No. 755,435. PATENTED MAR. 22, 1904.

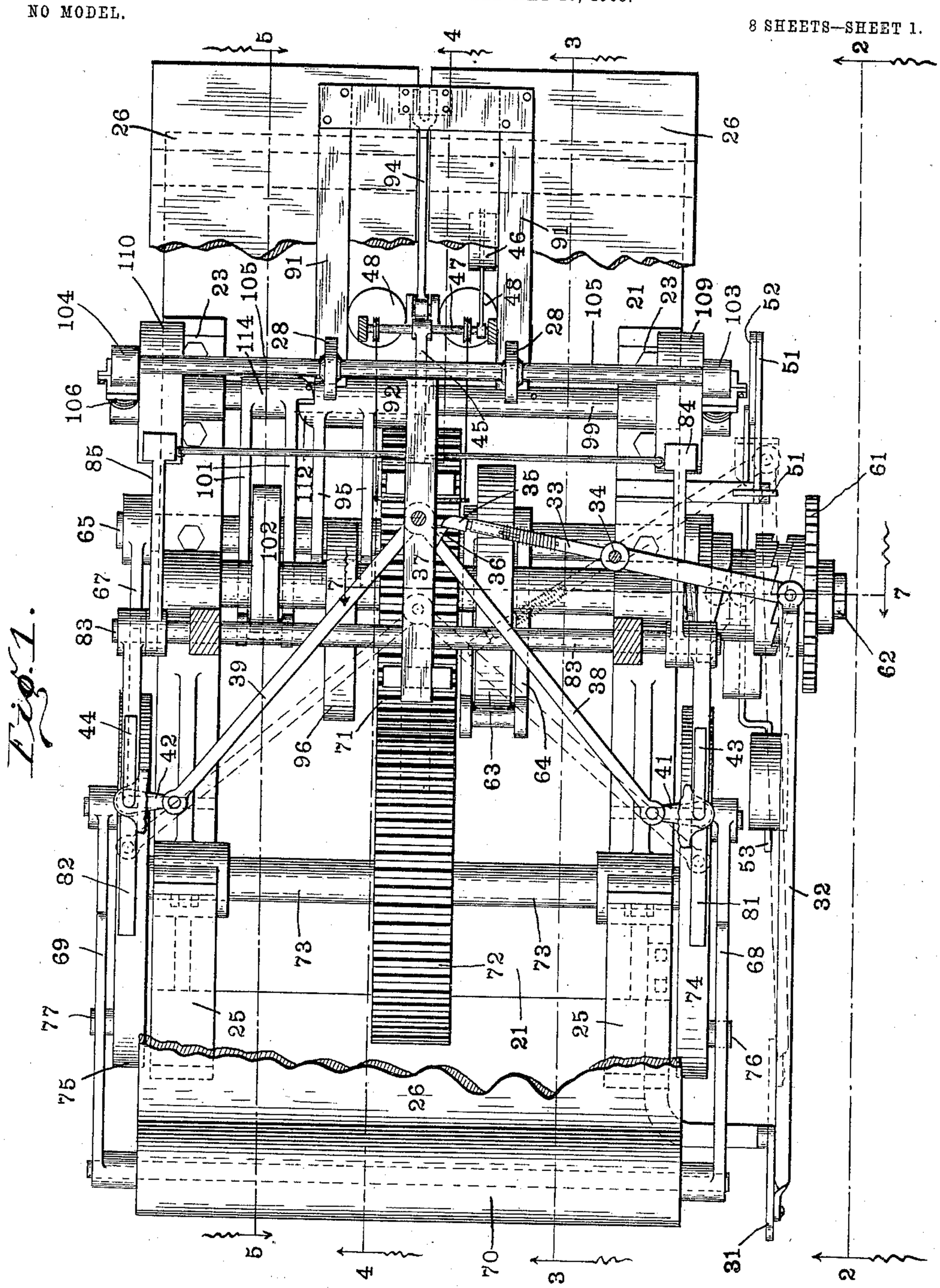
C. W. BENNETT.

SHEET FOLDING MACHINE.

APPLICATION FILED MAY 16, 1903.

NO MODEL. 8 SHEETS—SHEET 1.

Fig. 1.



