Nov. 17, 1953 W. F. HUCK 2,659,437

CUTTING AND GRIPPING MECHANISM FOR PRINTING MACHINES

Filed March 4, 1947

3 Sheets-Sheet 1

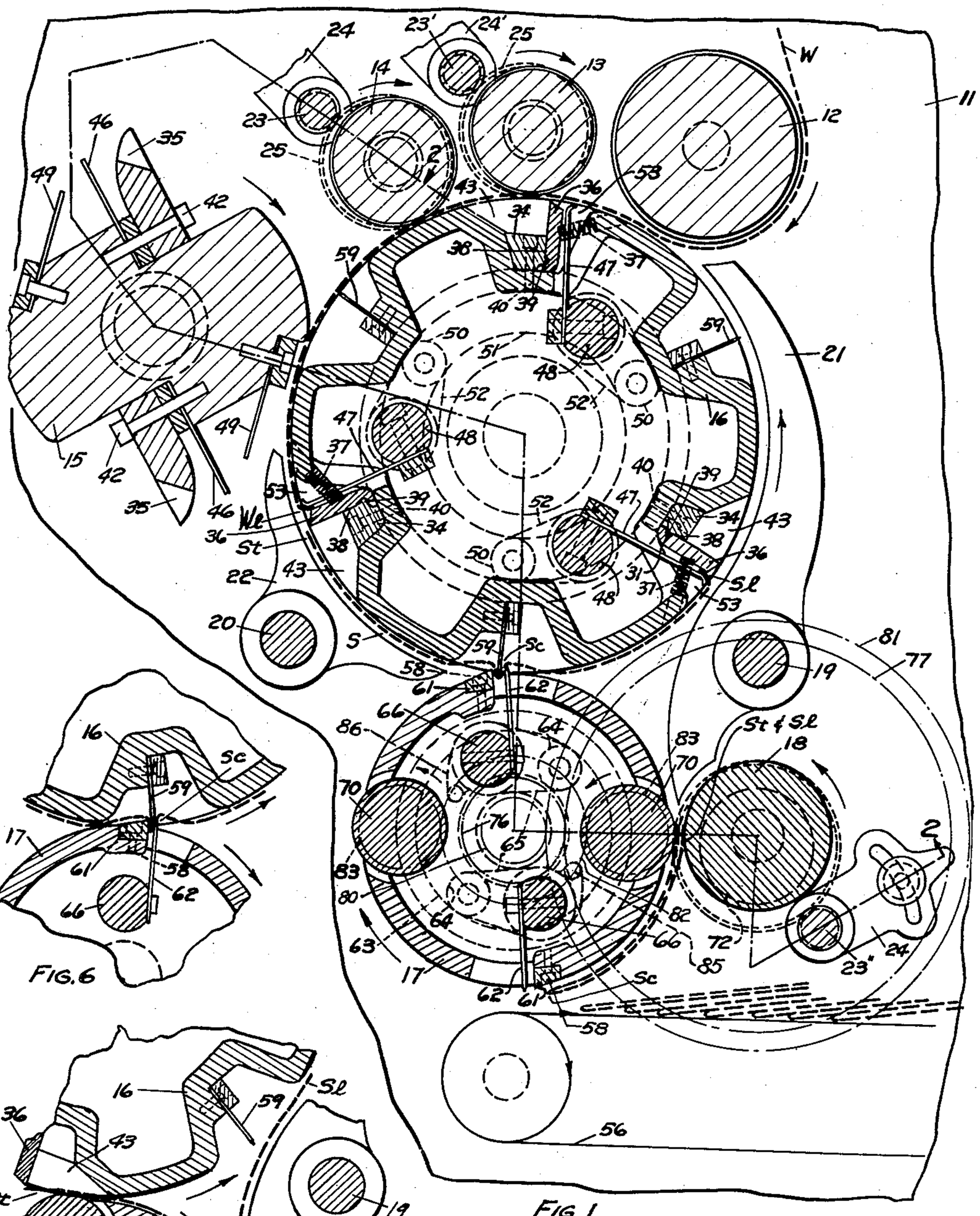

