

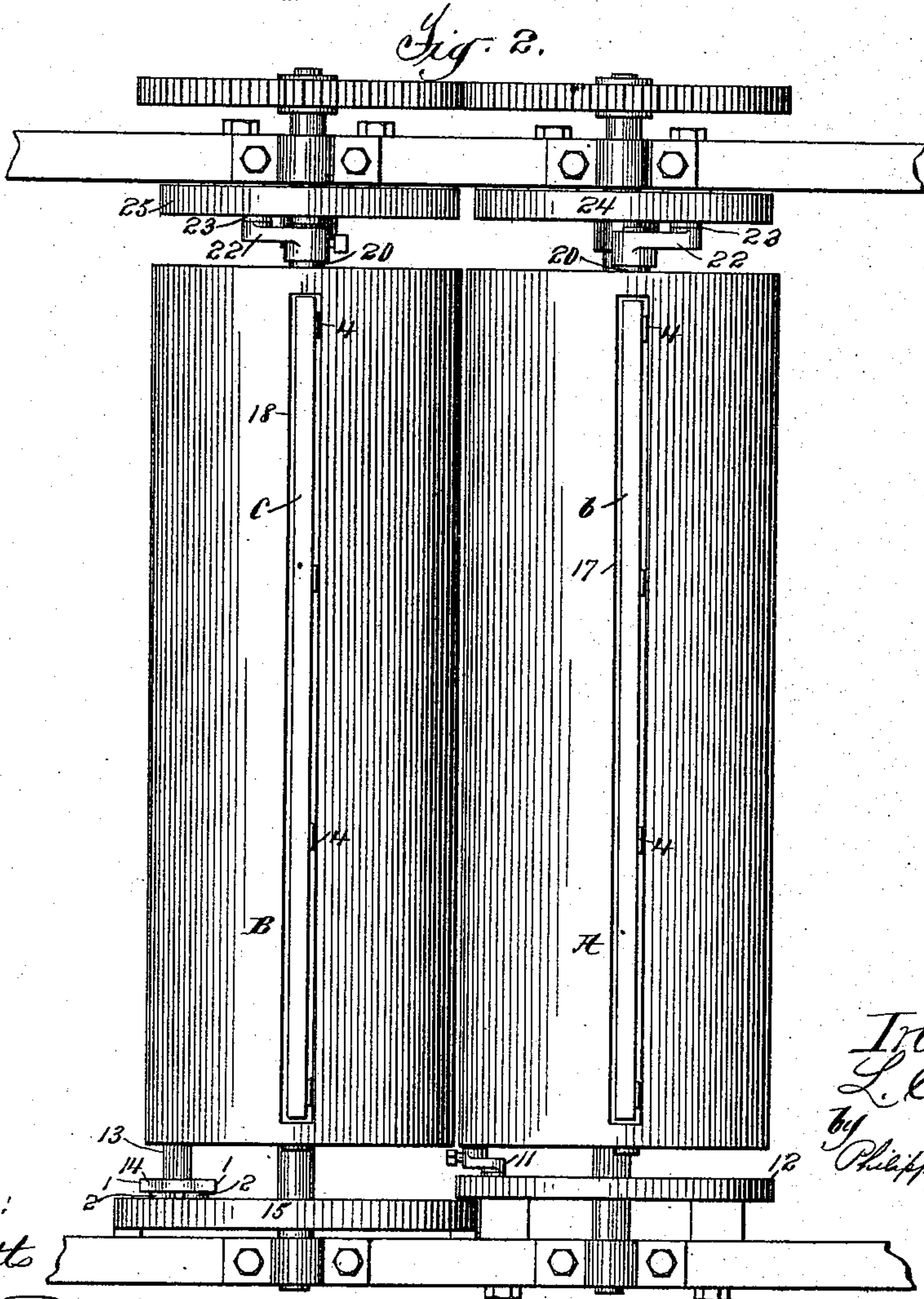
