

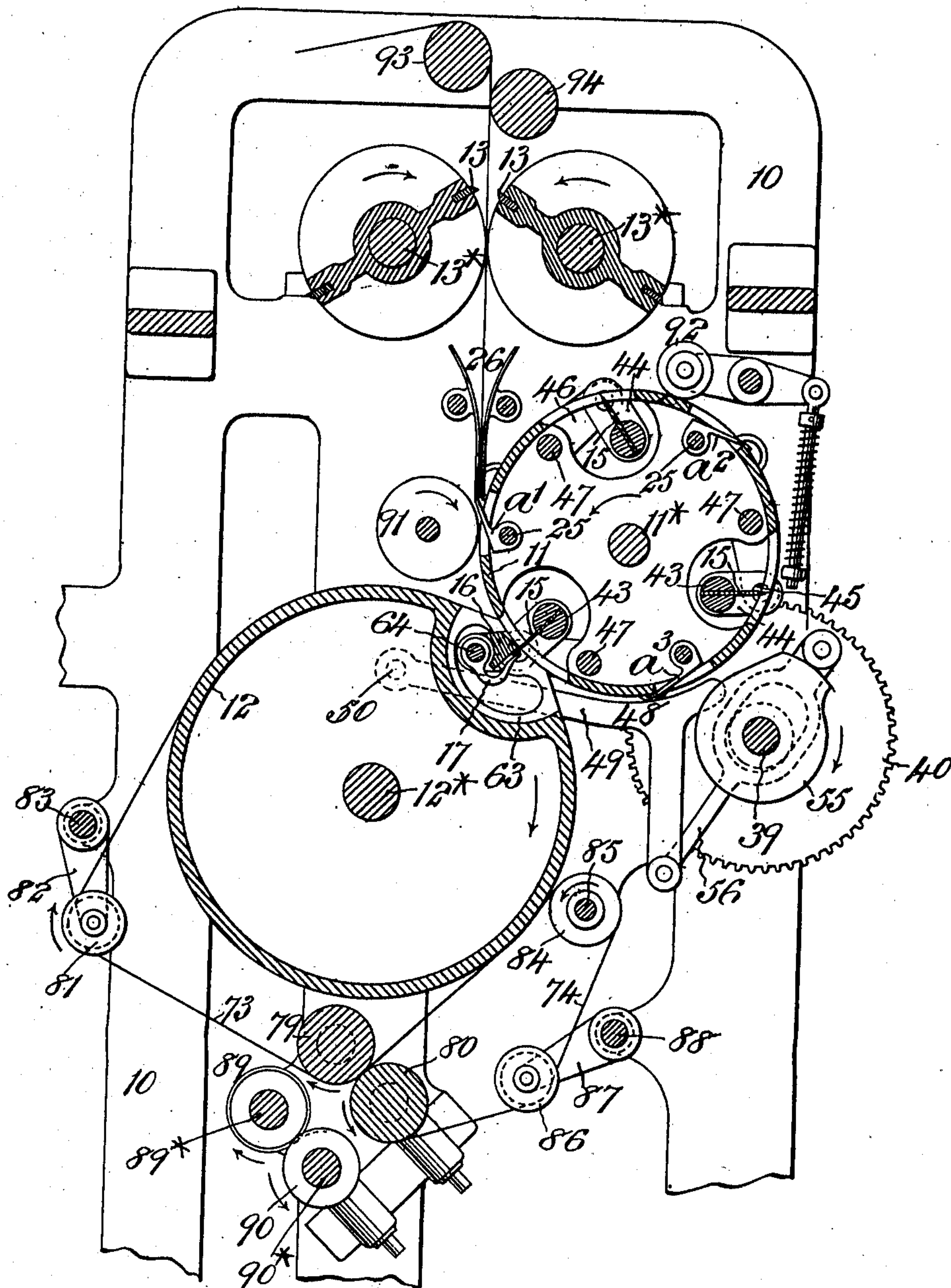
E. H. COTTRELL.  
FOLDING MACHINERY.  
APPLICATION FILED FEB. 16, 1905.

