Nov. 18, 1924. **1,516,228**

E. J. BRASSEUR

STENCIL DUPLICATING MACHINE

Filed June 7, 1922 7 Sheets-Sheet 1

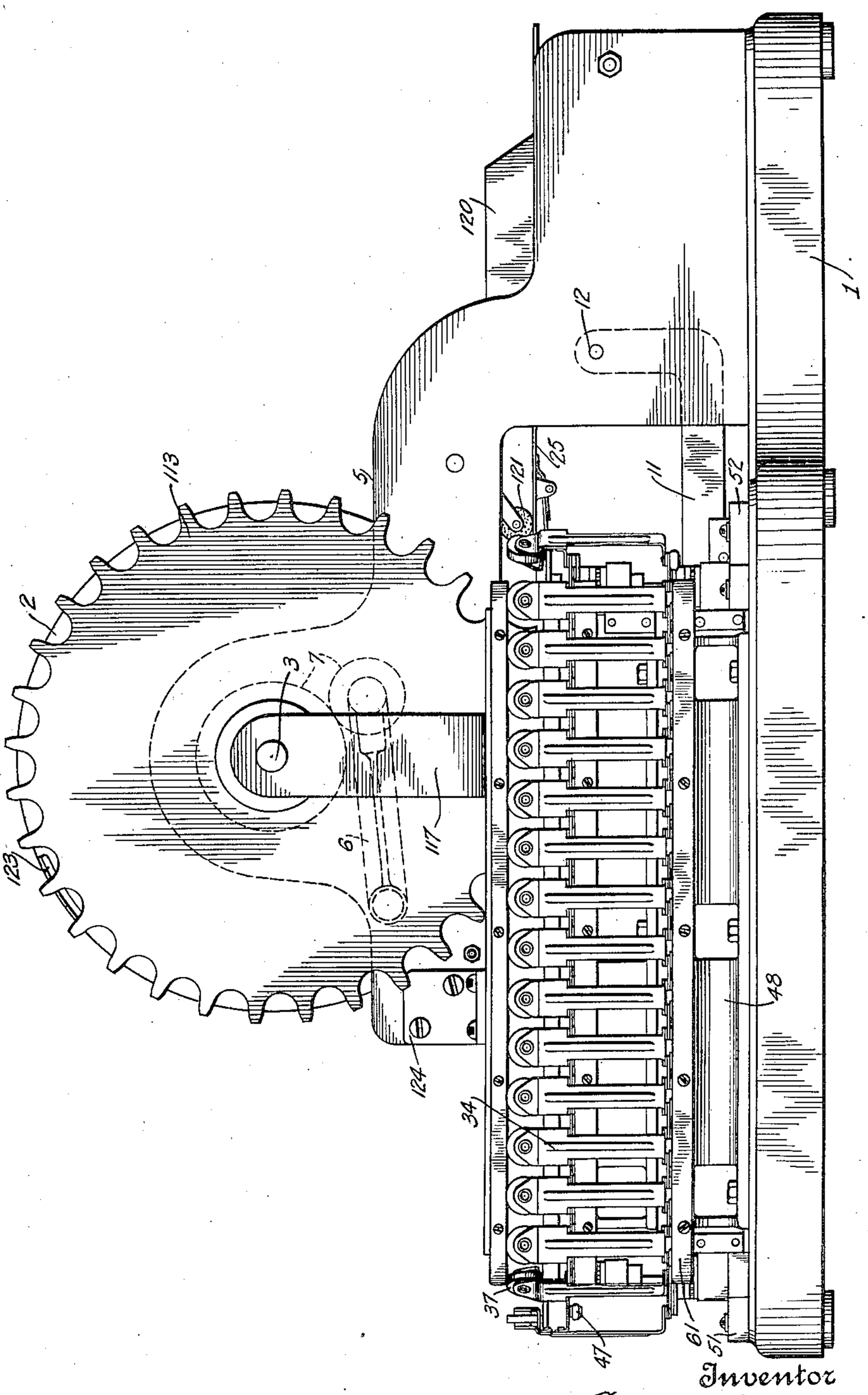

Fig. 1.

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Nov. 18, 1924. **1,516,228**

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STENCIL DUPLICATING MACHINE

Filed June 7, 1922 7 Sheets-Sheet 2

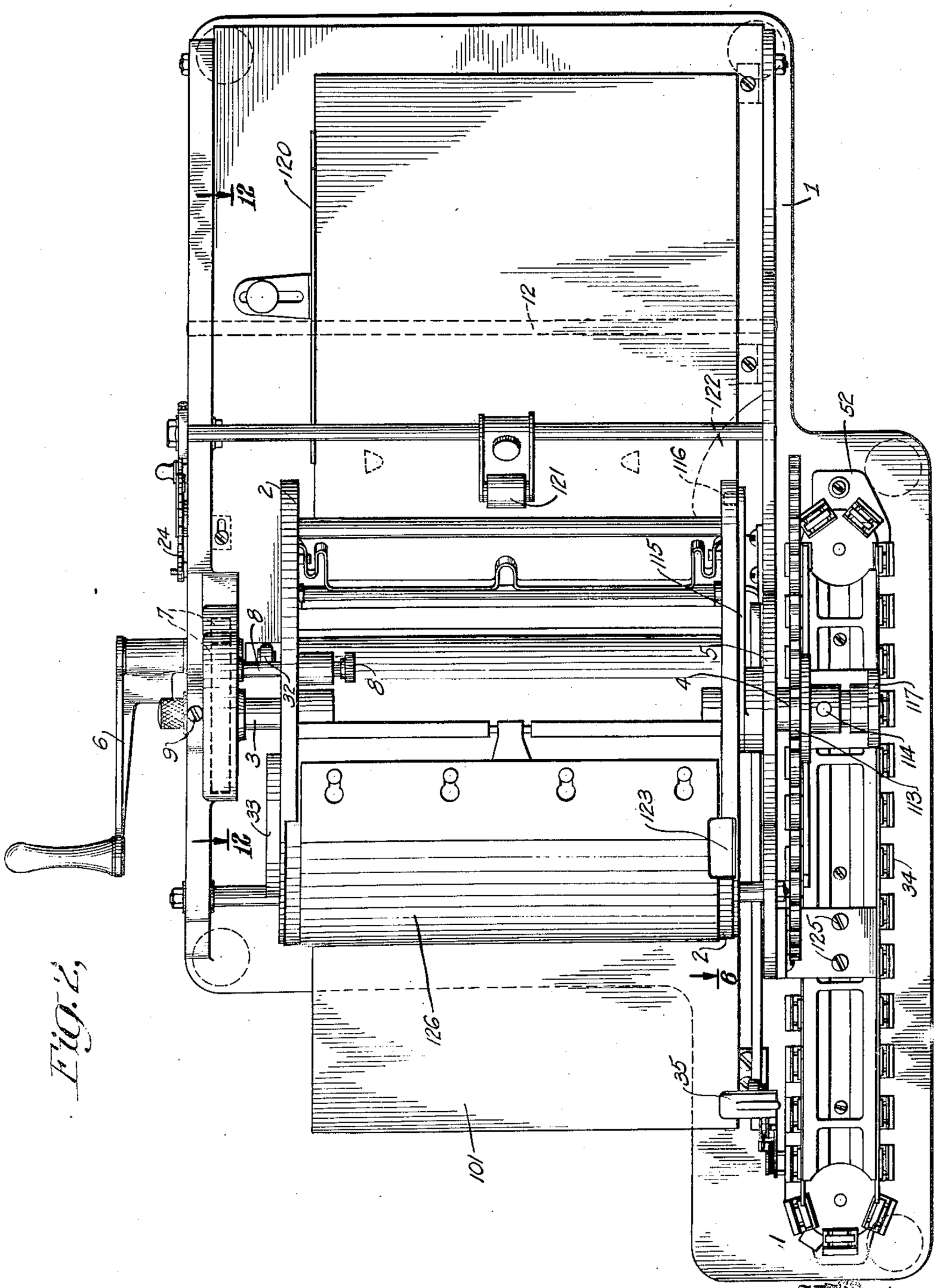

Fig. 2.

