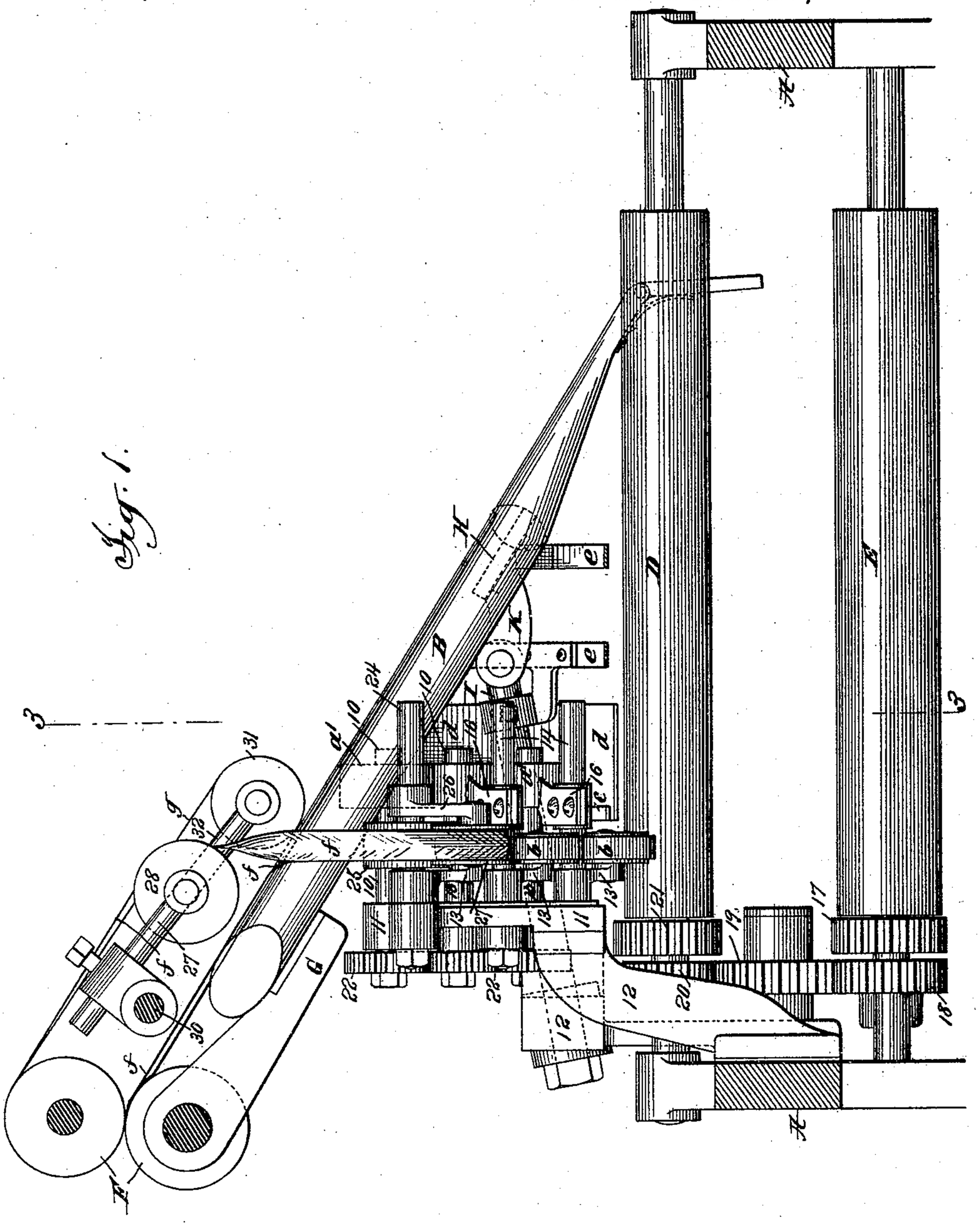
(No Model.) 5 Sheets—Sheet 1.

L. C. CROWELL.

FOLDING MECHANISM.

No. 492,760. Patented Feb. 28, 1893.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

L. C. CROWELL.

FOLDING MECHANISM.

