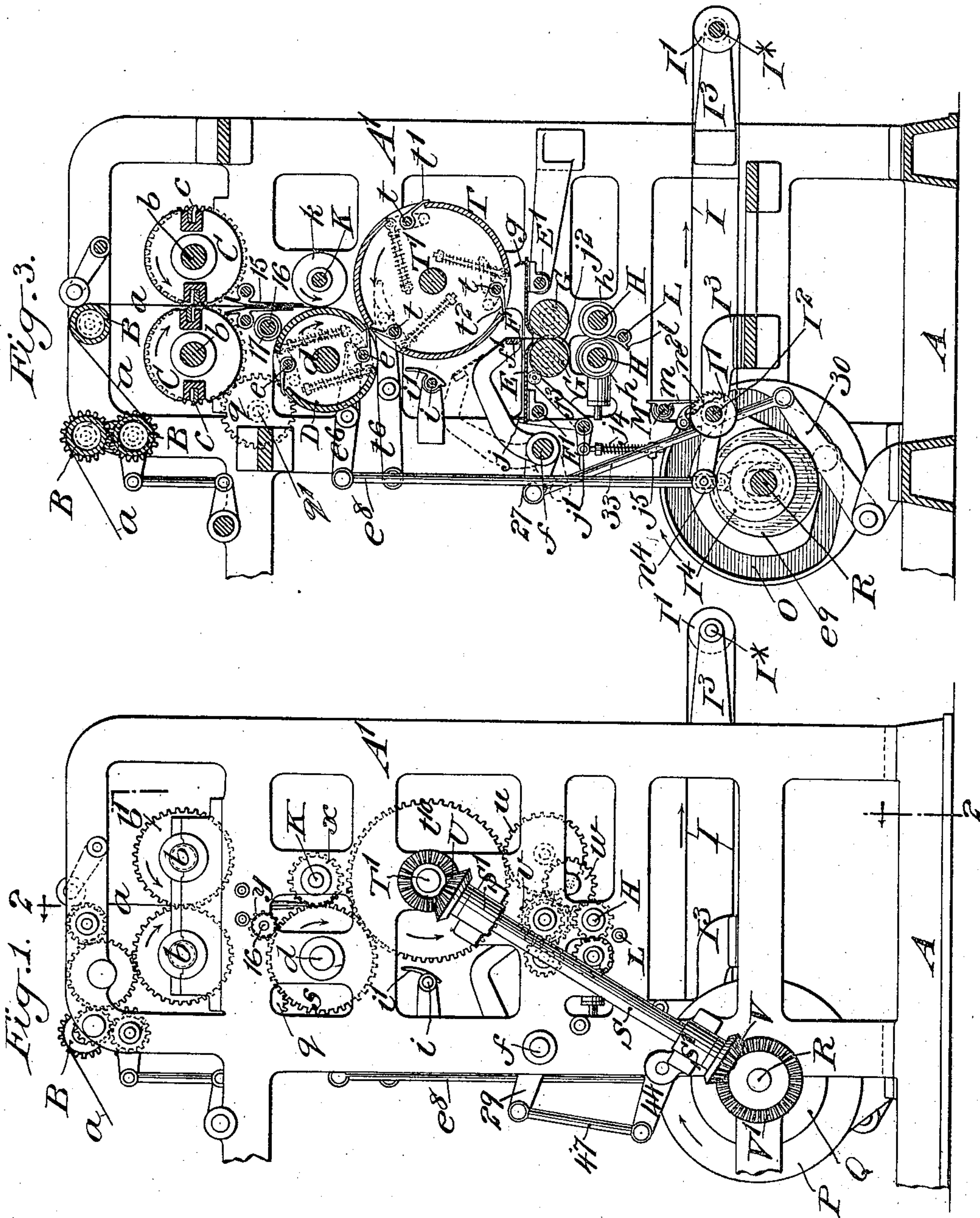


E. H. COTTRELL.  
MACHINERY FOR CUTTING AND FOLDING PAPER, &c.

APPLICATION FILED DEC. 18, 1902.

NO MODEL.