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STENCIL DUPLICATING MACHINE

Filed June 7, 1922 7 Sheets-Sheet 3

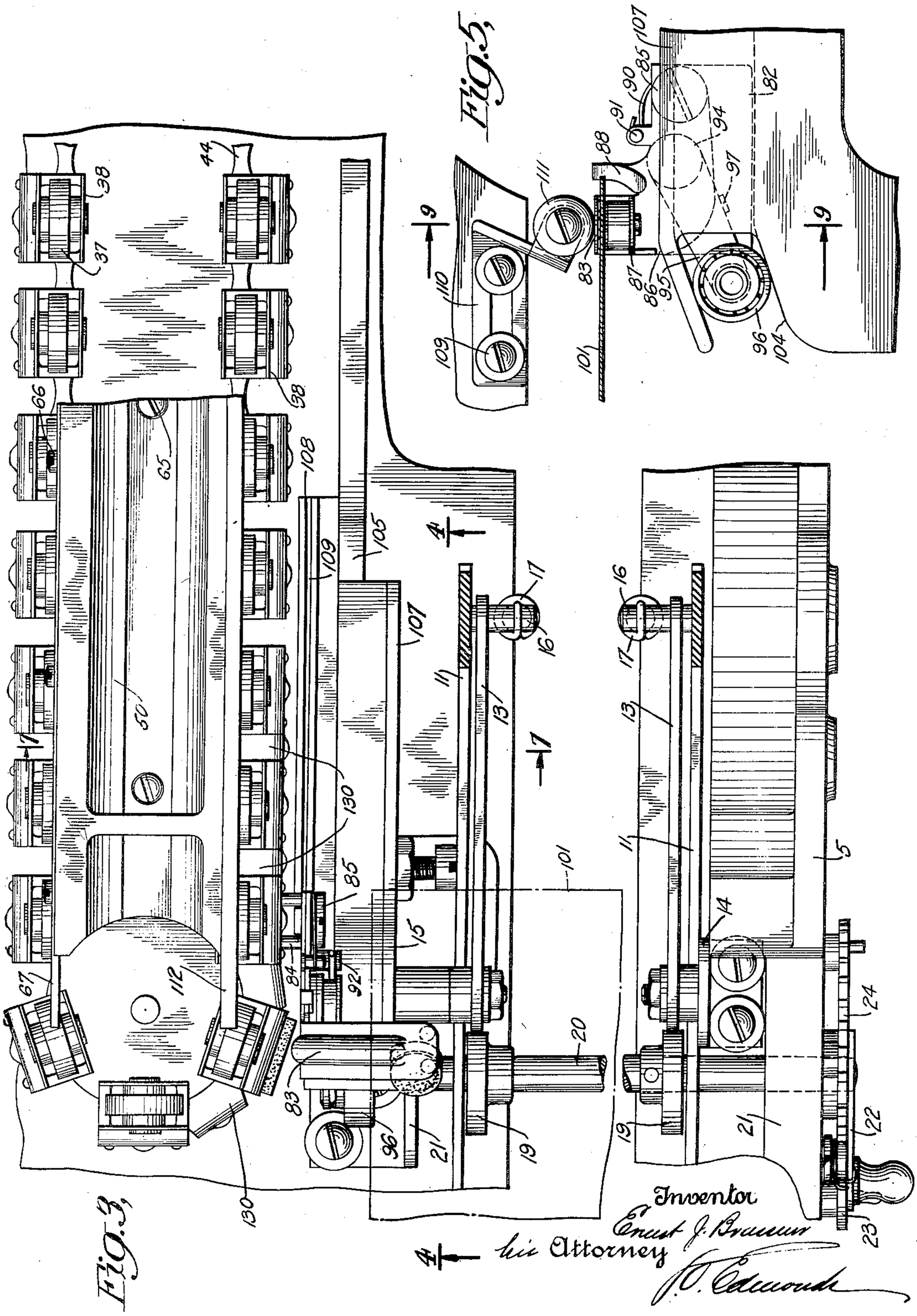

Fig. 3.

Fig. 5.

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Nov. 18, 1924. **1,516,228**