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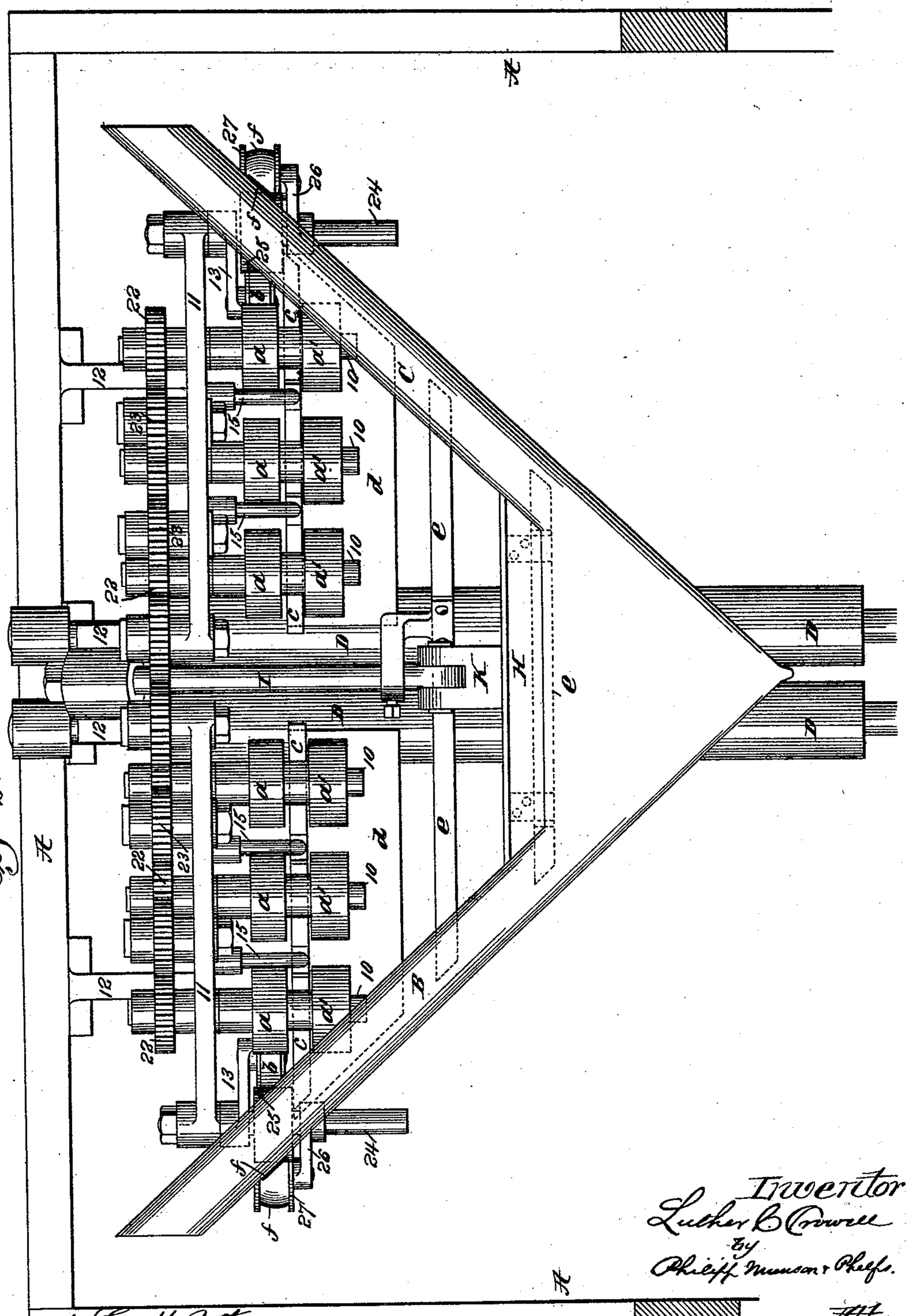

Fig. 2.

Witnesses
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(No Model.) 5 Sheets—Sheet 3.

L. C. CROWELL.

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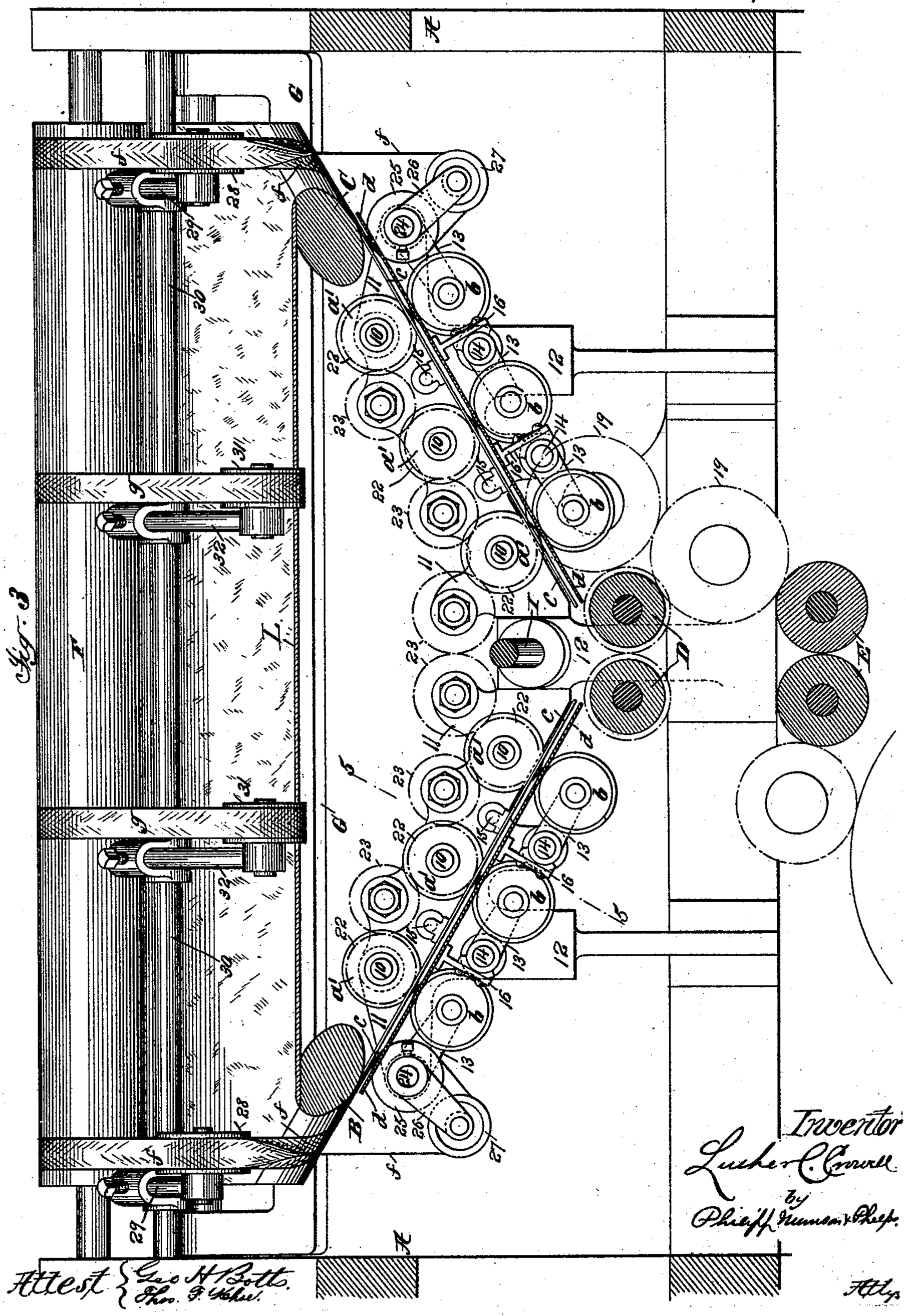

