No. 842,592. PATENTED JAN. 29, 1907.

E. TYDEN.

MACHINE FOR CUTTING BLANKS STAGGERING.

APPLICATION FILED MAY 25, 1906.

6 SHEETS—SHEET 1.

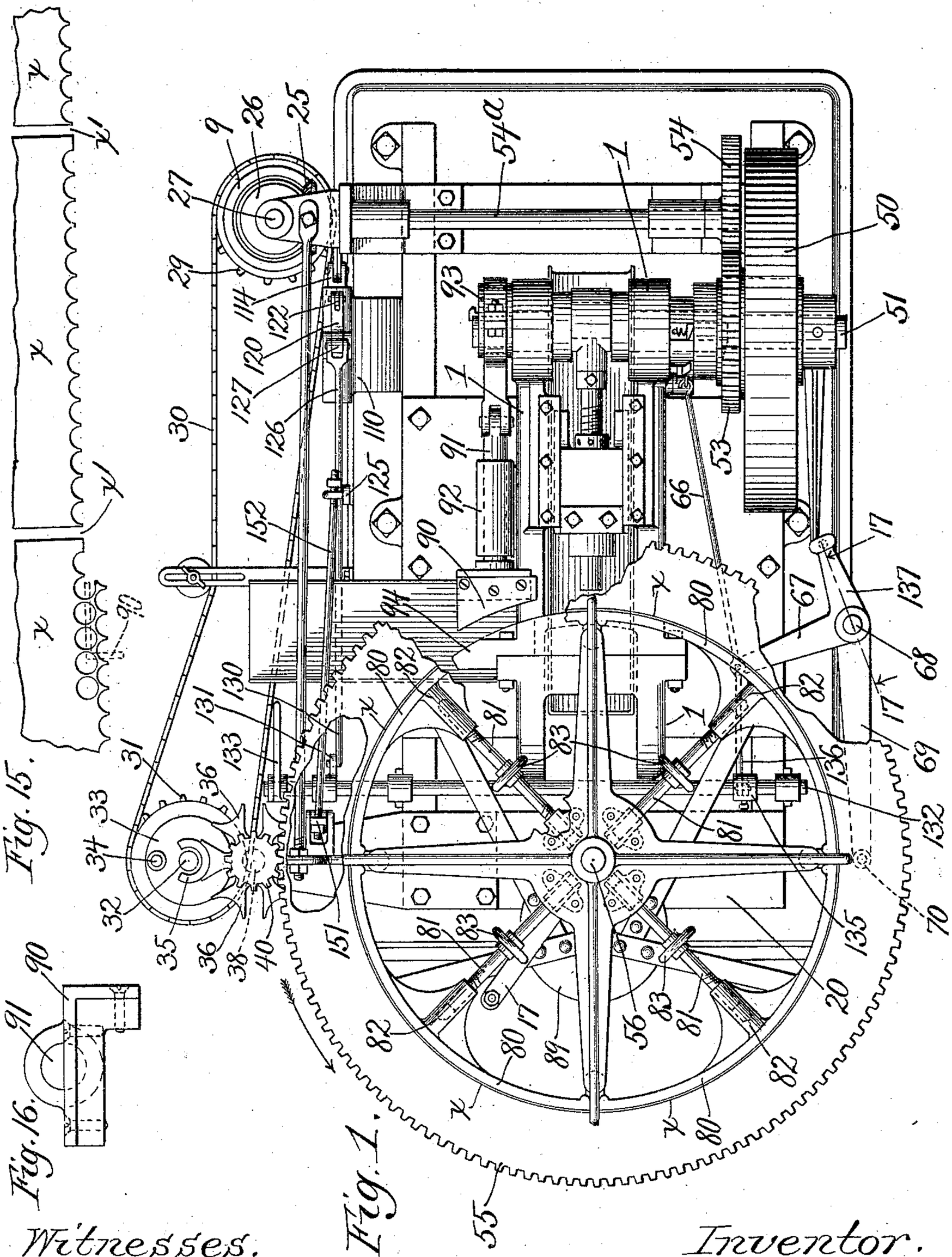

Fig. 15.

Fig. 16.

Witnesses.
Edward T. Wray.
J. S. Abbott

Fig. 1.

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6 SHEETS—SHEET 2.

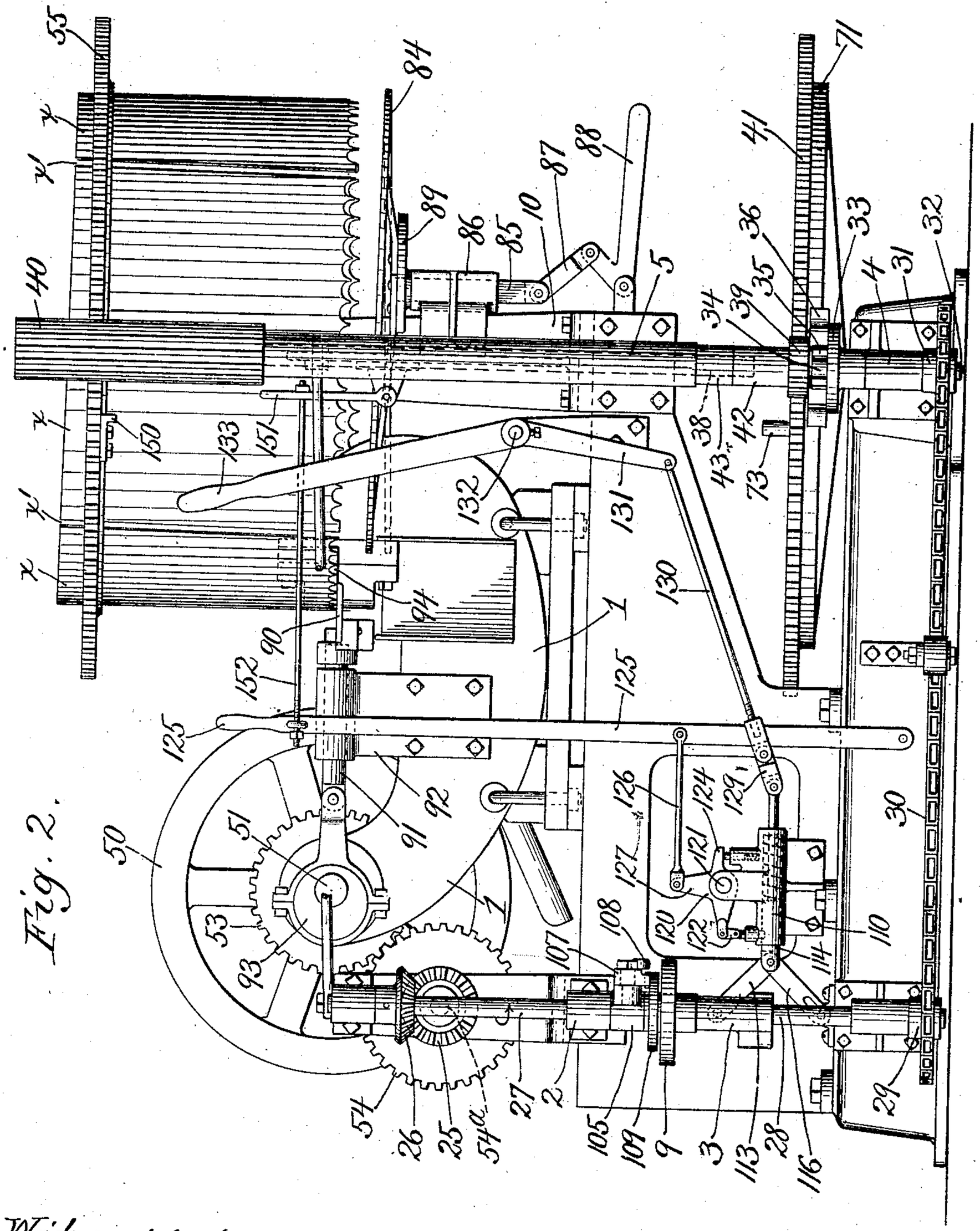

Fig. 2.

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6 SHEETS—SHEET 3.

Fig. 3.