970,688.

Patented Sept. 20, 1910.

3 SHEETS—SHEET 1.

Fig. 1.



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Inventor:  
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By attorney  
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E. H. COTTRELL.

FOLDING MACHINERY.

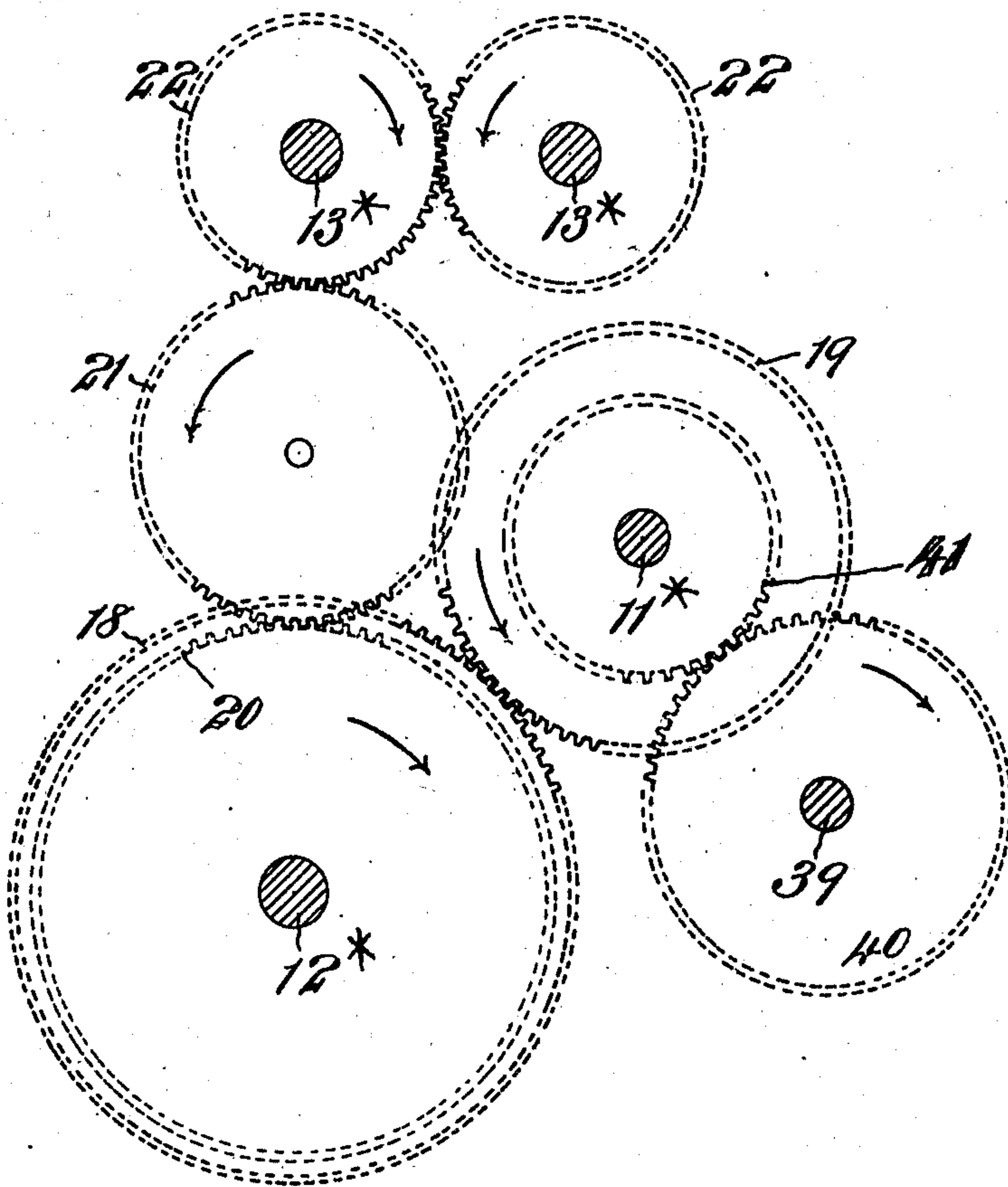
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3 SHEETS—SHEET 3.