Fig. 3

Attest { Geo. H. Bolte. Thos. F. Kline.

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(No Model.) 5 Sheets—Sheet 4.

L. C. CROWELL.

FOLDING MECHANISM.

No. 492,760. Patented Feb. 28, 1893.

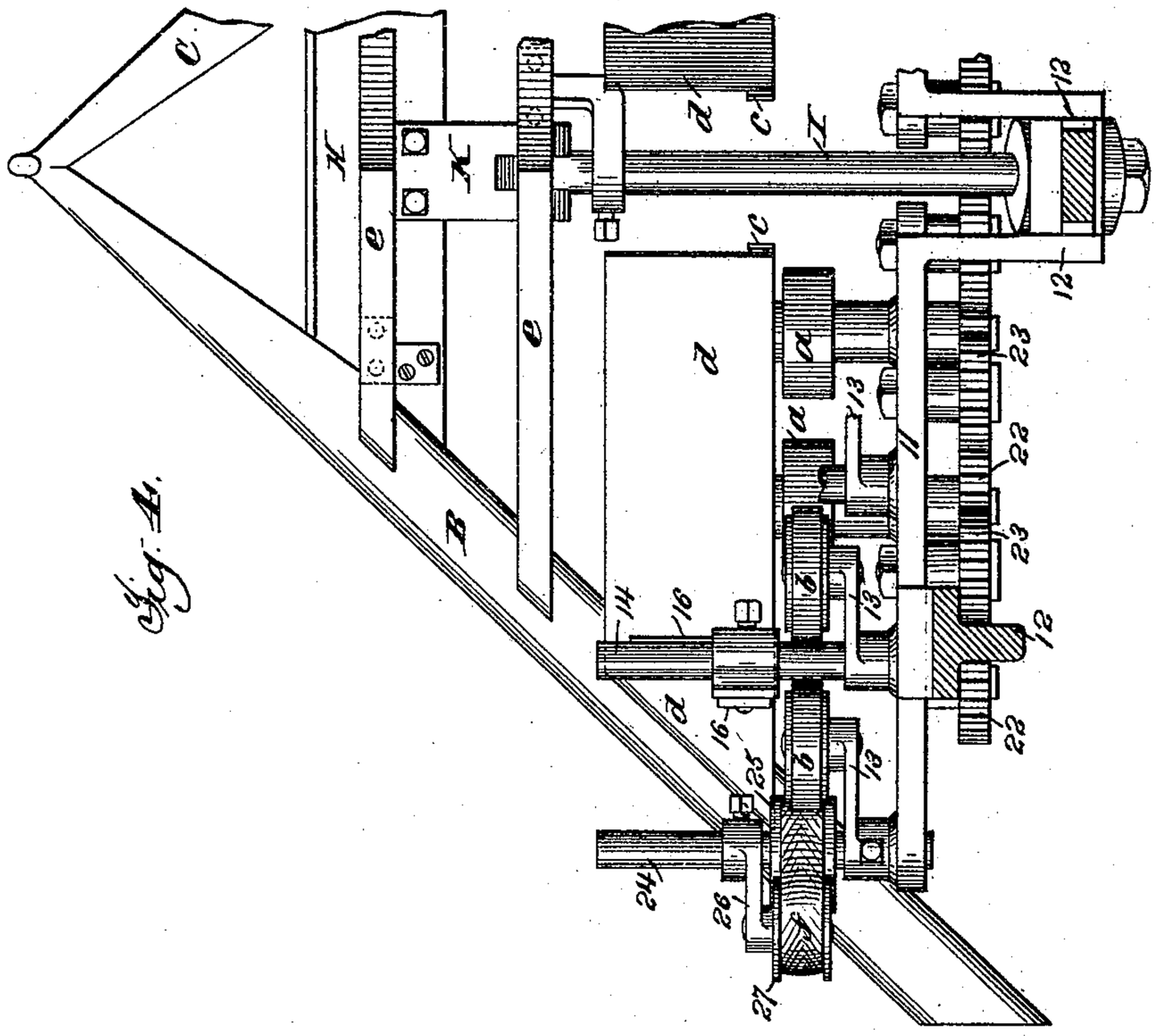

Fig. 4.

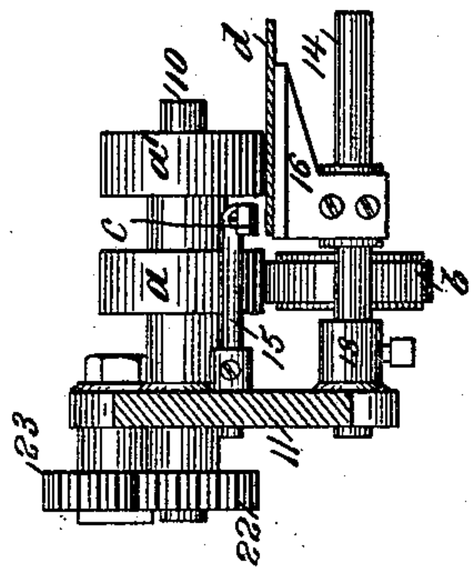