FIG. 1

FIG. 6

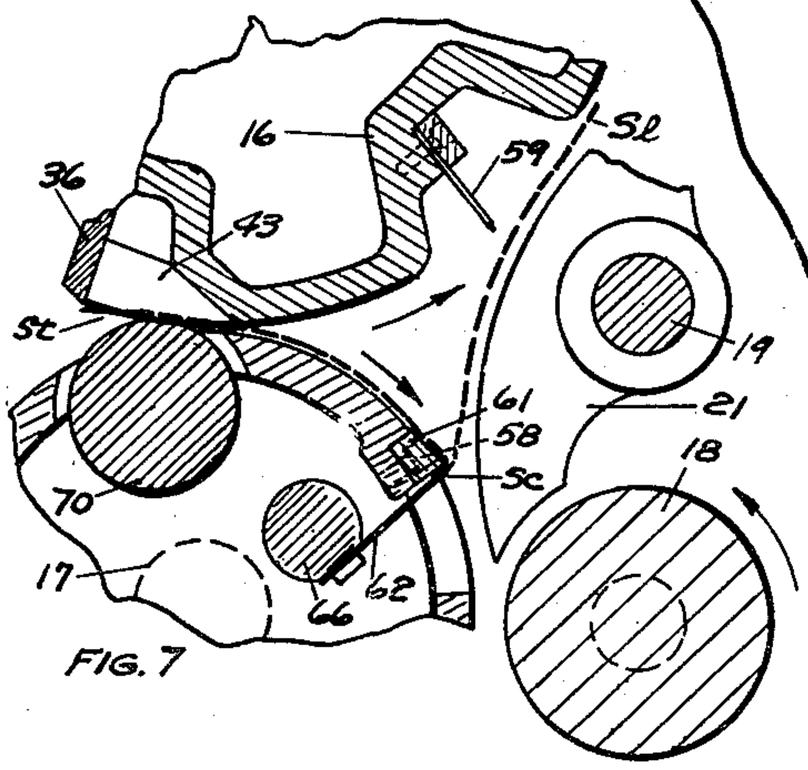

FIG. 7

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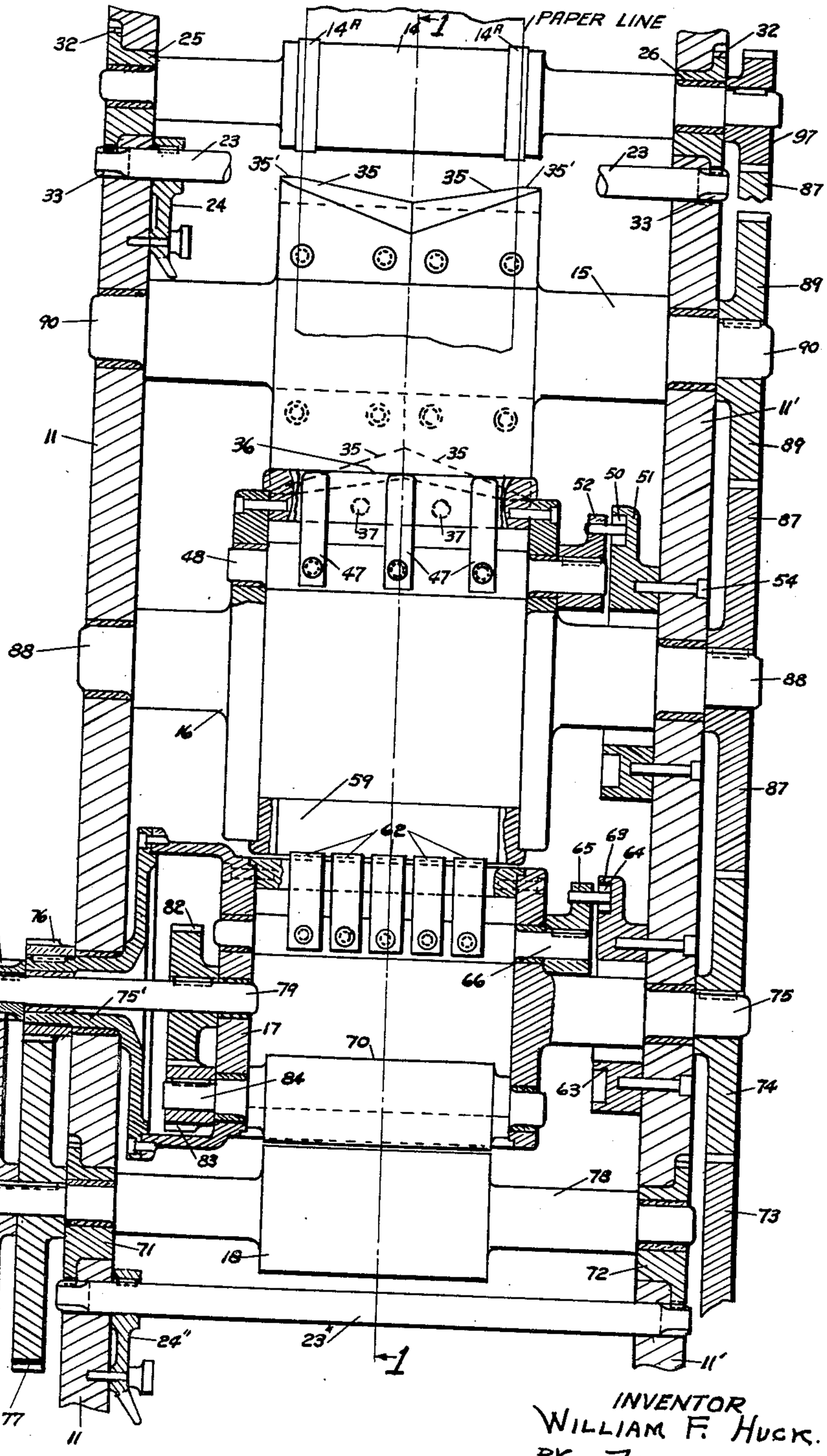
3 Sheets-Sheet 2