4 SHEETS—SHEET 1.



Witnesses:  
George Barry Jr.  
Henry Thorne

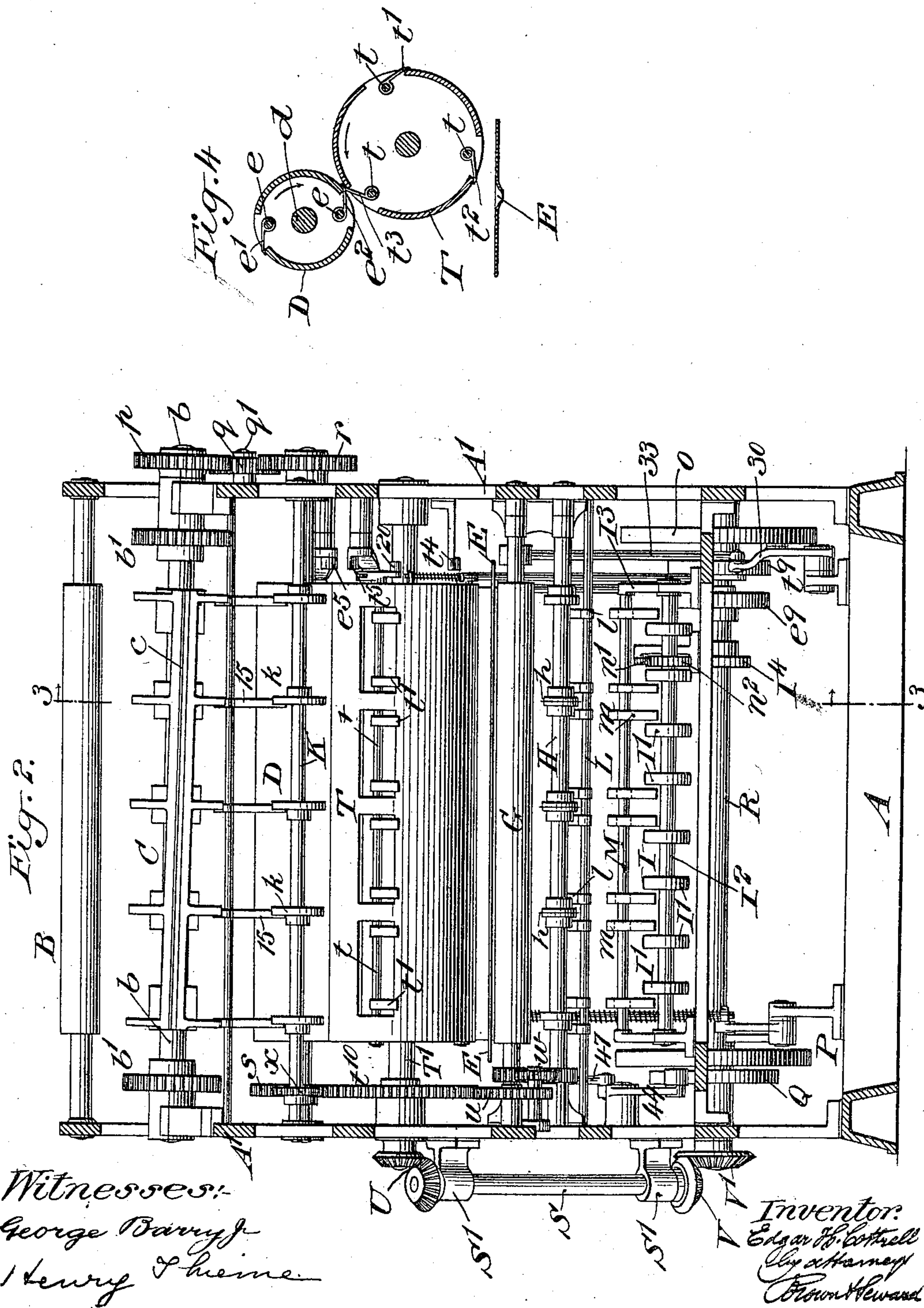
Inventor:  
Edgar H. Cottrell  
By attorney  
R. H. Howard

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4 SHEETS—SHEET 2.



Witnesses:  
George Barry  
Henry J. Heine

Inventor:  
E. H. Cottrell  
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Brown & Howard



No. 743,456.