Fig. 5.

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(No Model.) 5 Sheets—Sheet 5.

L. C. CROWELL.

FOLDING MECHANISM.

No. 492,760. Patented Feb. 28, 1893.

Fig. 7.

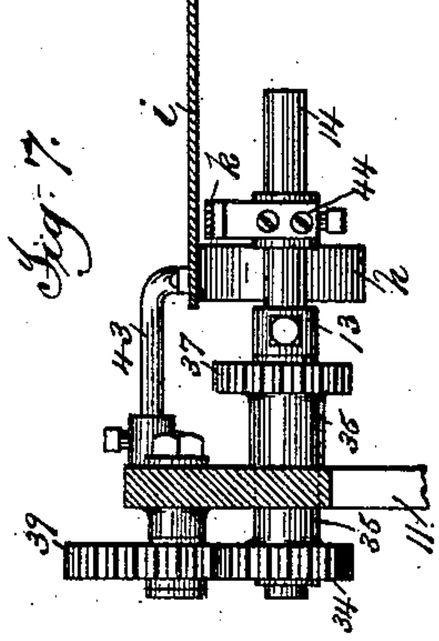
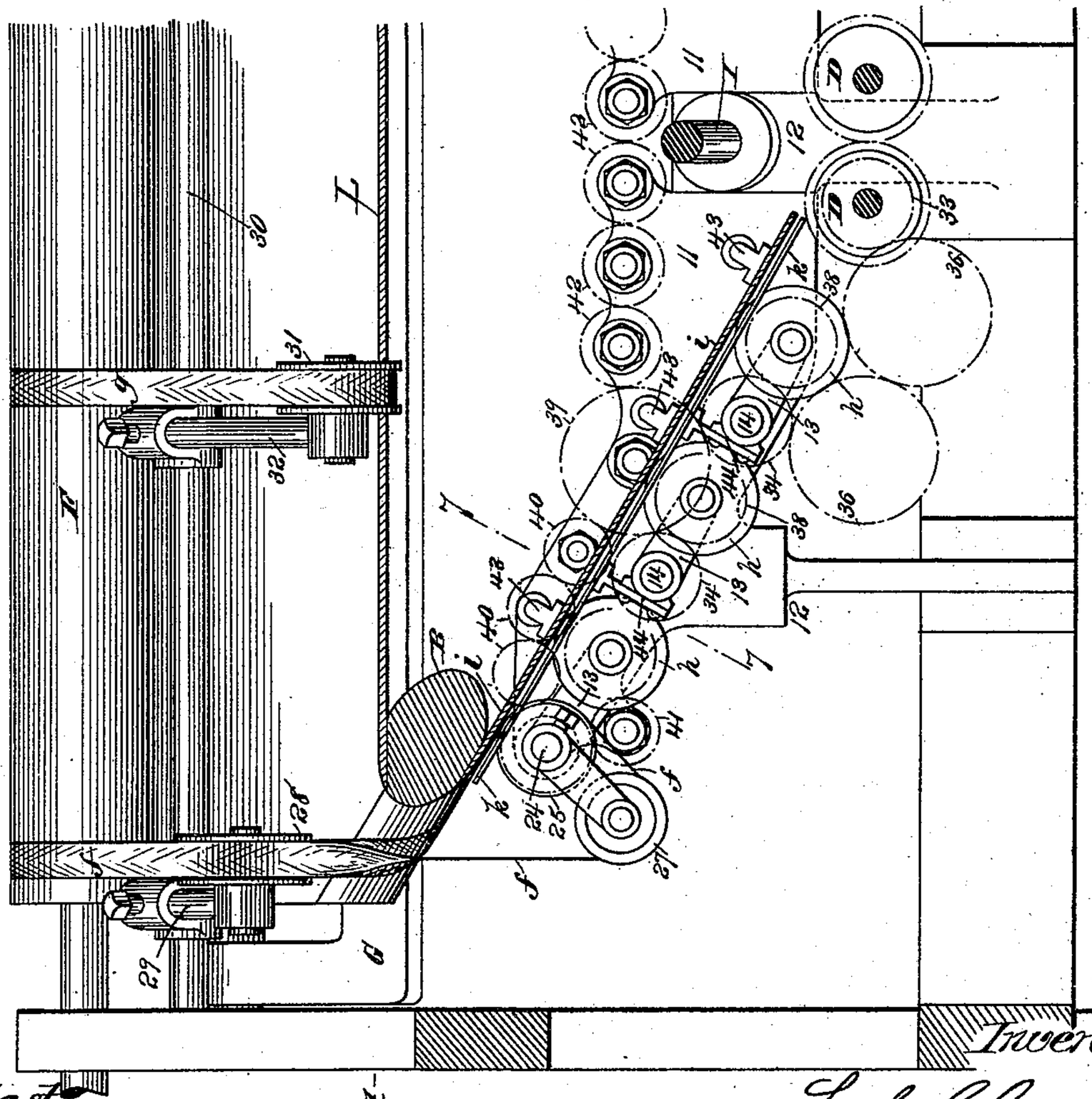


