

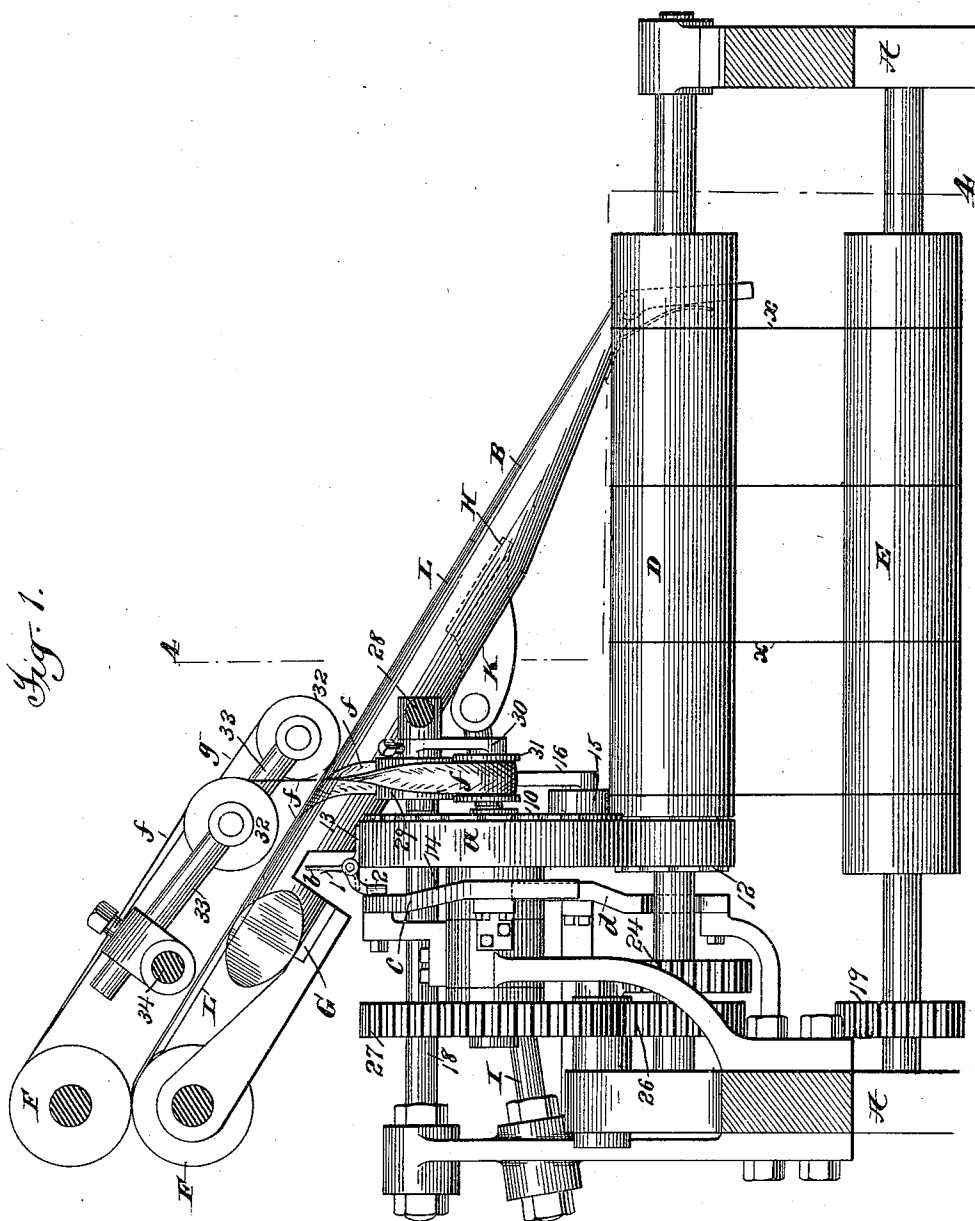
(No Model.)

7 Sheets—Sheet 1.

E. P. SHELDON.  
FOLDING MECHANISM.

No. 505,855.

Patented Oct. 3, 1893.



Attest.

F. Kehoe

C. J. Saurgen

*Inventor*

Edward P. Sheldon

Philip<sup>by</sup> Munson Phelps

Atty. S.