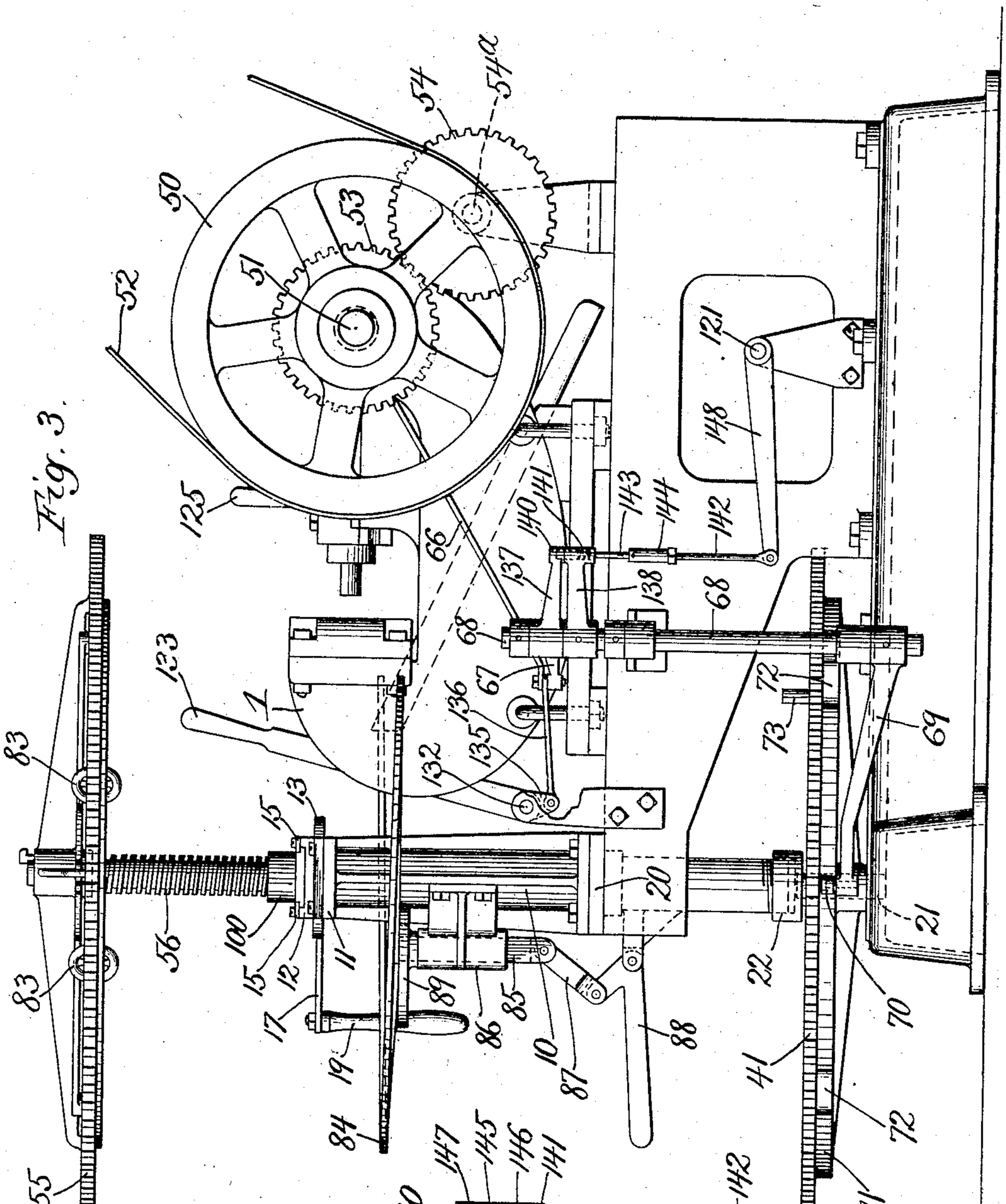
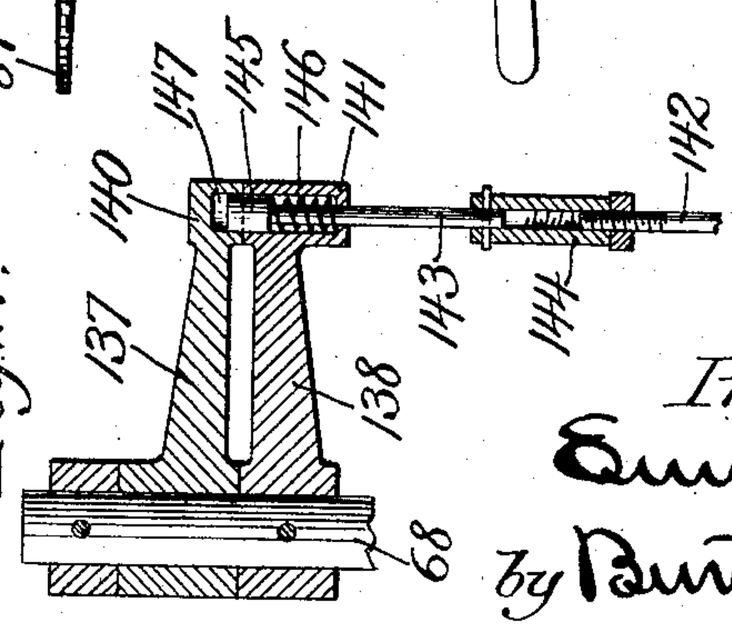


Fig. 17.



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6 SHEETS—SHEET 4.

Fig. 12.

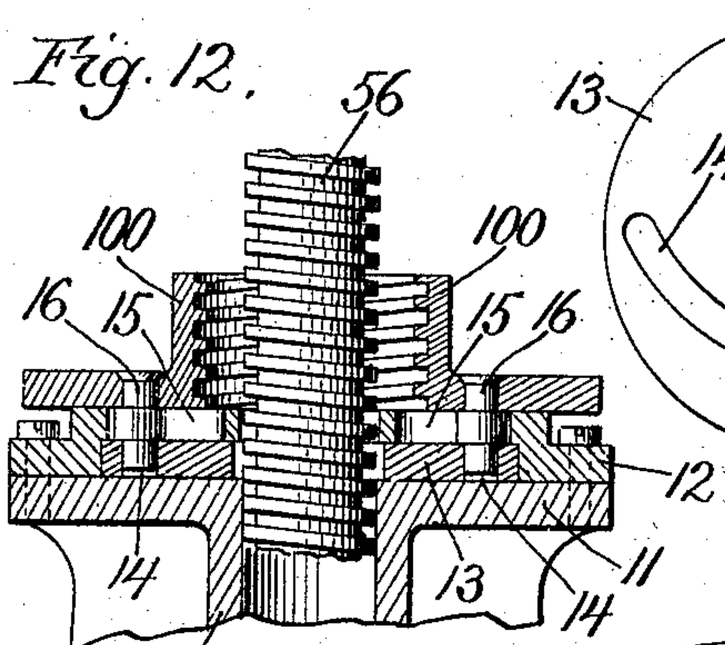

Fig. 13.

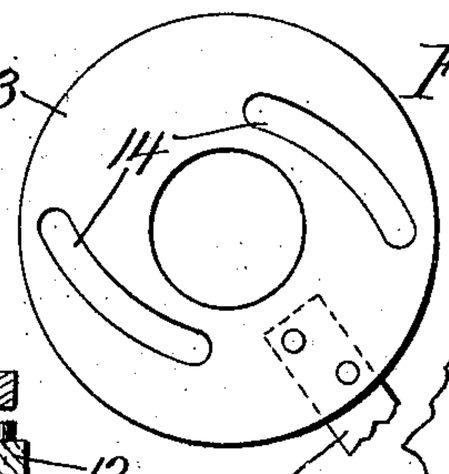

Fig. 14.

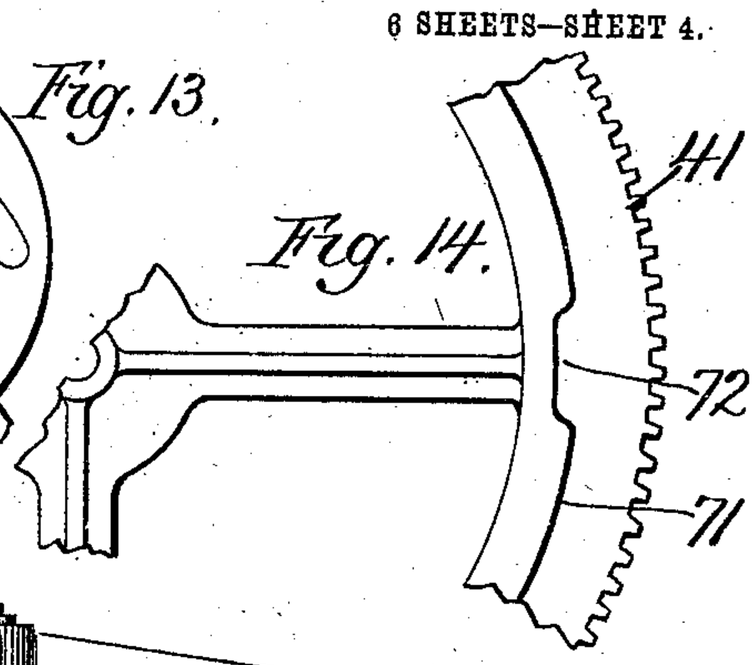

Fig. 4.

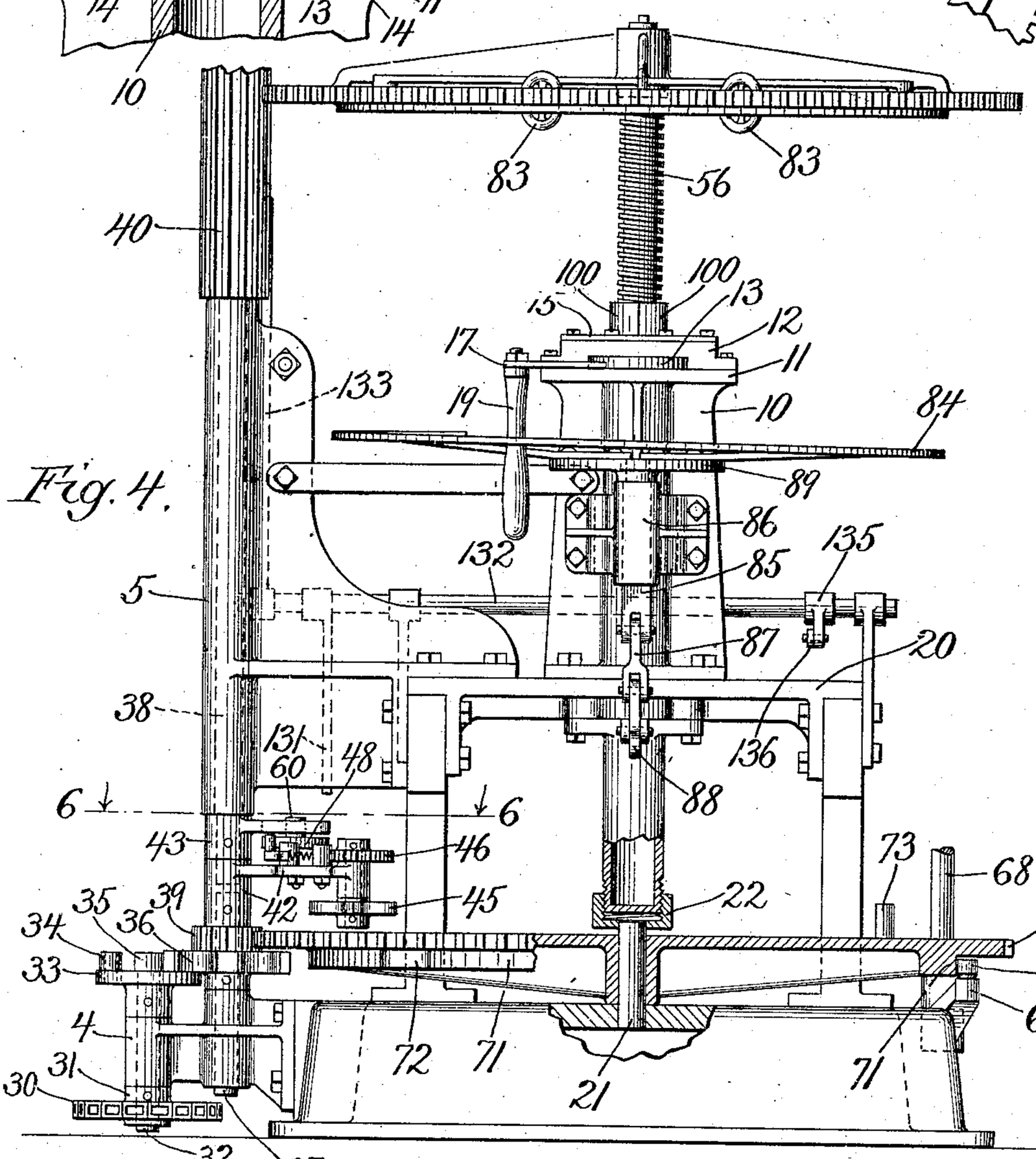

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Fig. 11.