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STENCIL DUPLICATING MACHINE

Filed June 7, 1922 7 Sheets-Sheet 4

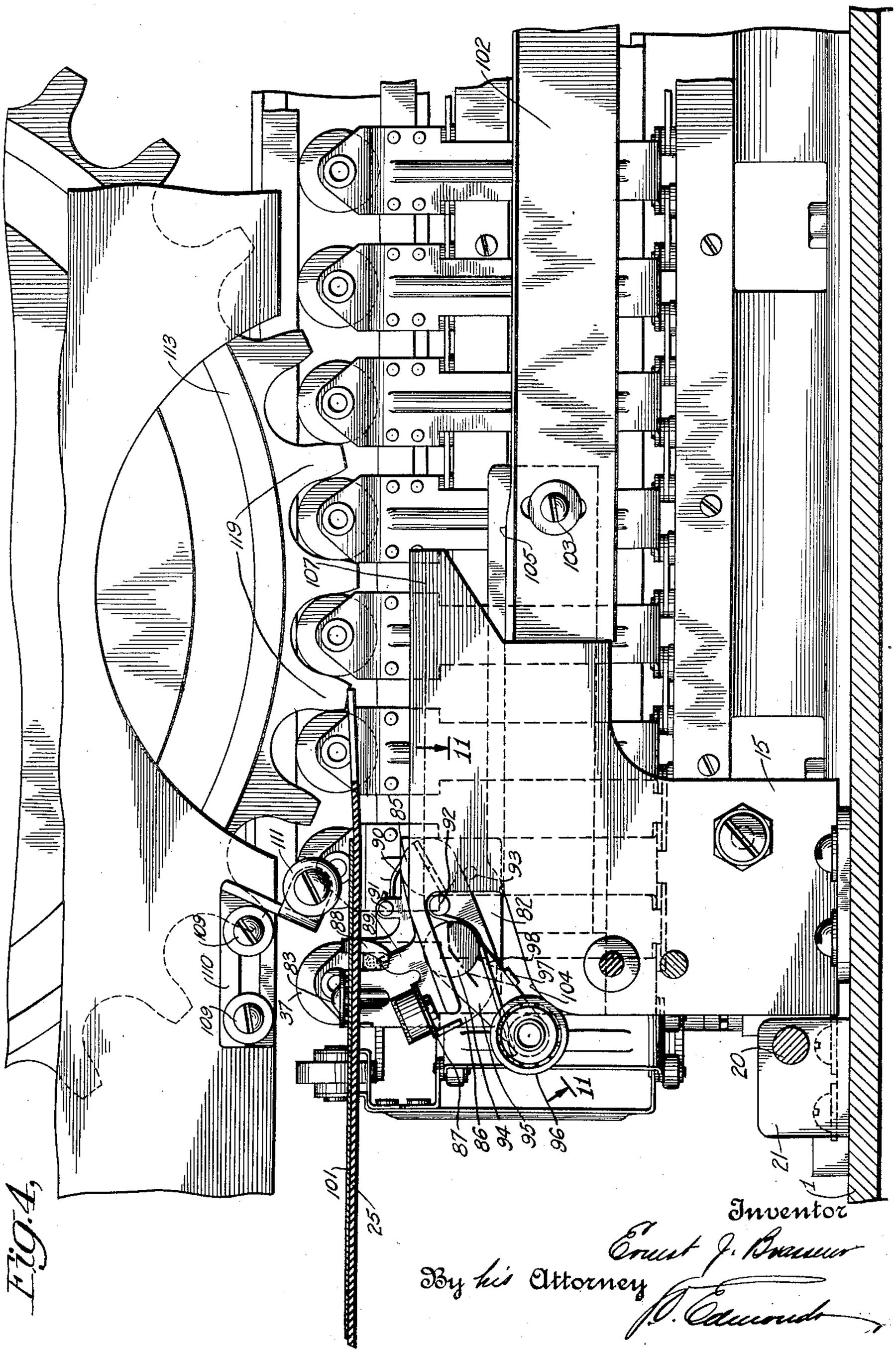

Fig. 4.

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STENCIL DUPLICATING MACHINE

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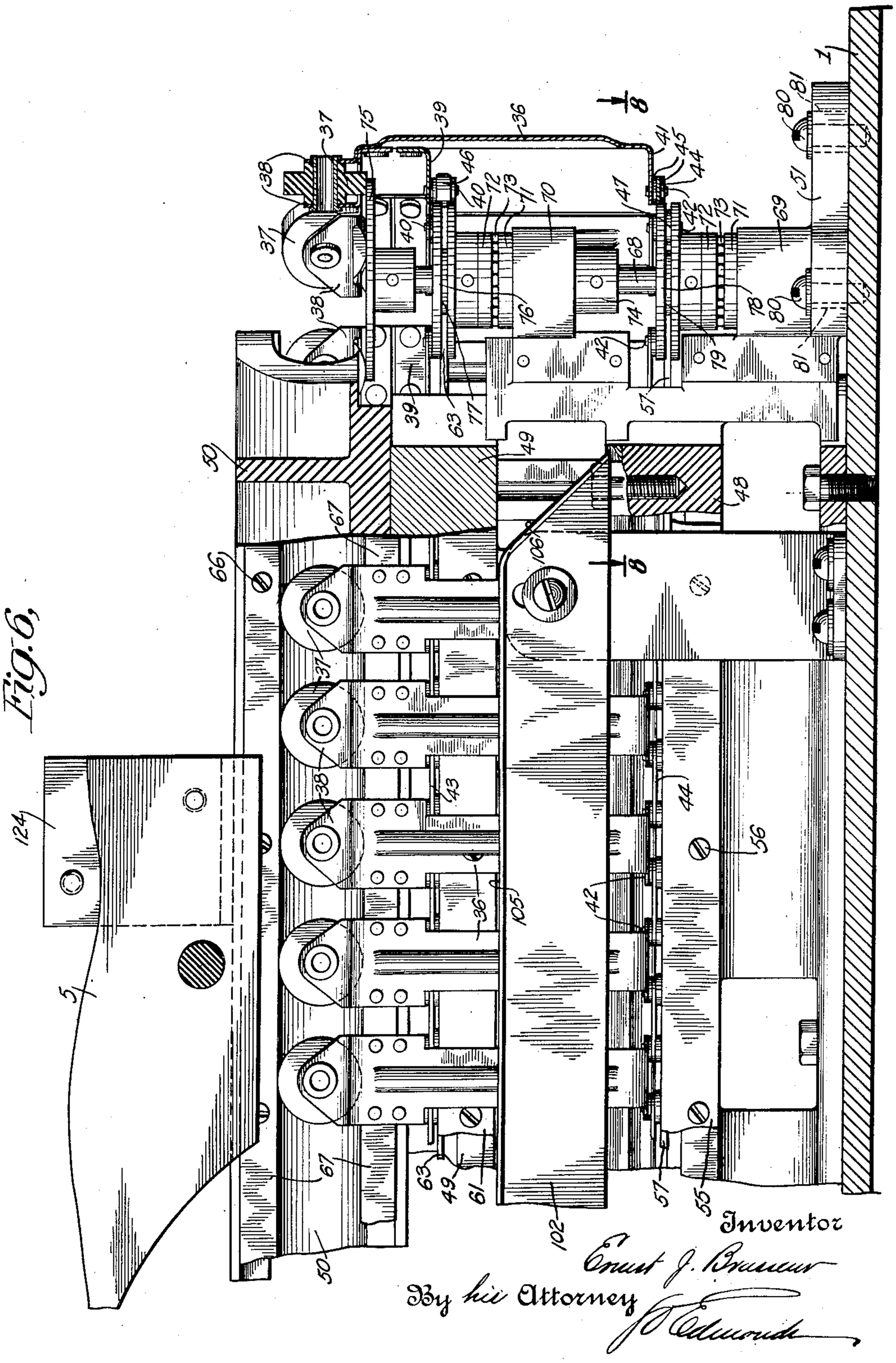
Fig. 6.