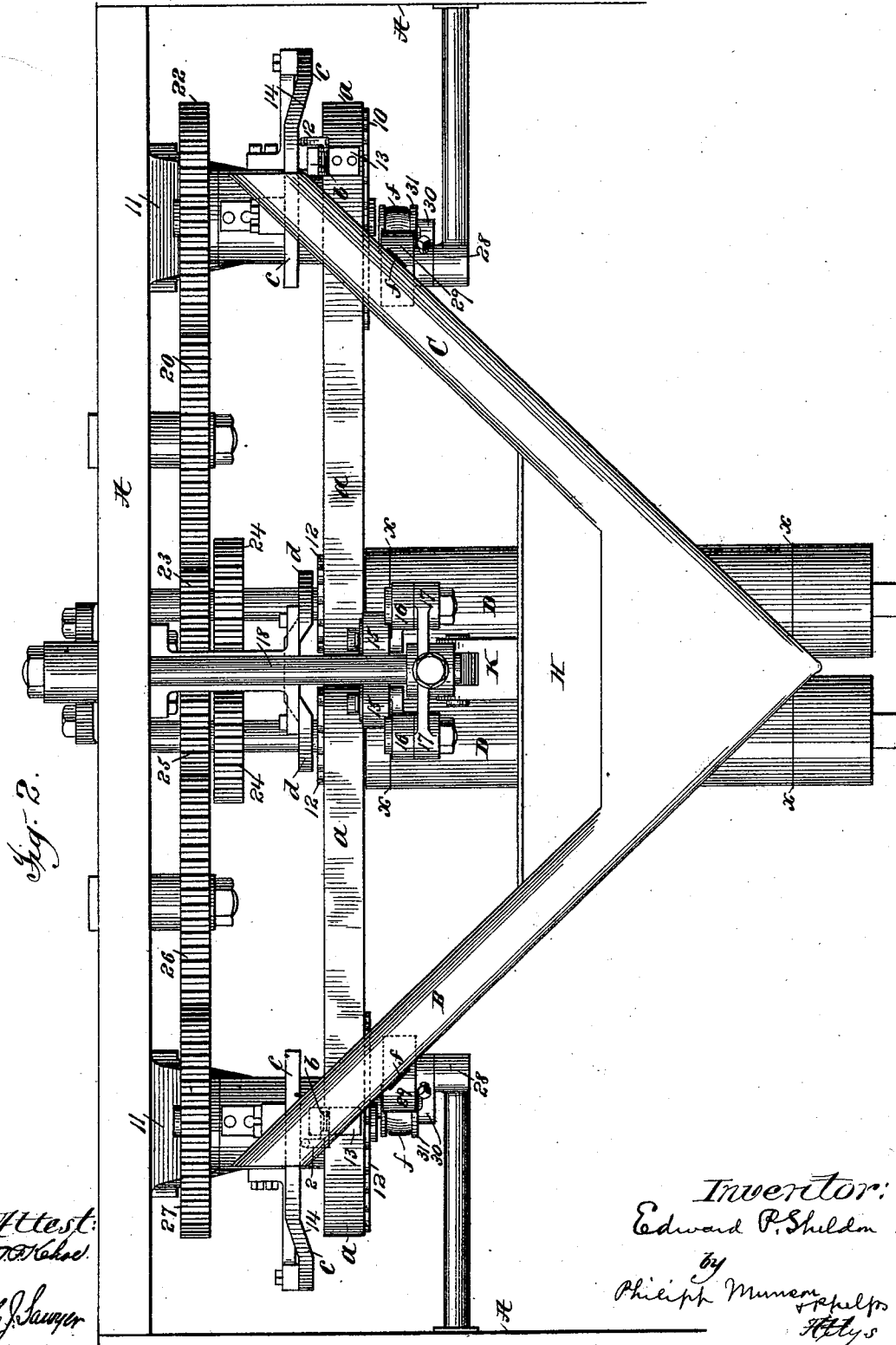
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7 Sheets—Sheet 2.

E. P. SHELDON.  
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Patented Oct. 3, 1893.



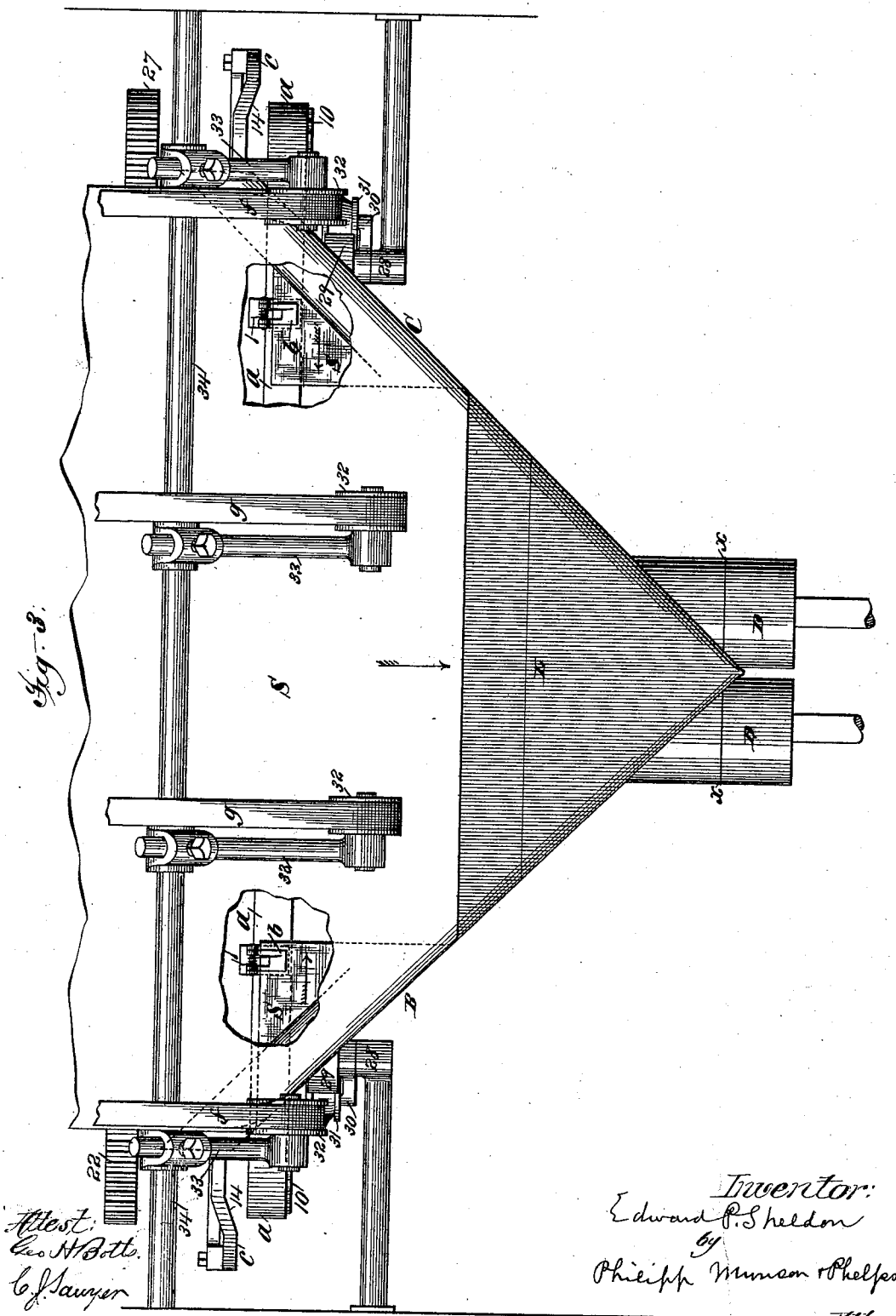
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7 Sheets—Sheet 3.