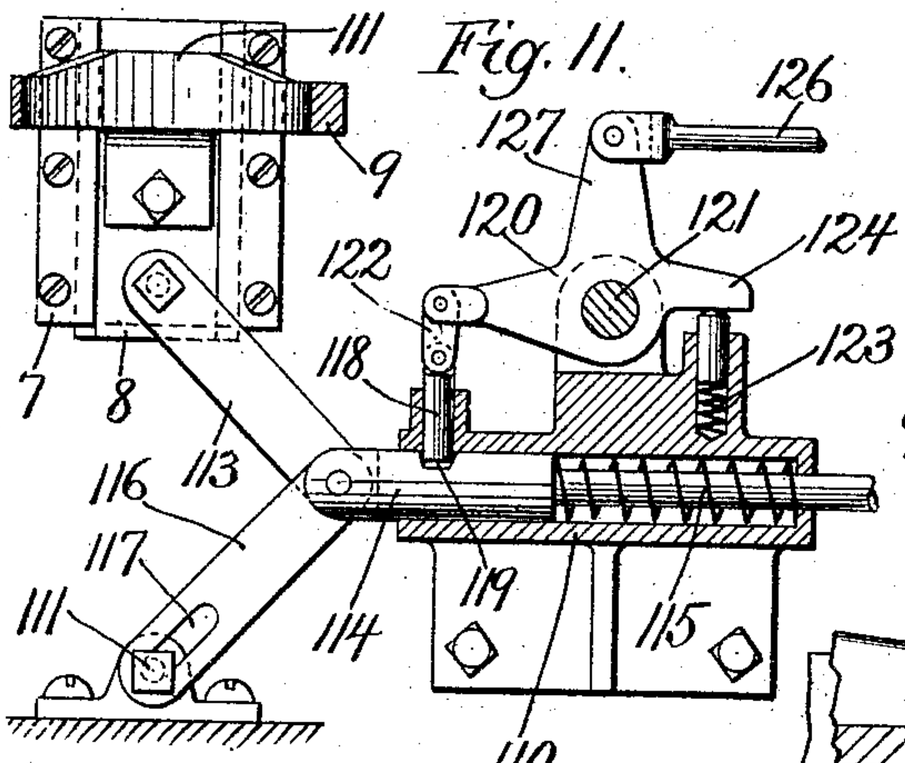

Fig. 8.

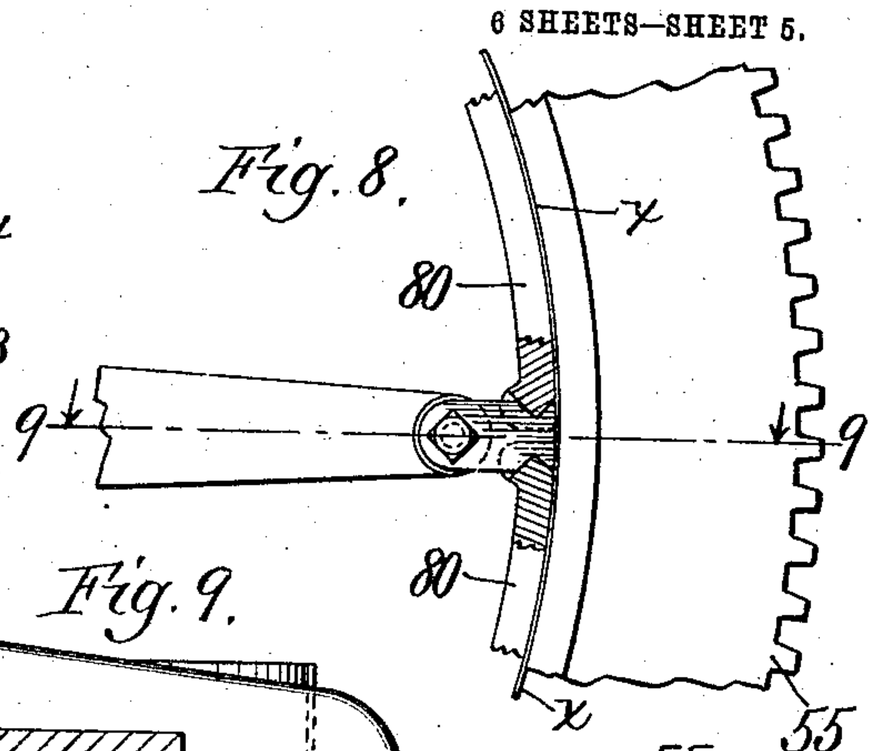

Fig. 9.

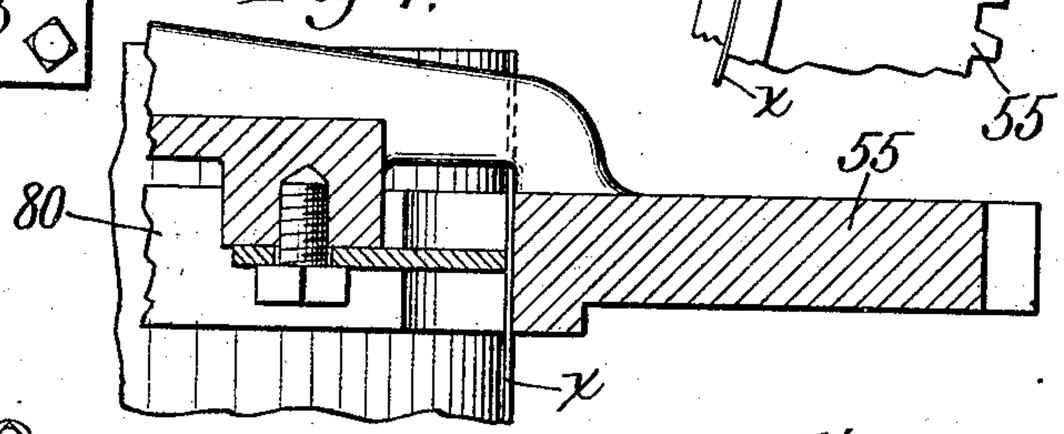

Fig. 5.

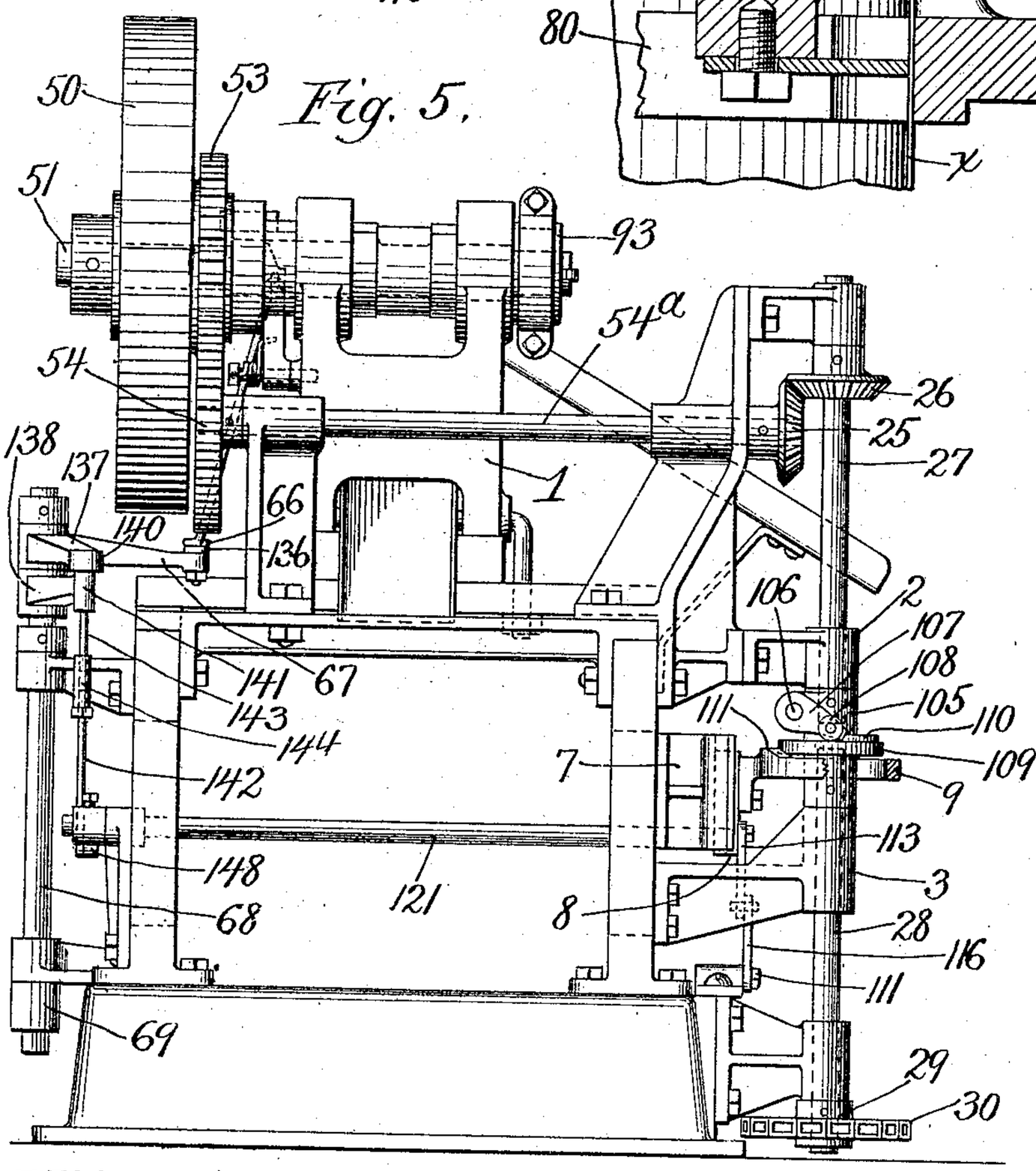

Fig. 10.