FIG. 2



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3 Sheets-Sheet 3

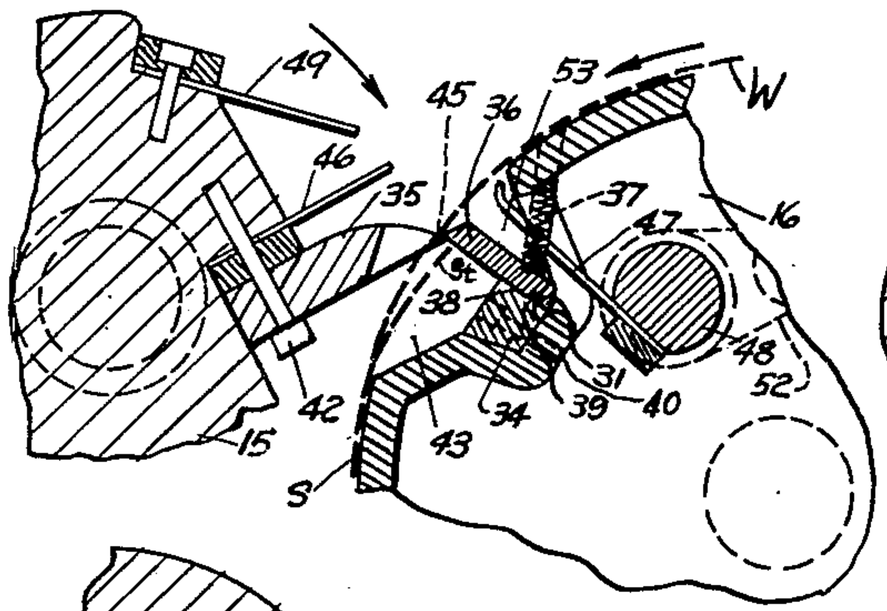

FIG. 3

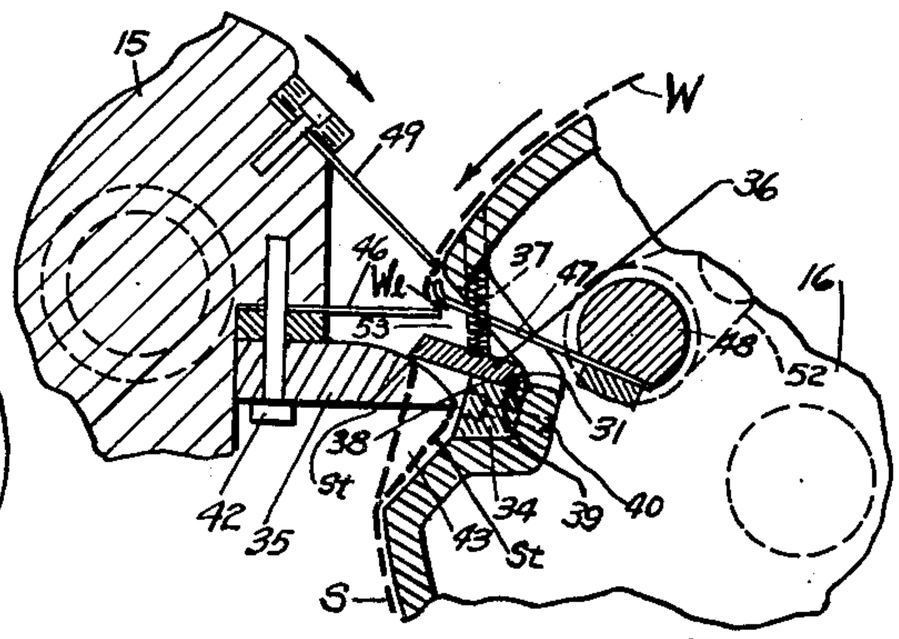

FIG. 4

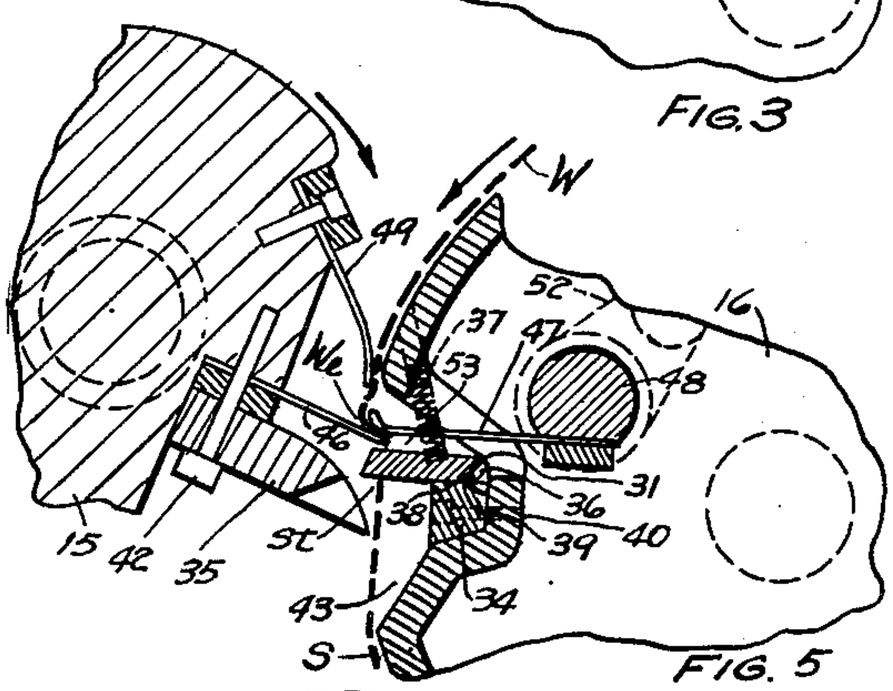

FIG. 5

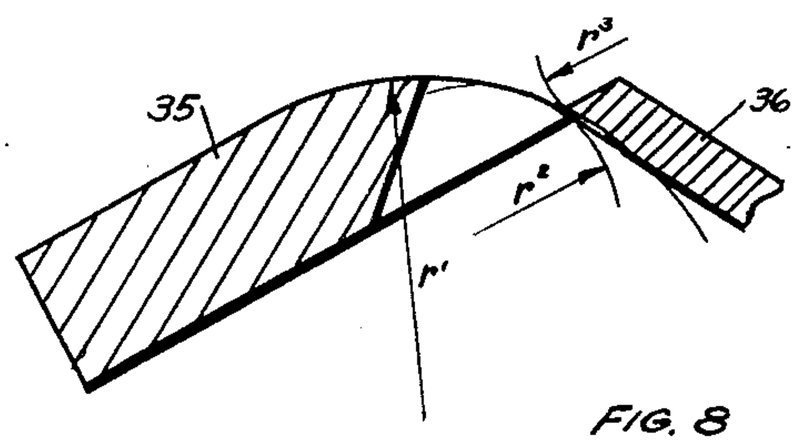

FIG. 8

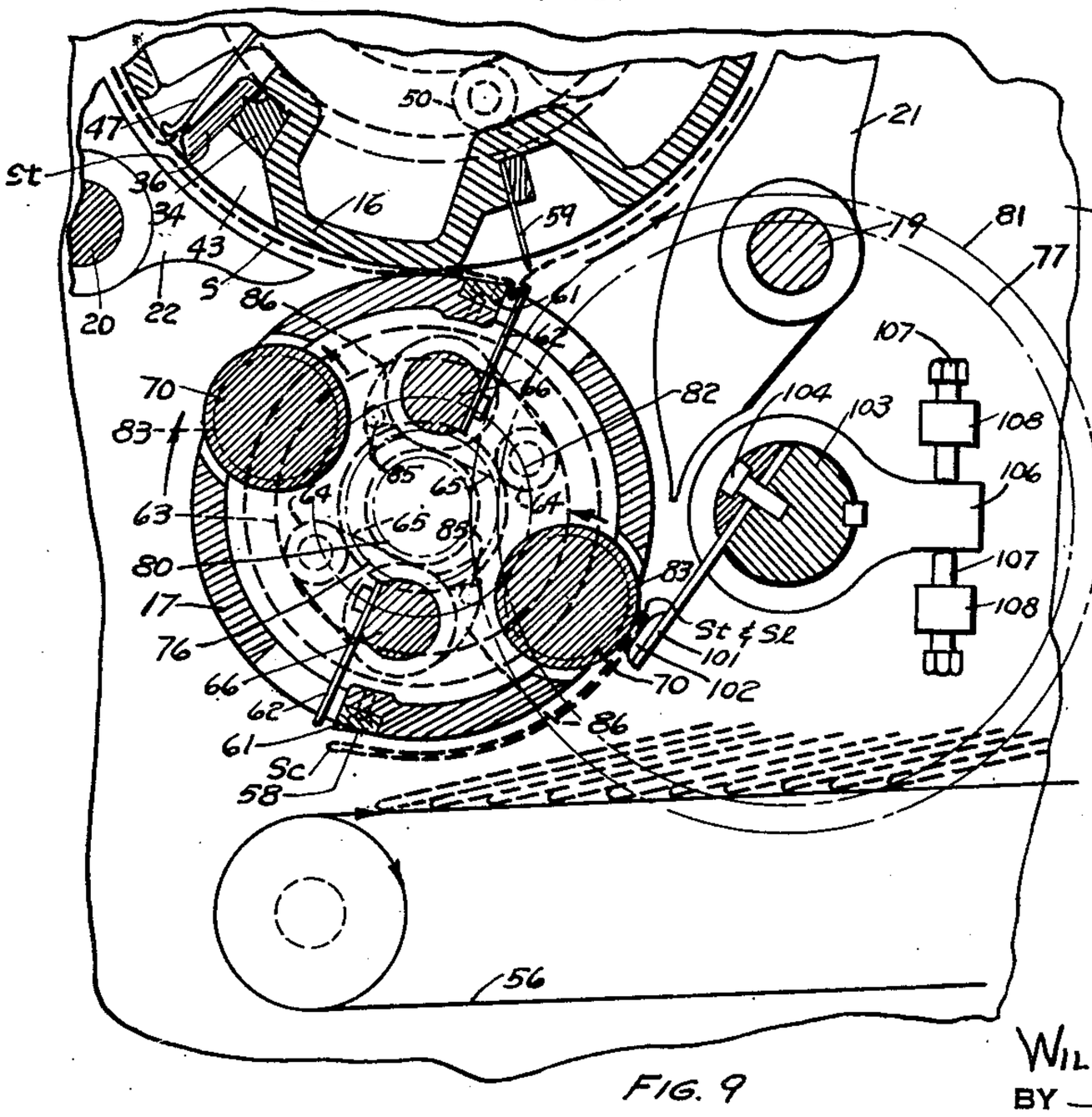

FIG. 9

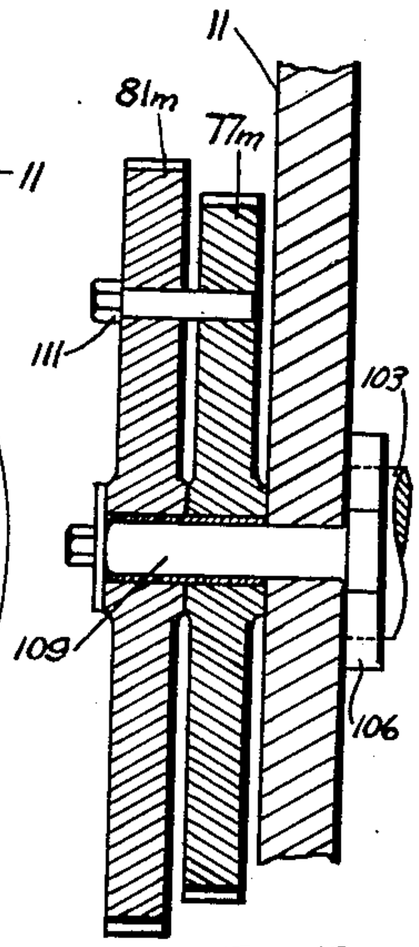

FIG. 10

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UNITED STATES PATENT OFFICE

2,659,437

CUTTING AND GRIPPING MECHANISM FOR PRINTING MACHINES

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Application March 4, 1947, Serial No. 732,247

9 Claims. (Cl. 164—67)

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This invention relates to high speed web printing machines and more particularly to a cutting, folding, and delivery mechanism, by which one or more printed webs can be cut into separate sheets at high speed, folded at high speed, and delivered at a much slower speed to a receiving mechanism.