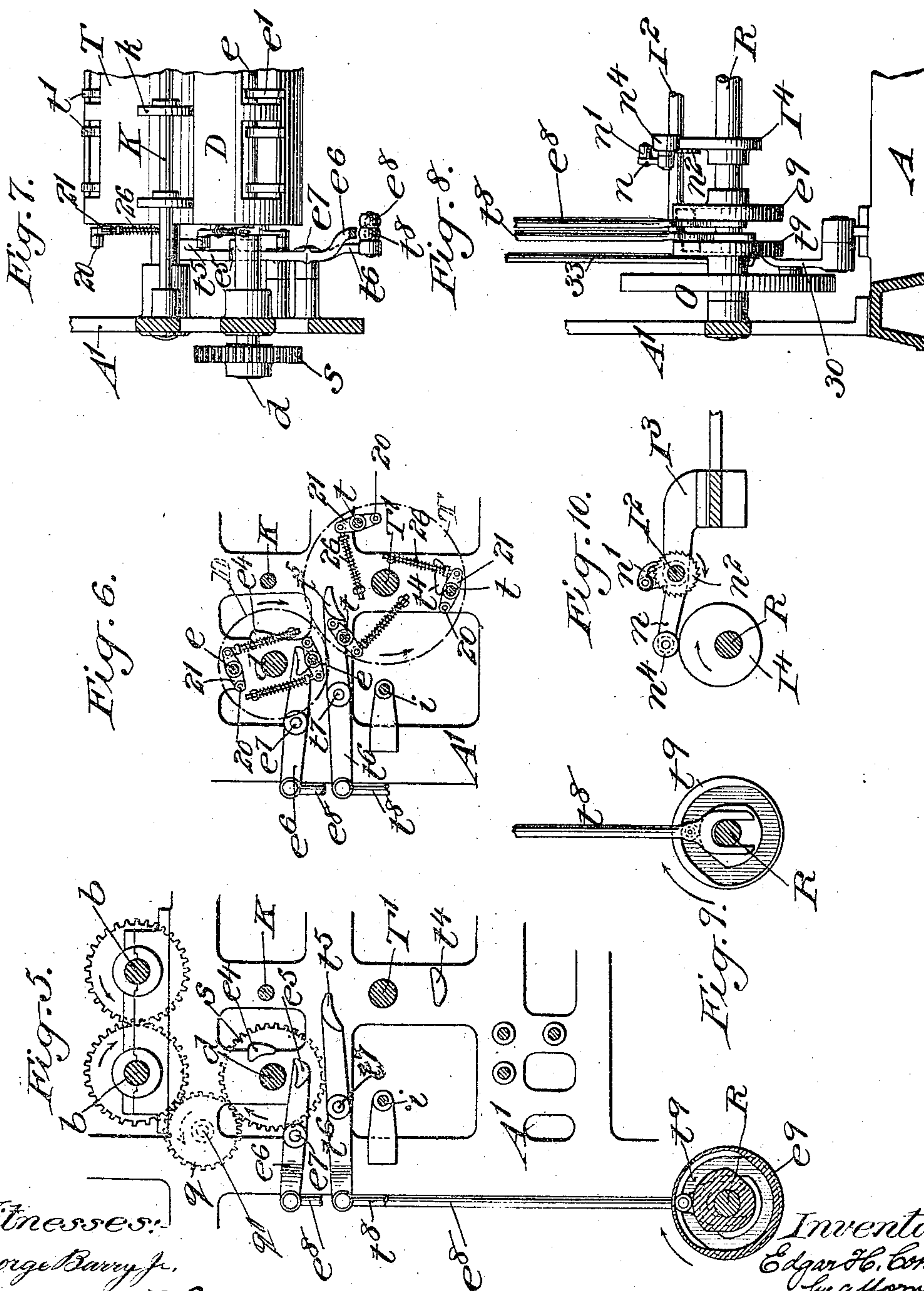
PATENTED NOV. 10, 1903.

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APPLICATION FILED DEC. 18, 1902.

NO MODEL.

4 SHEETS—SHEET 3.



Witnesses:  
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No. 743,456.

PATENTED NOV. 10, 1903.