Fig. 6.



Witnesses:
Geo. H. Botts.
Thos. F. Kehoe.

Inventor:
Lucien C. Crowell
by
Sheriff Numan & Sheffe
Attys

UNITED STATES PATENT OFFICE.

LUTHER C. CROWELL, OF BROOKLYN, ASSIGNOR TO ROBERT HOE, STEPHEN D. TUCKER, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

FOLDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 492,760, dated February 28, 1893.

Application filed May 20, 1892. Serial No. 433,685. (No model.)

To all whom it may concern:

Be it known that I, LUTHER C. CROWELL, a citizen of the United States, residing at Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Folding Mechanism, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to that class of folding mechanisms which operate to impart a longitudinal fold to material passing over or through them on the run, and more particularly to such as are provided with a pair of converging internal folding guides or formers in passing over which the material has its sides carried toward each other so as to be doubled or folded longitudinally. Longitudinal folders of this class are shown and described in many of my prior Letters Patent. In such longitudinal folders adapted to fold sheets, tapes have previously been used for advancing the sheets over the folder, two series of tapes being employed or a series of external tapes co-acting with an internal plate. Such tape folders are shown in my patents Nos. 276,672, 281,619 and 331,280. The construction thus formed, however, is not entirely satisfactory in operation, as it is difficult to secure and maintain by tapes the proper tension at all points of the sheet to assure its proper feed and accurate folding, the construction is complicated and requires careful attention and frequent readjustment to secure the best results, and there is danger of offsetting, as it is found in practice that the desired certainty of action is not secured by marginal tapes.

The special object of the invention is to provide an improved longitudinal folder by which these objections may be avoided and sheets fed positively and with certainty and the requisite tension at all points of the sheet secured and maintained at high rates of speed, and I attain this object by the use of positively driven feeding rollers arranged to seize the sheet at opposite sides and advance it over the folder, these rollers converging from the internal guides at opposite sides of the folder so as to bring the opposite sides of the sheet together and form the longitudinal fold. The feeding rollers may be arranged either interior or exterior of the sheet and may co-act with a smooth plate or guide on the opposite side of the sheet to seize the paper, the rollers being preferably rubber faced or roughened in any suitable manner to secure the proper feed of the sheets. I secure greater certainty, however, by the use of two sets of rollers, interior and exterior of the sheet, and I prefer to use this construction, the rollers in this case also being preferably rubber faced or roughened. Both sets of the rollers may be positively driven, but this is unnecessary and I prefer to drive but one set positively, and the other set by friction therefrom, so that absolutely uniform speed of the two sets of rollers is secured and the pressure between the rollers may be varied readily by adjusting the frictionally driven rollers toward or from the positively driven rollers. The rollers may be arranged to advance the leading edge of the sheet without guides, or exterior guides only may be used, but I preferably provide interior and exterior guides between which the leading edge of the sheet is positively guided between the successive pairs of rollers.

My invention, therefore, consists broadly in the combination with the converging internal guides of a longitudinal folder, of positively driven feeding rollers arranged on the sides of the folder and coacting with suitable devices to advance the sheet from the guides, and in various constructions and combinations of parts, all of which will be fully described in the following specification and pointed out in the claims.