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STENCIL DUPLICATING MACHINE

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Fig. 8,

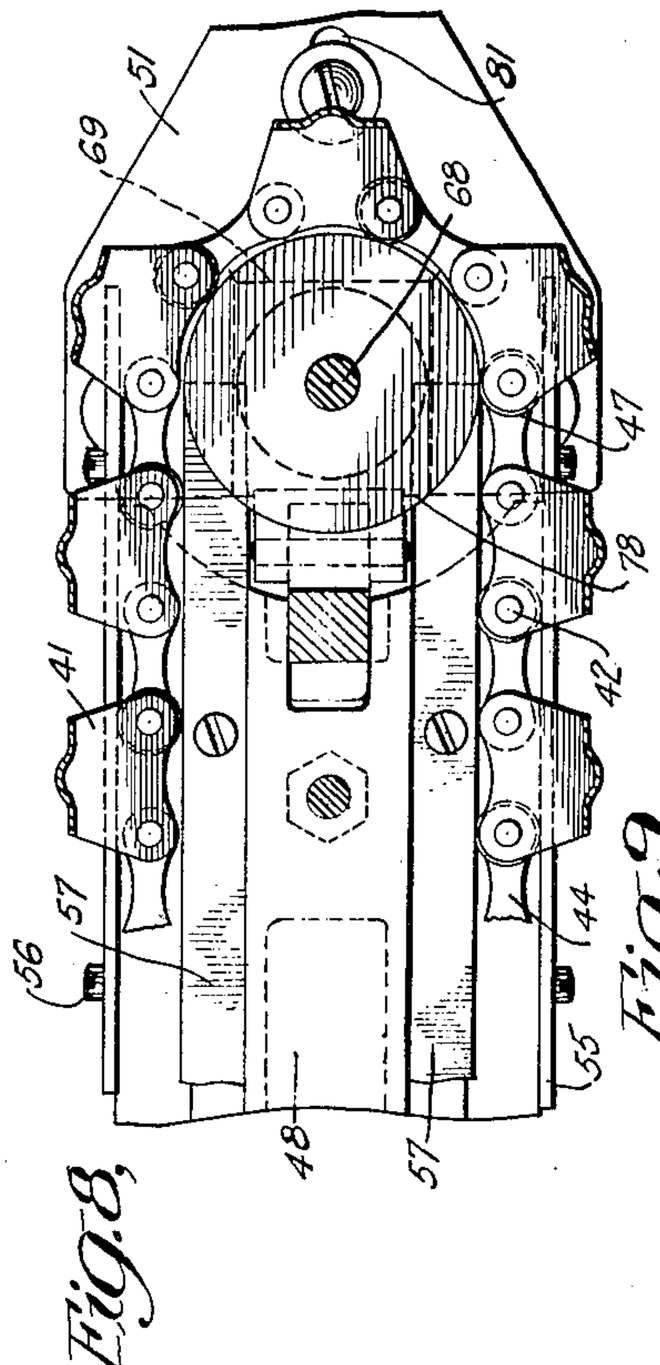


Fig. 9,

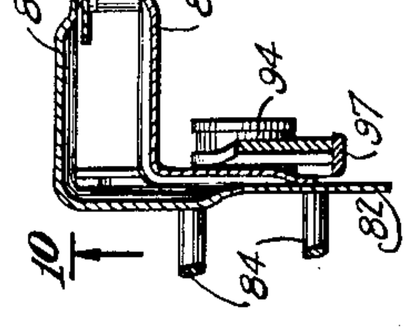


Fig. 10,

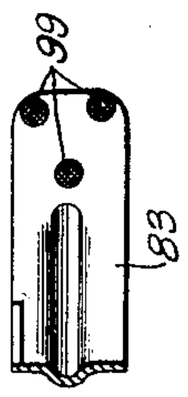
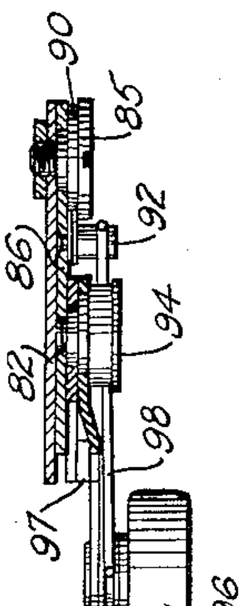


Fig. 11,



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STENCIL DUPLICATING MACHINE

Filed June 7, 1922 7 Sheets-Sheet 7

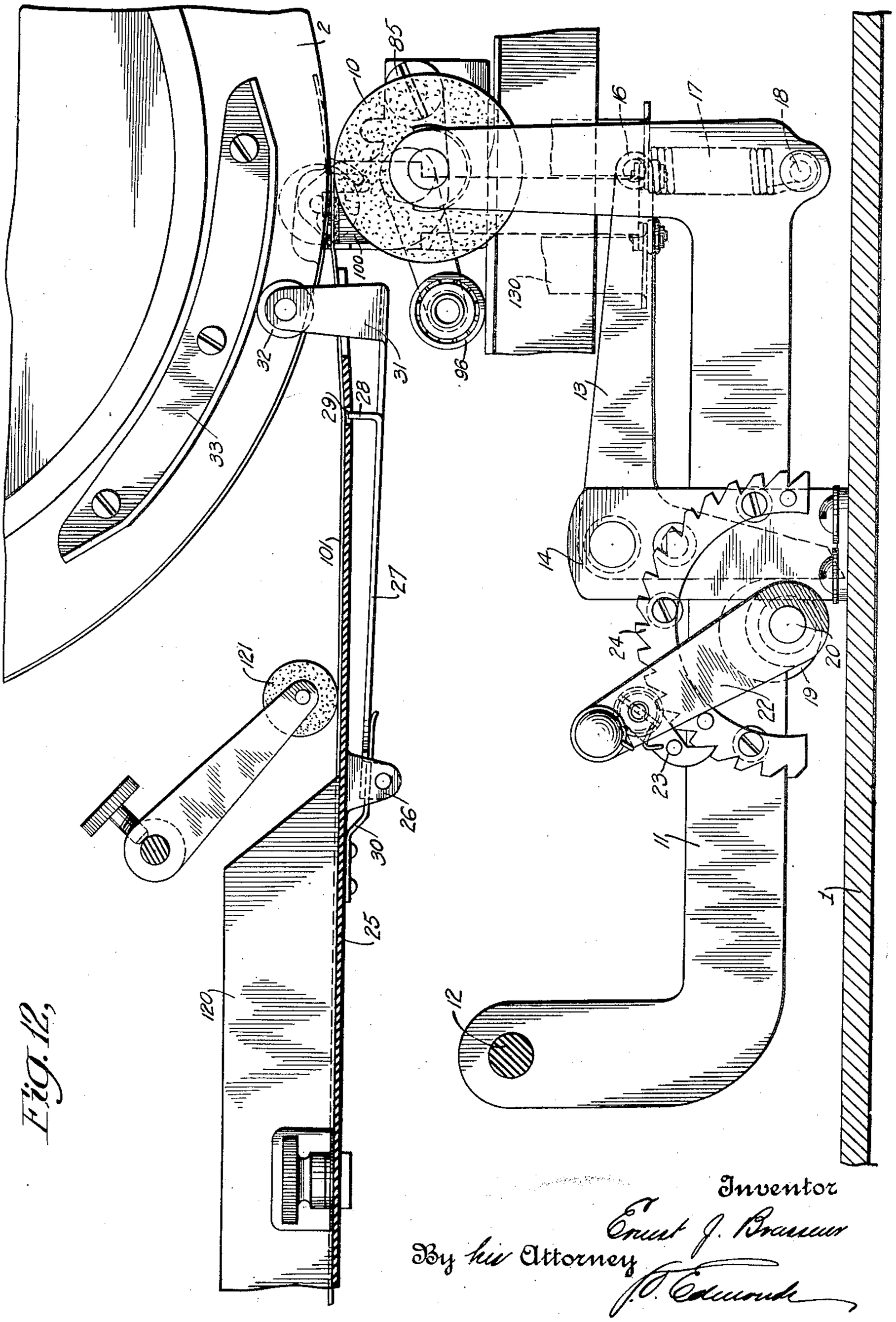

Fig. 12,

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Patented Nov. 18, 1924. 1,516,228

UNITED STATES PATENT OFFICE.

ERNEST J. BRASSEUR, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO A. B. DICK COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

STENCIL-DUPLICATING MACHINE.

Application filed June 7, 1922. Serial No. 566,473.

To all whom it may concern:

Be it known that I, ERNEST J. BRASSEUR, a citizen of the United States, residing in the city of Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Stencil-Duplicating Machines, of which the following is a specification.

This invention relates to stencil duplicating machines.

This application and an application filed by me on even date herewith, Serial Number 566,472 both relate to the same subject matter and both show broadly my invention in so far as the same relates to mechanism for feeding, stripping, and securing registration of sheets, and to the means for driving the various parts of the machine. In my said other application Serial Number 566,472 I have claimed such mechanism and means broadly. The claims in the present application include claims drawn on a specific embodiment of my said broad invention.

My aim is to provide a stencil duplicating machine which is durable in construction, easy to operate, one which operates smoothly and efficiently with a minimum of noise, and at a high speed, if desired; one which gives accurate registration in printing, and positively feeds the sheets into the printing couple for printing and positively strips the sheets from the printing couple; and a machine which operates efficiently and surely upon sheets within an unusually wide range of widths and thicknesses. The objects of this invention include the provision of a stripping mechanism which operates positively to strip the sheets from the printing couple. Another object of this invention is to provide a stripping mechanism which also operates to feed sheets successively into the printing couple. A further object of this invention is to provide a duplicating machine equipped with a feeding and stripping mechanism whereby printing registration is secured with the utmost accuracy. A further object of this invention is to provide a feeding and stripping mechanism for duplicating machines and the like, which is durable in construction, and positive, accurate and noiseless in operation, and which will operate surely and efficiently upon sheets within a wide range of width and thickness. A further object of this invention is to provide a duplicating machine equipped with simple and efficient means for tensioning one member of the printing couple, and means whereby said tensioning means may readily and easily be adjusted manually. Other objects will be in part obvious and in part pointed out hereinafter.