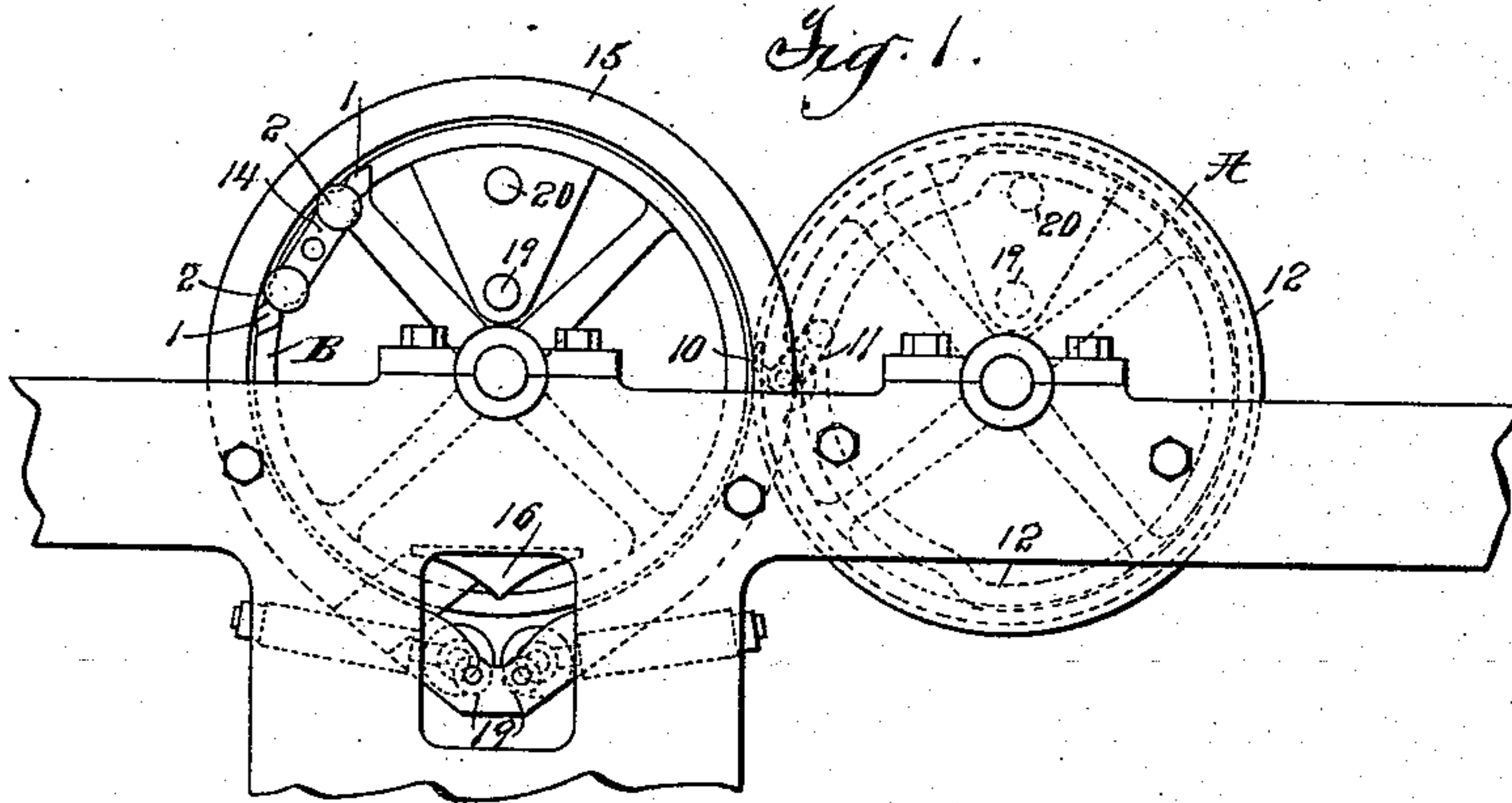
(No Model.)