E. P. SHELDON.  
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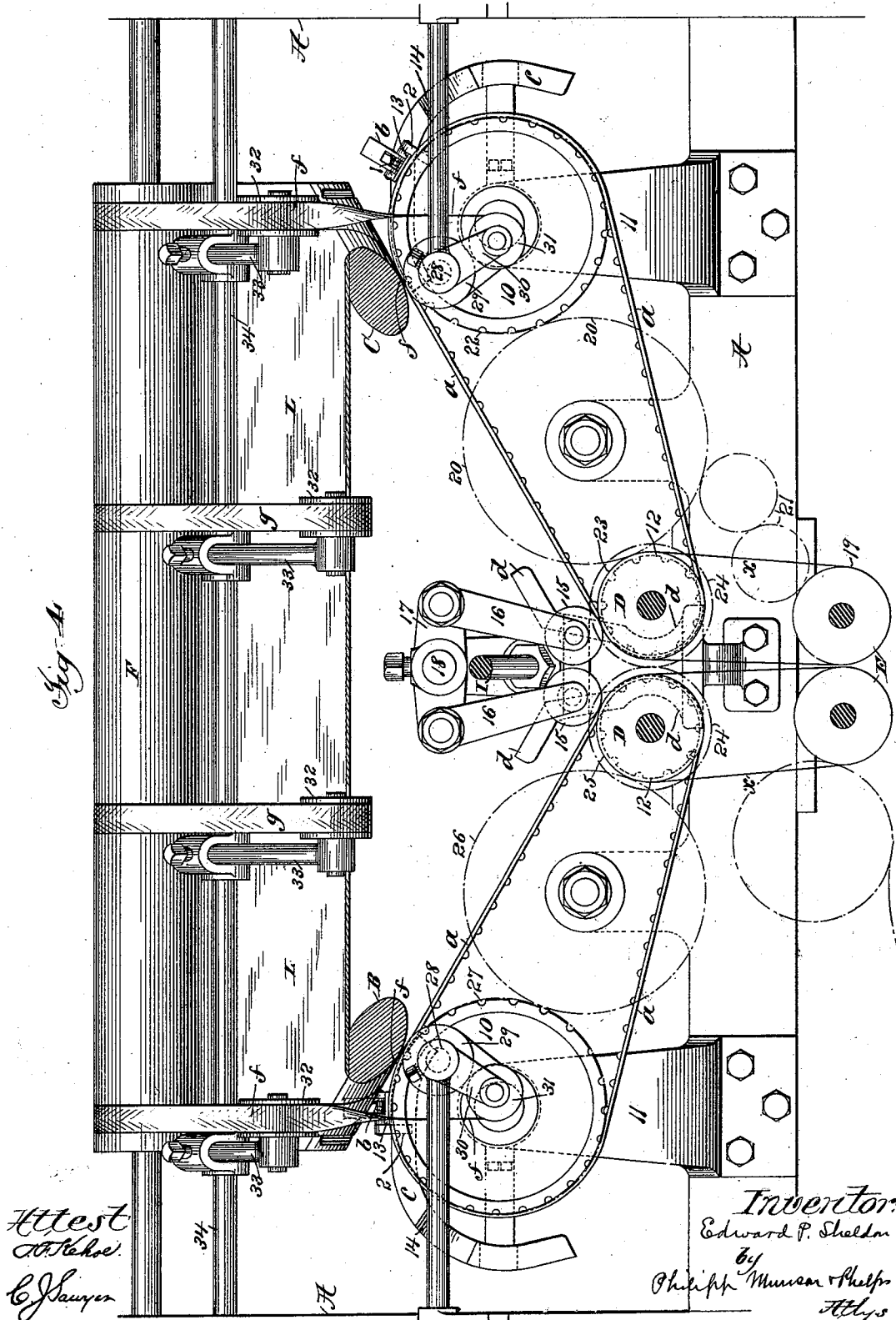
(No Model.)

7 Sheets-Sheet 4.

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(No Model.)

7 Sheets—Sheet 5.

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Fig. 5.

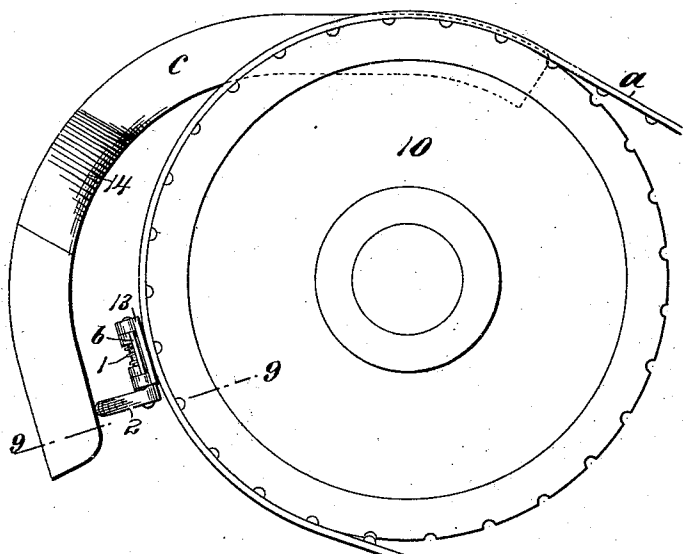


Fig. 7.