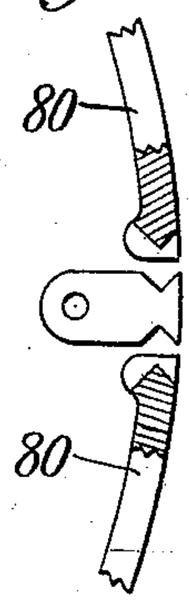

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Fig. 6.

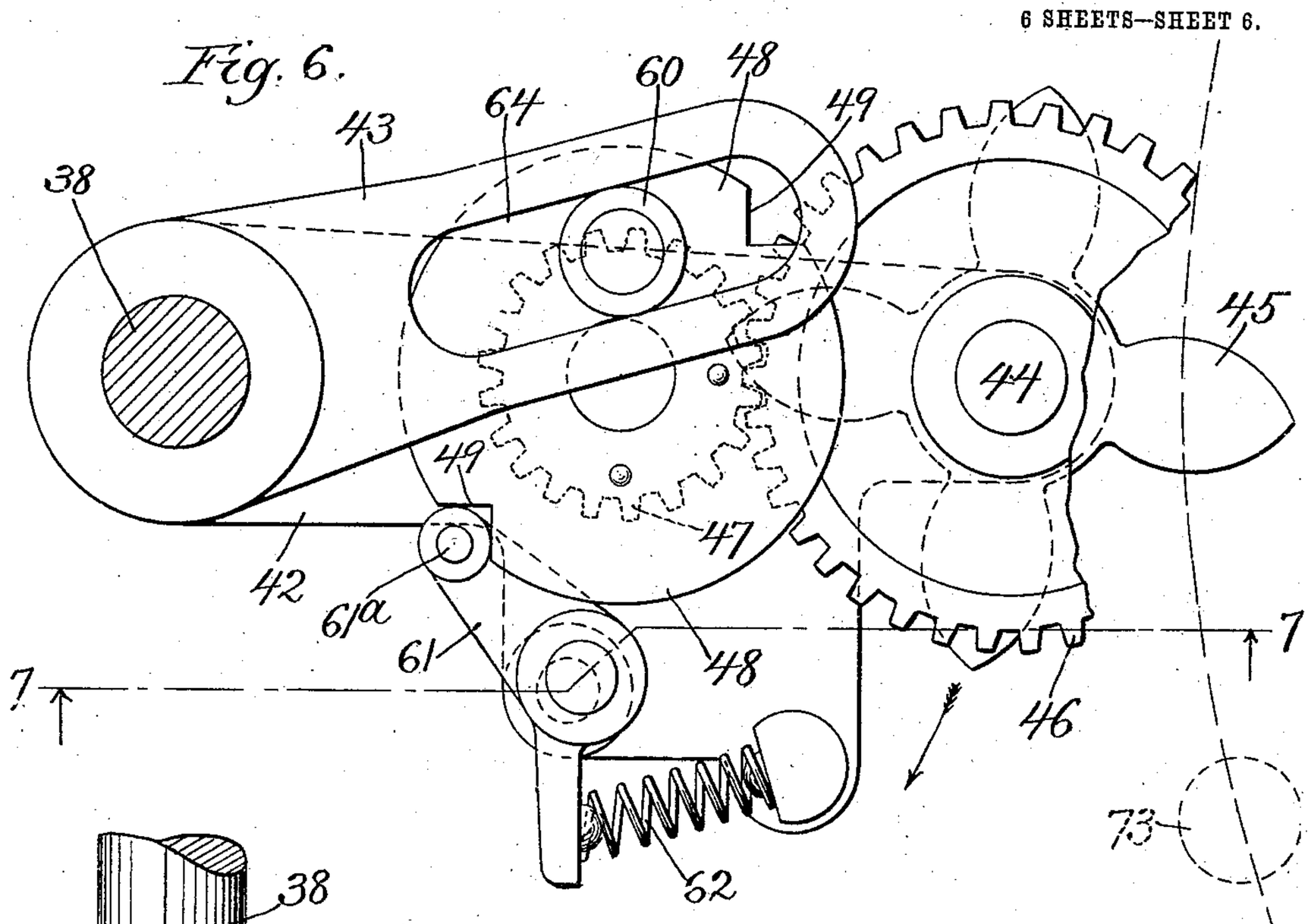
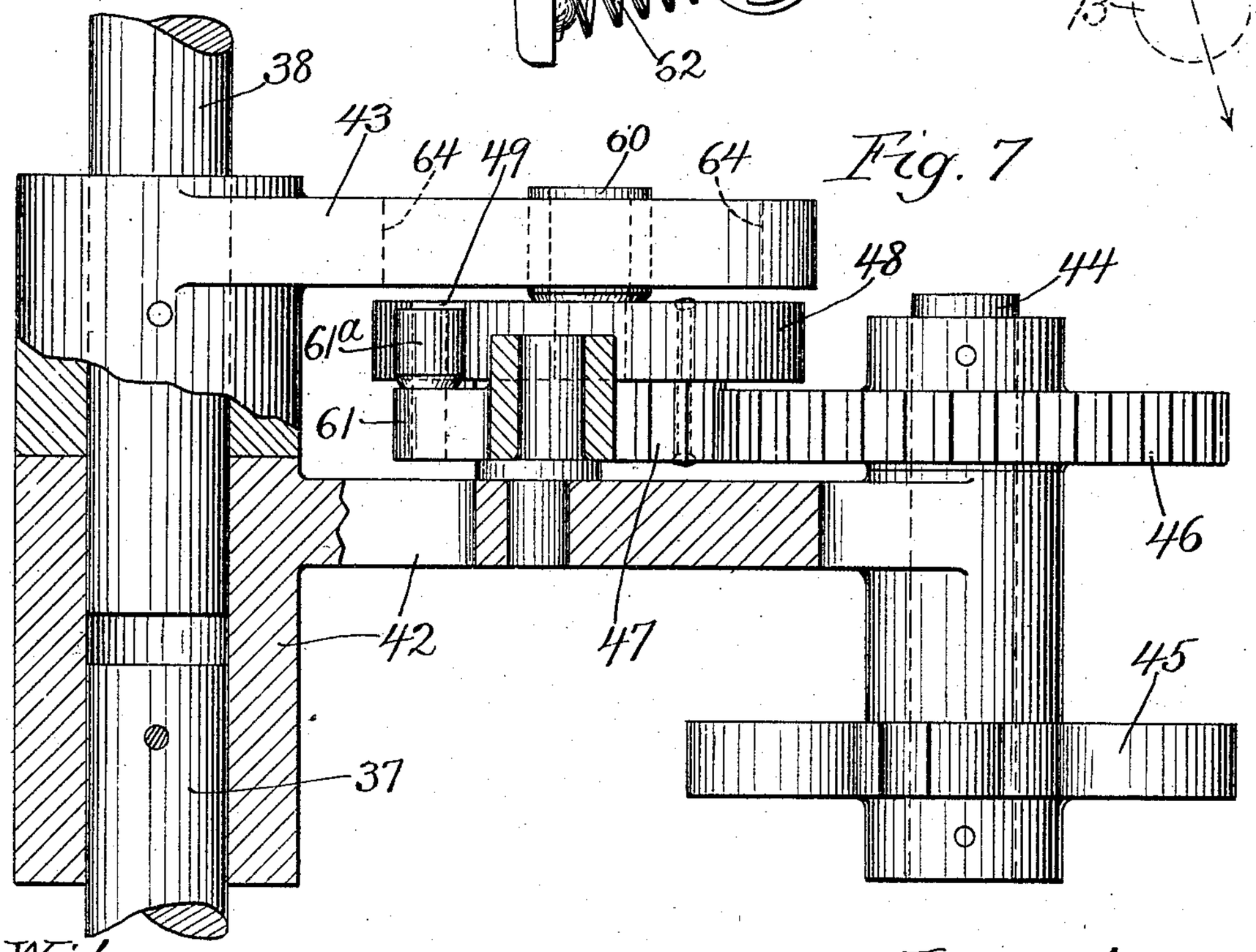


Fig. 7



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UNITED STATES PATENT OFFICE.

EMIL TYDEN, OF HASTINGS, MICHIGAN.

MACHINE FOR CUTTING BLANKS STAGGERING.

No. 842,592. Specification of Letters Patent. Patented Jan. 29, 1907.

Application filed May 25, 1906. Serial No. 318,630.

To all whom it may concern:

Be it known that I, EMIL TYDEN, a citizen of the United States, residing at Hastings, in the county of Barry and State of Michigan, have invented new and useful Improvements in Machines for Cutting Blanks Staggering, of which the following is a specification, reference being had to the accompanying drawings, forming a part thereof.

The purpose of this invention is to provide a machine for cutting blanks from sheet metal or other sheet material in which the sheets being placed in the machine may be entirely cut up with the least possible waste of material, being automatically fed to the cutting die or dies, and particularly for so feeding the sheets when the form of the blanks to be cut therefrom is such that for economical use of the material it is necessary to stagger the blanks—that is, to cut the blanks in one row opposite the intervals between the blanks in the adjacent rows.

It consists in the mechanisms and combinations of mechanisms and features of construction set out in the claims.

In the drawings, Figure 1 is a plan view of a machine embodying this invention. Fig. 2 is a front side elevation of the same. Fig. 3 is a rear side elevation. Fig. 4 is a partly-sectional right-hand end elevation with the die-press and some other parts omitted, certain parts being broken away and shown in a section radial to the main carrier-shaft. Fig. 5 is a left-hand end elevation, omitting certain parts. Fig. 6 is a detail section at the line 6 6 on Fig. 4 upon an enlarged scale. Fig. 7 is a section at the line 7 7 on Fig. 6. Fig. 8 is a detail view of a small segment of the blank-carrying gear and the clamp for holding the blanks thereto, broken away at one point to show certain details in horizontal section. Fig. 9 is a section at the line 9 9 on Fig. 8. Fig. 10 is a detail view of the clamping device for holding the sheets in the carrier. Fig. 11 is a partly-sectional detail view of a clutch and its operating connections for engaging and disengaging the sheet-feeding mechanism from the driving-power-Fig. 12 is an axial section of a divided nut and threaded shaft concerned in the vertical feed movement of the sheets. Fig. 13 is a plan view of an element for opening and closing the divided nut. Fig. 14 is a detail bottom plan view of a segment of the gear by which the carrier is rotated. Fig. 15 is an elevation showing a portion of the lower edge of the sheets as they would appear in the process of operation, illustrating the staggering. Fig. 16 is an end elevation of a cutter or punch for cutting round blanks and cutting away the waste. Fig. 17 is a detail section of certain parts shown in side elevation in Fig. 3, section being made at the line 17 17 on Fig. 1 upon an enlarged scale.