In accordance with my invention as disclosed both herein and in my said co-pending application, I provide a sheet-gripping device which, during the operation of the machine, moves to a point adjacent the feed table or apron where it grasps a sheet thereon and then, while carrying the sheet along, moves to and beyond the printing couple to feed the sheet thereto and to positively strip the sheet therefrom, and, when it has carried the sheet to a certain point, it drops the sheet and returns to its original position to grasp the next sheet placed on the feed table and to repeat the above cycle of operations. The movement past the printing couple is preferably tangential to the members of the printing couple where they coact to print a sheet, and the movement is synchronized with the movement of the printing couple. The gripping device includes operable means for gripping and for releasing a sheet, said means preferably comprising jaws, which are operable into closed position to grasp a sheet between them, and which are operable into open position to release a sheet held in the jaws or to straddle a sheet without gripping it. I provide means for moving the gripping device as above indicated periodically and in established synchronism with the movement of the printing couple and other parts of the machine, and I also provide means whereby, as the gripping device moves along its path, the gripping means are operated to first straddle and then grasp a sheet on the feed table or apron each time the device reaches a certain point, and to maintain the hold until the sheet has been fed forwardly into the printing couple for printing, and beyond the printing couple so as to be stripped therefrom and brought to a certain point where said means operate the gripping means to release and drop the sheet. The gripping device is preferably mounted

on an endless chain at one side of the machine. The chain may be driven continuously during the operation of the machine by means of a sprocket which meshes therewith and which rotates in the proper synchronism with the printing cylinder, so that when sheets are successively placed in a predetermined position on the feed table or apron, each sheet thereon is grasped at the same place by the gripping device, and the printing on each sheet will be in the same relative position thereon. The mechanism is adjustable so that the position of the printing on a sheet may be accurately predetermined, and which adjustment maintains for all successive sheets and until the stencil is changed or a readjustment is made. This is termed securing registration in printing. The actuation of the gripping device to grasp the paper at the proper time, to maintain the hold on the sheet until it has been fed into the printing couple for printing and has been stripped therefrom, and to release the sheet at the desired place is obtained by means of one or more cams suitably positioned along the path of travel of the gripping means. The cams are adapted to coact with a projection or roller carried on the gripper and connected with the jaws to effect their closing and opening.

In order to permit adjustment of the impression roller relative to the printing cylinder in accordance with different thicknesses of the sheets being operated upon, I provide spring means for yieldingly supporting the impression roller in operative position and provide means including a ratchet and pawl whereby the tension of the spring yielding means may be varied and latched in adjusted position.

In order that a clearer understanding of my invention may be had, attention is hereby directed to the accompanying drawings, forming a part of this application, and illustrating certain possible embodiments of my invention. In the drawings, Fig. 1 is a side elevation of a rotary duplicating machine embodying my invention; Fig. 2 is a top view of the same; Fig. 3 is an enlarged top view of a portion of the machine, showing the gripping device in position to grasp a sheet on the apron, certain parts being broken away and others being omitted for the sake of clearness; Fig. 4 is an enlarged side view of a portion of the machine, taken on the line 4—4 of Fig. 3, and shows the gripping device open; Fig. 5 is an enlarged detail side view of the gripper moved forwardly of the position shown in Fig. 4, and closed upon a sheet; Fig. 6 is an enlarged sectional view of a portion of the machine and is taken on the line 6—6 of Fig. 2; Fig. 7 is an enlarged sectional view taken on the line 7—7 of Fig. 3; Fig. 8 is an enlarged sectional view taken on the line 8—8 of Fig. 6; Figs. 9, 10 and 11 are detail views of the gripping device, Fig. 9 being taken on the line 9—9 of Fig. 5, Fig. 10 being taken on the line 10—10 of Fig. 9, and Fig. 11 being taken on the line 11—11 of Fig. 4; Fig. 12 is an enlarged sectional view taken on the line 12—12 of Fig. 2, certain parts being omitted and other parts being broken away for the sake of clearness. Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring to the drawings, the duplicating machine illustrated is of the rotary type, comprising the frame 1, rotary printing cylinder 2 mounted for rotation on removable pins 3 and 4 carried in the side pieces 5 of the frame 1. Cylinder 2 is driven by means of handle 6 operating through a train of gears 7, one of which rotates on pin 3 and is engaged eccentrically by pin 8 carried by the cylinder. A set screw 9 locks pin 3 in place. The cylinder may readily and easily be removed by loosening set screw 9, pulling pin 3 outwardly, and releasing pin 8 from the gear. The cylinder may as easily be replaced. In the usual place below the printing cylinder is the impression roller 10, which, in this instance, is removably carried between the ends of two U-shaped levers 11, which are secured at their other ends to shaft 12 which is rotatably carried on the two sides 5 of the frame 1. Adjacent each lever 11 is a bell crank lever 13 pivotally carried on brackets 14 and 15 secured to the frame. Each bell crank lever 13 has a horizontal arm extending forwardly, at the outer end of which is a pin 16 to which is attached the upper end of a spiral spring 17, the lower end of the spring 17 being attached to a pin 18 carried on the lever 11 below the roller 10. The other arm of the bell crank lever 13 extends downwardly and is adapted to be engaged by a cam 19 secured to a shaft 20 which is rotatably supported in brackets 21 on the frame 1. On one side of the machine and outside of frame 1 a crank handle 22 is secured to the end of the shaft 20. This handle is supplied with a pivoted pawl 23 which is adapted to engage in any one of the various notches of a ratchet segment 24 which is secured to the outside of the frame 1. The arrangement of the above described impression roller tensioning mechanism is such that when the crank 22 is moved to the right (Fig. 12), the cams 19 move the bell crank levers 13 to swing pins 16 upwardly and increase the tension of the springs 17, and thus increases the yielding resistance of impression roller 10 during a printing operation, which is desirable when heavier sheets are being printed. To decrease the tension, as when lighter sheets are printed, the crank 22 is moved toward the left (Fig. 12) the proper distance and

latched in place. Such adjustments may be made as well when the machine is in operation as when it is at rest.

The frame 1 of the machine also supports the usual feed table or apron 25 which supports a sheet and guides it into the printing couple. Depending lugs 26 on the bottom of table 25 pivotally support a plate 27 which presents a plurality of fingers 28 through suitable perforations 29 in the feed table 25. A leaf spring 30 secured to the under side of the table 25 engages the finger plate 27 to normally hold the fingers 28 extended through the perforations 29 so as to stop a sheet of paper from further progression along the upper surface of the paper plate, and to properly align its forward edge with the printing couple. The finger plate 27 has an upwardly extending finger 31 carrying a roller 32 which is adapted to be engaged at the proper times during the operation of the machine by a cam 33 carried on the outside of the printing cylinder to cam the finger plate downward and to move the fingers out of the path of a sheet on the table and to permit the sheet to pass into the printing couple. The printing couple consists of the printing cylinder 2 and the impression roller 10.