*Fig. 7.*



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# UNITED STATES PATENT OFFICE.

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## FOLDING MACHINERY.

970,688.

Specification of Letters Patent. Patented Sept. 20, 1910.

Application filed February 16, 1905. Serial No. 245,819.

*To all whom it may concern:*

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

Machinery embodying this invention comprises two cylinders on one of which are tucking or folding blades and on the other of which are folding jaws coöperating with said blades for the folding of sheets, one of said cylinders being furnished with means for collecting one upon another on its periphery a plurality of sheets to be folded together into one signature by the coöperation of said blades and jaws, the said sheets to be supplied from any suitable source as for example from a running web from which they are cut by suitable cutters on the way to the cylinder on which they are collected.

The invention consists in the combinations hereinafter described and claimed and illustrated by the accompanying drawings of folding machinery by which collections of four sheets are made one upon another and folded together into an open-edged sixteen-page signature.

Figure 1 of the drawings represents a vertical section taken transversely to the cylinder; Fig. 2 an end view of the cylinder on which the sheets to be folded are collected one upon another and a side view of parts of the mechanism for opening the sheet grippers and folding blades on said cylinder; Figs. 3 and 4 side views partly in section of cams and mechanism actuated thereby for operating said grippers and blades; Fig. 5, a side view partly in section of cams and mechanism actuated thereby for operating the folding jaws; Fig. 6, a side view of part of the folding jaw cylinder and of the mechanism for operating the folding jaws; Fig. 7, a diagram of the gearing for the cylinders and cutters and for some of the cams employed.

10 designates the framing in or on which are the bearings for the shaft 11\* of the cylinder 11, hereinafter termed the collecting cylinder, for the shaft 12\* of the cylinder 12, hereinafter termed the folding cylinder, and for the shafts 13\* of the rotary cutters 13 from which sheets thereby cut

from a running web proceeding from a perfecting printing machine or from any other source are presented to the collecting cylinder. The collecting cylinder 11 has a circumference a little in excess of three times the length of the sheets taken upon it from said cutters by its collecting grippers  $a'$ ,  $a^2$ ,  $a^3$ . The periphery of said cylinder is divided into three equal sections and there are three sets of collecting grippers one for each of said sections. The said cylinder is furnished with three tucking blades 15 which are arranged in openings provided in said sections and are interposed between the sets of grippers.

The folding cylinder 12 has a circumference equal to one and one-third that of the collecting cylinder and is furnished with a single set of folding jaws 16, 17, for co-operation in turn with the tucking blades 15 on the collecting cylinder. These folding jaws and tucking blades are such as form the subject of United States Patents Nos. 629,928 and 668,719 and therefore will only be herein described sufficiently to explain the present invention. The cutter shafts 13\* are furnished with two sets of cutters 13 to cut two sheets during every revolution. The cutter shafts, collecting cylinder shaft and the folding cylinder are geared together by the gearing 18, 19, 20, 21, 22, shown in Fig. 7, the gear 18 on the folding cylinder shaft meshing with a gear 19 on the collecting cylinder shaft and the gear 20 on the folding cylinder shaft meshing with an idler gear 21, and the said gear 21 gearing with one of the gears 22 on one of the cutter shafts, the said gears being so proportioned that the cutter shafts make two revolutions for each revolution of the folding cylinder and that the collecting cylinder makes one and one-third revolutions for every revolution of the folding cylinder and for every two revolutions of the cutters. With the gearing thus proportioned, and with the operations of the collecting cylinder grippers, the tucking blades on said cylinder and the folding jaws on the folding cylinder which will be hereinafter described, four sheets cut from the web will be first collected on the collecting cylinder and afterward folded on the folding cylinder.