This machine comprises the die-prsse, which is mounted in and forms a part of the frame of the machine, preferably in position for horizontal operation—that is, with the backbone or shank of the press-frame or standard extending horizontally to connect the die-bed with the slide-bearing of the reciprocating head and the bearing of the power-shaft. This press-frame is, as indicated, rigid with and may be formed in part integrally with other portions of the frame of the machine as a whole, but for convenience may be referred to separately as the "press-frame" 1. The die-press may be of any approved construction customary in die-presses having a fly-wheel and power-wheel 50, mounted for running loose and adapted to be tripped into engagement with the main power-shaft 51 for operating the punch intermittently. The specific mechanism for communicating the reciprocating motion from the shaft to the reciprocating head and for tripping the fly-wheel into and out of engagement with the shaft need not be described. Such parts of the devices for this purpose as are necessarily shown in the drawings will be understood by those familiar with the art without particular description. The fly-wheel 50, however, which is continuously driven bya belt 52, serves as a means for communicating power to the remainder of the mechanism by means of a gear 53, rigid with said fly-wheel and meshing with a gear-wheel 54, mounted on the frame. The other mechanisms associated with the die-press comprise, primarily, a carrier for the sheets to be punched, of which the characteristic element is a large gear-wheel 55, having its shaft 56 threaded and adapted to be screwed through its bearings, said bearings being at right angles to the plane containing the axis of the main power-shaft 51 of the press and the center line of reciprocation of the reciprocating head of the press—that is to say, substantially parallel to the plane of the die-surface over which the sheets are to be passed for being punched. This wheel is designed to carry the sheets which are to be punched as-

sembled in it so as to form a hollow cylinder, (see Fig. 2,) which cylinder is rotated about its axis and simultaneously advanced axially by the threaded shaft to carry the sheets between the punch and die, the cylinder in the process encompassing the entire die-bed. This rotation being effected with a step-by-step movement corresponding to the actions of the press—that is, so that the halt occurs in the cutting stroke of the press—results in cutting the blanks from the sheets in a spiral path beginning at the lower edge of the cylinder formed by the sheets and progressing regularly to the upper side.

The shaft has four spokes, in the interval between which four sheets *x x x x* are clamped to form the hollow cylinder. The necessity for the spokes creates the necessity for the intervals *x'* between the sheets. (See Fig. 2.) In order to avoid the damage to the punch and die which would result from cutting a half-blank, as at the edge of a sheet, with a tendency thereby to spring the punch and cause it to cut the die on the opposite side and also to skip the said interval between the sheets, it is necessary to make provision in the mechanism for interrupting the action of the press at points corresponding to those intervals—that is, while the edges of the sheets and the intervals between them are carried past the die. Part of the mechanism to be hereinafter described is contrived for this purpose.

In order that the blanks may be cut staggering, it is necessary that besides the skips for avoiding the edges of the sheets and intervals between them there should be a half-step skip once in each complete rotation of the carrier, the step length being understood to be the dimension of the blank plus whatever interval is allowed between said blanks. Part of the mechanism, hereinafter described, is for the purpose of causing this half-step skip once in each rotation.

In order that the feeding of the sheets to the die may continue from the bottom to the top, or as nearly as may be, in view of the necessity of providing for clamping the sheets at the upper edge the refuse must be cut away, since otherwise it would collide with the shank of the press and stop the advance. Suitable provision is made in the hereinafter-described mechanism for thus disposing of the refuse and also for conducting away separately the blanks and the refuse. Mechanism is also provided for interrupting the action of the sheet-feeding appliances and also for interrupting independently the action of the press and also for interrupting both actions simultaneously, leaving only the fly-wheel and gears 53 and 54 running.

When the cutting on a set of sheets is advanced as near to the upper clamped edges as possible, the feeding action must be automatically interrupted, and suitable devices are provided for that purpose. It is then necessary to restore the carrier-wheel to its upper position for removing the stubs of the sheets and loading it again with a new set of blanks, and mechanism is provided for making this reverse or restoring movement quickly and easily.

The several mechanisms, whose general purpose is above indicated, will now be described in detail.

The gear 54 is mounted on a shaft 54ª, which extends parallel to the main power-shaft 51 below and at one side therefrom and at the forward side of the machine it carries a bevel-gear 25, which meshes with a bevel-gear 26 on the vertical shaft 27 28, which comprises two members, the lower member 28 being clutched to the upper part by means of clutch devices, hereinafter described, located between the two bearings 2 and 3 on the frame of the machine. At the lower end of the member 28 of this vertical shaft there is rigid with it a sprocket-wheel 29, which actuates a power-transmitting chain 30, extending about it and about a sprocket-wheel 31, having its shaft 32 journaled at the right-hand forward corner of the machine in a bracket 4, the wheel being at the lower end of the journal-bearing of the shaft, which at the upper end carries the primary or actuating element 33 of a mechanism for deriving from the continuous rotation of the shaft of the wheel 31 an intermittent or step-by-step rotation of an actuated part. This mechanism is of familiar construction, commonly known as the "Geneva movement." The primary element 33 of this movement is a disk on which there is mounted a driving-abutment—stud and roll—34 and a delay-abutment—the annular segment 35. The secondary element 36 of this movement is a star-wheel, which is alternately actuated and delayed by the abutments 34 and 35, respectively, in a manner well understood. This star-wheel is fast on the lower member 37 of a vertical shaft whose upper member 38 extends vertically through a long bearing 5 on the frame. The lower member 37 has rigid with it immediately above the star-wheel a pinion 39, and the upper member 38 has at the upper end of the long bearing 5 a long pinion 40, the length of which is the limit of vertical movement which the gear is designed to receive in carrying the sheets to be punched downward as the work progresses in a spiral path, as described, from the lower to the upper edge of the sheets. In a standard 10, which forms part of the rigid frame, there is journaled in a divided nut, as hereinafter described, the screw-shaft 56 and coaxial therewith on the frame-base a bearing-stud for a gear-wheel 41 equal in diameter and number of its teeth with the gear 55. The gear 41 meshes with the pinion 39 and the gear 55 with the pinion 40. The two mem-

bers 37 and 38 of the vertical shaft, whose said members carry, respectively, the pinions 39 and 40, are connected together for rotation as one by means adapted and designed to permit the upper part 38 to receive at intervals determined by the mechanism rotation independent of the lower member 37 for the purpose of giving to the wheel 55 the exceptional movement necessary for staggering the cuts of the punch on the sheets, as already indicated. The devices for clutching the two shaft members together consist of two arms or brackets 42 and 43, the former made fast to the member 37 and the latter to the member 38, one of said shaft members extending, however, into the hub of the arm or bracket, to which the other is made fast for keeping the shafts axially alined. The arm or bracket 42 has journaled at its end remote from the shaft 37 38 a short shaft 44, having at the lower end of its bearing in said arm or bracket a star-wheel 45 and at the upper end a gear 46. The latter meshes with a pinion 47 of half the diameter and having half the number of teeth of the gear 46. This pinion is journaled in the bracket 42 between the shafts 44 and 37. Rigid with the pinion 47 there is a disk 48, having in the periphery diametrically opposite notches 49 49 and having projecting from its upper face a crank-wrist 60. A dog 61, fulcrumed on the arm 42, has an abutment, preferably a stud and roll 61^a, adapted to engage the notches 49, a spring 62 being provided, tending to hold the dog with its abutment pressed on the periphery of the disk 48 ready for engaging said notches. The bracket 43 is substantially a lever-arm of the shaft member 38, having a slot 64, which is engaged by the crank-wrist 60.

It will be seen that when the dog 61 is engaged with either notch of the disk 48 the two brackets 42 and 43 are locked together, because neither can revolve relatively to the other without swinging the crank-wrist 60, and thereby rotating the intermeshed gears 46 and 47, and that the two shaft members 37 and 38 are thereby locked together and rotated as one, and the wheels 55 and 41 revolve in unison with step-by-step movement, so that the sheets are halted for each stroke of the press. It will be seen, furthermore, that the position of the crank-wrist 60 in the slot 64 at the point at which the dog is engaged with either of the notches 49 is such that the rotation of either of the brackets will necessarily swing the other about the axis of the shaft 37 38 and will have no tendency to rotate the disk for disengaging the dog, because the action by which either bracket transmits rotation to the other is substantially radial to the shaft of the pinion 47. The clutch is therefore substantially positive in its capacity for transmitting the movement of either of the shaft members 37 38 to the other.

The four sheets which are clamped in the carrying-wheel are spaced from each other a distance equal to a half-stop of the movement of the carrying-wheel. In order that an action of the die at the edge of the sheet cutting a partial blank and exposing the punch and die to the danger of shearing each other at the side where no cutting is being done, provision is made for jumping the interval between the sheets—that is, for intermitting a stroke of the press while the sheet edges and interval between them advance past the die. The width of each sheet is a full number of steps plus a half-step, so that if the first blank is cut as close as possible to one edge the last blank that is cut from the same sheet will be cut a half-step back from the edge, and the intermission of one stroke of the die—that is, while the wheel moves one step—will carry the half-step length of the interval between the sheets past the die and present the next sheet for the first action of the die in the same position as the first sheet was presented for the first stroke—that is, so that the first blank will be cut as close to the edge of the sheet as may safely be done. In order to cause this interruption of the action of the press for one step at each interval between the sheets, the press-trip rod 66, which, it may be understood, operates the device for tripping the press into action in the ordinary manner of such devices, the details of which (only partly shown) need not be described, is connected to the arm 67 of a bell-crank lever on the upper end of a vertical shaft 68, which is provided at its lower end with a lever-arm 69, which projects under the gear-wheel 41 and carries an abutment—stud and roll—70, bearing against the periphery of a cam-flange 71, which projects downward from the lower side of the gear 41 and constitutes in general a circular track for the abutment 79, but with four recesses 72, into which the abutment 70 retreats as said recesses successively reach the abutment. It will be understood that the usual spring-action of the press-trip device operates upon the trip-rod 66 and all its connections and holds the abutment 70 pressed against said cam-flange, ready to retreat into the recesses as they reach it, and that the cam-flange thus operates upon the press as the foot of the operator of an ordinary press acts upon the pedal, holding the trip in for causing the press to be operated, and that the arrival of each recess 72 at the abutment 70 acts like the lifting of the foot of the operator from the pedal of a press in ordinary situation and causes the interruption of the action of the press while the abutment is in the recess. The recess is only of sufficient extent to let the abutment in long enough to cause the

press to lose one stroke, and thus, the recesses corresponding in position to the intervals between the sheets, a stroke is skipped at each interval—that is, four times in each revolution of the wheel 41.