At one side of the machine, and preferably at the side opposite the handle 6, I mount an endless chain 34, which carries a sheet gripping device 35, to effect the successive feeding of the sheets into the printing couple and the stripping of the sheets therefrom. This chain is of the roller type and runs horizontally in a specially constructed track which is supported on the frame of the machine. This horizontal chain is built up of a series of vertical members 36, each having at the top a vertical supporting roller 37 rotatably mounted between two flanges 38. Some distance below the roller 37 each member 36 has an inwardly extending horizontal flange 39 provided with two downwardly extending pins 40. At the lower end of the vertical member 36 is another inwardly extending horizontal flange 41 which also has two downwardly extending pins 42. These members 36 are joined together to form the chain by means of horizontal links 43 and 44, each link 43 engaging contiguous pins 40 of adjacent members 36, and each link 44 engaging contiguous pins 42 of adjacent chain members. The ends of these pins are tamped to hold the links in place. To reduce friction a washer 45 is placed on each pin at each side of a link. Each forward pin 40 of the upper flange 39 carries a horizontal roller 46 and each rear pin 42 of the lower flange 41 carries a horizontal roller 47. These rollers are adapted to run in vertical grooves or channel tracks to hold the chain in place while reducing friction to a minimum. The track for this chain may be provided by one or more metal castings which are secured to the frame of the machine. As shown, there is a tier of three straight castings 48, 49 and 50 providing the straight portions of the track and two castings 51 and 52, one at each end, supporting turntables for guiding the chain around the corners. The lower casting 48 is secured to frame 1 by bolts 53. Along each side of this casting 48 is a straight rabbet 54. Vertical strips 55, preferably of fibre, are secured by screws 56 to the sides of the casting 48 and form with the rabbet portions 54 a groove or channel track in which the lower horizontal rollers 47 of the chain are adapted to run. Horizontal confining strips 57, also of fibre, are secured by screws 58 to casting 48. Strips 57 cooperate with strips 55 to prevent overmuch lateral play to rollers 47 and to reduce friction. A second casting 49, similar to casting 48, is secured to the top thereof by means of screws or bolts 59. At the sides of this second casting 49 are straight horizontal rabbets 60 similar to rabbets 54 in casting 48, and associated therewith are similar vertical strips 61 of fibre secured thereto by means of screws 62, and horizontal strips 63, secured thereto by screws 64, forming the two straight grooves or channel tracks in which the upper horizontal rollers 46 of the chain run. Upon the top of this second casting 49 I secure a third casting 50 by means of bolts or screws 65. Along each side of casting 50 is a straight horizontal groove, and above and below these grooves are aligned vertical surfaces along which are secured, as by means of screws 66, vertical strips of fibre 67, and between which strips the upper vertical rollers 37 of the chain are adapted to run. Rollers 37 are supported by these lower strips and upward displacement of the chain is prevented by the upper strips, which are arranged in suitable proximity to the tops of the rollers 37. At each end, where the chain turns a corner, I mount for adjustment on the frame of the machine a casting, such as 51 and 52. Each casting 51, 52 provides a lower and a central bearing for a rotatable carrier or turntable which supports the chain at the ends and guides it around the corner. Each carrier comprises a rotatable vertical shaft 68, the lower end of which is mounted in the lower bearing 69 and extends through the central bearing 70. At each bearing there is an anti-friction device, which, as shown, comprises a lower bearing plate 71 resting on the top of the bearing portion 69, 70, and an upper bearing plate 72 secured to the shaft 68, plates 71 and 72 providing a ball race for ball bearings 73. Shaft 68 is held against displacement upwardly by a locking ring 74

which may be secured in adjusted position on the shaft 68 just below bearing portion 70. At the upper end of shaft 68, and close to tracks 67, I attach for rotation with the shaft, a horizontally disposed disk 75, the upper surface of which is on line with the upper edge of the lower track strips 67, so that the upper vertical rollers 37 of the chain will ride from strips 37 onto disks 75 and off again without jar. Below disk 75 and on shaft 68 is secured another horizontal disk 76, which has a groove or recess 77 extending about its periphery in line with track strip 63, the end of which is seated tangentially in this recess so that horizontal rollers 46 will pass freely from track 63 to the periphery of this disk without jar, and when these rollers have turned the corner they will be directed smoothly and surely to the track 63 on the other side. Above the lower bearing 69 and similarly aligned with the lower track strip 57 is a similar horizontal disk 78 secured to the shaft 68 for rotation therewith. The horizontal strip members 57 of the lower track have their ends seated within the peripheral recess 79 of disk 78. The periphery of this disk member 78 constitutes a continuation of track strip 57 just as disk 76 constitutes a continuation of track strip 63, and similarly aids in guiding the chain around the corner smoothly and with a minimum of friction. The castings 51 and 52 which carry the turntable disks 75, 76 and 78, preferably are secured for adjustment on frame 1 of the machine by means of screws or bolts 80 which extend through elongated perforations 81 in the casting, thus permitting the tension of the chain to be adjusted, and the chain to be adjusted bodily on the frame to a limited extent.

As the chain moves, the upper vertical supporting rollers 37 travel upon the upper edge of the lower track strip 67 and will be steadied by the lower edge of the upper track strip 67. The upper horizontal rollers 46 will be confined between the outer confining track strip 61 and the inner horizontal confining track strip 63. Similarly, the lower horizontal rollers 47 will be confined between the outer track strip 55 and the inner horizontal confining track strip 57 of the lower channel track. When the chain members 36 reach a corner, each upper roller 37 passes smoothly and without jar to the upper surface of the upper disk 75, and the two inwardly extending flange portions 39 and 41 of the chain members, and the rollers 46 and 47 thereon will ride onto the periphery of the other two disks 76 and 78. Disks 75, 76 and 78, by being attached to shaft 68, rotate in unison. To insure noiselessness in operation and to decrease friction, the track strips and the two lower rotatable disks are made of fibre material. Preferably, however, the upper disk 75 is constructed of more rigid material, such as steel, on account of the wear and strain to which it is subjected. My improved chain and track construction permits of operation at high speed, with a minimum of noise and friction, and positively maintains the chain in place.

This chain carries the sheet gripping device 35. This sheet gripping device, as shown, comprises a stationary jaw member consisting of a vertical plate 82 which has a horizontally extending finger 83 constituting the stationary jaw. Plate 82 is securely attached to one member 36 of the chain, as by means of a plurality of posts 84 riveted to the plate 82 and to a chain member 36. Pivoted on the stationary plate, as by means of screw 85, is a movable jaw member which comprises a vertical plate 86 having a horizontally extending finger 87 constituting a jaw which is movable toward and from the stationary jaw 83. The stationary plate 82 has a bent over portion 88 providing a groove in which a portion 89 of the movable jaw member is slidably seated to guide the jaw 87. A spring 90 coiled about the screw 85 has its ends connected respectively with a pin 91 on the stationary jaw member 82, and a pin 92 on the movable jaw member 86, holds the jaw members normally in separated condition, as shown in Fig. 4. A stop pin 93 on the stationary jaw member prevents undue separation of the jaw members. The movable jaw member carries pivoted thereto, as by means of a stud 94, a downwardly and rearwardly projecting lever 95 which carries a roller 96 at its outer extremity. A stop finger 97 is secured to the stationary jaw member to limit the downward movement of lever 95. A wire spring 98, heavier than spring 90, is fulcrumed at the stud 94, and has one end engaging with pin 92 and the other end engaging the hub of the roller 96, normally maintaining lever 95 and its roller 96 in their lowest positions, irrespective of whether the gripping device is in open or in closed condition. The upper stationary jaw 83 is preferably provided with roughened tabs 99, and the lower movable jaw 87 is provided at its outer end with a rubber pad 100, in order that when a sheet of paper is gripped between these two jaws it will be held thereby positively and without danger of its slipping.