The grippers  $a'$ ,  $a^2$ ,  $a^3$  on the collecting cylinder are such as are commonly used on the cylinders of printing and folding ma-



chinery and are closed in the usual way by springs 23 applied to arms 24 on their shafts 25 as shown in Fig. 2. For opening said grippers to receive a sheet every time they pass the guide 26 by which the sheets are conducted from the cutters, there is provided a single stationary cam 27 over which run the rollers 28 provided on the arms 29 of their shafts. For opening said grippers to release the sheets to the tucking blade and folding jaws, there is a movable cam 30 formed on the end of one arm 31, see Fig. 2, of a short rockshaft 32 which works in a stationary bearing. Between another arm 33 of this rockshaft 32 and a fixed abutment 34 on the framing, there is applied a pushing spring 35 which acts to raise the cam 30 to such a position that it will be out of range of the rollers 28 and inoperative on the grippers, except at such times as each set has collected four sheets ready for delivery to the folding jaws 16, 17. The stationary bearing above referred to for the rockshaft 32 is formed in the body of a stationary cam 36, 36\*, Fig. 3, to be hereinafter fully described, secured to the inside of the machine framing by bolts 37\* shown in section, inserted through lugs 37 on the hub of said cam. It may be here mentioned that the view Fig. 2 is taken between this cam 36 and the cylinder, the rockshaft 32 appearing in the last mentioned figure in section. The stationary gripper-opening cam 27 before described is carried by a bracket 27\* secured on the inner face of said cam 36. This bracket appears in section in Fig. 2. For depressing said cam 30 into position within the range of the rollers 28 for opening the grippers, there is a cam 38, Fig. 3, on a rotary shaft 39 which is geared by its gear 40 with a gear 41 on the collecting cylinder shaft, the said gears being so proportioned that the said shaft 39 makes one revolution for every revolution of the folding cylinder 12 and one for every one and one-third revolution of the collecting cylinder 11. This cam 38 acts upon the cam 30 to place it in its operative position through a yoke rod 42 connected with the rockshaft arm 33.

The tucking blades 15 which correspond with the tucking blades of Patents No. 629,928 and No. 668,719 hereinbefore referred to, except that there are three of them in the collecting cylinder, are each set in one of as many bars or stocks 43 formed with arms 44 on which are trunnions 45 which are pivoted into the two corresponding arms 46 at opposite ends of rockshafts 47, one for each blade stock, which are pivoted to the ends of said cylinder. These rockshafts 47 and their connections with the blade stock 43 and the mechanism for projecting the blades from the cylinder and swinging them in radial and tangential relation thereto are

shown in Fig. 4 in which the circumference of the cylinder is represented in dot and dash outline, the cylinder itself being omitted from said view because if appearing it would conceal the blade operating mechanism which is at that end of it farthest from the point of view. For the purpose of projecting said blades from the cylinder to produce the tucking of the sheets into the folding jaws 16, 17, which commences the folding operating, there is a movable cam-track 48 formed on a lever 49 which swings on a fixed fulcrum 50 secured in the framing. This cam-track is held normally out of its operative position until the time for projecting a blade, by means of a pushing spring 51 abutting against a stud 52 on the framing, but every time that by the revolution of the cylinders 11 and 12 a blade 15 and the folding jaws 16, 17, are caused to arrive opposite each other, the said cam-track 48 is brought to such a position that a roller 53 on the arm 54 of the rockshaft 47 before mentioned runs along it and is so thrown upward as to produce the necessary movement of said rockshaft to project the blade. This movement of the cam-track 48 into position is effected by means of a rotary cam 55 on the shaft 39 before described, the said rotary cam acting upon said cam-track through a yoke rod 56 connected with the lever 49. A pushing spring 57, applied between an arm 58 on each rockshaft 47 and an abutment stud 59 on the cylinder, serves to hold back said arm against a stop pin 59\* on the cylinder and so hold the blade withdrawn into the cylinder until the proper time for its projection by the cam-track 48. The swinging of the blades on the trunnions 45 of their stocks between positions radial to and tangential to the cylinder is effected by the stationary cam 36, 36\* hereinbefore mentioned arranged at that end of the cylinder which appears in Fig. 2. This cam which has a groove 36\* in its face which is presented toward the cylinder, is shown partly in section in Fig. 3. The said cam is engaged to operate on each blade-stock 43 through an arm 60 on one of the trunnions 45 of the latter, the said arm being furnished with a roller 61 which runs in the cam groove 36\*.