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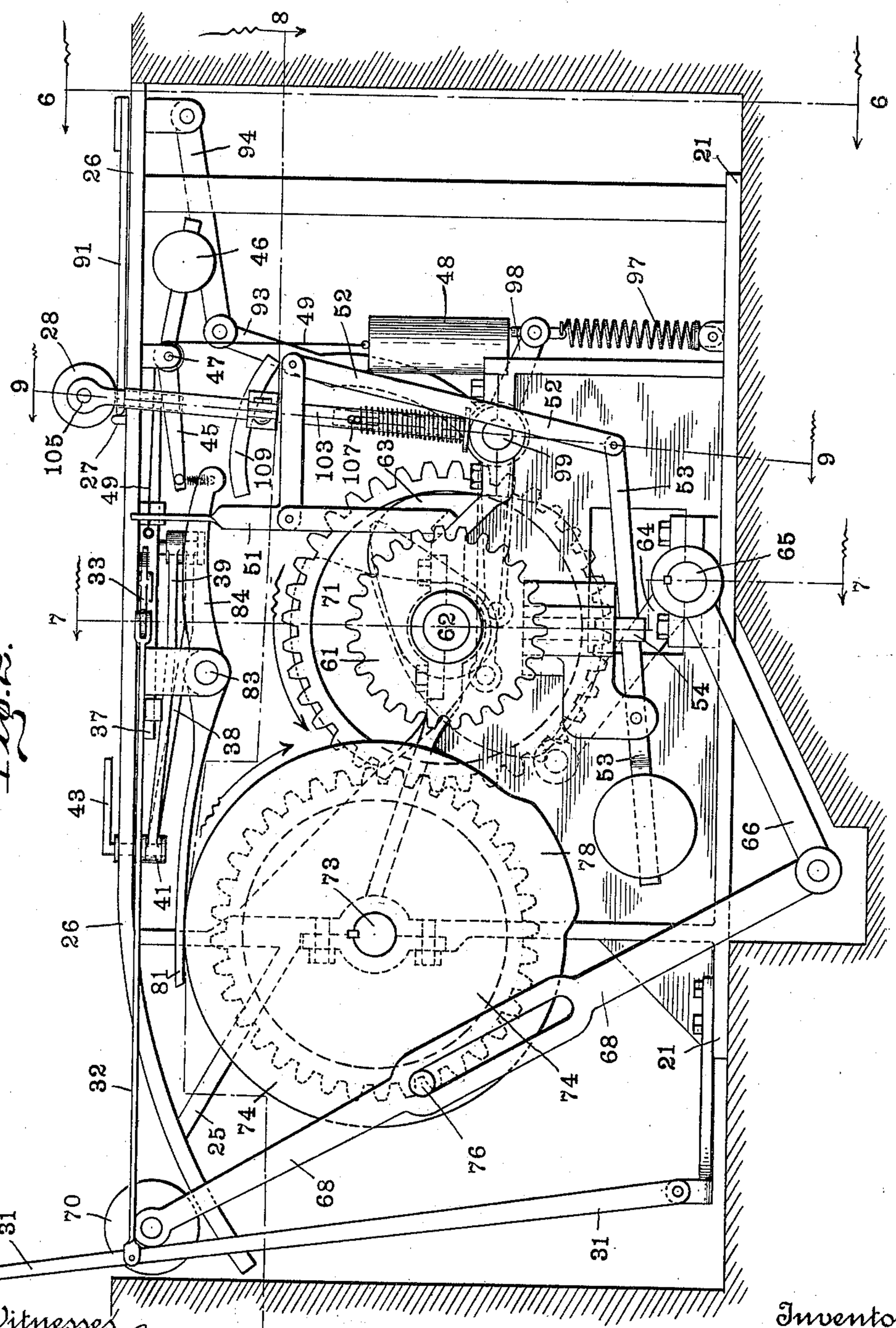
NO MODEL. 8 SHEETS—SHEET 2.

Fig. 2.



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NO MODEL. 8 SHEETS—SHEET 3.

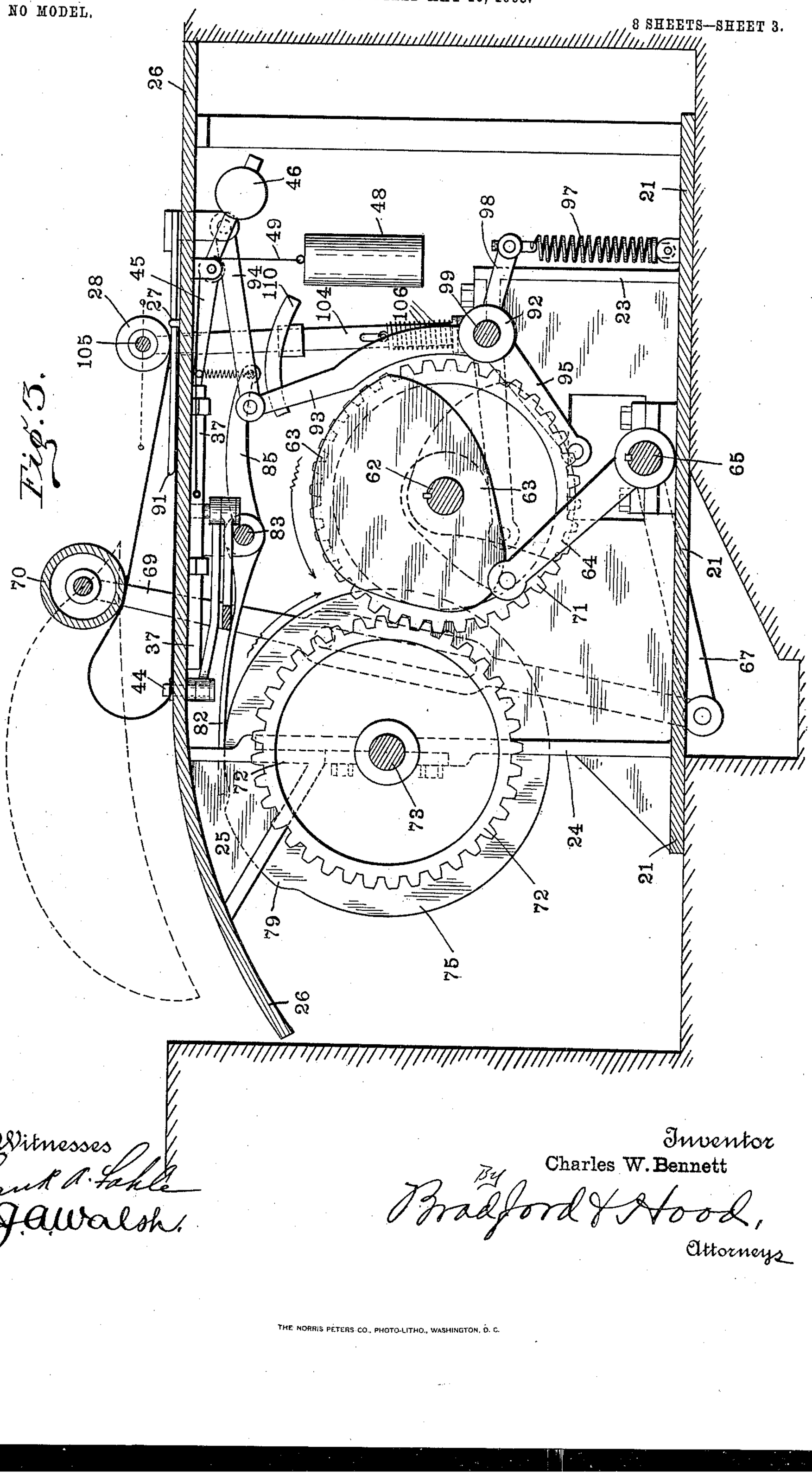

Fig. 3.