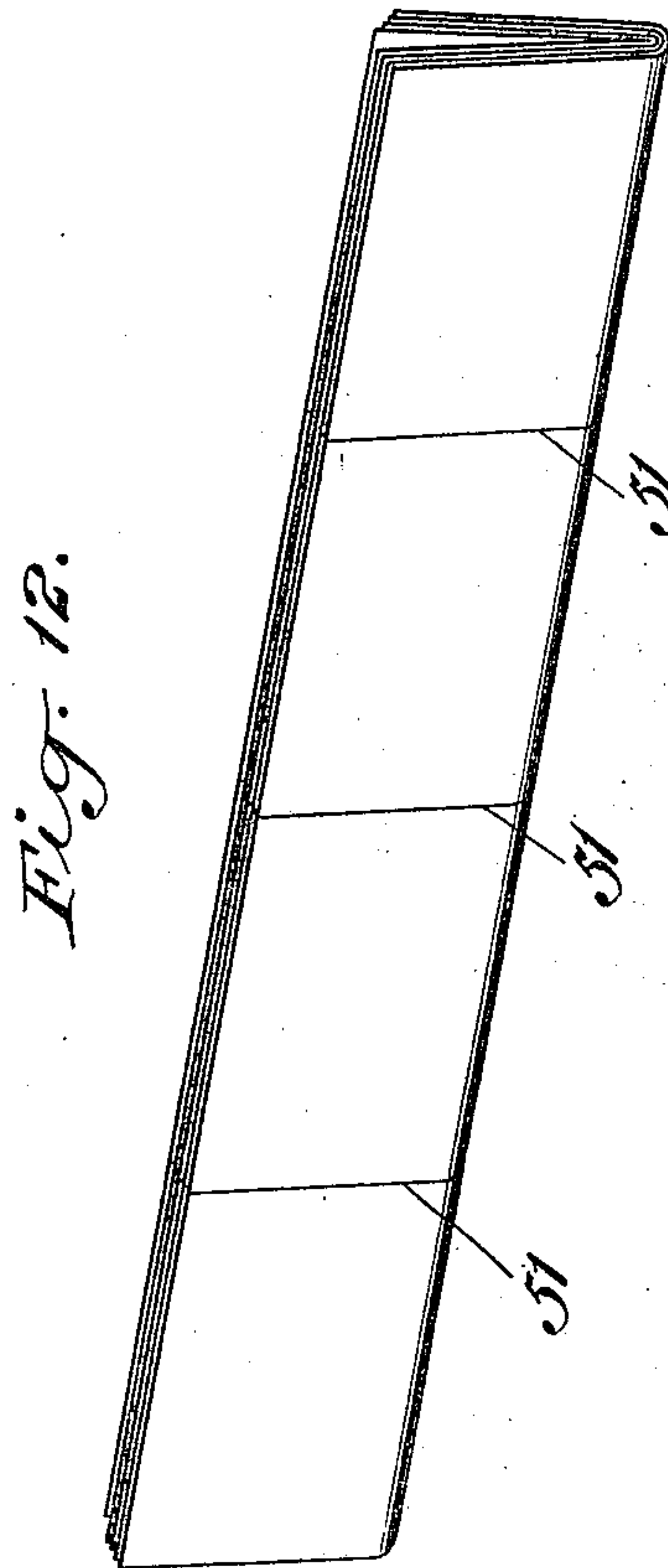
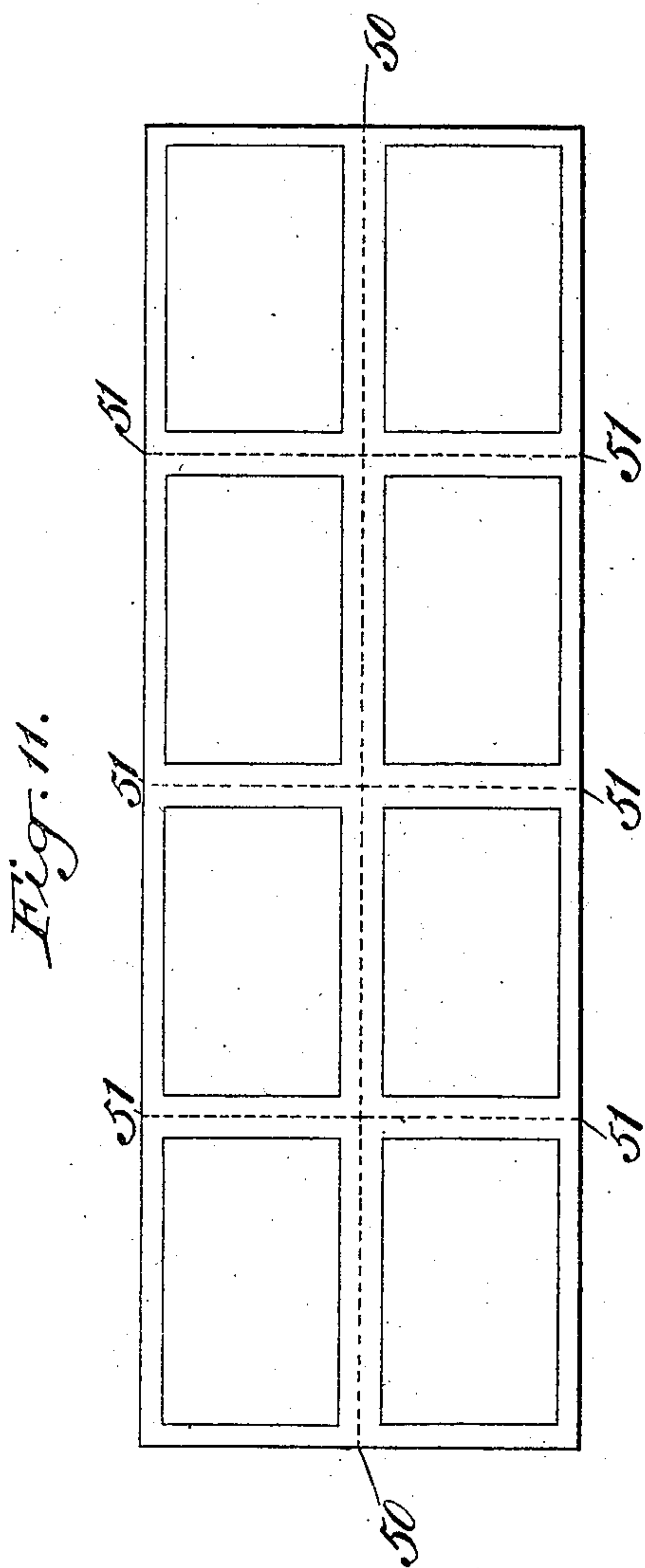
E. H. COTTRELL.

MACHINERY FOR CUTTING AND FOLDING PAPER, &c.

APPLICATION FILED DEC. 18, 1902.

NO MODEL.

4 SHEETS—SHEET 4.



*Witnesses:*  
*George Barry Jr.*  
*Henry T. Heine*

*Inventor:*  
*Edgar H. Cottrell*  
*by attorneys*  
*Brown & Seward*



# UNITED STATES PATENT OFFICE.

EDGAR H. COTTRELL, OF STONINGTON, CONNECTICUT, ASSIGNOR TO C. B. COTTRELL & SONS COMPANY, OF NEW YORK, N. Y., AND STONINGTON, CONNECTICUT, A CORPORATION OF NEW JERSEY.

## MACHINERY FOR CUTTING AND FOLDING PAPER, &c.

SPECIFICATION forming part of Letters Patent No. 743,456, dated November 10, 1903.

Application filed December 18, 1902. Serial No. 135,685. (No model.)

*To all whom it may concern:*

Be it known that I, EDGAR H. COTTRELL, a citizen of the United States, and a resident of Stonington, in the county of New London and State of Connecticut, have invented a new and useful Improvement in Machinery for Cutting and Folding Paper and other Fabrics, of which the following is a specification.