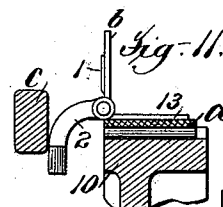
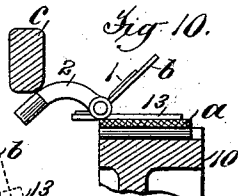
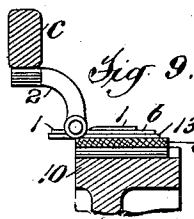
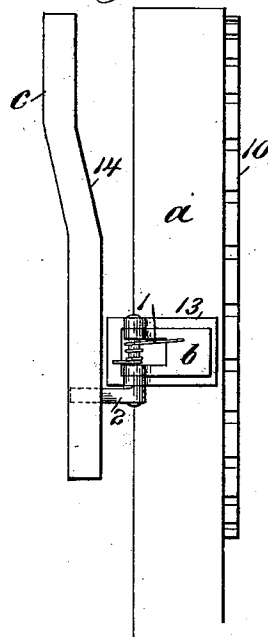
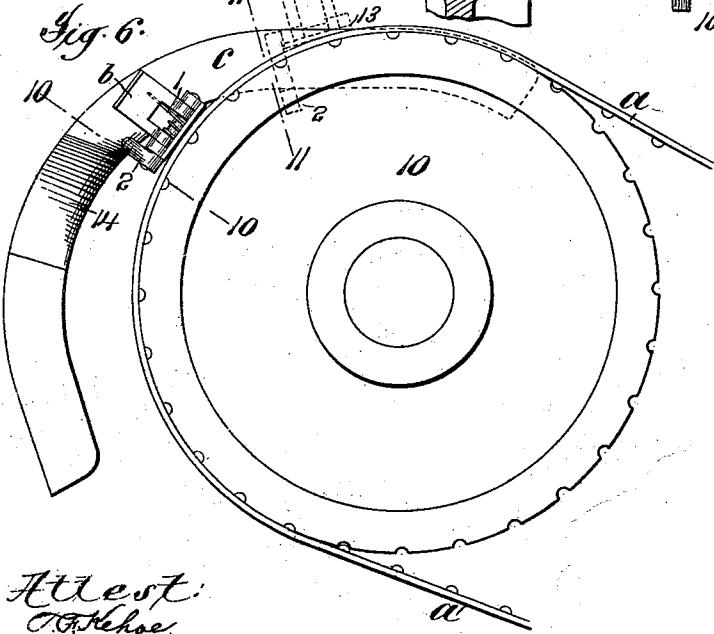
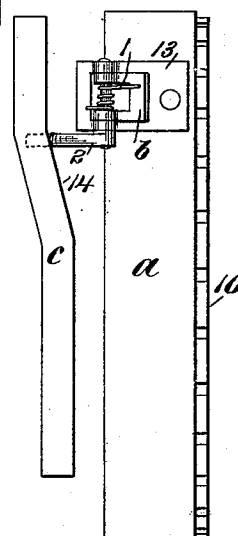


Fig. 8.



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Fig. 12.