Returning to consideration of the means connecting the shaft members 37 and 38, it will be evident also that notwithstanding the positive character of this connection for the purpose of transmitting rotation from one of said shaft members to the other disconnection will be very easy by means of any power applied to rotate the gear 46. It will be seen also that upon the rotation of the gear 46 actuating the pinion 47 each revolution of the pinion 47 will oscillate the lever-arm or bracket 42 back and forth over the area encompassed by the path of the crank-wrist 60. The entire train of mechanism carried by the two bracket-arms 42 and 43, it will be understood, is revolved by and with the shaft 37 38 partaking of the step movement of that shaft which it derives through the Geneva movement described, and in the orbital movement of the shaft 44 and its bearing about the shaft the star-wheel 45 swings above the face of a large horizontal gear 41, which has its movement synchronous in all respects with the wheel 55, including the step movement, with the exception caused by the operation of the train of mechanism carried by the brackets 42 and 43, as will now be described. From the upper side of the wheel 41 it carries an upwardly-projecting abutment 73, which operates as a tooth for engaging the star-wheel 45. The number of teeth of the pinion 39 is an aliquot part of the number of teeth of the gear-wheel 41, so that the planetary movement of the star-wheel 45 about the shaft 38 brings it in the path of travel of the abutment 73 at uniformly-recurring intervals in the rotation of the gear 41, and the abutment 73 is located so as to encounter the star-wheel when the latter is in one of these positions. The planetary movement of the star-wheel about the wheel 35 being much more rapid than the travel of the abutment 73 with the wheel 41, the engagement of said abutment with the star-wheel at the one point in the rotation of the gear 41 at which such engagement will occur retards the planetary movement of the star-wheel at the side remote from the shaft 37 38—that is, at the side at which it is engaged by the abutment 73—and the planetary movement of the shaft of the wheel continuing the star-wheel is by such retardment at the outer side (considered with respect to the shaft 37) caused to rotate about its own axis in direction reverse to its planetary movement around the shaft 37. The abutment 73 meshes with the star-wheel 45 deeply enough to rotate that wheel through a distance corresponding to the interval between the star-points or teeth at each encounter of the wheel and abutment—that is to say, through one-fourth of a revolution of said star-wheel—thus giving to the spur-gear 46 a like quarter-revolution by which it imparts a half-revolution to the pinion 47, causing the crank-wrist 60 on the disk 48, rigid with the pinion engaged in the slot of the bracket or lever-arm 43, to swing the latter in one direction or the other and alternately in opposite directions. If at a given encounter the oscillation of the bracket 43 about the axis of the shaft 38 is in the same direction as the continuous rotary motion of that shaft, said bracket being fast thereon advances the pinion 40 in its rotary motion an amount corresponding to the angular movement of said oscillation, and at the next encounter the swing given the bracket, being in the opposite direction, retards the pinion an equal amount. The gear-wheel derives from the pinion a like alternate advancement and retardment once in each complete rotation of the gear-wheel 41, with which the rotation of said wheel 55 agrees except as to such alternate advancements and retardments.

In order to stagger the cutting of the blanks from the sheet as desired, the alternate half-step advancement and retardment of the blank-carrying wheel 55, above described, is caused to occur at the same time as one of the skips or interruptions in the press-strokes produced, as above described, by the recesses 72 in the cam-flange 71, the two actions being thus relatively timed by properly locating the abutment 73 relatively to one of the recesses 72. The parts should be so timed or set at the commencement of the action that the first encounter of the abutment 73 with the star-wheel in operating upon a set of sheets will cause the wheel 55 to be advanced a half-step, so that while the press stands at rest for one stroke the sheets are carried a step and a half instead of a single step, and thereby the first blank cut in the second circuit of the sheets instead of being made at the edge is made a half-step inward from the edge, and so is opposite the interval between the first and second cuttings of the first circuit. This will bring the last cut upon each sheet at the edge and the first cut upon each succeeding sheet throughout this circuit, similarly to the first sheet, a half-step inward from the edge. The next encounter of the abutment 73 by retarding the wheel 55 one half-step while the action of the press is intermitted a single stroke will cause the sheets to be advanced only a half-step—that is, just enough to pass the half-step interval between them—so that while the last cut on the second circuit will be made close to the edge of the sheet the first cut upon the third circuit will also be made close to the edge of the sheet, as was the case with the first cut of the first circuit. Thus

alternate circuits will commence close to the edge and alternate circuits a half-step from the edge throughout the entire operation from the bottom edge of the sheets to the highest point at which they can be cut in view of the necessity of clamping them at the upper edge in the wheel.

For clamping the sheets to the carrying-wheel there are provided four clamping-segmentt 80, each of which is connected to the hub of the wheel by a right-and-left threaded spoke-rod 81, secured at its opposite ends into the hub and into a stem 82 of the clamping-segment and provided with a hand-wheel 83 for operating it to clamp the sheets. In order to adjust the sheets with their lower edges in the proper spiral line for cutting the blanks in the spiral path necessary to permit the operation to be continuous, as desired, a stop is provided, consisting of a ring 84, which encompasses the standard in which the divided nut for engaging the screw-shaft is mounted, said ring having a stem 85, which is mounted for sliding vertically in a guide-box 86 on the side of said standard, the lower end being connected by a link 87 with one arm of the bell-crank lever 88, fulcrumed at its angle on the standard and operated on the other arm for raising and lowering the ring 84. Radial arms from the ring 84 extend to a ring 89, which is cut at one point so that it may be slightly distorted into a spiral of pitch corresponding to the spiral path of the cuts to be made in the sheets, the radial arms holding it rigidly in this spiral form.

The standard 10 terminates at the upper end in a flat top or flange 11, upon which there is mounted a guide and housing 12 for the divided nut 100 100 and the parts for operating it. In the lower side of this housing 12 is a circular opening which forms a seat for a circular disk 13, having two eccentric slots 14 14. Two radial slots 15 15 open from the upper side of the housing into the circular seat of the disk 13, and upon the top of the housing there are secured two parallel guides 15 15. The two members 100 100 of the divided nut are mounted upon the top of the housing between these parallel guides, and each member has projecting downwardly from it a stud 16, having a larger portion which fits the radial slots 15 and a smaller portion at the lower end for engaging the eccentric slots 14 of the disk 13. The housing 12 is cut away at one side, cutting off a segment of the circular seat or cavity for the disk 13, and a lever-arm 17 is secured to the disk, so as to protrude at this cut-away portion and adapting the disk to receive an angular movement from said radial arm. A handle 19 is attached to the end of this radial arm and extends downward through the spiral sheet-support, so that it may be reached below the sheets for opening and closing the nut.

The standard 10 is mounted upon a bracket member 20 of the main-frame casting, which overhangs the wheel 41, and to the lower side of this overhanging bracket there is secured axially in line with the bore or central opening of the standard 10, through which the screw-shaft 56 extends, a cylindrical pocket or guard for the screw-shaft, into which it extends while it is being screwed down toward the lower limit of its range of vertical adjustment. This pocket is closed at the bottom, so that it affords means for an air-cushion to check the descent of the screw-shaft when the divided nut is opened to allow the screw-shaft to drop. This cylindrical pocket or guard is utilized to secure the upper end of the stud 21, upon which the wheel 41 is mounted for rotation, a cap 22, screwed onto the lower end of the pocket, having a central aperture which receives the upper end of the stud, whose lower end is entered through the base-casting.

The clutch devices for connecting the two shaft elements 27 and 28 will now be described.

Upon the upper shaft element 27 there is mounted rigidly below the bearing 2 a collar 105, upon the upper side of which there is journaled transversely a rock-shaft 106, having at one end a lever-arm or dog 107 and at the other end a tripping-lever arm 108. Upon the upper end of the shaft 28 there is made fast a flange-collar 109, from the upper face of whose flange an abutment 110 projects upwardly in the path of the dog 107, the abutment 110 adapted to be encountered and engaged by the dog for causing the rotation of the upper member of the shaft 27 to drive the lower shaft member 28. Upon the side of the frame in a bracket 7 there is mounted for horizontal sliding a bracket 8, which comprises a horizontal annulus 9, encompassing the shaft member 28, and the hub of the flange-collar 109 being concentric with the flange thereof, the opening in the annulus being of such diameter as to admit the flange of the collar 109. At the inner side—that is, toward the frame—the annulus has a cam-upraise 111, which at elevated position of the bracket 8 is in the path of rotation of the end of the tripping-lever arm 108, so that when the bracket is elevated the tripping-lever encountering the cam-upraise and being lifted thereby causes the shaft 106 to be rocked to lift the dog 107 out of engagement with the abutment 110, thereby causing the shaft member 28 to be disconnected from the driving power and to come to rest with the abutment 110 of the collar 105 standing at the position at which the dog passes out of engagement with it and in position, therefore, at which it is guarded from engagement with the dog, because at each rotation thereafter of the upper shaft member 27, carrying the dog, the tripping-lever 108 encounters the

cam-upraise 111 in time to lift the dog 107, so as to clear the abutment 110.

For operating the bracket 8 to raise and lower it for the purpose described it is connected at its lower end by a link 113 to a horizontal plunger 114, which is mounted for horizontal sliding in a bracket 110, rigid with the frame, wherein around the stem of the plunger, which is reduced for that purpose, there is lodged a spring 115, operating to thrust the plunger forward—that is, toward the vertical line of the path of reciprocation of the bracket 8. A second link 116, connected to the plunger at the same pivot which connects the link 113, has a slot 117, running on a guide-stud 11 on the frame in line with the path of the pivot of the link 113 to the bracket 8. The length of the slot 117 is just sufficient to allow the two links 113 and 116 to be very nearly straightened—that is, brought into line with each other by the thrust of the plunger 114—so that when the links are in this position the weight of the bracket 8 and all parts operating upon it tending to press it is practically supported on the stud 111. The spring 115 is strong enough to force the plunger forward for lifting the bracket 8. A locking-pin 118 is mounted in the bracket 110 in position for engaging a notch 119 in the upper side of the plunger, and a bell-crank fitting 120 on a horizontal rock-shaft 121, mounted on the upper side of the bracket 110, has a horizontal arm connected by a collar 122 with the pin 118 for lifting the latter out of engagement with the notch in the plunger to release the plunger and permit the action of the spring 115 to thrust it upward for lifting the bracket 8, as described. The locking-pin 118 is kept normally pressed down ready to engage the notch by means of a spring 123, lodged in a pocket in the upper side of the bracket 110, operating by means of a plug-pin above it upon a tailpiece 124 of the bell-crank 120. For disconnecting the clutch it will be only necessary, it will be seen, to withdraw the locking-pin 118, so as to permit the spring 115 to operate. For this purpose a hand-lever 125 is pivoted on the frame and connected by a link 126 with the upstanding arm 127 of the bell-crank 120.