The cutting and folding machinery which constitutes this invention is intended as a whole to be used in connection with a perfecting printing-machine in which the printing of pages sufficient to make a signature is performed on a continuous web before cutting the latter into sheets. Machinery embodying the invention in its entirety cuts the web transversely into sheets, collects several of the so-cut sheets together one upon another, and so folds the collections together parallel with the lines on which the sheets are cut from the web that they are inset one within another and then cuts the so-inset folded collections of sheets transversely to the fold into several signatures.

An important feature of the invention relates to cylinders which collect one upon another the sheets cut from the web and present the collections in a pile ready for folding; and this feature consists in the novel organization and combinations of such cylinders, hereinafter described, including a collecting-cylinder for collecting the sheets one upon another, and a second cylinder, which may be termed a "transfer-cylinder," for taking collections of sheets from the collecting-cylinder and piling one upon another a plurality of said collections ready for folding.

The invention further consists in certain other combinations hereinafter described, including folding, cutting, and delivering devices.

The invention is illustrated in the accompanying drawings, which represent cutting and folding machinery for producing four sixteen-page open-edged signatures from two collections, each consisting of two sixteen-page sheets.

Figure 1 is a side elevation; Fig. 2, a vertical section taken transversely to Fig. 1 in the line 2 2 thereon; Fig. 3, a section taken

parallel with Fig. 1 in the line 3 3 of Fig. 2; Fig. 4, a transverse section of the collecting-cylinder, transfer-cylinder, and folding-table; Fig. 5, a side view, partly in section, of cam mechanism for opening the grippers of the collecting and transfer cylinders; Fig. 6, a side view of parts of the mechanisms for closing and opening the grippers; Fig. 7, a plan of parts of the collecting and transfer cylinders and of the mechanism for operating their grippers; Fig. 8, a front view of parts of the cam mechanism for operating the grippers of the two cylinders; Fig. 9, a side view of the cam and part of its connections for operating the grippers of the transfer-cylinder; Fig. 10, a side view, partly in section, of parts of mechanisms for operating the tape-carrier to and by which the signatures cut from the folded sheets are delivered; Fig. 11, a plan of one of the sixteen-page sheets of which the collections made into signatures by this machine are composed; Fig. 12, a perspective view of four of said sheets folded, inset together, and cut transversely into four signatures.

A A' designate the framing within which the several parts of the machinery constituting my invention are supported. This framing may constitute part of the framing of a perfecting printing-machine to which the said invention is an adjunct. In the upper part of this framing are feed-rollers B, which receive the web *a* and feed it to the cutter, which is represented as consisting of two rotary cutter-carriers C and attached cutting-blades *c*, the shafts *b* of said carriers C running in suitable bearings in the framing and being geared together by gears *b'*. Below this cutter the collecting-cylinder D, furnished with grippers *e' e''*, has its shaft *d* running in suitable bearings in the framing.

At some distance below the collecting-cylinder D there is supported in the framing or stationary horizontal bars E' the stationary slotted table E, upon which two collections of sheets made by the cylinder D are piled to be folded and through which works the folding blade F, the said table being a little longer than the said cylinder. Between the collecting-cylinder and the table is the transfer-cy



inder T, furnished with grippers  $t' t^2 t^3$  and serving to pile upon the table E one upon another every two successive collections of sheets made by the cylinder D and taken therefrom by said cylinder T. The shaft T' of the transfer-cylinder is so arranged in suitable bearings in the framing as to bring the said cylinder partly under the collecting-cylinder and almost in contact therewith and at some distance above the table and nearer to one side than the other of the latter. Under the table are the folding-rollers G, running in suitable bearings in the framing, and under the folding-rollers is a rotary splitter for slitting the folded collections of sheets crosswise of their fold into signatures, the said splitter consisting of pairs of shearing-disks  $h$ , carried by two shafts H, running in suitable bearings in the framing. There are three pairs of such disks in the present example for cutting the sheets into fours. At a suitable distance below this splitter is an intermittently-moving endless carrier consisting of tapes I, running on wheels I', carried by shafts I<sup>2</sup> I\*, running in bearings in brackets I<sup>3</sup> on the framing. This carrier is of a width equal, or approximately so, to the length of the table E.

Between the cutter and the collecting-cylinder D are stationary guides 15 for directing the end of the web and the tail ends of the sheets cut therefrom to said cylinder. In front of the collecting-cylinder D, between said guides 15 and the transfer-cylinder T, are rollers  $k$  for holding to said cylinder D the front edges and adjacent parts of the web  $a$  and the sheets taken by the grippers of said cylinder D and for preventing the tail ends of the so-taken sheets from dropping to the cylinder T until the front ends of the collections have been taken by the grippers of the latter cylinder, the said rollers  $k$  being fast on a rotary shaft K, running in bearings in the framing. At the back of said guides 15 are rollers 17 for holding the first sheet of every collection of two which is taken by either set of grippers  $e' e^2$  to the cylinder in proper register, while the same set of grippers are open to take the second sheet.