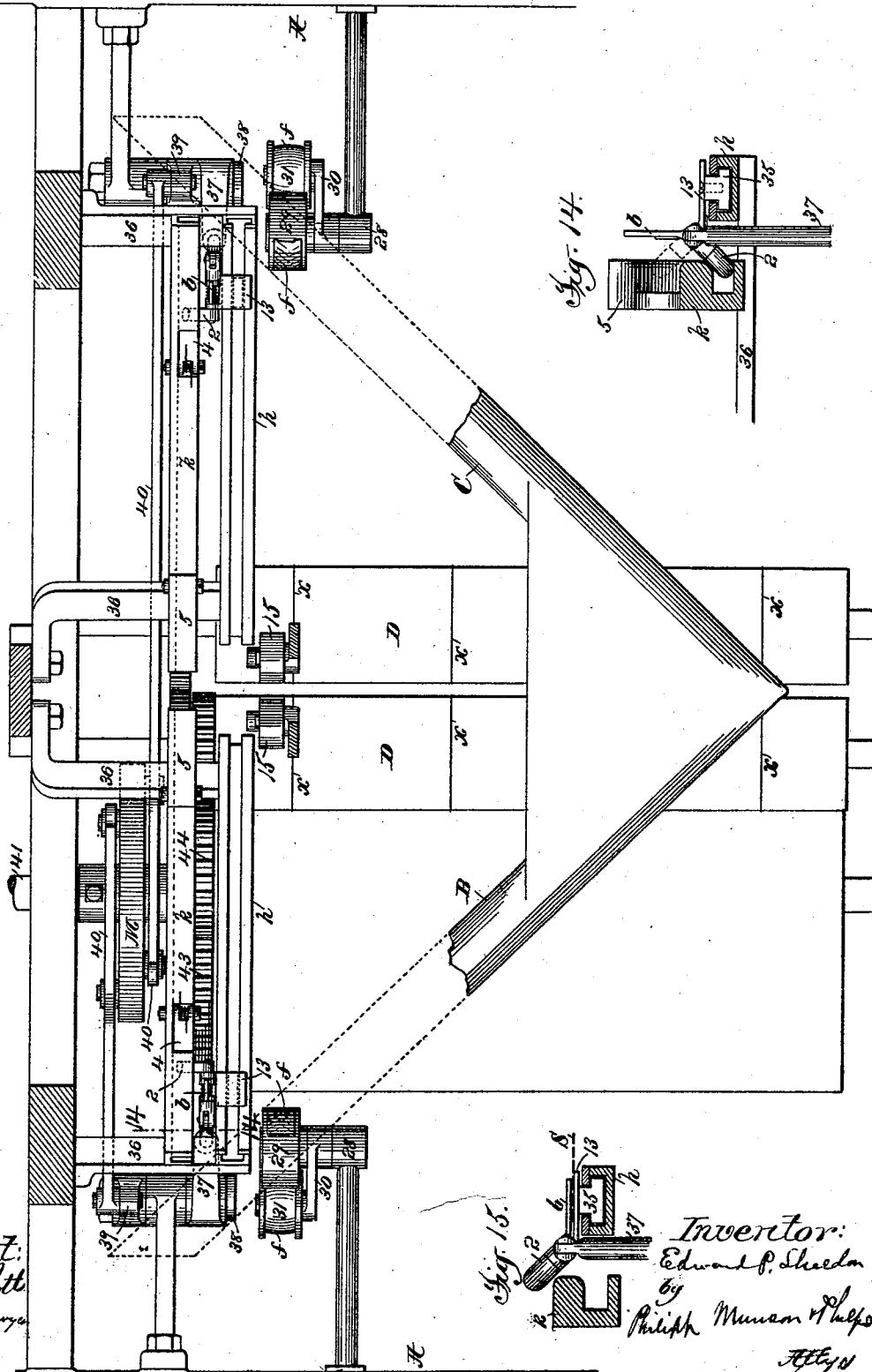


Fig. 14.

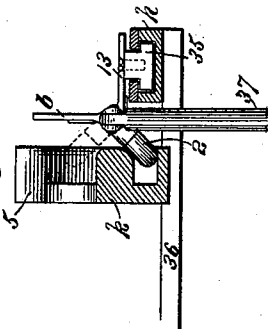
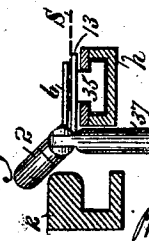


Fig. 15.



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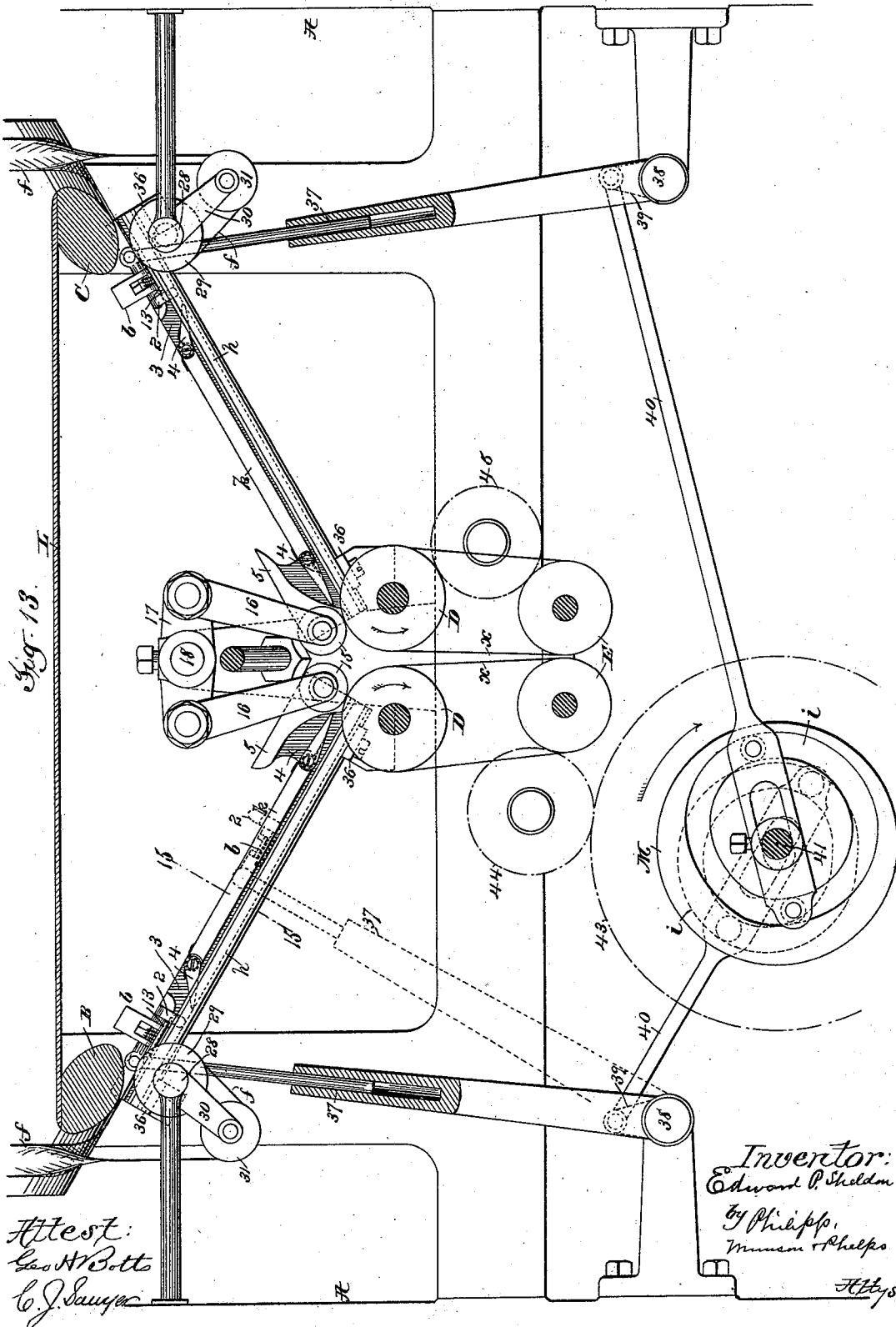
(No Model.)

7 Sheets—Sheet 7.

E. P. SHELDON.  
FOLDING MECHANISM.

No. 505,855.

Patented Oct. 3, 1893.



# UNITED STATES PATENT OFFICE.

EDWARD P. SHELDON, OF BROOKLYN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, TO ROBERT HOE, THEODORE H. MEAD, AND CHARLES W. CARPENTER, OF NEW YORK, N. Y.