The chain 34 is so positioned relatively to the paper feed plate 25 and to the printing couple 2, 10, and the sheet gripping device 35 is positioned on the chain 34 at such a height, that when the paper gripping device is carried by the chain around the end which is adjacent to the table 25, the open gripping device 35 will be carried into the plane of a sheet of paper 100 positioned on table 25, with the upper jaw 83 of the gripper above the sheet and the lower jaw 87 below the

sheet, as shown in Fig. 4. As the chain carries the sheet gripping device forward after it has turned the corner, the roller 96 of the sheet gripping device engages a cam plate 102 which is supported on the frame 1 of the machine by means of screws or bolts 103. The cam plate 102 has an inclined cam surface 104 at its inner end leading to a horizontal cam surface 105 which extends to another sharply inclined surface 106 at the other end of the cam member 102. These cam surfaces are in the path of the roller 96 of the sheet gripping device as it is carried along by its chain, and cooperate therewith to close and open the gripping device at predetermined points along its path of travel. The cam 33 on the cylinder 2 is so arranged that it will cooperate with the roller 32 of the finger plate 27 to remove the fingers 28 from out of the path of the sheet 101 just before the gripping device 35 has taken hold of the sheet to carry it forward into the printing couple. The cam track 102 for the sheet gripping device extends beyond the printing couple and is arranged to keep the sheet gripping device closed upon the paper until the gripping device has carried the paper into the printing couple and has stripped it therefrom. At the desired point beyond the printing couple, the cam track 102 falls off, as at 106, and when the gripping device reaches this point, the movable jaw 87 of the gripping device moves away from stationary jaw 83 under the action of spring 90 and releases the paper. If the paper has not been carried completely through the printing couple, the rotation of the printing couple will continue the forward feed of the paper. The gripping device, at all events, has positively stripped the end of the printed sheet from the printing couple and has positively prevented the sheet of paper from adhering to the printing cylinder or to the impression roller for rotation therewith.

The cam track 102 referred to has associated with it an upper track member 107 which is formed by flanging the top of the bracket 15 and which confines roller 90 of the gripping device 35 from above for a certain distance and thereby steadies the gripper and chain as the gripper closes upon a sheet of paper and carries it into the printing couple. To further steady and to guide the gripper 35 as it grips and carries the paper, a stationary vertical plate 108 is attached to the side of cam track 102, the upper edge of plate 108 having a horizontally extending groove 109ª into which the lower edge of plate 82 of the stationary jaw member of the gripping device is adapted to enter and in which plate 82 slides as the gripping device is moved. To decrease noise and friction, plate 108 may be of fibrous material. To further insure positive gripping of the sheet by the gripper, and to prevent rebound of the jaw members, there is attached to the frame 1 of the machine by screws or bolts 109, a bracket 110 which carries a roller 111 in such position that it will bear downwardly upon the stationary gripping member 83 from above as the lower member 87 is being pressed against it from below to grip a sheet of paper. Preferably, also, a portion of the inside upper track member 67, where it is adjacent the table 25 and the printing couple, is constructed of metal, as at 112, so that the chain will be further stabilized, and to provide a more rigid and sturdier confining track for taking the upward thrust imparted to chain rollers 37 when the gripper roller 96 rides upward on cam track 102. Also reenforcing link members 130 may be applied between members 36 of the chain near the gripper.

The chain 34 is driven in synchronism with the printing cylinder 2 by means of a sprocket wheel 113 which is secured, as by means of a set screw, key or pin 114, to pin 4, which has secured to it, by means of a set screw, key or pin, a lever 115 which extends radially along one side of cylinder 2 and at its outer end has a pin 116 which engages in a suitable recess in cylinder 2, so that sprocket wheel 113 will rotate in unison with cylinder 2. To steady pin 4 its outer end is rotatably seated in a perforation provided therefor in a bracket 117 which rests upon and is secured to casting 50 of the track by means of bolts 118. The teeth 119 are in mesh with rollers 37 of chain 34 to effect the driving of the sheet feeding and stripping mechanism. Preferably, chain 34 carries a single gripping device 35, and in this case the number of teeth on the sprocket wheel equals the number of rollers 37 so that for every complete revolution of cylinder 2 the chain 34 will have made a complete circuit. When the machine is set up to print, the position of gripper 35 and cylinder 2 are relatively adjusted so that the printing couple will place the desired imprint in the desired place or places upon a sheet fed thereto by gripper 35. Since gripper 35 moves in exact synchronism with cylinder 2, and grips each sheet of paper at exactly the same place, each sheet of paper subsequently fed to the printing couple during the continued operation of the machine will receive the imprint in exactly the same place or places. This feature is of utmost importance in this art and is commonly defined as securing registration. When rollers are relied upon to secure the feed of the sheets of paper there is apt to be some slippage caused by the failure of the rollers tc positively grip the sheets or by improper buckling of the sheets. This has been the method heretofore used.

The paper table 25 is equipped with one or more of the usual adjustable lateral paper guiding plates 120. If desired, the side member 5 may be used as a fixed lateral guiding plate at the side where the gripper 35 operates. The usual roller 121 may also be provided over plate 25 to hold the paper against this plate and insure of the paper being in proper position for being picked up by gripper 35. To provide room for the gripper 35 as it moves, a portion of plate 25 is cut away as at 122, and a portion of the cylinder 2 is also cut away as at 123. Since gripper 35 extends inwardly of side frame member 5 at this side of the machine, this member is cut away and at its outer end is supported by a bracket 124 which is secured upon the top of casting 50 of the chain track by means of bolts 125.

In the gripper 35 the object of pivotally mounting roller 96 on plate 86 of the movable jaw member and providing spring 98 is to dampen the shock when roller 96 strikes and rides upward on cam track 102 and also to permit the gripper to take care of sheets of paper or cardboard, or the like, of different thicknesses within a very wide range.

Since gripper 35 engages a sheet close to its margin and preferably close to its front edge, my improved machine will successfully and accurately print sheets which are very narrow and short. In consequence my machine operates upon sheets of different widths and lengths within a very wide range.

The machine is set up by mounting the cylinder in proper relative position with the gripper 35, with the sprocket connected for rotation therewith and in mesh with the chain. The stencil sheet 126 may already have been mounted on the cylinder 2 in the usual manner, or it may be now placed thereon. The machine having been set up and adjusted, and the stencil placed on the cylinder, arrangement is made for feeding sheets of paper successively to the paper table 25 either by hand or by any suitable automatic means. The lateral paper guides plates 120 and roller 121 are adjusted to properly guide and position the sheets according to their width. Each sheet passes forwardly on the table 25 until its front edge is arrested by the fingers 28 of the paper stopping device. These stops 28 place the forward edge of the sheet to be printed in the desired alignment with the cylinder 2, and the forward edge of each sheet should be brought snugly against these stops. When a sheet is in this position, operation of the machine brings cam 33 on the cylinder into engagement with the roller 32 of the stop plate 27 to move the stops 28 out of the path of the sheet, and simultaneously brings the gripper 35 into the plane of the sheet and along cam track 102 so that it will grip the sheet, and, upon further operation of the machine, will carry the sheet forwardly into the printing couple and beyond the same until the gripper 35 passes the end 106 of the cam track 102, whereupon the gripper will loosen its hold upon the sheet and permit it to drop. Meanwhile, the synchronism between the cylinder 2 and the gripper 35 is such that as the gripper 35 carries the sheet into and past the printing couple the stencil sheet on the cylinder will leave the desired imprint on the sheet. If the sheet has not passed completely through the printing couple when it is dropped by the gripper, the engagement of the sheet by the printing couple will cause its forward feet to be continued until the sheet has been completely disengaged from the machine. As the operation of the machine is continued, as by continuing the turning of handle 6, the gripper 35 is carried around by the chain until it is again in position to grip and carry along the next sheet which in the meantime has been properly positioned on the table 25 against the stops 28. Thus after the machine has been adjusted for the particular size of the sheets which are to be printed upon, it is only necessary to effect the proper feed of the sheets to the table 25 and to turn the handle 6 to print as many copies as desired. Obviously, the machine may be driven mechanically instead of manually.