For a full understanding of my invention a detailed description of a construction embodying the same in its preferred form and a modification thereof will now be given in connection with the accompanying drawings forming a part of this specification, in which—

Figure 1 is a sectional side elevation of a folder of the preferred form with the exterior guiding plate on one side removed to show the parts. Fig. 2 is a plan view with the top plate removed. Fig. 3 is a vertical section on the line 3 of Fig. 1. Fig. 4 is a reversed plan

of one side of the folder, one of the exterior rollers being broken away. Fig. 5 is a detail cross section on the line 5 of Fig. 3, looking to the right. Fig. 6 is a partial section similar to Fig. 3, showing a modification. Fig. 7 is a detail cross section on the line 7 of Fig. 6, looking to the right.

Referring particularly to Figs. 1 to 5, it will be understood that the frame A may be of any suitable construction, as common in web printing and other machines employing longitudinal folders of this class.

B, C are the internal guides over which the sides of the sheet are bent to form the fold, these internal guides B, C being shown as consisting of bars converging to the apex *a* between a pair of rolls D forming the fold laying device or external guides and from which the folded sheet passes to a pair of feeding rolls E. The sheet is advanced to the folder by a pair of feeding rolls F mounted at the top of the folder.

The internal guides B, C are supported at their upper ends by a bar G extending across the top of the folder and mounted on the shaft of the lower feed roll F, and at their lower ends by a cross bar H carried by a vertically adjustable arm K on a bar I extending rearward under the folder and mounted in a bracket on the frame A, so as to be adjustable longitudinally, thus securing the proper positioning of the guides B, C. The folder may be left open at the top, only the internal guides B, C being used, but a top plate L extending between the internal guides will preferably be used to aid in supporting the middle of the sheet.

The construction thus far described is that of longitudinal folders now in common use in web printing and other machines, and it will be understood that my invention may be applied to other similar constructions.

Referring now to the parts in which my invention is embodied, on each side of the folder are two sets of rollers or pulleys *a*, *b*, arranged respectively inside and outside of the path of the sheet as it passes over the folder, these rollers being mounted so as to rotate in the proper plane to advance the sheet over the folder, and the angle of this plane to the guides B, C, being accurately adjusted to keep the sheet taut and secure the proper tension at every point. These rollers *a*, *b* are mounted so as to engage each other and thus advance the sheet between them, and are preferably rubber faced or provided with surfaces roughened in any suitable manner to give a better hold upon the paper. The rollers *a*, *b*, are preferably mounted so as to engage the margin of the sheets close to the edge, so as to hold the corners of the sheets down, but it will be understood that this position may be varied somewhat.

The interior rollers *a* are carried by short shafts 10 supported in bars 11 extending across the rear of the folder and mounted in standards 12 on the frame A. The exterior rollers *b* are mounted in arms 13 sleeved on studs 14 carried by the bars 11 and held in adjusted position on the studs by set screws, as shown, or by any other suitable means, so that by adjustment of the arms on the studs, the position of the rollers *b* of each pair relatively to rollers *a* may be varied independently of the other pairs to secure the proper pressure on the sheets.

A single set of interior rollers *a* may be used, but I preferably provide a second series of rollers *a'*, so that by moving the rollers *b* longitudinally of their supporting studs 14, they may be brought into position to engage one or the other of the sets of rollers *a*, *a'*, the folder thus being readily adjusted for folding sheets of different widths.

The rollers *a*, *b* and internal guides B, C will operate to fold a sheet without side guides, but I prefer to provide guides for the leading edge of the sheet as it is advanced by the rollers *a*, *b*, these guides operating to insure the proper advancement of the sheet to the fold laying device, and especially to secure the proper movement of the leading edge of the sheet between one pair of rollers *a*, *b* and the next. These guides may be formed in any suitable manner and only exterior guides be employed, but preferably both interior and exterior guides will be used. The exterior guides may consist of plates extending from the internal guides B, C downward to the fold laying device and slotted for the engagement of the rollers *a*, *b* and the interior guides may be formed in the same manner, the sheet thus being fed downward between two broad plates. It is unnecessary, however, that these guides, especially the interior guides, should extend over more than a small portion of the sheet and I prefer to use substantially the construction shown. In this construction a single narrow interior guide *c* on each side of the folder is used, these guides being carried by studs 15 mounted in the cross bars 11, and the exterior guides consist of plates *d* adjacent to the rollers and co-acting with the interior guides *c*. Narrow exterior guides *e* are preferably added between the guides *d* and the apex of the folder. The guides *d* are carried by brackets 16 adjustably mounted on the studs 14 so that these brackets may be adjusted longitudinally of the studs 14, and the guides *d* be simultaneously moved inside the rollers *a'* when the rollers *b* are shifted from the position shown in Fig. 5 into position to engage the inner rollers *a'* on the shafts 10.