The one set of jaws 16, 17, of the folding cylinder is organized precisely as in Patents No. 629,928 and No. 668,719 hereinbefore referred to, the main jaw 16 being pivoted at each end by a pivot 62, see Figs. 1, 5 and 6, into slotted plates 63 attached to the cylinder heads, the jaw 17 being pivoted to 16 by a pivot 64 at each end. One of the said pivots 62 of the main jaw is furnished with an arm 65, Figs. 5 and 6, on which is a roller 66 running in the groove 67 of a stationary cam 67, 68, for turning the jaws 16, 17, together toward and from the tucking blades 15 of the collecting cylinder 11. One of the piv-



ots 64 of the jaw 17 is furnished with an arm 69 on which is a roller 70, shown in Fig. 6, and in dotted outline in Fig. 5, which runs over a stationary cam 71 for giving the opening movement to the jaw 17 for the reception of the tucks produced between the jaws 16, 17, by the tucking blades. There is another stationary cam 72 on the opposite side of the machine from cam 71, and the other pivot 64 of the jaw 17 is provided with an arm 77, Fig. 6, like that 69 before mentioned which arm is provided with a roller 78 like that 70 which runs under the stationary cam 72 to produce the opening of the jaws to release the folded assembled sheets from the cylinder to delivery tapes 73, 74, shown in Fig. 1. The jaws are kept closed at all times but when receiving the tuck and delivering the folded sheets by a spring 75 between the arm 65 and an arm 76 on one of the pivots 64 of the jaw 17. The coöperation of each of the folding blades with the one set of folding jaws is the same as in the patents hereinbefore referred to and has been herein so fully described only because it is so intimately associated with the sheet collecting mechanism of the cylinder 11 as to require its representation in the drawings.

Of the delivery tapes 73, 74, above mentioned, shown in Fig. 1, for taking the folded collections of sheets from the cylinder 12, the tapes 73 which run around the folding cylinder run also under one 79, of a pair of rollers 79, 80, the shaft of which runs in fixed bearings in or on the framing 10 below said cylinder. These tapes also run around tightening pulleys 81 carried by the arms 82 dependent from a shaft 83 which is supported by the framing. The other tapes 74 run around the other roller 80 of the pair above mentioned and around pulleys 84 on a shaft 85 running in bearings in or on the framing. These tapes 74 are also provided with tightening pulleys 86 on arms 87 dependent from a shaft 88 supported in the framing. The two sets of tapes serve to take between them the folded collections of sheets from the cylinder 12 and carry them between rotary slitting cutters 89, 90, of a well known kind for slitting the folded collections crosswise of their fold into as many sixteen-page signatures as may be desired, the number of said signatures depending on the number of cutters 89, 90 on their shafts 89\*, 90\*.

In Fig. 1, there are represented rollers 91, 92 applied in well known ways for confining the sheets to the cylinder. In the same figure there are represented feed rollers 93, 94, by which the web from which the sheets are to be cut is carried to the cutters 13.