## FOLDING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 505,855, dated October 3, 1893.

Application filed November 14, 1892. Serial No. 451,869. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD P. SHELDON, 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 Mechanisms, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 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  
15 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. In such longitudinal folders adapted to fold sheets, tapes have commonly been used for advancing the sheets over the guides, series of internal and external tapes being employed, or  
20 a series of external tapes coacting with an internal plate. Such tape folders are shown in 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  
25 insure its proper feed and accurate folding, the construction requires careful attention and frequent readjustment to secure the best results, and there is danger of offset, as the desired certainty of action cannot be secured by marginal tapes alone.

30 The special object of this 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 grippers by which the sheet is seized at opposite  
35 sides and advanced positively over the folder, these grippers being moved in paths converging from the internal guides at opposite sides of the folder, so as to bring the opposite sides of the sheet together to form a longitudinal fold. The grippers may be of any suitable

construction, and any suitable means may be 50 used for moving the grippers in their converging paths, and for closing and opening the grippers to grip and release the sheets. I prefer, however, to mount the grippers on endless conveying belts running in converging paths at opposite sides of the folder, and to actuate the grippers by a cam acting against spring pressure. The cam may actuate the grippers in either direction, but I preferably open the grippers by a fixed cam with which  
55 a member controlling the grippers is brought in contact at the proper time during the movement of the belts, and close the grippers by spring action upon their release by the cam, and in order to shorten the cams, separate  
60 cams are preferably used at the points of receipt and delivery of the sheet, so that the grippers are closed by spring pressure except as they are opened for this purpose, although it will be understood that the action of the  
65 grippers between these points is not essential, so long as the grippers are open at the proper time to receive the sheet, then close and grip the sheet, and again open at the proper time to deliver the sheets.

70 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—

75 Figure 1 is a side elevation of a folder of the preferred form embodying my invention, the grippers being shown open to receive a sheet. Fig. 2 is a plan view with the top plate removed. Fig. 3 is a broken plan view showing the position of the paper and grippers as the sheet is seized. Fig. 4 is a vertical section on the line 4 of Fig. 1. Figs. 5 and 6 are enlarged front views showing in detail the operation of opening the grippers to receive the paper, the grippers being shown in different positions. Figs. 7 and 8 are plan views corresponding respectively to Figs. 5 and 6. Figs. 9, 10 and 11 are detail cross sections on respectively the lines 9, 10 and 11 of Figs. 5 and 6. Fig. 12 is a broken plan view showing a modification. Fig. 13 is a section of the



same similar to Fig. 4, and Figs. 14 and 15 are cross sections on the lines 14 and 15 of Figs. 12 and 13.

Referring to Figs. 1 to 11, 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 S are bent to form the fold, these internal guides B, C being shown as consisting of bars converging to the apex between a pair of rolls D forming the fold laying device or external guides, and from which the folded sheet is guided to a pair of feeding rolls E by converging cords or tapes *a*. 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 an arm K pivoted 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 printing and other machines, but 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 is an endless belt *a*. These belts are arranged so as to converge at the fold laying device, and are preferably mounted so as to engage the margin of the sheets close to the edge. Each belt carries a gripper *b* arranged to grip the paper against the belt or a plate thereon by which the gripper is supported, so as to hold the sheet and advance it with the belt and not engage the printing portion of the sheet, the grippers engaging the sheet at the corner formed by the head and side margins, but it will be understood that this position may be varied somewhat. The belts *a* are carried at their upper ends by large belt rolls or pulleys 10 supported in brackets 11 on the frame A, and at their lower ends are carried by belt rolls 12 on the inner ends of the shafts of the fold laying rolls D. In order to secure absolute uniformity of movement and prevent slip, the belt rolls or pulleys 10, 12 are preferably provided with grooves or depressions, and the belts *a* carry a series of projections on their inner surfaces which run in said grooves or depressions, so that the belts are thus positively driven by the rolls. The grippers *b* may be constructed and secured to the belts in any suitable man-

ner, and any suitable means may be used for opening and closing the grippers. As shown, the gripper *b* consists of a small plate pivoted in a larger plate 13 secured upon the face of the belt in any suitable manner. The gripper is closed to seize the sheet by spring pressure, and is opened against the spring pressure by a cam, and for this purpose a coiled spring 1 is used pressing the gripper *b* normally against its supporting plate 13 upon the belt, and the gripper is provided with an arm 2 by which it may be rocked against the tension of spring 1 and opened. For the purpose of thus opening the grippers to receive the sheets, there is placed opposite each of the belt rolls or pulleys 10 a cam *c* by which the grippers *b* are operated through the arms 2, so as to open them at the required time, and hold them open until the sheet is in position to be seized. These cams *c*, as shown in the drawings, are so shaped and positioned that the arm 2 is engaged on the under face of the cam as it is carried upward around the pulley 10, and thus partially opened, then passes from the under face of the cam to the side face on the incline 14, and then runs around upon the side face of the cam and is held open until it passes off the cam at the time the sheet is to be seized, the converging guides B, C, being cut away, as shown, so as to allow the open grippers to pass them in the proper position. It is necessary, also, that the grippers should be opened as they reach the rolls D to release the sheet as the fold is completed, and for this purpose cams *d* similar in construction and operation to the cams *c* are used, these cams engaging the arms 2 of the grippers *b* as the grippers approach the rolls D and holding the grippers open until they have passed to the under side of the belt pulleys 12, when they are released by the cams and the grippers are closed by the springs 1.

To secure a positive feed of the sheets as they are released by the grippers *b*, I employ feeding rolls 15 mounted in position so that the sheets are gripped by them and the rolls D just before the sheets are released by the grippers, these rolls 15 being carried by arms 16 supported on a bracket 17 carried by a rod 18 mounted in the frame A, the parts being so constructed and arranged that the rolls 15 may be adjusted so as to secure their proper position and the requisite pressure upon the rolls D.