Devices of this general character have heretofore been used, but their design and method of operation have left much to be desired. For example, the prior art mechanisms of this character have not been entirely satisfactory because of one or more of the following undesirable features, viz; the products produced had irregular cut edges, the cutting knives wore out too soon, the cutting operation was accompanied by considerable impact and shock, small holes were punched in the product, variation in folded length of product occurred at various running speeds, and the mechanism had inefficient means for controlling the product during the transition operation from high folding speed to slow delivery speed.

Therefore, one object of the present invention is to provide an improved combined cutting, folding and slow-speed delivery mechanism that can advantageously be used with modern high speed printing machines of the type that are generally used to print newspapers, magazines and other printed products and which will not have the above undesirable features.

Another object of the invention is to provide an improved web cutting mechanism.

Still another object of the invention is to provide an improved folding mechanism.

A further object of the invention is to provide an improved delivery mechanism.

Other important objects of the invention will be apparent from the following description and appended claims

Portions of the invention not claimed herein are described and claimed in a divisional patent application Serial No. 206,159, filed January 16, 1951.

For a complete understanding of this invention, reference should be made to the accompanying drawings in which:

Fig. 1 is a vertical cross sectional view taken substantially on the longitudinal center line of a printing machine and showing cutting, gripping, folding, and delivery mechanisms, the cutting and gripping mechanisms embodying this invention;

Fig. 2 is a diagrammatic view of the mechanism as seen in the direction of the arrows and

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taken substantially along the broken line 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a portion of cutting and gripping mechanisms shown in Fig. 1;

Figs. 4 and 5 are views similar to Fig. 3 but showing advanced stages of the cutting and gripping operations;

Fig. 6 is an enlarged view of a portion of the folding mechanisms shown in Fig. 1;

Fig. 7 is a view similar to Fig. 6 but showing an advanced stage of the folding operation;

Fig. 8 shows a detail of one of the cutting knives; and

Figs. 9 and 10 show a modified form of the invention.

Referring to the drawings, this invention has been shown in one preferred form in Figs. 1 to 8 inclusive as applied to a cutting, gripping, folding and delivery mechanism for printing machines.

Numerals 11 and 11' indicate a pair of spaced side frames for supporting a plurality of rods, rollers and cylinders including a first rotatable propelling roller 12, second and third rotatable propelling rollers 13 and 14, a rotatable cutting roller 15, a rotatable collecting cylinder 16, a rotatable folding cylinder 17, a rotatable slow down roller 18, a pair of non-rotatable stationary rods 19 and 20 for carrying a pair of paper guides 21 and 22, and a plurality of pivotally mounted adjusting shafts 23, 23' and 23''.

The rollers 13 and 14 are identical in construction and operate in a similar manner. Therefore, the mounting of only one roller will be described. Roller 14 is rotatably supported in a pair of eccentric bearing boxes 25 and 26 which in turn are rotatably supported in frames 11 and 11' respectively. Each bearing box 25 and 26 is provided with a gear sector 32 that is in mesh with a pair of pinions 33, also carried in the frames and secured to opposite ends of the adjusting shaft 23, the shaft having an operating handle 24. By turning the handle 24, the eccentric boxes 25 and 26 are rotated in unison, thus adjusting the space between the propelling roller 14 and the collecting cylinder 16. A web W (indicated by a heavy broken line), which may be a single web or a plurality of collated webs is, in a manner well known in the art, propelled by rollers 12, 13 and 14 and the cooperating collecting cylinder 16. It will be noted (Fig. 1) that the rollers 13 and 14 are so spaced, circumferentially around the cylinder 16, that one of these rollers will at all times by means of raised annular portions 14A (Fig. 2) press the margins of the web W against the cylinder 16.

As the web W passes beyond the roller 14, it is acted upon by coacting cutting knives 35 and 36, the collecting cylinder 16 supporting three knives 36, whereas, the cutting cylinder 15 supports two knives 35. It will be understood that the cylinders 15 and 16 are driven in a manner hereinafter described and at such speeds that one of the knives 35 will always coact with one of the knives 36. Each of the knives 36 on the cylinder 16 is positioned entirely below the surface of the cylinder 16 and each blade has a straight cutting edge that is parallel with the axis of cylinder 16. Each of the knives 35 on the cylinder 15 are V-shaped, as best seen in Fig. 2. By this arrangement, which is known as involute cutting, the knives start to cut the web W simultaneously at both outer edges as the knives start to engage, and the cutting progresses inwardly from the edges of the web until the two cuts join at the center of the web, at which instant a sheet becomes completely severed from the web W. This method of cutting produces a perfectly straight cut. Each of the knives 36 is mounted for limited pivotal movement by means of a fulcrum groove 31 (Fig. 3) that cooperates with a fulcrum tongue 39 formed on one side of a support bar 34 that is secured to the cylinder 16 by a plurality of bolts 40, and by having a compression spring 37 that biases the knife 36 against a stop 38 formed on the bar 34.