For retracting the plunger against the spring to depress the bracket 8 and cause the clutch device to connect the shaft members 27 28 there is provided a jointed link comprising two members 129 and 130, fitted together, the former being fitted directly to the stem of the plunger and the latter at the remote end to a lever-arm 131, mounted upon the forward end of a rock-shaft 132, which extends across the machine, having connection at the rear side for purposes hereinafter stated, but having at the forward end a lever-arm 133 for operating it. At the rear side of the machine the shaft 132 has a short lever-arm 135, which is connected by a link 136 to the arm 67 of the bell-crank 67–137 on the upper end of the vertical shaft 68, already described, so that the rocking of the shaft 132 in the proper direction operates the trip-rod 66 for tripping the press into action. The bell-crank 67–137 is mounted pin-fast on the shaft 68 directly above a lever-arm 138 on said shaft, and at the position at which the arm 138 stands when the abutment 70 rests on the cam-flange 71 and not in one of its recesses and the position at which the bell-crank arm 137 stands when the trip-rod 66 is thrust in direction for tripping the press into action the cylindrical bosses 140 and 141 at the ends of said arms 137 and 138, respectively, coincide, the former overhanging the latter, and at this position the two arms 137 138 are arranged to be pinned together, so that the bell-crank 67–137 will operate as rigid with the shaft 68. For pinning these two elements together and for disconnecting them at proper time and for purposes which will appear there is provided a link consisting of two members 142 and 143, connected by a turnbuckle 144 for adjusting the length, the upper end of the member 143 of said link being arranged to operate as a coupling-bolt for connecting the two lever-arms, each of the bosses 140 141 being chambered to receive the enlarged head 145 of this upper member of the link and the boss 141 being adapted to accommodate below the said head and around the stem of the link a spring 146, operating with a tendency to throw the link member upward for engagement of its head with the recess or socket 147 in the lower side of the boss 140. The rock-shaft 121, which is rigid with the bell-crank fitting 124, which actuates the locking-pin to release the plunger, extends across the machine to the rear side and is there provided with a lever-arm 148, which is connected with the lower link member 142. The direction in which the shaft 121 is rocked for withdrawing the locking-pin 118 causes the lever-arm 148 to be moved in direction for also withdrawing the coupling-head 145 of the link 142–143 from its socket in the end of the bell-crank arm 137, and the spring devices of the press-clutch mechanism operating through the trip-rod 66 being then free from restraint operate to throw the press out of action, swinging the bell-crank on the shaft 68 and rocking the shaft 132 in the same direction in which it will be rocked by the concurrent action of the spring 115 operating on the plunger for thrusting the latter in direction to lift the bracket 8 and disconnect the clutch which communicates rotary movement to the blank-carrying devices. Thus simultaneously both parts of the mechanism, the press, and the carrying devices will come to rest, and only the fly-wheel and gears 53 and 54 will remain in operation.

It will be observed that the rock-shaft 132 cannot be operated by the lever-arm 133 for tripping the press out of action while the lever-arms 137 and 138 of the shaft 68 are coupled together by the bolt-head of the link 143, because the arm 69 of the rock-shaft 68 is restrained by bearing against the cam track or flange 71 of the wheel 41. The press, however, can be thrown into action when the rest of the mechanism is at rest by operating the lever 133, the movement for that purpose having the effect to buckle the two-part link connection between the lever-arm 131 and the plunger.

In order that the mechanism may be tripped out of action automatically when the sheets have been cut away as close as possible to the wheel 55, there is provided from the lower side of that wheel an abutment 150, which when the wheel carrying the blanks has been lowered to cut as close to the wheel as possible encounters the upper end of the lever 151, fulcrumed on the frame and connected by a link 152 to the lever-arm 125, and by such encounter said last-mentioned lever is rocked for disengaging the locking-pin 118, with the result which follows the disengagement of that pin by whatever means caused, as already described.

I claim—

1. In a machine for the purpose indicated, in combination with a die-press, a carrier for the sheets to be punched comprising means for holding the sheets in the form of a hollow cylinder and for rotating such cylinder between the punch and the die with step-by-step movement.

2. In a machine for the purpose indicated, in combination with a die-press, a carrier for the sheets to be punched comprising means for holding the sheets sprung into cylindrical shape and for carrying them in corresponding cylindrical path between the punch and die, and means for moving them axially with respect to such cylindrical path.

3. In a machine for the purpose indicated, in combination with a die-press, a rotary carrier for the sheets to be punched comprising a gear-wheel; means for clamping the sheets thereto interiorly with respect to its gear-rim; means for rotating such carrier with step-by-step movement corresponding to the strokes of the press, and means for advancing the carrier axially a determined distance for each rotation.

4. In a machine for the purpose indicated, in combination with a die-press, a carrier for the sheets to be punched provided with means for holding the sheets sprung into cylindrical form; means for rotating the carrier to carry the sheets thus sprung in a corresponding cylindrical path between the punch and die; means for giving the carrier a determined axial movement in each rotation, and means for supplementing the regular step-by-step rotative movement of the carrier with one half-step movement in each revolution.

5. In a machine for the purpose indicated, in combination with a die-press, a carrier for the sheets to be punched provided with means for holding the sheets sprung into cylindrical form; means for rotating the carrier to carry the sheets thus sprung in a corresponding cylindrical path between the punch and die; means for giving the carrier a determined axial movement in each rotation, and means for supplementing the full step-by-step rotative movement of the carrier with one half-step movement in each revolution and for causing said half-step movement to be in opposite directions in the alternate revolutions of the carrier.

6. In a machine for the purpose indicated, in combination with a die-press, a carrier for the sheets to be punched provided with means for holding the sheets thereto sprung or bent into cylindrical form; means for rotating the carrier to carry the sheets in corresponding cylindrical path between the punch and the die; means for giving the carrier axial movement simultaneously with its rotative movement to cause the successive registrations of the sheet with the die to stand in a spiral path on the sheet, and means for giving the carrier one half-step independent of the full steps in each revolution.

7. In a machine for the purpose indicated, in combination with a die-press, means for carrying the sheets in an endless circuit between the punch and the die with step-by-step movements corresponding to the strokes of the press, and means for giving them one half-step independent of the full steps in each complete circuit.

8. In a machine for the purpose indicated, in combination with a die-press, means for carrying the sheets to be cut in a cylindrical path between the punch and the die with step-by-step movements corresponding to the strokes of the press, and means for independently giving the sheets one half-step in each complete circuit.

9. In a machine for the purpose indicated, in combination with a die-press, means for carrying the sheets to be punched in an endless circuit between the punch and the die; means for giving the sheets step-by-step movement in such circuit; means for causing the press to skip a stroke at the proximate edges of the successive sheets of the circuit, and means for moving the sheets in the circuit-path once in each full circuit a distance equal to a half-step independently of the full-step movements.

10. In a machine for the purpose indicated, in combination with a die-press, means for mounting and carrying the sheets to be punched with step-by-step movement corresponding to the strokes of the press in an

endless path encompassing the die and passing between the same and the punch; means for advancing the sheets edgewise transversely to such path a determined distance for each circuit, and means for cutting away and discharging the waste as the sheets move in such path.

11. In a machine for the purpose indicated, in combination with a die-press, means for mounting and carrying the sheets to be punched in an endless path encompassing the die and transverse to the direction of the stroke of the press; means for moving the sheets edgewise transverse to their path of movement around the die a determined distance for each complete circuit about the die; means for intermitting the stroke of the press at the edges of the sheets, and means for cutting away and discharging the waste.

12. In a machine for the purpose indicated, in combination with a die-press, a carrier in which the sheets to be punched are mounted in an endless circuit encompassing the die transverse to the stroke of the press; means for operating the carrier to carry the blanks in such die-encompassing path; means for causing the press to skip a stroke at the lines at which the edges of the sheets pass the die; means for giving the carrier a half-step movement once in each complete circuit and for reversing the direction of such half-step at alternate circuits.

13. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; an intermittent stop and drive mechanism for rotating the carrier and stopping it at the working stroke of the press; a clutch in the carrier-rotating train, and means for disengaging the clutch to interrupt the rotation at will.

14. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; mechanism for rotating the sheet-carrier with step-by-step movement corresponding to the strokes of the press; a clutch in the carrier-operating train adapted to be disengaged at a point corresponding to the rest interval in the step-by-step movement of the carrier; means for tripping the clutch, and means for operating the clutch-tripping devices at will.

15. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; mechanism for operating the sheet-carrier with step-by-step movement; means for giving the carrier axial movement; a clutch in the carrier-operating train adapted to be disengaged at a point corresponding to the rest intervals of the step movement of the carrier; means for tripping the clutch for disengagement; means for operating the tripping means, and an abutment on the carrier in position to encounter and actuate the operating means at the limit of a predetermined axial movement of the carrier.

16. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; a train for operating it with a step-by-step movement; a clutch in the train adapted to be disengaged at a point corresponding to the rest interval of the step movement of the carrier; spring-actuated means for tripping the clutch for disengagement; a catch for locking said means out of tripping position, and means for releasing the catch adapted to be operated at will.

17. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; a train by which it is rotated with step-by-step movement; means for giving the carrier axial movement during its step-by-step movement; a clutch in said train adapted to be disengaged at a point corresponding to the rest intervals of the step-by-step movement of the carrier; spring-actuated means for tripping the clutch for its disengagement; a catch for locking said spring-actuated means out of tripping position; means for releasing the catch; an abutment on the carrier in position to encounter and actuate said catch-releasing means after a predetermined axial and rotative movement of the carrier.