The belts *a* and parts co-operating therewith to complete the fold may be driven in any suitable manner. As shown, these parts are driven from gear 19 on the shaft of one of the rolls E, this gear driving a large intermediate 20 placed between pulleys 10, 12 by small intermediates 21, and the large intermediate 20 driving pulleys 10, 12 through gears 22, 23 on their respective shafts. The pulleys 12 and rolls D are geared together by gears 24, and movement is transmitted from one side of the folder to the other by gear 25

on the shaft of the roll D corresponding to gear 23 and meshing with an intermediate 26 corresponding to intermediate 20, and from which gear 27 on the shaft of the other belt pulley 10 is driven.

Any suitable feeding devices may be used for securing the proper advance of the sheet over the top plate of the folder, and bending it about the internal guides B, C so as to carry the leading edges into position to be seized by the grippers *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 grippers. In this construction, a stud 28 is mounted on each side of the folder just below the upper ends of the internal guides B, C, and these studs 28 carry belt pulleys 29 and arms 30 adjustable on the shafts of these pulleys. These arms 30 carry belt turning pulleys 31 so that by the adjustment of these arms the marginal tapes *f* running over the edges of the internal guides B, C may be adjusted to run as desired. These marginal tapes are led from the upper feed roll F over the upper end of the internal guides B, C, then around the guides and downward around the belt pulleys 29, 31, returning over adjustable tension pulleys 32 mounted in arms 33 on bar 34 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 feed 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 32 on arms 33 on bar 34, 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.

The operation of the construction will be understood from a brief description in connection with the drawings.

The sheet to be folded is advanced over the folder by the feed rolls F and tapes *f*, *g*, and the leading edge is bent around the internal guides B, C by the tapes *f* into position to be seized by the grippers *b*. As the leading edge of the paper reaches the position shown in Fig. 3, the arms 2 of the grippers *b* pass off the ends of the cams *c* and the grippers are closed by spring pressure so as to seize the sheet on each side at the leading end and preferably on the margin, as in the construction shown. The side margins of the leading ends of the sheet are then carried positively downward to the fold laying rolls by the grippers *b*, and as the leading end of the sheet is brought into position to be grasped by the rolls 15 co-acting with the rolls D, the arms 2 of the grippers *b* engage the cams *d*, and the grippers are opened to release the sheet. The sheet is then carried onward by the rolls 15, D, and by the cords *x* to the feed rolls F, and the fold thus completed, while the grippers *b* are carried about the lower belt rolls

12, and returned to position for seizing another sheet. It will be seen that one of the grippers *b* is placed a little behind the other, so that they will not engage in passing about the pulleys 12, and that the cams *c*, *d* are so shaped that they seize and release the sheet simultaneously. It will be seen that the length of the belts 5 in the construction shown is twice that of a sheet, so that it is obvious that the belts might deliver two sheets at each complete belt movement by adding another gripper *b* to each belt, the two grippers on each belt being arranged in proper position to take successive sheets. It will be understood also that it is not material that the belts be only twice the length of the sheets, as shown, and that longer belts may be used carrying more grippers if desired, but the construction shown employing one or two grippers on each belt will be found efficient.

While I prefer to use endless belts as the means for carrying the grippers, as this forms a very simple and efficient construction, it is obvious that the grippers may be mounted and carried by any other suitable means securing the proper movement. Thus in Figs. 12 to 15, I have shown a construction in which the grippers *b* instead of being carried by belts are mounted and actuated so as to reciprocate between the points of receipt and delivery of the sheets, the grippers being as shown carried by oscillating arms actuated by cams, although it will be understood that any other suitable means may be employed for reciprocating the grippers. The general construction of the folder and feeding devices co-operating with the grippers may be substantially the same as in the construction previously described, and is thus shown, and the same letters of reference will be applied to corresponding parts. The grippers *b* are of the same construction as previously described, but the plates 13 instead of being attached to belts are secured to and carried by carriers 35, mounted to slide in grooved guides *h* carried by brackets 36 on the frame of the machine, these guides converging from the internal guides B, C, on opposite sides of the folder to the rolls D, 15, previously described. These carriers 35 are carried by extensible arms 37 mounted on short rock shafts 38, which are actuated to reciprocate the arms between the points of receipt and delivery of the sheets by crank arms 39, and connecting rods 40 provided with bowls running on cam grooves *i* on opposite sides of a cam disk M carried by a shaft 41. It will be seen that the length of the extensible arms 37 varies with their movement, so that the speed of the grippers would vary correspondingly, but a movement of uniform speed is secured for the grippers by the construction of the cam grooves *i*, which are arranged to compensate for the variations in the length of the arms 37.

The grippers *b* are spring pressed and thus normally closed and are opened as follows:—Cams *k* are provided on opposite sides of the

folder engaging the arms 2 on the grippers *b*, these cams *k* having a straight portion extending substantially through the length of movement of the grippers and above and below which the arms 2 travel, the grippers being opened against the spring pressure when the arms are moving on the lower surfaces, and closed by spring pressure when released to permit them to be thrown to and travel upon the opposite or upper surfaces. The cams *k* are cut away at opposite ends to provide openings through which the arms 2 may pass, and spring pressed switches 4 are provided at the opposite ends for guiding the arms to the opposite sides of the cams *k*. Adjacent to the rolls D, 15, the cams *k* are provided with vertically inclined portions 5 arranged to engage the arms 2 of the grippers and force them downward against the spring pressure so as to open the grippers for the delivery of the sheets to the rolls 15, 16, these cam surfaces 5 being of sufficient length and of suitable construction to force the arms 2 downward until they have passed the point of the lower switches 4 and allow the latter to be returned to the upper side of the arms 2 by the spring pressure.