Either one or both of the sets of rollers *a*, *b* may be driven positively but one of the sets is preferably driven positively and the other by friction with the same, and I prefer to drive the interior set of rollers *a*, as the driving mechanism can thus be simplified and made more compact.

As shown the fold laying rolls D and the rollers *a*, *b* are driven from the feeding rolls E as follows:—The feeding rolls E are geared

together by gears 17 and one of them carries a gear 18 from which the fold laying rolls D are driven through an intermediate 19 and gear 20 on the rolls, the fold laying rollers being geared together by gears 21. The rollers *a* are driven from gear 18 through a second intermediate 19 in addition to that previously described, gears 22 on shafts 10, and intermediates 23 connecting said gears so as to drive all the rollers *a* at a uniform rate of speed.

Any suitable feeding devices may be used for securing the proper advance of the sheet to the rollers *a*, *b* and bending it about the internal guides B, C, so as to carry the leading edges into the grasp of the rollers *a*, *b*. I prefer, however, to use the construction shown, which I have found to form a simple and efficient means for this purpose, co-acting well with the rollers *a*, *b*. In this construction a stud 24 is mounted on each side of the folder just below the upper ends of the interior guides B, C, these studs corresponding in position and means of support to the studs 14 previously described. These studs 24 carry belt pulleys 25 and arms 26 adjustable on the studs, these arms carrying belt turning pulleys 27, so that by the adjustment of these arms the marginal tapes *f* running over the edges of the interior guides B, C may be adjusted to run as desired. These marginal tapes are led from the upper feeding roll F over the upper ends of the internal guides B, C, then around the guides and downward around the belt pulleys 25, 27, returning over adjustable tension pulleys 28 mounted in arms 29 on bar 30 supported in the frame at the top of the folder.

Between the marginal tapes *f*, two or more tapes *g*, two being shown in the present case, are led from the upper feeding roll F over the plate L on the top of the folder to points about opposite the upper ends of the guides B, C, and returned over adjustable tension pulleys 31 on arms 32 on bar 30, as in the case of the tapes *f*. It will be understood that the folder may be operated without the middle tapes *g*, but they are preferably used to aid in feeding the sheet.

While I prefer to use two sets of feeding rollers interior and exterior of the sheet, as I thus secure greater certainty of action, a construction employing but one set of rollers coacting with a plate or similar device to seize the sheet will be found to operate fairly well, and such a construction is within my invention. In such a construction, the feeding rollers may be placed either interior or exterior of the sheet, but I prefer to use exterior rollers with an interior plate, and I have illustrated such a construction in Figs. 6 and 7 which will now be described. The general construction of the folder shown in these figures is identical with that previously described, and the same means are used for advancing the leading end of the sheet over the internal guides to the feeding rollers. The single set of exterior feeding rollers *h* correspond in position and means of mounting and adjustment toward and from the path of the sheet with the rollers *b* of the construction previously described, being carried by sleeves 13 adjustably mounted on studs 14 carried by bars 11.

The feeding rollers *h* are driven positively from one of the fold laying rolls D as follows:— The fold laying roll carries a gear 33 which drives through two intermediates 36 a gear 34 carried by a sleeve 35 loose on the stud 14 adjacent to the roll D, and this sleeve 35 carries a gear 37 which meshes with a gear 38 on the shaft of the feeding roll *h*, which is carried by arm 13 adjustable on stud 14 as in the construction previously described, so that the roll *h* may be adjusted toward or from the path of travel of the sheet without interfering with the mesh of the gears, the proper feeding pressure thus being secured. The next feeding roll *h* is driven from the gear 34 by similar gearing on its stud 14 and shaft through an intermediate 39, and the upper feeding roll *h* is driven from the intermediate 39 through intermediates 40 and a gear and sleeve on the stud 24 carrying belt pulley 25, except that the movement is transmitted from gear 37 on the stud 24 to the gear 38 on the shaft of the feeding roll *h* through an intermediate 41 carried by the arm 13. Only one side of the folder is shown, but it will be understood that the construction of the opposite side is identical with that shown, and the feeding rollers *h* on the opposite side may be driven from the other fold laying roll D by similar gearing, although I prefer to carry the movement from one side of the folder to the other from intermediate 39 by the series of intermediates 42, as shown. In this construction the feeding rollers *h* coact with highly polished rigid plates *i* supported firmly in position so as to sustain the feeding pressure of the rollers *h*. These plates *i* may extend over the whole width of the sheet or may consist of comparatively narrow plates. I prefer, however, to use plates extending substantially the width of the sheet and corresponding to the ordinary side plates frequently used in longitudinal folders. The plates *i* may be mounted and supported in any suitable manner, but as shown they are supported at their upper edges by being secured to the internal guides B, C, the guide and plate being cut away so as to make the exterior surfaces of the plate continuations of the guides. The plates are preferably supported also at their rear edges opposite the rollers *h* so as to give a rigid support against the feeding pressure, by brackets 43 mounted in bars 11 similarly to brackets 15 of the construction previously described.

