontal sectional view taken substantially along line **7—7** in Figure 2;

Figure 8 is a fragmentary enlarged view partly in section looking toward the wire feed and showing the wire cutoff taken substantially along line **8—8** in Figure 7;

Figure 9 is a fragmentary sectional view along line **9—9** in Figure 8;

Figure 10 is a view of the mechanism shown in Figure 8 taken from the opposite side;

Figure 11 is a fragmentary exploded perspective view of the mechanism shown in Figures 7 through 10;

Figure 12 is a fragmentary sectional view taken substantially along line **12—12** in Figure 2;

Figure 13 is a fragmentary enlarged sectional view showing the staple forming operation;

Figure 14 is a view similar to Figure 13 showing the staple driving operation; and

Figure 15 is a view similar to Figures 13 and 14 showing the staple clinching operation.

Referring partciularly to Figures 1 and 2, the mechanism of the present rotary stapler is a compact unit adapted to be positioned and driven from a collator or intreleaving machine. Printed stationery strips and strips of carbon material are interleaved, bringing the strips and cross lines of weakening into registry to form a manifolding pack of continuous forms. This work is done on an interleaving machine and the stapler mechanism may be used to fasten the forms together. Preferably the staple is of a fine wire accurately positioned in the edges of the strips so as not to interfere with a subsequent writing operation on the stationery in a billing machine, typewriter or other writing instruments.

The stapler mechanism has a frame formed in two section including a lower section **16** and an upper section **17** hinged together about pin **18** and provided with an adjusting screw **19** on the opposite side threaded through a barrel nut **20** in boss ears **21** secured to the upper frame and a similar barrel nut **22** held captive in ears **23** formed integrally with the lower frame **16**. The pivot and adjusting screw thus securely mount the two frame sections together. The lower frame has a base portion **24** for mounting the unit upon the frame of a collator or interleaving machine. A drive shaft **25** extends outwardly of the lower frame in order to receive motive power for driving the stapler unit. All of the mechanism of the rotary stapler receives its driving force through the shaft **25**.

The staple forming and driving functions are performed by the mechanism housed in the upper frame section. In Figure 1 a wheel-like member **26** receives the wire which eventually is made into staple form having two spaced legs and from which the so formed staple is driven. Another wheel-like member **27** immediately thereabove rotates counter to the wheel **26** and has cooperating staple forming and staple driving members. The mounting for these members is best seen in Figure 5, the member **26** being mounted upon a shaft **28** secured in the side walls of the upper frame **17** by the use of appropriate bearings held spaced by a sleeve spacer and the upper member **27** being likewise mounted upon a shaft **29** similarly supported in appropriate bearings. These shafts are rotated from the input drive shaft **25** through meshing gears **30** and **31** driven by a gear **32** fastened on the input shaft.

The unit also includes a wire feeding mechanism driven from the same source of power. This mechanism is shown in Figure 2 as embodying a guide **35** for the wire W leading to a pair of surface relieved feed rollers **36** and **37** directing the wire into a guide tube **38**. The drive for the feed rollers is best seen in Figures 5 and 6 wherein a worm wheel **39** on the shaft **28** drives a shaft **40** at right angles thereto. The shaft **40** through appropriate gearing **41** drives the shafts **42** and **43** which mount the wire feed wheels **36** and **37** respectively. The advance of the wire is made intermittently in timed relation to the operation of the forming and driving functions.

Various appurtenances are provided with the wire feeding apparatus to insure its proper operation. For example, Figures 3 and 4 detail a device to insure that the wire once fed forwardly does not retract from its proper position. In order to accomplish this, a spring steel

finger 33 is secured to a portion of the frame 34 with an upper edge thereof in the path of the wire so that the wire must deflect the finger slightly in passing the same. Any backward motion of the wire is thus snubbed and the feed wheels may thus accurately project the wire forwardly into the guide tube 38. Also, the wire will not move when a staple forming length is severed from the wire stock.