Each of the knives 35 has the form of an involute throughout the portion of the arc that is used for cutting. However, the tips 35' (Fig. 2) at both ends of the blade 35, outside of the paper range, are rounded to a smaller radius in order to provide for easy engagement of any one of the knives 35 with any cooperating knife 36, which is also provided with similarly rounded edges of smaller diameter. The smaller radius tips on the blades 35 and 36 lie outside of the shearing portion of the knives. With this arrangement, it is possible to co-act different pairs of knives for each engagement without adjusting any of the knives to a great degree of accuracy. When the two knives 35 and 36 are engaged, the knife 36 moves pivotally on the tongue 39 against the bias of the springs 37, and is forced against the knife 35. Firm shearing action between the knives 35 and 36 is obtained by resiliently mounting one of the knives. In the embodiment illustrated this is accomplished by pivotally mounting one of the knives and biasing it by spring 37. Other resilient means may be employed, however.

The cylinder 16 is provided with a plurality of clearance spaces 43 each being located in a leading position ahead of each of the knives 36. As the web is severed by the knives 35 and 36 (Fig. 3) the trailing cut edge S_t of the sheet S being cut off is forced by the forward face of the knife 35 to enter the recess 43 (see Figs. 3 and 4). At the same time the leading cut edge W_1 of the web from which the sheet is being cut is forced by a tucking blade 46 (Fig. 4) into a position leading the gripper 47. This position is in a recess 53 formed in the cylinder 16 in a position trailing the knife 36. (The tucking blades 46 are carried by the cutting roller 15 in a parallel trailing relationship to the knives 35 and are held in position by the bolts 42 which are the same bolts that hold the knives 35 in place.) A short time thereafter a row of fingers 49 (Fig. 4) which are made of spring metal and carried by the roller 15 in an angled relationship to the blades 46, press and hold the leading cut edge W_1 of the web W, from which the sheet is being cut against

the surface of the cylinder 16, and thus assist momentarily in forwarding the leading edge of the web. It will be realized that the cut trailing edge of the sheet S is bowed with respect to the cylinder 16 during the time the cut is being made. This is due to the fact that the knives cut the web from the edges progressively toward the center. The cylinder 16 is provided with three sets of equally spaced grippers 47, and each gripper 47 is positioned approximately radially with respect to the cylinder 16 and no part of said grippers extends beyond the peripheral surface of said cylinder. Each gripper 47 is supported from a shaft 48 that is pivotally mounted on the cylinder 16. Each set of grippers 47 is opened and closed at the proper instant by a lever 52 having a cam roller 50 which is acted upon by a cam 51 supported from the frame 11' by bolts 54. The shape of the cam 51 is such that each set of grippers 47 will be open as they approach the point of cutting. This allows the tucking blade 46 to press the leading edge W_e of the web into the recess 53. The grippers 47, under control of the cam 51, close (Fig. 5) to press the leading edge W_1 of the web against the trailing side of the knife 36. It should be noted that the bite of the grippers is substantially radially disposed on the cylinder 16, that the grippers grip the paper on the side that is toward the cylinder, and that each gripper is substantially below the surface of the cylinder and therefore underneath the paper. Preferably the grippers will remain closed for the remainder of the revolution of the cylinder 16, opening only at a point just prior to the cutting operation as hereinbefore described, and, as will be better understood when the remainder of this description has been read, the sheet is pulled from the grippers while the cam is holding them closed.

In addition to the above described mechanism, the cylinder 16 carries three sets of flexible folding blades 59, the supported ends of which are securely bolted to the cylinder 16. The unsupported ends of the blades 59 may or may not, as desired, protrude slightly above the surface of said cylinder 16, and these blades are positioned substantially radially with respect to this cylinder. The blades 59 cooperate with a jaw seat 61 and a jaw blade 62, two sets of which are carried one-hundred eighty degrees (180°) apart on the folding cylinder 17. Each seat 61 is secured to the cylinder 17 by a bolt 58 and, like the folding blade 59, may or may not protrude above the surface of the cylinder 17 and is positioned substantially radially with respect to the cylinder 17.

Each jaw blade 62 is pivotally carried on the cylinder 17 by being secured to a pivotally mounted shaft 66 and each blade 62 may or may not protrude slightly above the surface of the cylinder 17. The shaft 66 carries an abutment arm 86 and a cam arm 65, the latter supporting a cam roller 64. The shaft 66 and the blade 62 are under control of the cam roller 64, which rides in a cam groove 63 supported from the frame 11'. As the center S_c of the sheet S or collated sheets, which are held to the cylinder 16 by grippers 47, arrives at the bite between cylinders 16 and 17, one of the jaw blades 62 (Fig. 6) gradually folds the paper around the folding blade 59, and finally presses this folded edge against the jaw seat 61, thereby, securing the center fold of the cut sheet S onto the cylinder 17. The travel of the jaws 61—62 around the cylinder 17 (Fig. 7) carries the sheet with them and pulls the leading edge S_1 of the sheet

from the grasp of gripper 47. In Fig. 1, it will be noted, that the pull on the sheet by the jaws 61—62 tends to open the gripper 47. This is because the pull of the sheet on the gripper blade 47 is exerted at approximately right angles thereto and in such a direction as to flex the blade to the open position. As the cylinder 17 continues to turn and carry with it the folded portion of the sheet, the leading edge S_l and the trailing edge S_t of the cut sheet or sheets become lined up or collinear.