The feeding rollers *h* and plates *i* may be used without other guides, but I prefer to use also exterior guides *k* adjacent to the rollers *h* so as to insure the proper lead of the edge of the paper between the rollers, these guides *k* consisting of narrow plates supported on

brackets 44 carried adjustably by studs 14, similarly to brackets 16 of the construction previously described. It will be seen that the rollers *h* and guides *k* are thus longitudinally adjustable on the studs 14, as in the case of rollers *b* and guides *d* of the construction previously described, so that by moving the rollers *h* and guides *k* longitudinally of the studs 14, the rollers may be brought into position to engage the margins of sheets of different widths.

While I have shown sets of three feeding rollers on each side of the folder, and this number forms a convenient and efficient construction for longitudinal folders of the size common in newspaper printing machines, it will be understood that rollers of any suitable size or number may be used and this will vary with the size of the folder.

It will be found that my invention provides a very simple, efficient, and durable longitudinal folder, capable of folding either a single sheet or two or more sheets with certainty at a very high rate of speed, the proper tension upon the sheet or sheets at every point being readily secured by the adjustment of the guides B, C relatively to the feeding rollers, and all danger of offsetting being avoided as the rollers need engage only the unprinted margin of the sheet. While the construction has been described as applied to folding sheets, it will be understood that it is applicable also to associating two or more sheets or webs led over the opposite sides of the folder, my improved construction being admirably adapted for this use. It will be understood also that a slitter, and other devices in use with the present longitudinal folders, are equally applicable to folders embodying my invention.

What I claim is—

1. In a longitudinal folder, the combination with converging internal guides, of feeding rollers on the opposite sides of the folder converging from the internal guides, means coacting with said rollers to form feeding devices and means for advancing the leading end of the sheet over the guides to the feeding rollers, substantially as described.

2. In a longitudinal folder, the combination with converging internal guides, of feeding rollers on the opposite sides of the folder converging from the internal guides, means coacting with said rollers to form feeding devices guides for directing the leading end of the sheet between the successive rollers, and means for advancing the leading end of the sheet over the converging guides to the feeding rollers, substantially as described.

3. In a longitudinal folder, the combination with converging internal guides, of feeding rollers on the opposite sides of the folder converging from the internal guides, rollers coacting therewith to advance the sheet, and means for advancing the leading end of the sheet over the guides to the feeding rollers, substantially as described.

4. In a longitudinal folder, the combination with converging internal guides, of feeding rollers on the opposite sides of the folder converging from the internal guides, frictionally driven rollers co-acting with said feeding rollers to advance the sheet, and means for advancing the leading end of the sheet over the guides to the feeding rollers, substantially as described.

5. In a longitudinal folder, the combination with converging internal guides and a fold laying device, of feeding rollers on the opposite sides of the folder converging from the internal guides to the fold laying device, means coacting with said rollers to form feeding devices and means for advancing the leading end of the sheet over the guides to the feeding rollers, substantially as described.

6. In a longitudinal folder, the combination with converging internal guides, of feeding rollers on the opposite sides of the folder converging from the internal guides, means coacting with said rollers to form feeding devices and marginal tapes advancing the leading end of the sheet over the guides to the feeding rollers, substantially as described.

7. In a longitudinal folder, the combination with converging internal guides B, C, of interior and exterior feeding rollers *a*, *b* on the opposite sides of the folder, means for driving said rollers, external guides *d* and means for advancing the sheet over the guides B, C to the rollers, substantially as described.

8. The combination with converging internal guides B, C, of interior and exterior feeding rollers *a*, *b* on the opposite sides of the folder, means for driving one series of said rollers positively, external guides *d* and means for advancing the sheet over the guides B, C to the rollers, substantially as described.

9. The combination with converging internal guides B, C, of interior and exterior feeding rollers *a*, *b*, on the opposite sides of the folder, means for driving said rollers, internal and external guides *c*, *d* and means for advancing the sheet over the guides B, C to the rollers, substantially as described.

10. The combination with converging internal guides B, C, of interior feeding rollers *a*, *a'* and exterior rollers *b* adjustable into position to co-act with either of said rollers *a*, *a'*, substantially as described.

11. The combination with converging internal guides B, C, of shafts 10 carrying interior feeding rollers *a*, *a'*, means for driving said shafts, studs 14, and exterior rollers *b* adjustable on said studs to co-act with either of said rollers *a*, *a'*, substantially as described.

12. The combination with converging internal guides B, C, of shafts 10 carrying rollers *a*, means for driving said shafts, studs 14, and rollers *b* carried by arms 13 adjustable on said studs to vary the feeding pressure, substantially as described.

13. The combination with converging internal guides B, C, of interior and exterior feeding rollers *a*, *b*, and marginal tapes *f* bend-

ing the sheet about the guides B, C and advancing the leading end of the sheet to the feeding rollers, substantially as described.

14. The combination with converging internal guides B, C, of interior and exterior feeding rollers *a*, *b*, top plate L, marginal tapes *f* extending over the guides B, C, and central tapes *g* co-acting with said plate L, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

LUTHER C. CROWELL.

Witnesses:
THOS. F. KEHOE,
C. J. SAWYER.