There are two sets of cutting-blades on the cutter-carriers and two sets of grippers  $e' e^2$  on the collecting-cylinder. The shafts of said carriers and that of the cylinder are geared together to make the same number of revolutions, and therefore two sheets are cut by every revolution of the cutter and two taken by the collecting-cylinder during each revolution. The circumference of the collecting-cylinder is a little greater than the circle circumscribed by the edges of the cutting-blades in order that there may be a sufficient space between succeeding sheets taken on the cylinder for either set of grippers to receive the front edge of one sheet without disturbing the tail of the preceding sheet taken by the other set.

The transfer-cylinder T is of a diameter greater than that of the collecting-cylinder.

The reason for the introduction of this larger cylinder between the collecting-cylinder and a table arranged below it for the reception of sheets therefrom is that if not absolutely necessary it is at least desirable that the collecting-cylinder should not exceed a certain size, but that with a cylinder of such size without special devices for throwing off the sheets there is a liability of the sheets to remain on it after the grippers have been opened to liberate them. With a cylinder of larger size this liability of the sheets to remain upon it is obviated or at least greatly reduced.

The circumference of the transfer-cylinder and the number of grippers thereon must bear certain proportions to the circumference of and number of grippers on the collecting-cylinder, as the grippers on both have to be at corresponding distances apart, and the surface velocity of the two must correspond. In the example represented the transfer-cylinder T is of a circumference one and a half times that of the collecting-cylinder and has three sets of grippers, and the said cylinder T is geared with the collecting-cylinder to make two revolutions for every three of the latter. The several grippers have on their shafts  $e$  and  $t$ , respectively, outside of one end of their respective cylinder, levers 21, Fig. 6, through which the grippers receive their opening and closing movements, the closing being effected by springs 26, applied to one end of each of said levers in a well-known manner not necessary to be here described, and the other end of each of said levers being furnished with a friction-roller 20, which as the cylinder rotates runs against one of a system of cams located outside the cylinder. These cams are shown in Figs. 5 and 6 and are partly visible in Fig. 7. The cam  $e^1$  for opening the grippers  $e' e^2$  of the collecting-cylinder for the reception of the sheets and the cam  $t^1$  for opening the grippers  $t' t^2 t^3$  of the transfer-cylinder for the deposit on the table E of successive collections of two sheets taken from the collecting-cylinder are stationary on the framing A' in operative position, as these several grippers are opened for those two purposes every time they pass their respective cam; but the cam  $e^5$  for opening the collecting-cylinder grippers to release the successive collections of sheets therefrom and the cam  $t^5$  for opening the transfer-cylinder grippers for the reception of every so-released collection have to be in their operative positions for opening their respective grippers for the transfer of the sheets from one cylinder to the other every other time only that the grippers pass the said cams  $e^5 t^5$  and have to be kept out of said operative position during the intervening times of the grippers passing them. The said cams  $e^5$  and  $t^5$  are therefore carried, respectively, each by one of two levers  $e^6 t^6$ , which work on fixed fulcrums  $e^7 t^7$  of the framing A', the levers  $e^6 t^6$  being respectively operated upon through rods  $e^8 t^8$  by cams  $e^9 t^9$  on a rotary shaft R, running in fixed bearings on the framing, the



said shaft making one revolution for every two of the collecting-cylinder. The relative and successive operations of the grippers produced by the several cams will be hereinafter more fully described.

Behind and near the transfer-cylinder T and below the collecting-cylinder there is supported on the framing A' a stationary bar *i*, which is parallel with the cylinders and on which are a series of curved guard-fingers *i'*, facing the transfer-cylinder to prevent the flying away therefrom and over the folding-blade of the tail ends of the collected couples of sheets which have been taken from the collecting-cylinder by the transfer-cylinder and are being carried by the latter to the table E to be piled thereon for folding. Immediately below the slit and parallel with the shafts thereof there is supported in the framing A' a stationary guide-bar L, on which are a series of guide-fingers *l*, which project upward between the shafts H and between their disks *h* and which have an inclination downward under one of said shafts and toward a series of stationary stop-fingers *m*, which are upright immediately above that part of the carrier I on which the folded and cut signatures are to be received, the said fingers *m* being carried by a stationary bar M, which is supported in the framing.

Attached to the front edge of the table there are fixed sheet-stops *g*, against which the sheets so piled on said table are jogged to register by joggers *j*, Fig. 3, at the back of the table. These joggers are carried by a rock-shaft *j'*, working in fixed bearings below the table and receiving necessary motion from an eccentric cam *j''* on the shaft of one of the folding-rollers G, the said cam acting on an arm *j'''* of said rock-shaft to throw the joggers back from the table, and a spring *j''''*, applied between the said arm *j'''* and a fixed stop *j'''''* on the framing, serving to throw them forward toward the table.