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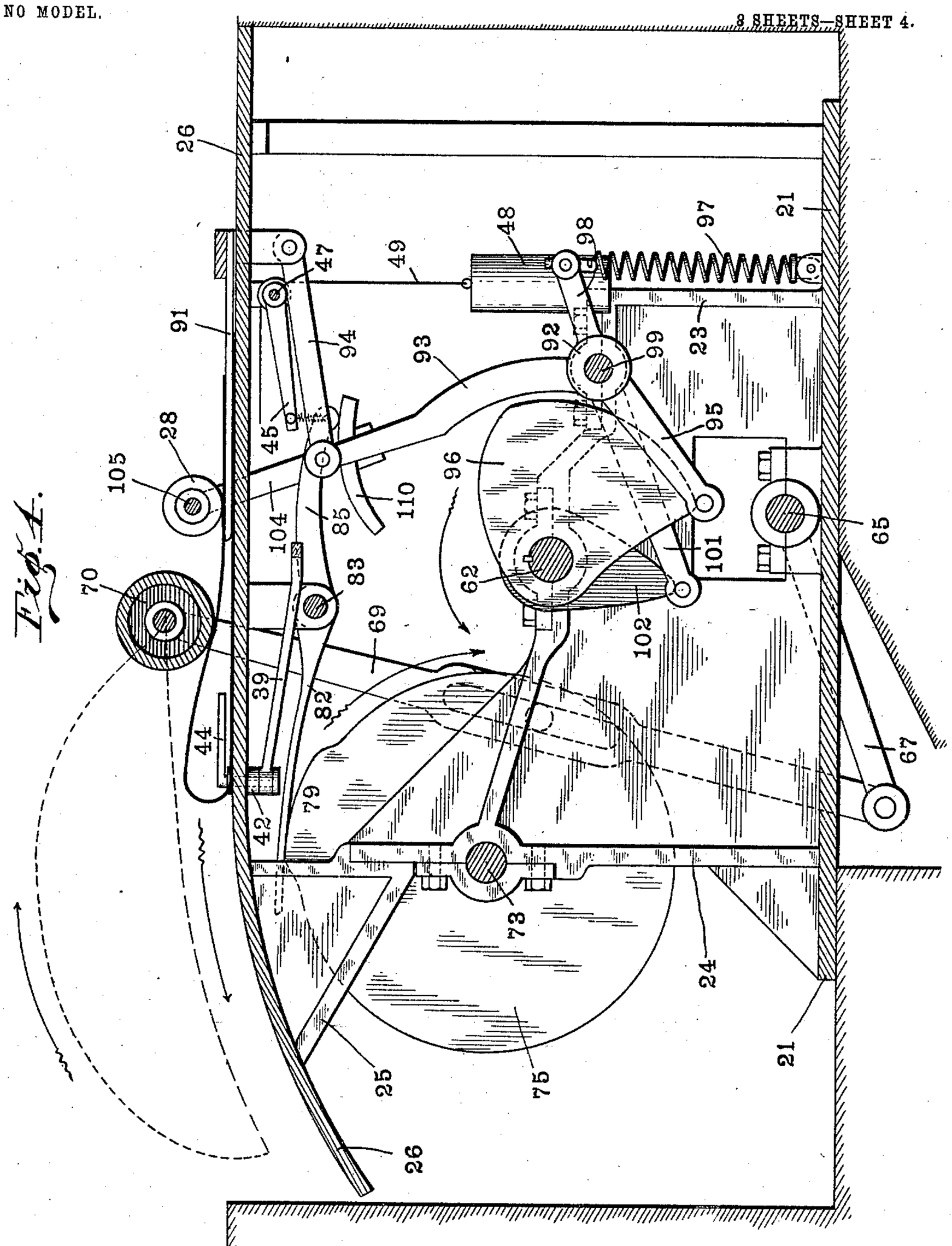
NO MODEL. 3 SHEETS—SHEET 4.

Fig. 4.