All the parts are shown as driven from the shaft 41, which carries a large gear 43, driving the rolls E through an intermediate 44 and the rolls D are driven from the rolls E through an intermediate 45. It will be understood, however, that any other suitable driving mechanism may be used. The operation of this construction will be understood from a brief description in connection with the drawings, it being understood that the sheets are advanced to the grippers and delivered therefrom in the same manner as previously described, and that the operation of the grippers in respect to the time of receipt and delivery of the sheets is the same. Only a description of the special method of carrying and operating the grippers, therefore, need be given. With the parts in the position shown in Fig. 13, just before receiving a sheet, the grippers *b* have just been carried to the limit of their upper movement and returned slightly so as to have a movement of the same speed as the sheet when they close to take the latter, the arms 2 are on the under surface of the cams *k* and the switches 4 have been thrown into the lower position so as to positively guide the arms 2 into the openings 3. As the extensible arms 37 are moved downward and inward toward each other, and as the arms 2 reach the openings 3, the grippers are closed by the spring pressure, the arms being thus thrown to the outside of the cams *k* through openings 3. The grippers then move downward with the arms 2 upon the upper side of the cams *k*, as shown in connection with one of the grippers in dotted lines in Fig. 13, and in Fig. 15. As the grippers reach the lower ends of the cams *k* and approach the point of delivery of the sheet, they are actuated by cam surfaces 5 en-

gaging the arms 2 and throwing them downward, and thus the grippers are opened against the spring pressure. The arms 37 and grippers move downward to such a distance as to carry the arms 2 of the grippers past the points of the spring pressed switches 4, and as the sheets are delivered to the rolls D, 15, these switches 4 are released and returned to position above the arms 2, so as to guide them onto the lower surface of the cams *k* as the grippers return to position for taking another sheet. As the arms and grippers return, therefore, the cams are kept open by the arms 2 running on the lower surface of the cams *k*, and held in such a position as not to interfere with the feeding of the sheet over the folder. Near the limit of their upward and outward movement, the arms 2 of the grippers *b* pass below the switches 4, when the switches are returned under spring pressure to the positions shown in Fig. 13, and thus the operation is repeated.

It will be understood that my invention is not to be limited to the specific devices shown, but that the construction of the grippers and of the means shown and described for mounting and actuating them may be varied widely without departing from my invention.

What I claim is—

1. In a longitudinal folder, the combination with converging internal guides, of grippers on the opposite sides of the folder moving in paths converging from the internal guides, means for operating said grippers to seize and release the sheet, and means for advancing the sheet over the guides to the grippers, substantially as described.

2. In a longitudinal folder, the combination with converging internal guides, of grippers on the opposite sides of the folder moving in paths converging from the internal guides, means for operating said grippers to seize and release the sheet, feeding devices on each side of the folder receiving the leading edges of the sheet from the grippers, and means for advancing the sheet over the guides to the grippers, substantially as described.

3. In a longitudinal folder, the combination with converging internal guides and a fold laying device, of grippers on the opposite sides of the folder moving in paths converging from the internal guides to the fold laying device, means for operating said grippers to seize and release the sheet, and means for advancing the sheet over the guides to the grippers, substantially as described.

4. In a longitudinal folder, the combination with converging internal guides and fold laying rolls, of grippers on the opposite sides of the folder moving in paths converging from the internal guides to the fold laying rolls, rolls on opposite sides of the folder co-acting with the fold laying rolls to receive the edge of the sheet, means for operating said grippers to seize and release the sheet, and means for advancing the sheet over the guides to the grippers, substantially as described.

5. In a longitudinal folder, the combination with converging internal guides, of endless belts on the opposite sides of the folder converging from the internal guides, grippers carried by said belts, means for operating said grippers to seize and release the sheet, and means for advancing the sheet over the guides to the grippers, substantially as described.

6. In a longitudinal folder, the combination with converging internal guides, of endless belts on the opposite sides of the folder converging from the internal guides, grippers carried by said belts, means for operating said grippers to seize and release the sheet, feeding devices on each side of the folder receiving the leading edge of the sheet from the grippers, and means for advancing the sheet over the guides to the grippers, substantially as described.

7. In a longitudinal folder, the combination with converging internal guides, of grippers on the opposite sides of the folder moving in paths converging from the internal guides, grippers carried by said belts and spring-pressed in one direction, cams by which the grippers are operated in the opposite direction against the spring pressure, and means for advancing the sheet over the guides to the grippers, substantially as described.

8. The combination with the converging internal guides B, C, of rolls D, belts *a* converging to the rolls D, grippers *b* carried by said belts, and means for operating said grippers to seize and release the sheet, substantially as described.

9. The combination with the converging internal guides B, C, of rolls D, belts *a* con-

verging to the rolls D, rolls 15 co-acting with said rolls D, grippers *b* carried by said belts, means for operating said grippers to seize the sheets and deliver them to the rolls 15, D, substantially as described.

10. The combination with the converging internal guides B, C, of rolls D, belts *a* converging to the rolls D, rolls 15 co-acting with said rolls D, grippers *b* carried by said belts and closed by spring pressure and cams *c*, *d* opening the grippers to receive and deliver the sheet, substantially as described.

11. The combination with the converging internal guides B, C, of the rolls D, belts *a* converging to the rolls D, rolls 15 co-acting with said rolls D, grippers *b* carried by said belts, means for opening and closing said grippers to seize and release the sheet, and marginal tapes *f* advancing the sheet over the guides to the grippers, substantially as described.

12. The combination with the converging internal guides B, C, of the rolls D, belts *a* converging to the rolls D, rolls 15 co-acting with said rolls D, grippers *b* carried by said belts, means for opening and closing said grippers to seize and release the sheet, marginal tapes *f* advancing the sheet over the guides to the grippers, plate L, and tapes *g* between said marginal tapes co-acting with said plate, substantially as described.

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

EDWARD P. SHELDON.

Witnesses:

F. W. H. CRANE,  
E. L. SPEIR.