The folding-blade F is affixed to a bar *f'*, carried by the arms of a rock-shaft *f*, which is supported in fixed bearings in the framing, and it may be actuated and controlled by any suitable cam or system of cams in such manner that it remains stationary when raised to its highest position, (shown in dotted outline in Fig. 3,) while two couples of sheets which have been collected by the cylinder D are successively deposited in a pile of four sheets on the table E by the transfer-cylinder and that after the two couples have been so deposited and before another couple shall have been so deposited it will strike the pile and force the sheets through the slot in the table, thereby commencing an inset fold, which is to be completed by the folding-rollers G, and will return to its highest position or high enough not to interfere with the next deposit on the table. The particular system of cams O P Q and the mechanism actuated thereby for producing this operation of the folder not constituting any part of the present invention will

only be here described sufficiently to prevent their confusion in the drawings with other parts of the machinery. The cam O operates through a lever 30 and a connecting-rod 33 on an arm 27 of the rock-shaft *f*, and the cam Q operates through a lever 44 and connecting-rod 47 upon an arm 29 of said rock-shaft.

The delivery-carrier I derives its motion from an eccentric cam I', Figs. 3, 8, and 10, on the rotary shaft R, the said cam acting on a roller *n'* on a pawl-lever *n*, which is fitted to oscillate on the said shaft R and which carries a pawl *n'*, working in a ratchet-wheel *n''*, fast on the said shaft.

The driving of the shafts of the rotary cutter C c, collecting-cylinder D, transfer-cylinder T, folding-rollers G, and rotary slit H and the driving of the cam-shaft R at the proper relative speeds may be effected in any suitable manner by properly-proportioned gearing. Let it be supposed that the one of the cutter-shafts *b* is the driver for all the rest and that it is driven by any suitable gearing from a rotary printing-machine to which this cutting and folding machinery is an appurtenance. A gear *p*, Figs. 2 and 5, on said shaft *b* gears with and drives the collecting-cylinder through a loose gear *q* on a stud *q'* on the framing, said gear *q* gearing with said gear *p* and with a gear *r* on the shaft of the collecting-cylinder. The transfer-cylinder is driven from the collecting-cylinder by a gear *s*, Figs. 1 and 2, on the latter and a gear *t* on the former. The shafts of the folding-rollers G, which are geared together, are driven from the gear *t* on the transfer-cylinder shaft through a stud-gear *u*, Figs. 1 and 2, which gears with a gear *v* on one of the folding-roller shafts. The slit-shafts, which are geared together, are driven from one of the folding-roller shafts through a stud-gear *w*. The cam-shaft R is driven from the shaft T' of the transfer-cylinder through a side shaft S, running in brackets S' on the outside of the framing, said shaft S gearing by miter-gears U with said shaft T' and by bevel-gears V V' with the cam-shaft. The shafts K and 16 of the rollers *k* and 17 are driven directly from the gear *s*, before mentioned, on the collecting-cylinder through gears *x* and *y*, Fig. 1, on said shafts K and 16.

The several parts of the machinery itself having now been described, the successive operations from the cutting from the web of the sheets, such as are shown in Fig. 11, to the production of the signatures, such as are shown in Fig. 12, will now be briefly explained.

Four sheets cut successively from the web are taken, the first and the third ones by one set of grippers *e* or *e'* of the collecting-cylinder to form one couple, and the second and fourth ones by the other set of grippers of said cylinder to form another couple, and the two so-collected couples are taken from each of said sets of grippers in succession by one



after another of the sets of grippers  $t'$   $t^2$   $t^3$  of the transfer-cylinder, the relative positions of the several sets of grippers  $e'$   $e^2$  and  $t'$   $t^2$   $t^3$  on their respective cylinders and their respective opening and closing operations being so timed that as a set of grippers of the transfer-cylinder passes a set of those of the collecting-cylinder both sets are opened to make the transfer from one cylinder to the other and that the grippers of the transfer-cylinder are closed again before the closure of those of the collecting-cylinder. As each collection of a couple of sheets collected on the transfer-cylinder is brought by a set of grippers of said cylinder to a proper position over the table the said grippers are opened and the collection is deposited on the table and jogged to register thereon. Two such deposits having been successively made upon the folding-table while the folding-blade remains raised to its highest position, (represented in dotted outline in Fig. 3,) the said blade descends, striking the sheets on the center line 50, Fig. 11, which is parallel with the edges formed by cutting from the web, and carries the set of four sheets through the slot in the table and between the folding-rollers, by which they are inset and folded together, as shown in Fig. 12, and thence carried through the slit, by which they are severed transversely on the line 51 into four sets, each consisting of a signature of four folded and inset sheets. These several severed signatures passing together through the slit strike the guides  $l$ , by which they are so deflected that they strike the stops  $m$  and are so caused to be deposited, lying down, upon the endless carrier  $I$  in sets of four sixteen-page open-edged signatures. The carrier making a very short movement after every deposit carries away the successive deposits, each overlapping the greater part of its predecessor, leaving the successive deposits so separated at their edges that they can be each removed separately.

It may be hardly necessary yet well to remark that the first two or three sheets taken on the collecting-cylinder will be delivered from the said cylinder and the transfer-cylinder single without being made into collections, and these may be thrown away as useless or otherwise disposed of, and that the operation above described of collecting, transferring, and depositing on the table does not begin until after the removal of the said single sheets.

The term "cylinder" as used in this specification is intended to include any rotary carrier of substantially cylindrical contour furnished with grippers for taking sheets.