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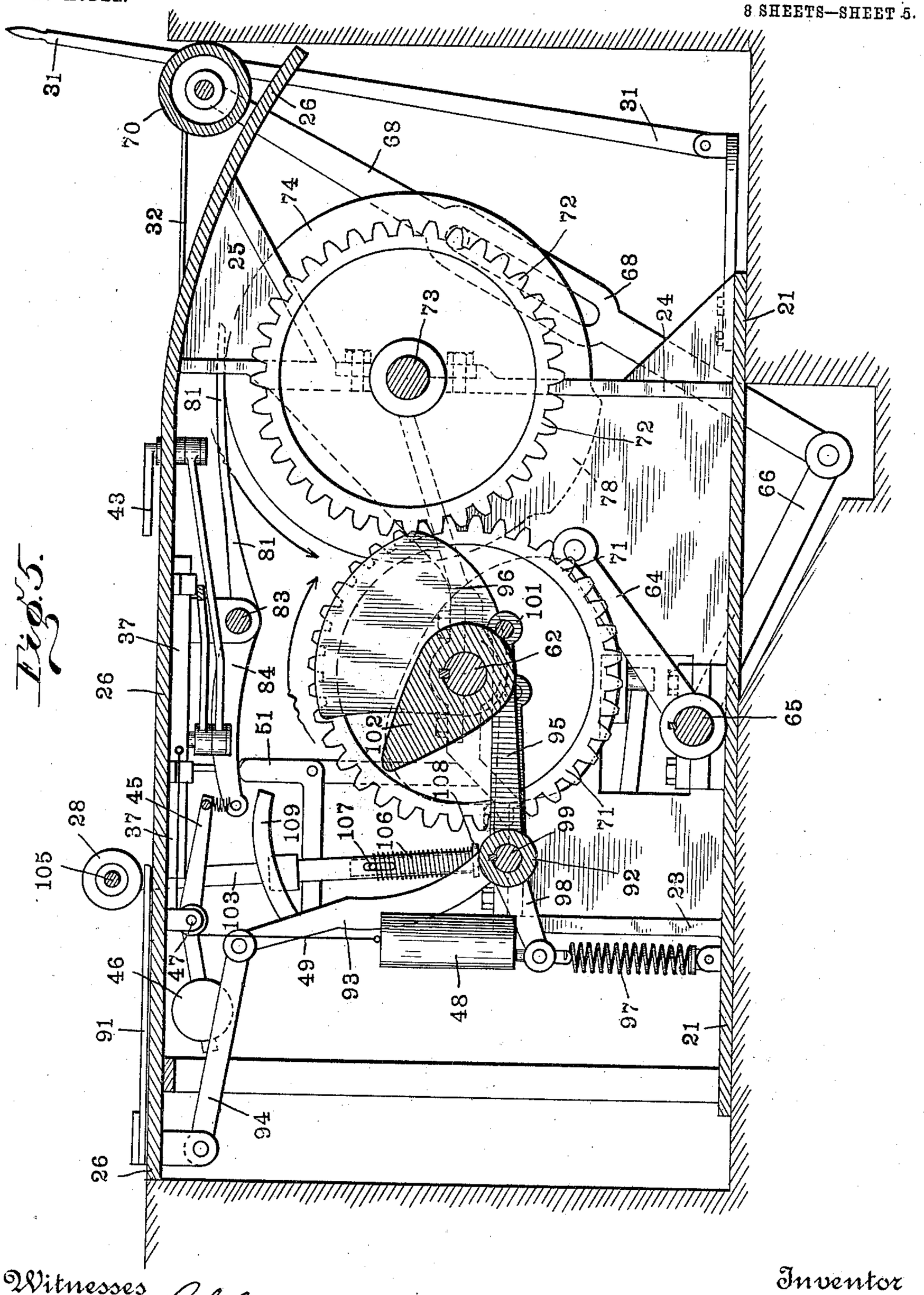
NO MODEL. 8 SHEETS—SHEET 5.

Fig. 5.



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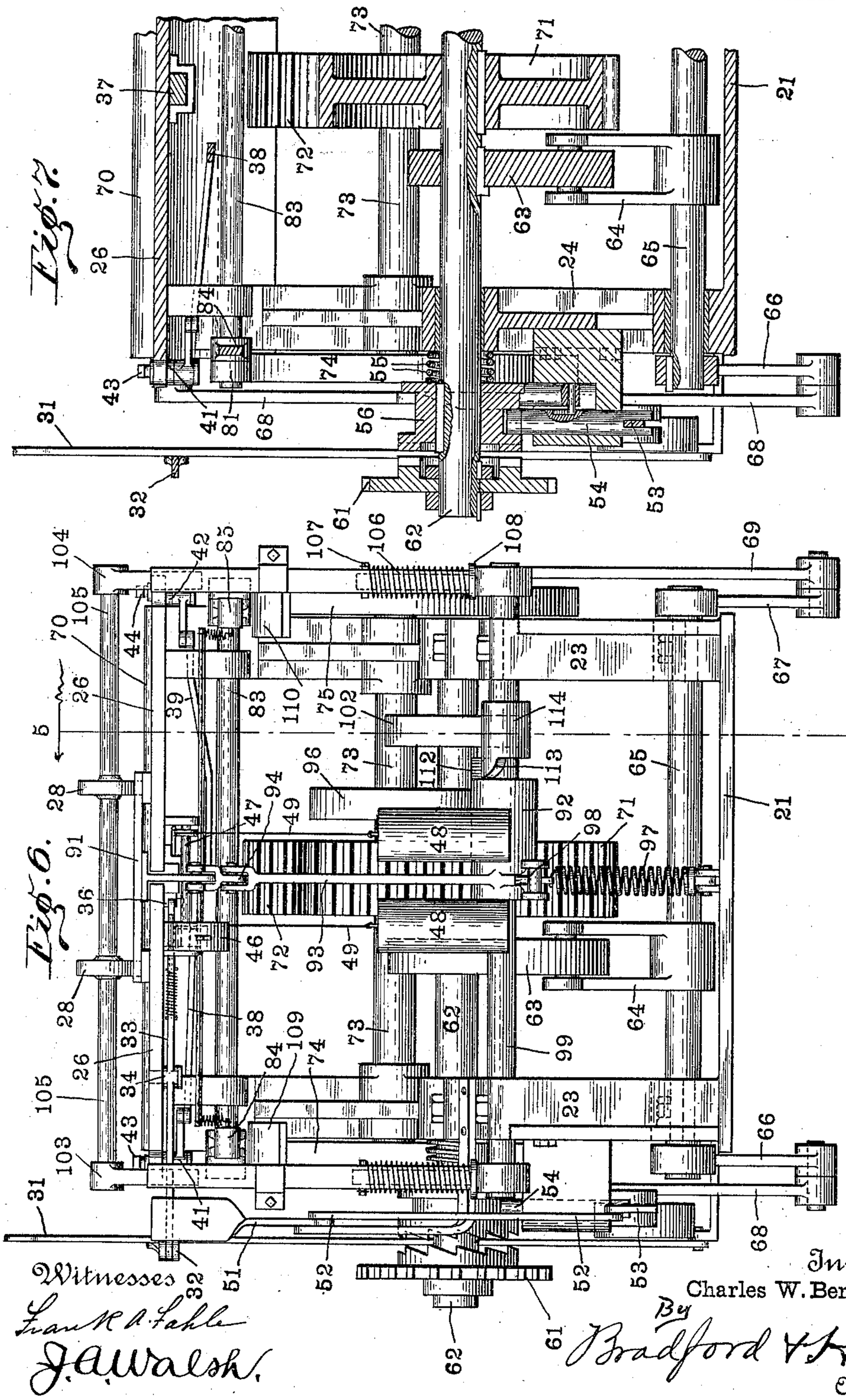
APPLICATION FILED MAY 16, 1903.