The cylinder 17, in addition to the jaws 61—62, also carries a pair of slow down rollers 70, these being spaced one-hundred eighty degrees (180°) apart around the cylinder. Each roller 70 is rotatably driven, by gears presently to be described, to rotate in such direction that their peripheral surfaces will move in a direction opposite to that in which the peripheral surface of the cylinder 17 moves. This results in a surface carried by the cylinder 17 that in relation to a fixed point moves slower than does the surface of the said cylinder 17. The roller 18, that is driven at a peripherial speed of approximately one-eighth (⅛) the peripherial speed of the cylinder 17, cooperates with the pair of rollers 70, and in the preferred mechanism the relative peripherical or surface speed of a point on the cylinder 70 is equal to the surface speed of the roller 18 when the two are adjacent one another. The roller 18 is spaced from the surface of the cylinder 17 a sufficient distance so that the surface of the roller 18 does not contact the surface of the cylinder 17. In fact, this spacing is of such magnitude that the folded product S can pass between the surfaces of the cylinder 17 and the roller 18 without being pressed therebetween except when one of the rollers 70 is opposite the roller 18. Thus, when one of the rollers 70 and the roller 18 are opposite each other they pinch the collinear trailing edge or tail S_t—S_l of the folded product with firm contact and due to their relatively slow speeds they pull the leading folded edge S_c of the product from the fast moving jaws 61—62, which at the proper instant are opened by the action of the cam 63. Thus the folded product is slowed down to approximately one-eighth (⅛) of its original speed, and since the product is slowed down only by the rollers 18 and 70 acting on the trailing or rear unprinted margin thereof, the product is in no way damaged, cut or punctured as is the case in many prior art devices. The position of the roller 18 can be adjusted laterally with respect to the cylinder 17 and the rollers 70. This is accomplished by a pair of eccentric bearing bushings 71 and 72, the shaft 23'' and a handle 24'' in much the same way as the rollers 13 and 14 are adjusted with respect to the cylinder 16. When the slowed down product is released from the bite of the rollers 70 and 18, it drops at slow speed upon a belt conveyor 56 that is driven at slow speed and in either direction desired by a motor or other means not here shown.

The various rollers and cylinders, hereinbefore described, are driven in the following manner. A main drive gear 73 is driven by a motor or other prime mover (not shown), and this gear is in mesh with a gear 74 that is keyed to a shaft 75 that mounts one end of the folding cylinder 17. The opposite end of the cylinder 17 has a hollow shaft 75' which has secured to it a pinion 76 that is in mesh with a gear 77 keyed to a shaft 78 for the roller 18. Keyed to this same shaft 78 is a gear 81 that meshes with a pinion 80 keyed to the end of a shaft 79 rotatably and coaxially carried through the hollow center of the shaft 75' and the pinion 76. Internal of the folding cylinder 17, the shaft 79 carries a gear 82 that is in mesh with a pair of pinions 83 carried on the end of shafts 84 for the two slow down rollers 70. The gear 74, in addition to driving the shaft 75, meshes with and drives a gear 87 that is keyed on the end of a shaft 88 of the collecting cylinder 16, and the gear 87 also drives a gear 89 keyed on the end of a shaft 90 of the cutting roller 15. The gear 87 also meshes with a gear 97 keyed to the end of the shaft for the roller 14, the roller 13 being driven in a similar, though not shown, manner. The driving cylinders and rollers are rotated in directions as indicated by arrows shown in Fig. 1, and the peripherical or surface speed of all the driven cylinders and rollers, except rollers 18 and 70, will be equal.

It is frequently the practice to imprint a web W, so that the printed matter is repeated. When this is done, it becomes desirable to use the cylinder 17 as a collecting cylinder as well as a folding cylinder. In the mechanism of this invention, this is accomplished by rendering one of the jaws 61—62 inoperative by removing one of the cam rollers 64 from its arm 65, and at the same time locking the inactivated jaw 62 in an open position below the surface of the cylinder 17 by placing a pin 85 in the way of the abutment 86 formed integral with the arm 65. Thus, when the center S_c of a first printed sheet S that is held to the cylinder 16 by the grippers 47 passes the inoperative jaws 61—62, the sheet S will not be pinched by these jaws but will continue around the cylinder 16, being held by the grippers 47. Furthermore this sheet will not be damaged or folded by blades 59. As the leading edge S_l of the first printed sheet arrives between the rollers 12 and the cylinder 16, it is positioned under and becomes aligned with a leading portion W_l of the web W that is to become the leading edge S_l of a printed sheet or a plurality of collated printed sheets. The web W and the first printed sheet S then pass under rollers 13, 14, and past the cutting knives 35 and 36. Thereafter the first and now second printed sheets are simultaneously gripped by grippers 47. When the plural sheets arrive at the opposite set of jaws 61—62 from the inactivated ones, all sheets are removed from the cylinder, as hereinbefore set forth for the sheet S when only one sheet was being gripped.