18. In a machine for the purpose indicated, in combination with a die-press, a rotative sheet-carrier; a train for giving it rotative movement; said train comprising a driving and a driven shaft and means for clutching them together for operating as one, said clutching means comprising a pivoted dog carried by the driving-shaft and provided with an operating lever-arm; a collar on the driven shaft having an abutment in the path of rotation of the dog; a cam mounted for adjustment longitudinally with respect to the shaft, said cam having an upraise which stands in the path of the lever-arm of the dog when the cam is adjusted longitudinally of the shaft toward the dog, and means for so adjusting the cam.

19. In a machine for the purpose indicated, in combination with a die-press, a rotative sheet-carrier; a train for giving it step-by-step rotative movement, said train comprising a driving and a driven shaft adapted to be coupled together for rotation as one; a clutch device for so coupling them comprising a pivoted dog provided with a lever-arm mounted upon the driving-shaft; a collar mounted on the driven shaft having an abutment adapted for driving engagement with the dog; a cam mounted for movement longitudinally with the shaft having an upraise in the path of the lever-arm of the dog for lifting the dog out of engagement with the abutment at a point corresponding to the rest intervals in the step-by-step movement of the carrier, and means for moving the cam longitudinally with respect to the shaft.

20. In a machine for the purpose indicated, in combination with a die-press, a ro-

tative sheet-carrier; a train for giving it step-by-step rotative movement comprising a driving and a driven shaft adapted to be coupled together for rotation as one; a clutch device for so coupling them comprising a dog carried by the driving-shaft, an abutment carried by the driven shaft and a cam mounted for movement parallel with the shafts having an upraise for disengaging the dog from the abutment; spring-actuated connections for operating the cam; a catch for engaging such connections for locking the cam out of dog-tripping position; spring-actuated means for tripping the press out of action; a cam-wheel rotating with the carrier and connections from the press-tripping devices coöperating with said cam-wheel for holding the press in action; releasably-connected elements in said connections; means for releasing them operated by the means for releasing the clutch-tripping cam connections to cause the press to be tripped out of action when the carrier-train clutch is tripped.

21. In a machine for the purpose indicated, a die-press; a rotative sheet-carrier; a train which gives said carrier step-by-step rotative movement; die-press-tripping devices; a cam rotated with the carrier; a lever having an abutment resting on the cam and connections therefrom to the press-tripping devices, said connections comprising two disengageably-connected parts and a locking device for connecting them; a clutch in the carrier-operating train; means for tripping the clutch for its disengagement to interrupt the movement of the carrier, and connections from said tripping means to the said locking device for operating the latter to disengage the parts which it connects to permit the press to be tripped out of action when the clutch in the carrier-driving train is tripped.

22. In a machine for the purpose indicated, in combination with a die-press, a gear by which the sheets are rotatively carried; a driving and a driven shaft and means connecting them for rotation together; a pinion on the driven shaft for actuating the sheet-carrying gear; an element actuated in an endless path by the driving-shaft; a device on said element which once in each rotation of the sheet-carrying wheel encounters the connections of the driven shaft for rotating the latter a distance corresponding to a half-step of the carrying-wheel independently of the direct actuation of said driven shaft by the driving-shaft.

23. In a machine for the purpose indicated, in combination with a die-press, a gear on which the sheets are mounted in circumferential succession for being rotatively carried; a press-tripping device which at normal position holds the press out of action; a cam-wheel and connections coöperating therewith extending to the press-trip devices for holding the latter out of normal position for permitting the press to act, said cam-wheel having recesses which permit the press-trip to resume normal position for interrupting the action of the press, said recesses being located at positions corresponding to the proximate edges of successive sheets on the carrying device, or the intervals between them, for interrupting the strokes of the press while said edges pass the die.

24. In a machine for the purpose indicated, in combination with a die-press having a tripping device normally in position for causing the press to be inactive, a carrier for the sheets to be punched on which the sheets are mounted successively in circular order, edge toward edge; operating connections for the trip devices and a cam-wheel rotating with the carrier and controlling said operating devices, the cam on said wheel having recesses for permitting the trip device to take normal position for interrupting the action of the press, located at positions corresponding to the proximate edges of the successive sheets or the intervals between them on the carrier, and means for giving said carrier step-by-step rotation, with rest intervals at the operative strokes of the press.

25. In a machine for the purpose indicated, in combination with a die-press, a gear by which the sheets are rotatively carried; a driving and a driven shaft and means connecting them for rotation together; a pinion on the driven shaft for actuating the sheet-carrying gear; a second gear coaxial with the sheet-carrying gear, and means by which the driving-shaft rotates said second gear; an abutment on said second gear which encounters the connections between the driving and driven shafts once in each rotation of said gear for rotating the driven shaft a distance corresponding to a half-step of the carrying-wheel independently of the direct actuation of the driven shaft by the driving-shaft, and means by which alternate encounters of said abutment actuate said driven shaft in opposite directions.

26. In a machine for the purpose indicated, in combination with a die-press, a gear by which the sheets are rotatively carried past the die; a driving and a driven shaft and means for connecting them for rotation together consisting of two lever-arms fast on the shafts respectively; a gear mounted on one of the arms having a crank-wrist rotated by it, the other arm having a slot engaged with the crank-wrist; a pinion on the driven shaft for actuating the sheet-carrying gear; a second gear on the lever-arm meshing with the first-mentioned gear thereon; an element actuated in an endless path by the driving-shaft; a device on said element which once in each rotation of the sheet-carrying wheel actuates said second gear through a sufficient angle to rotate the first gear one hundred and eighty degrees for oscillating the slotted lever-

arm alternately in opposite directions at alternate encounters of said device, the angular movement of the slotted arm and its shaft in such oscillation being the amount necessary to actuate the carrying-wheel one half-step.

27. In a machine for the purpose indicated, a die-press; a sheet-carrier; means for rotating it and means for giving it axial movement; a disengageable clutch in the carrier-operating train; means for operating the clutch for disengagement of the train from the carrier; and an abutment on the carrier in position to encounter and actuate the clutch-operating means at a predetermined limit in the axial movement of the carrier.

28. In a machine for the purpose indicated, a die-press; a sheet-carrier; a train for rotating it; a disengageable clutch in the train; spring-actuated means for tripping the clutch for disengagement; a catch for locking said tripping means out of tripping position, and means for releasing the catch.

29. In a machine for the purpose indicated, a die-press; a sheet-carrier; a train for rotating it and for giving it axial movement; a disengageable clutch in the train; spring-actuated means for tripping the clutch for its disengagement; a catch for locking said means out of tripping position; means for operating the catch for release, and an abutment on the rotating carrier which encounters said catch-operating means at a predetermined point in the axial and rotative movement of the carrier.

30. In a machine for the purpose indicated, a carrier for the sheets to be punched comprising a spoked gear within which they are mounted between the spokes; means for securing the sheets to the gear consisting of segmental clamps located between the spokes and means for advancing them radially from the axis toward the rim.

31. In a machine for the purpose indicated, a carrier for the sheets to be punched comprising means for holding the sheets in the form of a hollow cylinder consisting of a gear against the inner side of whose rim the sheets are clamped and a spiral gage mounted upon the shaft-bearing of such gear for adjusting the edge of the sheets in a spiral position.

32. In a machine for the purpose indicated, in combination with the sheet-carrier comprising a gear to which the sheets are clamped, an annular spiral gage for the edges of the sheets having a stem; a bearing for said stem mounted at the side of the shaft-bearing of the gear, and means for thrusting the stem through its bearing for forcing the gage against the edge of the sheets to adjust the latter.

33. In a machine for the purpose indicated, in combination with the die-press, a rotary carrier for the sheets to be punched provided with means for holding the sheets sprung into cylindrical form, such carrier comprising a gear within which the sheets are thus held; a long pinion for actuating the gear; a threaded shaft on which said gear is mounted; a sleeve in which said shaft telescopes, and a divided nut mounted at the end of the sleeve, and means for opening and closing the nut.

34. In a machine for the purpose indicated, in combination with the die-press, a carrier for the sheets to be punched comprising means for holding them in the form of a hollow cylinder and for rotating such cylinder between the punch and the die with a step-by-step movement; means for causing the press to skip a stroke at the edges of the sheets, consisting of a wheel rotated with the carrier having a flange, 71, provided with the recesses, 72, at intervals corresponding to the distance between the corresponding edges of consecutive sheets, a lever, 69, bearing on said flange and adapted to retreat into said recesses, and press-tripping devices connected with such lever.

35. In a machine for the purpose indicated, in combination with the die-press, a carrier for the sheets to be punched comprising means for holding the sheets sprung into cylindrical shape and for carrying them in a corresponding cylindrical path between the punch and die; means for moving them axially with respect to such path consisting of a threaded shaft for the carrier, a sleeve in which such shaft telescopes, a nut mounted on the sleeve and a long pinion actuating the gear.

36. In a machine for the purpose indicated, in combination with the die-press, means for carrying the sheets to be cut in a cylindrical path between the punch and the die with step-by-step movements corresponding to the strokes of the press; means for independently giving the sheets an additional movement periodically in their cylindrical travel consisting of the combination with the divided shaft, 37 38, for communicating rotary movement to the carrier, of means for connecting the two parts of such shaft consisting of a gear-train mounted on the driving member of said shaft for rotation therewith about its axis, the initial wheel of such train being a star-wheel and the final wheel having an eccentric abutment or crank; an element mounted on the driven member of said shaft engaged by said abutment; a wheel rotating with the carrier, and an abutment thereon mounted at position corresponding to the point in the rotation of the latter at which such periodic additional movement is to be caused, said abutment engaging the star-wheel.

37. In a machine for the purpose indicated, in combination with the die-press and means for carrying the sheets to be cut in a cylindrical path between the punch and the

die with step-by-step movement corresponding to the strokes of the press, means for independently giving the sheets one half-step movement in each complete circuit, alternately in opposite directions, consisting of the combination with the divided shaft, 37 38, which communicates rotary motion to the carrier, of means for connecting the two members comprising a bracket on one of them and a gear-train mounted on such bracket, the first wheel of the gear-train being a star-wheel and the final wheel having a crank-wrist; a slotted arm on the other member with which the crank-wrist engages and a wheel rotating with the carrier having an abutment which engages the star-wheel.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Hastings, Michigan, this 5th day of May, 1906.

EMIL TYDEN.

In presence of—
A. C. BROWN,
GEO. MENHENNICK.