NO MODEL. 8 SHEETS—SHEET 6.

Fig. 5.



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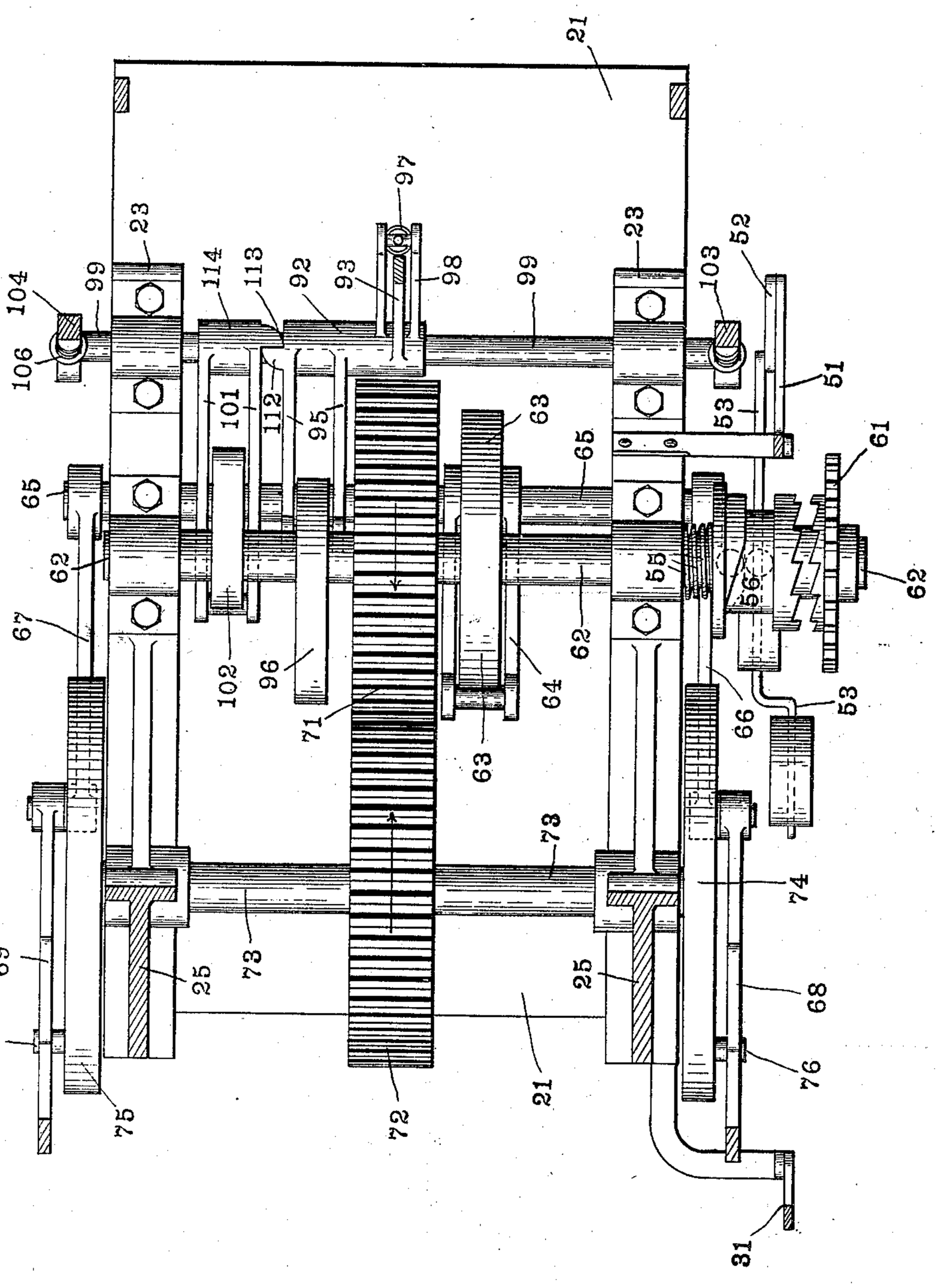
NO MODEL. 8 SHEETS—SHEET 7.

Fig. 8.