The forming operation of the member 26 receiving the wire, forming the staple and preparing it for driving, is best illustrated in Figures 7 through 15. Referring first to Figure 7, the wire W directed into the guided tube 38 is advanced across the path of the wheel member 26 until it strikes a guard plate 45. The wire has been fed so as to be in a position just beyond the periphery of the wheel 26. At the time that a length of wire has been fed out sufficiently far to come into contact with the guard plate 45, the length is severed and thereafter carried around the periphery of the wheel. The severing occurs as shown in Figures 8 through 11. The wheel carries a cut-off blade 46 which sweeps the flat ground and hardened end 47 of the guide tube 38, shearing the wire at the point from which it emerges from the tube. The tube is accurately held in place with a set screw threaded opening 48 (Figure 12). The wire is picked up upon the ledges 49 and 50, the former being on the cut-off blade 46 and the latter on the wheel cover 52. The wire travels with the wheel 26 and is not permitted to escape from the grooves 53 and 54 at the base of the ledges because of the presence of a guard 55. A proper length of wire to form a staple is thus positioned in the grooves 53 and 54 and carried on the periphery of the wheel toward the staple forming position. In Figure 12, a length of wire is shown in position to be picked up by the wheel 26 and about to be cut off by the cut-off blade and guide tube.

The staple is formed in a cavity formed by the base and cover of the wheel 26 and a plunger mounted therein. In Figure 12, the plunger 56 is shown in a position in which the wire would seem to interfere with the ends thereof. In Figure 11, the plunger 56 is more detailed and shows the groove 57 in its end which may embrace the wire. As the wheel 26 turns, so that the wire would be uppermost, the plunger is acted upon by a staple forming anvil 58 to form the wire into a staple form *St* shown in Figure 13. The base of the staple remains in the groove 57 in the plunger and the legs each fall within a groove, one of which is shown at 59 in Figure 11 in the cover plate, there being a similar groove formed between a recess in the base 51 and the blade 46 of the wheel 26. A hardened pin 60 travelling in a groove 61 in the plunger limits its movement. Once the staple is formed it will remain in its grooves by friction.

After the staple forming operation, the wheels rotate sufficiently further to bring the staple into the lowermost position on the wheel 26 preparing the same for driving. In Figure 1, the stationery S is shown travelling at the lower periphery of the wheel 26. This stationery may be several strips or webs to be stapled together. The wheel 26 may be driven so that its periphery travels at the same rate as the surface speed of the paper. It has been found that this speed may vary in order to place the staples in the web at the desired spaced locations; that is, the wheel may travel faster than the web, thus placing the staples closer together or slower to place them further apart.

In the present invention the staples are driven through the strips and thereafter clinched in place. The driving is accomplished as noted in Figures 1 and 14. A driving anvil 62 strikes the opposite end of the plunger 56 from that holding the staple, thus ejecting the staple through the stationery. In the present device a staple is formed and is driven with each rotation of the wheel 26.

The stationery is supported during the staple driving on the upper arcuate surface 65 of a clinching mechanism 66 and during all other times the stationery is tensioned by feed means (not shown) of other mechanism with which the stapler unit is used. The adjusting screw 19 may be used to vary the distance between the wheel periphery and clincher to accommodate different thicknesses of stationery. Threaded parts 67 and 68 of the adjusting screw vary in pitch enough to allow a very fine adjustment in increments less than the thickness of a paper strip.

The clinching mechanism is supported in the lower frame 16. The clincher 66 is mounted on an extension of the drive shaft 25 so as to rotate therewith and the clincher operator 67 is mounted on a shaft 68 therebelow. Appropriate gearing 69 and 70 is selected to drive the operator rotatably much faster than the clincher preferably in the ratio of about 3 to 1. In only one position of plunger 71 will a stapler be driven and at other times the unit 66 rotates out of contact with the follower 72.

The clincher itself is shown in Figures 1, 1*a* and 15 and embodies a slidable plunger 71 having a lower portion to be struck by a follower 72 on the arm 73 of the operator. The upper end of the plunger has a flange 74 for operating a pair of clinching jaws 75. These jaws are caused to pivot upwardly about an outer pivot pin support 76 from the position shown in Figure 15 to the position shown in Figure 1*a* by upward movement of the plunger thus clinching the legs of a staple *St*. The flange 74 is embraced loosely by the jaws below the staple engaging upper surfaces of the jaw and thus move upwardly and downwardly with the plunger. The plunger is biased to its lower position by an internal spring (not shown).