It is to be noted that the positive forward feed of each sheet and its positive stripping from the printing couple is obtained automatically by means of a gripping device which moves forwardly in the plane of the table 25 and substantially tangentially to the printing cylinder and the impression roller where they oppose each other. The gripper automatically and positively clamps itself upon each successive sheet to be printed. Slippage in the gripping action is positively prevented, and the gripper continues to positively keep its grip on the sheet until it has carried the sheet into the printing couple and has stripped the forward portion of the sheet from the printing couple. As before pointed out, this gripper is adapted to operate successively on sheets varying considerably in thickness.

It is desirable to make an adjustment in the printing couple for various thicknesses of sheets. According to the construction above described, whereby the impression roller is mounted so as to be yieldingly pressed toward the cylinder 2, the tension of the compression roller may be readily and easily varied for different thicknesses or quality of paper by making a corresponding adjustment of handle 22.

Obviously, means to prevent the impression roller from contacting the printing cylinder or a stencil thereon when no sheet is

in position to be printed, may be provided. Such mechanism, however, is well known and forms no part of the present invention, and, therefore, no description thereof is included herein.

Another advantage of my machine is that it may be run at very high speed without sacrificing efficiency or accuracy in registration. Moreover, with this machine it is unnecessary to drive the cylinder through a train of four or more gears, as heretofore required to drive sheet feeding and stripping mechanism, etc. associated with the machine.

As many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all novel matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim is:—

1. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including, in combination, a sheet gripping device operable into and out of sheet-gripping condition and movable bodily along an established path, means for positively guiding said mechanism in said established path, said means including vertical and horizontal guide members movable with said mechanism, means normally maintaining said device out of sheet-gripping condition and means coacting with said device at predetermined places along said path for operating said device into sheet-gripping condition, and means for moving said device along said path.

2. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including a movable endless chain and a sheet gripping device movable vertically, said gripping device comprising, in combination, a plate having a jaw portion, a member pivoted to said plate and providing a complementary jaw portion, and spring means engaging said plate and said member, normally holding said jaws in separated condition, said endless chain comprising a plurality of connecting vertically extending members held against lateral and vertical displacement.

3. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including a movable sheet gripping device comprising, in combination, a plate having a jaw portion, a member pivoted to said plate and providing a complementary jaw portion, and spring means engaging said plate and said member, normally holding said jaws in separated condition, a projecting lever pivoted to said pivoted jaw member, and a spring connected with said lever and said member yieldingly holding said lever in a predetermined position on said member.

4. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including a movable sheet gripping device comprising, in combination, a plate having a jaw portion, a member pivoted to said plate and providing a complementary jaw portion, and spring means engaging said plate and said member, normally holding said jaws in separated condition, a projecting lever pivoted to said pivoted jaw member, and a spring connected with said lever and said member yieldingly holding said lever in a predetermined position on said member, said gripping device being secured to a movable endless chain for transportation thereby, a track for said chain, and cams positioned along said track in the path of said projecting lever and adapted to coact therewith to determine movement of the jaw portion of said pivoted member relative to the jaw portion of said plate.

5. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including, in combination, a movable endless chain and a gripping device secured to said chain for transportation thereby, said chain including a plurality of connected, vertically extended members, each carrying a vertical roller at the top, a horizontal roller near the bottom, and another horizontal roller intermediate said other two rollers.

6. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including, in combination, a movable endless chain and a gripping device secured to said chain for transportation thereby, said chain including a plurality of connected, vertically extended members, each carrying a vertical roller at the top, a horizontal roller near the bottom, and another horizontal roller intermediate said other two rollers, and supporting and guiding means for said chain, said means comprising a supporting track for said vertical rollers supporting said chain members, a confining track above said vertical rollers, confining said chain members against upward displacement, confining tracks for said horizontal rollers, guiding and confining said chain members against lateral displacement, and turntables at the ends of said tracks for supporting and guiding said chain members around a corner.

7. In a duplicating machine, mechanism for determining movement of a sheet fed to said machine, said mechanism including a movable sheet gripping device comprising, in combination, a plate having a jaw portion, a member pivoted to said plate and

providing a complementary jaw portion, and spring means engaging said plate and said member, normally holding said jaws in separated condition, a projecting lever pivoted to said pivoted jaw member, and a spring connected with said lever and said member yieldingly holding said lever in a predetermined position on said member, a roller on said pivoted lever, a cam, stationary on said machine and adapted to coact with said roller to move the jaw portion of said pivoted member toward the jaw portion of said plate, a stationary confining track over said cam confining said roller from above, a stationary vertical plate adjacent said cam and having a horizontally extending groove adapted to slidably receive the lower edge of said plate to guide and steady the gripping device, and a stationary bracket presenting roller over said cam adapted to engage and reenforce said jaw portion of said plate from above as said roller coacts with said cam.

8. In a device of the character described, in combination, printing mechanism including a rotatable printing cylinder, a feed table, a paper stop associated with said feed table normally in operative position to stop progress of a sheet thereon, operable means for placing said stop in inoperative position to permit a sheet to be fed from said table, sheet-gripping means adapted, during the operation of the machine, to be brought periodically to said table and to be operated to grasp a sheet thereon and then to be moved to feed a sheet so gripped from said table, and means movable in synchronism with said gripping means for operating said stop placing means to place said stop in inoperative position when said gripper feeds a sheet from said table, said means including a roller carried by said paper stop adapted to co-act with a cam on said printing cylinder during rotation thereof.

9. In a device of the character described, in combination, printing mechanism including a rotatable printing cylinder, a horizontally disposed, movable, endless chain an operable sheet gripping device mounted on said chain for movement therewith in a circuit which is substantially tangential to said cylinder, means, comprising cams along the path of movement of said device and adapted to coact therewith, for operating said device, a feed table, operable sheet stopping mechanism associated with said table, a sprocket wheel connected with said cylinder for rotation simultaneously and in established synchronism therewith and in driving mesh with said chain, a cam carried on said sprocket adapted to coact with said operable sheet stopping mechanism at stated times during the rotation of said sprocket to operate said mechanism, and means connected with said cylinder for rotating the same, whereby said cylinder is rotated and said gripping device is moved and operated in its circuit and said sheet stopping mechanism is operated simultaneously and in established mutual synchronism.

10. In a device of the character described, in combination, printing mechanism including a printing cylinder and a co-acting impression roller, mechanism for determining movement of a sheet fed to said printing mechanism, said last named mechanism including an endless chain and a gripping device secured thereto, said endless chain including a plurality of connected vertically extended members adapted to be restrained from lateral and vertical displacement, and means permitting an adjustment and positioning of said impression roller with relation to said printing cylinder.

This specification signed and witnessed this 22nd day of May, 1922.

ERNEST J. BRASSEUR.