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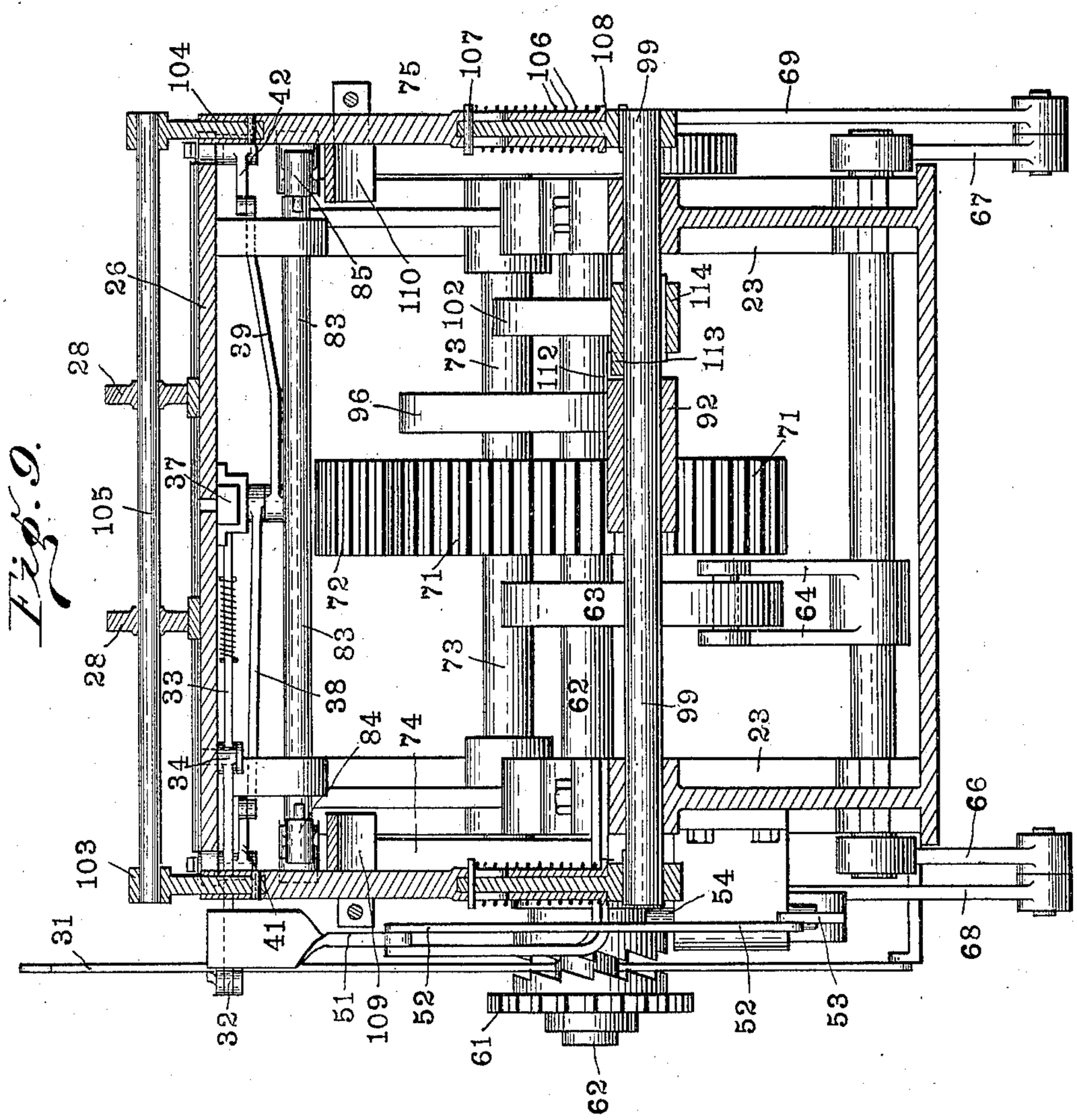
NO MODEL. 8 SHEETS—SHEET 8.

Fig. 9.



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No. 755,435. Patented March 22, 1904.

UNITED STATES PATENT OFFICE.

CHARLES W. BENNETT, OF ELWOOD, INDIANA, ASSIGNOR TO AMERICAN SHEET AND TIN PLATE COMPANY, OF PITTSBURG, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

SHEET-FOLDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 755,435, dated March 22, 1904.

Application filed May 16, 1903. Serial No. 157,367. (No model.)

To all whom it may concern:

Be it known that I, CHARLES W. BENNETT, a citizen of the United States, residing at Elwood, in the county of Madison and State of Indiana, have invented certain new and useful Improvements in Sheet-Folding Machines, of which the following is a specification.

In the manufacture of tin-plate the sheets during the rolling process are doubled from time to time before the rolling operation is finally completed, thus producing what are known as "packs," which generally contain eight sheets or thicknesses when finally finished. Heretofore this doubling operation has generally been performed principally by manual labor, the only machine heretofore used being a squeezing-press for forcing the sheets closely together at the line of bend.

It is the object of my invention to provide means for performing this work mechanically; and it consists in a machine for the purpose wherein cam-operated swinging arms carrying suitable contact members perform the folding operation, as will be hereinafter more particularly described and claimed.

Referring to the accompanying drawings, which are made a part hereof, and on which similar reference characters indicate similar parts, Figure 1 is a top or plan view of a machine embodying my invention, the greater portion of the top plate or table thereof being broken away to show the mechanism which is arranged beneath; Fig. 2, a side elevation on the side indicated by the dotted line 2 2 below Fig. 1; and Figs. 3, 4, and 5, longitudinal vertical sections of the same as seen when looking in the directions indicated by the arrows from the dotted lines 3 3, 4 4, and 5 5, respectively, in Fig. 1; Fig. 6, an end elevation of said machine as seen when looking in the direction indicated by the arrows from the dotted line 6 6 in Fig. 2; Fig. 7, a partial transverse vertical sectional view as seen when looking in the direction indicated by the arrows from the dotted line 7 7 in Fig. 2; Fig. 8, a horizontal vertical sectional view as seen when looking in the direction indicated by the arrows from the dotted lines 8 8 in Fig. 2, and Fig. 9 a vertical section on line 9 9 in Fig. 2.

The frame of this machine (in the construction shown) consists of a base-plate 21, various upright members 23, 24, and 25, and a table or platform 26. These may be of such dimensions and in such arrangement as are suitable for the purpose and support or contain the bearings for the various shafts and pivots. The forward end of the platform or table 26 is curved downwardly to conform to the travel of the folding-roller, as will be hereinafter more fully described.

The main or driving shaft 62 is mounted in suitable bearings in the framework and is intermittingly driven through a suitable clutch thereon from any convenient source of power. (Not shown.) I have shown a sprocket-wheel 61 (mounted to revolve loosely on the shaft 62 and embodying one clutch member) as the immediate means of driving this shaft, and this in turn is ordinarily to be driven through the medium of a link belt from a line-shaft, counter-shaft, or other power-shaft of the mill. The throwing into and out of engagement of this clutch is performed in connection with another operation of the machine, as will be presently described.