What I claim as my invention is—

1. The combination of a web-feeding device, a cutting device, a table, a rotary collecting-cylinder for collecting sheets on its periphery from said cutting device, and a transfer-cylinder interposed between said collecting-cylinder and the table for taking sheets

from said collecting-cylinder and depositing them directly therefrom upon the table.

2. The combination of a table, a rotary collecting-cylinder for collecting sheets on its periphery and a transfer-cylinder of larger circumference than said collecting-cylinder interposed between said collecting-cylinder and the table for taking sheets from said collecting-cylinder and depositing them directly therefrom upon the table.

3. The combination of a table, a rotary collecting-cylinder for collecting a plurality of sheets one at a time and one upon another on its periphery, and a transfer-cylinder interposed between said collecting-cylinder and the table for taking a so-collected plurality of sheets from said collecting-cylinder and depositing them directly therefrom upon the table.

4. The combination of a table, a rotary collecting-cylinder for making on its periphery a plurality of collections each consisting of a plurality of sheets, and a transfer-cylinder interposed between said collecting-cylinder and the table for taking said collections one at a time from said collecting-cylinder and depositing them one directly upon another in a pile on the table.

5. The combination of a table, a rotary collecting-cylinder for making on its periphery a plurality of collections each consisting of a plurality of sheets, and a transfer-cylinder of larger circumference than said collecting-cylinder interposed between said collecting-cylinder and the table for taking from said collecting-cylinder a plurality of collections of sheets so made thereon and depositing said collections one upon another in a pile upon the table.

6. The combination of a table, a rotary cutter for cutting sheets from a web, a rotary collecting-cylinder for making on its periphery collections of sheets cut from the web, a transfer-cylinder interposed between said collecting-cylinder and table for taking sheets from said collecting-cylinder and depositing them upon the table, a stationary guide for the web and cut sheets between the cutter and collecting-cylinder, and rollers located between said stationary guide and transfer-cylinder for confining the tail ends of sheets to the collecting-cylinder.

7. The combination of a table, a rotary sheet-collecting cylinder furnished with grippers for collecting a plurality of sheets one at a time and one upon another, a transfer-cylinder furnished with grippers interposed between said collecting-cylinder and the table for taking collections of sheets from said collecting-cylinder and depositing them upon the table, a stationary cam for opening the grippers of the collecting-cylinder for the reception of sheets, a stationary cam for opening the grippers of the transfer-cylinder for the deposit of collections of sheets upon the table, a third cam for opening the grippers of the collecting-cylinder for the release of



the collections of sheets therefrom, a fourth cam for opening the grippers of the transfer-cylinder for the transfer of collections of sheets from one cylinder to the other, and means for placing said third and fourth cams in their operative positions for opening the grippers during alternate times of the grippers passing by them and keeping the latter cams out of their operative positions during the intervening times of the passage of the grippers by them.

8. The combination of a table, a rotary sheet-collecting cylinder furnished with grippers for collecting a plurality of sheets one at a time and one upon another, a transfer-cylinder furnished with grippers interposed between said collecting-cylinder and the table for taking collections of sheets from said collecting-cylinder and depositing them upon the table, a stationary cam for opening the grippers of the collecting-cylinder for the reception of sheets, a stationary cam for opening the grippers of the transfer-cylinder for the deposit of collections of sheets upon the table, a third cam for opening the grippers of the collecting-cylinder for the release of the collections of sheets therefrom, a fourth cam for opening the grippers of the transfer-cylinder for the transfer of collections of sheets from one cylinder to the other, a rotary shaft geared with the collecting-cylinder, and two cams on said shaft one for placing said third and fourth cams respectively in operative positions for opening the grippers during every other passage by them of the grippers and for holding said third and fourth cams respectively out of said operative positions during the intervening passage by them of the grippers.

9. The combination of a folding-table, a rotary collecting-cylinder for collecting a plurality of sheets one at a time and one upon another on its periphery, a transfer-cylinder

interposed between said collecting-cylinder and table for taking the collected plurality of sheets from said collecting-cylinder and depositing them upon said table, and a reciprocating folding-blade cooperating with said table for folding the so-deposited collected plurality of sheets.

10. The combination of a folding-table, a rotary collecting-cylinder for making on its periphery a plurality of collections each consisting of a plurality of sheets, and a transfer-cylinder interposed between said collecting-cylinder and table for taking said collections one at a time from said collecting-cylinder and depositing them one upon another in a pile on said table, and a reciprocating folding-blade cooperating with said table for folding together all the sheets of the so-deposited pile.

11. The combination of a folding-table, a cylinder for depositing sheets on said table, a reciprocating folding-blade, and a guide located in proximity to said cylinder above the folding table and blade for preventing the tail ends of sheets on the cylinder from being thrown over the folding-blade.

12. The combination of rotary folding-rollers and a reciprocating folding-blade cooperating therewith, a rotary slitter below said rollers, an endless carrier beneath said slitter, stationary stops above said carrier and an inclined guide between the slitter and said stops, substantially as and for the purpose herein described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 11th day of December, 1902.

EDGAR H. COTTRELL.

Witnesses:

FREDK. HAYNES,  
GEORGE BARRY, Jr.