In summary, the rotary stapler mechanism of this invention operates to pick up a wire on the rotating wheel 26 (Figure 1) carrying to its upper position where the rotating forming anvil 58 depresses the wire into the cavity in the wheel 26 forming the staple. The staple is then carried through another 180° to a position next adjacent the stationary S. The driving anvil 62 has, in the meantime, rotated around to push the plunger 56 across wheel 26 driving the staple. In timed relation the clinching device 66 has rotated into proper position to clinch the staple legs and the faster rotating arm 73 of the cylinder driver swings against the plunger operating the same very quickly. Thus, each rotation of the wheel 26 through 360° cuts off a length of wire, forms it into a staple, and drives the staple where it is clinched by the clinching mechanism.

It has been found that by operating the clinching operation much faster than the driving of the staple, the staple location can be accurately chosen and the staple driven before the clinching operation. The staple moves forward less than ⅛" even in very fast collating machines, during the complete operation of the clinching. The driving is, of course, much slower, permitting accurate location even though the staple carrying wheel 26 may be running at a variance in speed to the advance of the stationery. Tearing of the paper is practically unnoticeable. It can be detected only with the aid of magnifying glasses. It is believed that the described clinching operation contributes a great deal to the accuracy of staple location.

The foregoing detaile ddescription has been given for clearness of understanding only and no unnecessary limitations should be understood therefrom for modifications will be obvious to those skilled in the art.

I claim:

1. A rotary stapler adapted to place a staple in moving superposed strips, comprising: a frame; a rotary member mounted in the frame and including a staple carrying portion; means for driving the staple from said carrying portion into superposed strips moving adjacent the rotary member; drive means for rotating the rotary member at a speed to carry a staple to said moving strips at desired locations; means for operating said means for

driving the staple in timed relation with rotation of the staple carrying rotary member; and a clincher rotatably mounted in said frame for clinching said driven staple; drive means for operating said clincher immediately following driving of a staple from said staple carrying rotary member and at a speed in excess of the speed of driving of the staple to effect clinching against the driving means during a relatively small advance of said strips.

2. A rotary stapler unit adapted to place a staple in moving superposed strips, comprising: a frame including an upper section and a lower section secured together; a staple forming and driving mechanism mounted in the upper frame section and including a rotary member to receive staple wire stock and a cooperating staple forming and driving anvil; a staple clinching mechanism mounted in said lower frame section and including a clincher and a clincher operator; drive means including a drive shaft mounted in said frame and means connecting said shaft with the staple forming and driving mechanism and with said clinching mechanism, said drive means rotating the driving mechanism and clincher at a peripheral speed substantially equal to the surface speed of strips to receive the staple and said drive means for said clincher operator rotating the same in timed relation to operate the clincher immediately following the driving of a staple, said clincher operator drive rotating the clincher operator at a whole integer multiple of the clincher rotation and in timed relation to clinch a driven staple relatively rapidly.

3. A rotary stapler as specified in claim 3 in which a tube guide is provided to direct staple wire stock to said staple forming mechanism and said rotary member

carries a cutoff blade positioned to sweep the end of the tube guide to sever a staple-length of wire from the stock.

4. A rotary stapler unit for use in applying staples to moving strips of stationery, comprising: a frame; a plurality of parallel shafts in the frame connected together for simultaneous rotation; drive means for driving said parallel shafts; a staple carrying member on one shaft; a staple forming and driving anvil on a second of said shafts; a staple clincher on a third of said shafts, said staple carrying member and clincher being spaced one above the other for passage of said strips therebetween; and a clincher operator on a fourth of said shafts; means including said drive means for driving said carrying member, forming and driving anvil and clincher in timed relation so that each has peripheral portions revolving at the same speed substantially equal to the surface speed of the stationery strips so as to position the staple and clincher on opposite sides of the strips simultaneously, and driving means for said clincher operator to operate the clincher immediately after a staple is driven, said operator being revolved at greater speed and in timed relation to said clincher revolutions to operate the clincher at a relative speed in excess of said clincher revolution speed.

References Cited in the file of this patent

UNITED STATES PATENTS

881,900	Church	Mar. 17, 1908
2,026,135	Meyer	Dec. 31, 1935
2,211,027	Quick	Aug. 13, 1940
2,224,743	Nolan	Dec. 10, 1940