The "at-rest" position of the various parts is shown in all the figures of drawings except Figs. 3 and 4. The extreme operated position of said parts, when the folding-roll and holding-rollers are nearest to each other, is shown in Fig. 4. Another position, just after the holding-rollers have started into operation, is shown in Fig. 3. The dotted lines passing through the axes of the rolls, Fig. 3, indicate the path of movement. By these it will be seen that the folding-roll in the position illustrated in this figure has nearly reached the limit of its movement preparatory to starting back, while the holding-rollers have moved forward only a short distance. Assuming now that the machine is ready for operation, with its parts in the relative positions shown in Figs. 1 and 2, a sheet of metal

is thrown onto the platform or table 26, with one end resting against the stop-pins 27 therein, which are located just in advance of but slightly aside from the holding-rollers 28. The operator then by suitable means, as the hand-lever 31 and link 32, throws the lever 33, which is pivoted at 34, around to the position indicated by the dotted lines in Fig. 1. This lever 33 has a latch-like point 35, which engages with a projection 36 on the reciprocating bar 37 and forces the same, together with the links 38 and 39, which are pivoted thereto, forward into the positions indicated by the dotted lines in Fig. 1, at the same time swinging the bell-crank levers 41 and 42, to which said links are connected at the other end, around as indicated and bringing the fold-point-determining arms 43 and 44 around at right angles with their normal position and extending in (toward each other) across the sheet of metal which has been placed upon the table. The latch 45, operated by the weight 46 on an arm beyond the pivot 47, on which it is mounted, passes up behind the slide 37, holding it (for the time being) to this operated position. The lever 33 continuing in its movement comes in contact with the upper end of the vertical member of the bell-crank lever 51, which through the link 52 operates the lever 53, which in turn withdraws the clutch-pin 54, (see especially Fig. 6,) permitting the spring 55 to throw the clutch member 56 into engagement with the clutch face or member on the sprocket-wheel 61, and thus starting the machine into operation. As the main shaft 62 revolves the cam 63 thereon operates upon the arm 64, which is shown as a double arm, (see especially Figs. 5 and 6,) and rocks the shaft 65, which in turn, through the arms 66 and 67, raises the carrying-bars 68 and 69, in the upper ends of which the folding-roll 70 is mounted. At the same time the shaft 62, through the gear-wheels 71 and 72, drives the shaft 73, upon which are mounted the combined cam and crank wheels 74 and 75, in which are the wrist-pins 76 and 77, with which suitable slots in the roll-carrying-bars 68 and 69 engage, by means of which said roll-carrying bars and the folding-roll carried thereby are driven backwardly toward the opposite end of the machine, as will be readily understood. By the combined motion thus imparted to the folding-roll 70 it describes the movement indicated by the upper dotted line in Fig. 3, folding the hot metal sheet over and bringing its free end down onto the frame 91, which by this time has begun to move forward, as will be presently described. At about this time after the frame 91 and the roll 28 have moved forward sufficiently to receive and grip the sheet end the cam projections 78 and 79 on the wheels 74 and 75 come into contact with the ends of the levers 81 and 82, which are mounted on a rock-shaft 83, carried in suitable hangers on the under side of the table 26, rocking said shaft and operating the arms 84 and 85, which extend forward therefrom and through suitable connections, pulling down the latch-lever 45, releasing the bar 37, and permitting it to be retracted to its initial position, which is done by means of weights 48, which are connected thereto by means of cords 49. This swings the arms 43 and 44 back into their original position parallel with the table sides and off from the sheet being folded, which by this time, with the exception of the closing down of the fold, has reached and is being held in its final position so far as this machine is concerned.

The frame 91, heretofore referred to, is designed to coöperate with the holding-rollers 28 to hold the sheet into proper position while the folding-roll 70 is doing its work. This frame (see especially Fig. 1) is preferably U-shaped in form, and its two longitudinal members are arranged, respectively, under the two holding-rollers 28, so that in operation the sheet is gripped between said members and said rollers. Said frame when the machine starts into operation is thrust forward so that its longitudinal members pass above the end of the sheet which has been placed upon the table against the pins 27, and after the other end of the sheet has been folded over onto said longitudinal frame members the holding-rollers pass onto said sheet end, and the frame and rollers thereafter coöperate in the holding work. The frame is operated by an arm 93 through a link 94, which arm rises from a sleeve 92, carried upon the shaft 99, which sleeve also has an arm 95, extending out alongside the cam 96 on the main shaft 62, whereby it and the sleeve and arm 93 are operated in one direction, thus driving the frame 91 forward. The sleeve 92 and its arms are retracted (after the cam passes) by means of the tension-spring 97, connected to the arm 98 on said sleeve, as shown. The cam 96 is so formed as to cause the movement of the frame 91 immediately after the machine starts into operation.

The shaft 99 besides serving as a pivot for the sleeve 92 also carries the arm 101 mounted thereon, and this arm extends out alongside and is operated by the cam 102 on the main shaft 62. Upon the ends of the shaft 99 are the arms 103 and 104, which carry the shaft 105, on which the rollers 28 are mounted. The cam 102 is so formed as to permit the rollers 28 to remain substantially at rest until after the machine has so far progressed in its movement as that the folding-roller 70 has reached nearly the end of its first movement and is nearly ready to start on its return movement. The cam then forces the rollers 28 out quickly to the limit of their movement, so that they are positioned in connection with the frame 91 to grip and hold the sheet while the folding operation is finished. It is at about this time that the cam projections 78 and 79

operate the levers composed of the parts 81 84, 82 85, and said levers, through the segmental projections on the arms 103 and 104, force said arms downwardly and cause the holding-rollers 28 to bear heavily, and thus firmly grip the sheet.