The construction and individual operations of the several parts of the machinery having now been described the explanation

of their combined operations will now be proceeded with. During every one-third of a revolution of the collecting cylinder a sheet will be collected upon one of its three sections by the opening and closing of one of the three sets of grippers, but it will be only once in one revolution and one third that the cam 30 will come into the operative position for opening any at all of the three sets in the position for releasing the collections of sheets to the tucking blades and folding jaws, but on the completion of every cycle of one revolution and one third the cam will come to its operative position and the set of grippers which then passes it will be opened. This will take place with respect to the several sets of grippers in regular succession. Suppose for example that the set  $a'$  takes a sheet in the position in which it is shown in Figs. 1 and 2, it will three times skip the cam 30 in passing the point at which  $a^3$  is represented, but the fourth time it passes that point the cam 30 will be in the operative position and the said set  $a'$  will be opened, and as it has taken a sheet at every revolution of the cylinder it will have collected thereon one upon another four sheets which will be delivered to the tucking blade and folding jaws to be folded. The next set of grippers  $a^2$  following  $a'$  in the revolution of the cylinder will take and deliver four sheets in like manner and so on with the set  $a^3$ .

It will be obvious that by changing the number of sets of grippers and the corresponding numbers of tucking blades on the cylinder 11 and giving the said cylinder and the folding cylinder the proper relative circumferences and speeds of revolution and by the proper timing of the operation of the cam 30, collections of a larger or smaller number of sheets may be made and folded together in the manner described.

What I claim as my invention is:

1. In a folding machine, a pair of rotary cutters for cutting sheets from a running web, a collecting cylinder having three sets of grippers thereon, each arranged to collect sheets one at a time and one upon another on the collecting cylinder, means for conducting the sheets from the cutters to the collecting cylinder, three tucking blades on the collecting cylinder alternating with the three sets of collecting grippers, a folding cylinder having a single set of folding jaws and mechanism arranged to cause the folding jaws to coact with successive tucking blades on the collecting cylinder every one and one-third revolutions of the collecting cylinder.

2. In a folding machine, a pair of rotary cutters for cutting sheets from a running web, a collecting cylinder having three sets of grippers thereon, each arranged to collect sheets one at a time and one upon another



other on the collecting cylinder, means for  
conducting the sheets from the cutters to  
the collecting cylinder, three tucking blades  
on the collecting cylinder alternating with  
5 the three sets of collecting grippers, a fold-  
ing cylinder having a single set of folding  
jaws and mechanism arranged to cause the  
folding jaws to coact with successive tuck-  
ing blades on the collecting cylinder every  
10 one and one-third revolutions of the col-  
lecting cylinder, and means for rotating the  
cutters two revolutions for each revolution  
of the folding cylinder and for rotating the  
collecting cylinder one and one-third revo-  
15 lutions for each revolution of the folding  
cylinder.

3. In a folding machine, a pair of rotary  
cutters for cutting sheets from a running  
web, a collecting cylinder having three sets  
20 of grippers thereon, each arranged to col-  
lect sheets one at a time and one upon an-  
other on the collecting cylinder, means for  
conducting the sheets from the cutters to

the collecting cylinder, three tucking blades  
on the collecting cylinder alternating with 25  
the three sets of collecting grippers, a fold-  
ing cylinder having a single set of folding  
jaws, mechanism arranged to cause the fold-  
ing jaws to coact with successive tucking  
blades on the collecting cylinder every one 30  
and one-third revolutions of the collecting  
cylinder, a stationary cam for successively  
opening each set of collecting grippers to re-  
ceive a sheet, and a movable cam for open- 35  
ing each set of collecting grippers after it  
has collected a group of four sheets, to per-  
mit the collection to be folded from the col-  
lecting cylinder on to the folding cylinder.

In testimony, that I claim the foregoing  
as my invention, I have signed my name in 40  
presence of two witnesses, this 15th day of  
February 1905.

EDGAR H. COTTRELL.

Witnesses:

FRED HAYNES,  
HENRY THIEME.