Figs. 9 and 10 illustrate a second preferred embodiment of the invention, which is identical with the previously described mechanism, except that the roller 18 and its adjusting mechanism is replaced by a stationary stop plate 101 having a paper contacting shoe 102. The plate 101 is secured to an adjusting shaft 103 by a plurality of bolts 104, only one of which is shown in the drawings. The shaft 103 is pivotally supported between the two side frames 11 and 11' and has keyed to it an adjusting lever 105. The lever 105 is adjustably held between a pair of adjusting screws 107 that are threaded into bosses 108, protruding from one of the side frames of the machine. In this embodiment of the invention, the rollers 70, carried on the cylinder 17, are driven, by gears (presently to be described) at a peripherial speed equal to and opposite in direction to the surface speed of the cylinder 17 on

which they are mounted. This results in the provision on the rotating cylinder 17 of a surface that is stationary relative to the stationary stop plate 101 and shoe 102, when the said surface is opposite the said shoe 102. Thus, when the trailing unprinted margins S_t and S_l of the sheet S are caught between the rollers 70 and the stationary shoe 102, the folded product S will be pulled from the grip of the jaws 61—62, which are opened at this instant by the cam 63 acting on the cam roller 64. This results in the speed of the folded product being reduced to zero. As the roller 70 moves beyond its position opposite the shoe 102, the stationary product S drops onto the conveyor belts 56. The means of driving the rollers 70 is somewhat similar to that previously described. A pinion, not shown in Fig. 10 but equivalent to pinion 80 of Fig. 2, drives gear 81_m which is rotatably mounted on an extension 109 of the adjusting shaft 103. The gear 77_m is likewise rotatably mounted on the extension 109. A pin 111 is threaded through a hole in the gear 81_m and into a hole in gear 77_m, thereby causing the two gears to rotate in unison. The gear 77 drives a gear, not shown in Fig. 10 but which is equivalent to the gear 76 shown in Fig. 2, and from this point on the two drives for the rollers 70 are similar except for the speed ratios previously described.

While I have illustrated and described two preferred embodiments of my invention, it is to be understood that the invention may be otherwise embodied and practiced within the scope of the following claims.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a cutting and gripping mechanism for use with high speed web printing machines, a pair of web cutting knives, a collecting cylinder on which one of said knives is mounted and said cylinder having a recess trailing said knife, a gripper carried by said cylinder in said recess and being positioned entirely below the surface of said cylinder, and means for causing said gripper to press the leading end of said web against the trailing surface of said knife.

2. In a cutting and gripping mechanism for use with high speed printing machines operating on a web, a large diameter cylinder around which said web is wrapped, a straight edged cutting means carried by said cylinder and positioned entirely below the surface thereof, a V-shaped cutting means arranged to coact with said straight cutting means, radially positioned grippers carried by said large diameter cylinder, and tucking blades associated with said V-shaped cutting means; said tucking blades being arranged to tuck the leading end of said web beneath said grippers.

3. In a cutting and gripping mechanism for use with high speed web printing machines, a straight edged cutting knife, a large diameter collecting cylinder carrying said cutting knife and having a recess trailing said knife, and said straight edged cutting knife being positioned entirely below the surface of said cylinder, a second cutting knife arranged to coact with said straight edged cutting knife; said second cutting knife being V-shaped in form and arranged to sever the web by starting simultaneously at both edges and finishing the cut at the center of the web, a gripper being carried by said collecting cylinder in said recess and being positioned entirely below the surface of said cylinder, and means for causing said gripper to press the leading end of said

web against the trailing surface of said cutting knife.

4. In a cutting and gripping mechanism for use with high speed printing machines operating on a web; a first cylinder rotating in a predetermined direction; a second cylinder adjacent said first cylinder and rotating in the opposite direction so that the surfaces of said two cylinders move in the same direction, a first cutting knife carried by said first cylinder; a second cutting knife carried by said second cylinder, said second cylinder having a recess trailing said second cutting knife, and said cutting knives being arranged to cut a sheet from said web; a gripper carried by said second cylinder and operating in said recess in said second cylinder; a tucking blade carried by said first cylinder and arranged to tuck the leading end of said web from which the sheet is cut into said recess in said second cylinder; a finger also carried by said first cylinder and arranged to hold the same leading end of said web against said second cylinder; and means for operating said gripper in such a manner that the said gripper grips the leading end of said web.

5. In a cutting and gripping mechanism for high speed web printing machines, a first cutting knife; means for rotatable mounting said first cutting knife; a second cutting knife cooperating with said first cutting knife for cutting a sheet from the leading end of a web and thereby providing a new leading end for the web; means for rotatably mounting said second cutting knife; a pressing finger carried by said means for rotatably mounting said second cutting knife, said pressing finger having a forward end which engages the new leading end of the web and presses said new leading end against the means for rotatably mounting said first cutting knife; a tucking blade also carried by said means for rotatably mounting said second cutting knife, said tucking blade having a forward edge which projects and engages the new leading end of the web, thereby bending the new leading end of the web adjacent said first cutting knife; and a gripper carried by said means for rotatably mounting said first cutting blade, said gripper having a forward portion adjacent the new leading end of web as said new leading end is bent by said tucking blade; and means causing said gripper to grip the new leading end of said web.

6. A cutting and gripping mechanism constructed in accordance with claim 5 and wherein, said tucking blade is located in a position trailing said second cutting knife and said pressing finger is located in a position trailing said tucking blade.

7. A cutting and gripping mechanism constructed in accordance with claim 5 and wherein, said gripper is located in a position trailing said first cutting knife.

8. A cutting and gripping mechanism constructed in accordance with claim 5 and wherein, one of said cutting blades is an involute blade, and wherein one of said blades is V-shaped in form and is arranged to sever the web by starting simultaneously at both edges and finishing the cut at the center of the web.

9. In a cutting, and gripping mechanism for use with high speed web printing machines, a pair of cutting edges for severing the web, a collecting cylinder on which one of said cutting edges is mounted and said cylinder having a recess trailing said cutting edge, a gripper and an anvil carried by said cylinder in said recess and being posi-

tioned entirely below the surface of said cylinder, and means for causing said gripper to press the leading end of said web against said anvil thereby holding the leading end of the web after the web has been severed by said cutting edges.

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