The arms 103 and 104 are telescopically constructed and are held yieldingly inward toward the shaft 99 by the springs 106. Said springs are interposed between pins 107 (mounted in the inner telescopic members) and collars 108, (mounted on the outer telescopic members,) as is most clearly shown in detail in Fig. 9. This permits the rollers to remain at all times in contact with the sheets being held thereby, notwithstanding the varying distances from the axis of the shaft 99 to the various points on the surfaces of such sheets which the rollers reach during their movement. Upon the upper members of the arms 103 and 104, however, are segmental flanges 109 and 110, over which the ends of the arms 84 and 85 extend. When the machine has reached the point where the final folding operation is to take place, when the folding-roller 70 is about to pass back over the fold in the sheet and tightly compress the two sides together the cams 78 and 79 on the crank-wheels 74 and 75 come in contact with the levers 81 and 82, forcing the arms 84 and 85 down onto these segments 109 and 110, and consequently bringing the rollers 28 down forcibly onto the sheet being operated upon and there holding them until the folding operation is completed. The levers 81 and 82 are in themselves in the form of heavy strong flat springs and will yield the slight amount necessary to prevent breakage or undue strain upon the machinery.

It will be observed that each of the arms 64 and 95 and 101, which are operated upon by the cams 63, 96, and 102, respectively, are double arms between the two members of which the cams can swing and that the heads of said arms, with which the cams come in contact, are in the form of cross-bars. This insures that the force shall be equally distributed and avoids twisting strains on said arms.

The operation of the spring 97 in retracting the sleeve 92 and parts carried thereby has already been described. As is best shown in Fig. 8, said sleeve 92 has a projection 112, which is adapted (when it reaches the proper point) to come in contact with a corresponding projection 113 on the hub 114 of the arm 101. The result is that when the cam 102 passes around and ceases to exert its force on the arm 101 said arm, as well as the shaft 99, and the arms 103 and 104, carrying the shaft 105 and rollers 28, are also retracted by the force of the spring 97, which insures that all of said parts shall be held in their retracted or initial position until forcibly driven forward at the appropriate time during the operation of the machine.

Having thus fully described my said invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination, in a sheet-folding machine, of a sheet-receiving table, a sheet-gripping frame and rollers arranged above the table, a sheet-folding roll arranged to travel over said table, fold-line-determining devices arranged intermediate the ends of the path of the sheet-folding roll, and mechanism for operating said several devices, whereby the sheet is held to position, folded over at the predetermined line, and flattened down at the folded line.

2. The combination, in a sheet-folding machine, of a main shaft bearing a series of cams, arms carried by suitable pivots or rock-shafts extending into the paths of said cams, a sliding frame, connections between one of said arms and said sliding frame, sheet-holding rollers, connections between said sheet-holding rollers and another of said arms, a sheet-folding roll, and connections between said sheet-folding roll and another of said arms.

3. The combination, in a sheet-folding machine, of a suitable table for receiving the sheets, arms arranged at the sides of said table and adapted to be swung over said sheet temporarily during the earlier portion of the folding operation and to be swung back to initial position during the latter part of the folding operation, and a folding-roller adapted to first swing one end of the sheet up and over said arms and then on its return movement to complete the fold by pressing the folded portions closely together.

4. The combination, in a sheet-folding machine, of a suitable table therefor, stop-pins placed in said table against which the sheets are to be placed for folding, a sliding frame adapted to be thrust out over the end of the sheet as the machine begins its operation, fold-line-determining arms adapted to be swung in across the sheet at a point substantially midway thereof, a folding-roller adapted to raise the free end of the sheet and fold the same over onto the said frame, holding-rollers adapted to be brought forward and clamp the folded end of the sheet onto said frame and there hold it while the folding is completed, means for withdrawing the fold-line-determining arms from across the sheet, and means for driving the folding-roller back over the folded line of the sheet and compressing the sheet at said fold-line closely together.

5. The combination, in a sheet-folding machine, with the table thereof, of fold-line-determining arms mounted in vertical bearings at the sides of said table, arms extending horizontally below the table from the shafts of the fold-line-determining arms, links extending from said arms inwardly and diagonally to a common point of union, means for moving the structure to which said links are united and thus swinging the fold-line-determining arms simultaneously on their pivot-shafts, a latch

for holding said structure to its moved position until released, means for retracting said structure and throwing the fold-line-determining arms back into initial position, and means for disengaging said latch when the first folding operation is accomplished.

6. The combination, in a sheet-folding machine, of a main shaft, a driving-clutch mounted on said shaft whereby the shaft will be driven when said clutch is thrown into engagement, fold-line-determining arms mounted at the sides of the table of the machine, a lever whereby said arms may be swung across the sheet, connections by which the clutch may be operated and the machine set in motion, and a lever by which first the fold-line-determining arms are operated and then the clutch-operating connections shifted, whereby the sheet is first secured to be properly folded and then the mechanism for performing the folding set in motion at the proper relative times.

7. The combination, in a sheet-folding machine, of a suitable table, horizontally-positioned fold-line-determining arms located at the sides of said table on vertical pivot-shafts, and means for swinging said shafts axially, whereby the fold-line-determining arms are swung transversly of the table across the sheet being folded and then swung back to their initial position parallel with the sides of the table after the folding has been done.

8. The combination, in a sheet-folding machine, of a reciprocally-moving holding-frame, reciprocally-moving holding-rollers arranged to coöperate with said frame, telescopically-yielding arms carrying the latter and provided with segmental wings, levers arranged alongside said wings, and cams adapted to operate said levers when said rollers arrive at the final holding-point and thus cause said rollers to forcibly grip the sheets during the final holding operation.

In witness whereof I have hereunto set my hand and seal, at Indianapolis, Indiana, this 8th day of May, A. D. 1903.

CHARLES W. BENNETT. [L. S.]

Witnesses:

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JAMES A. WALSH.