4 Sheets—Sheet 1.

L. C. CROWELL.  
FOLDING MECHANISM.

No. 484,142.

Patented Oct. 11, 1892.



*Attest:*  
*Geo. H. Bots*  
*C. J. Sawyer*

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*L. C. Crowell*  
*by* *Philip M. Munn* *Attys*

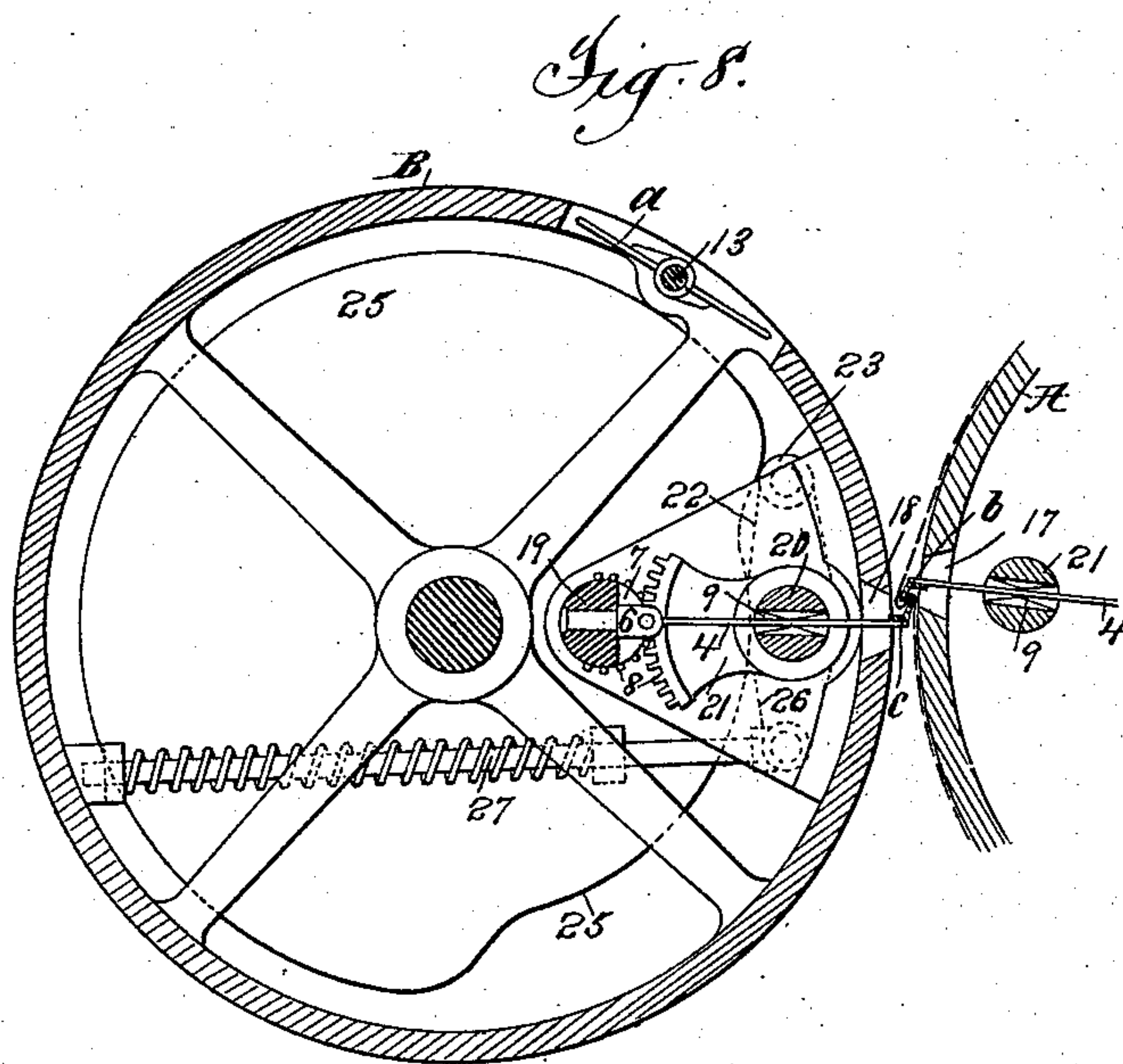
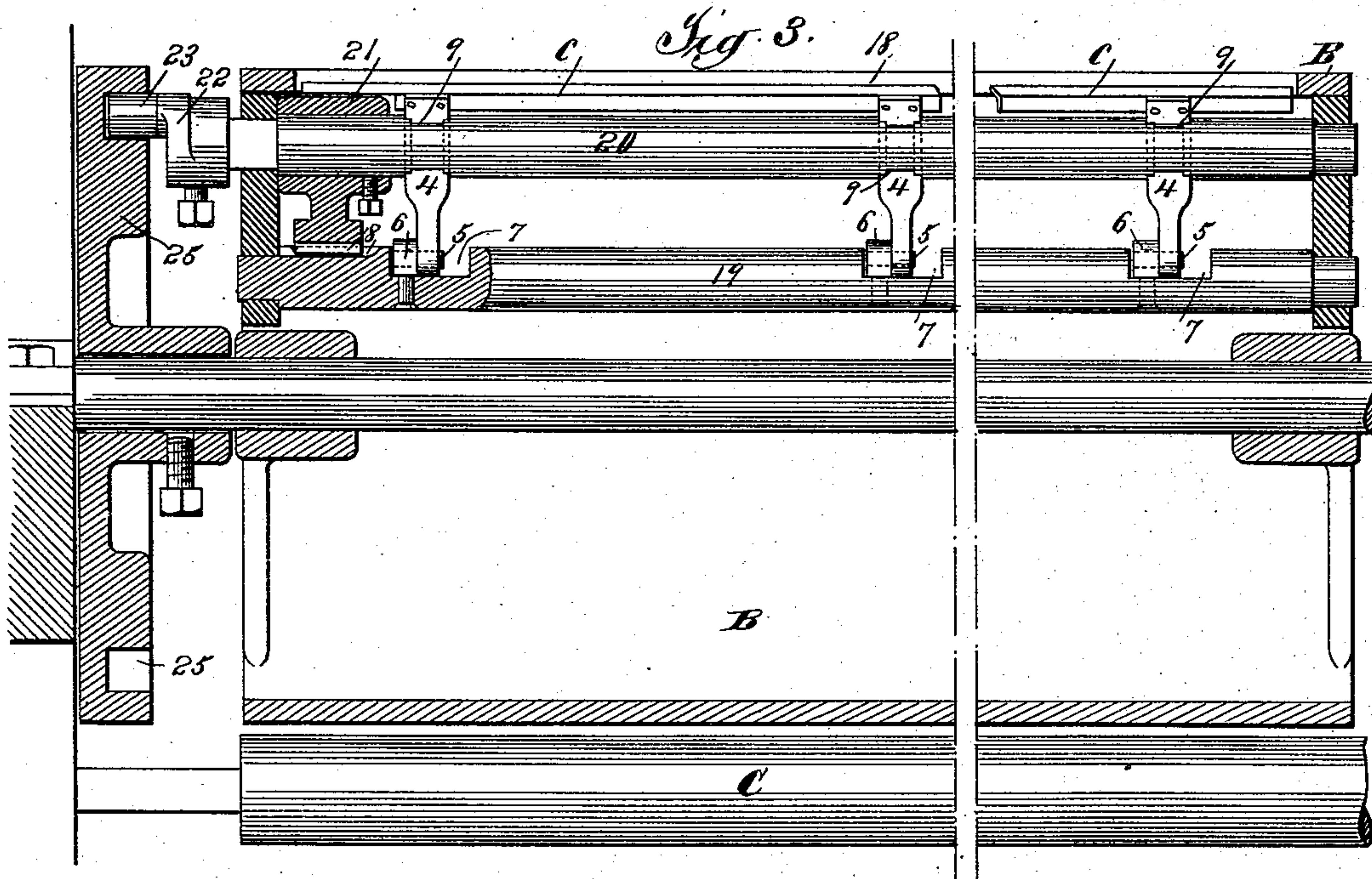
(No Model.)

4 Sheets—Sheet 2.

L. C. CROWELL.  
FOLDING MECHANISM.

No. 484,142.

Patented Oct. 11, 1892.



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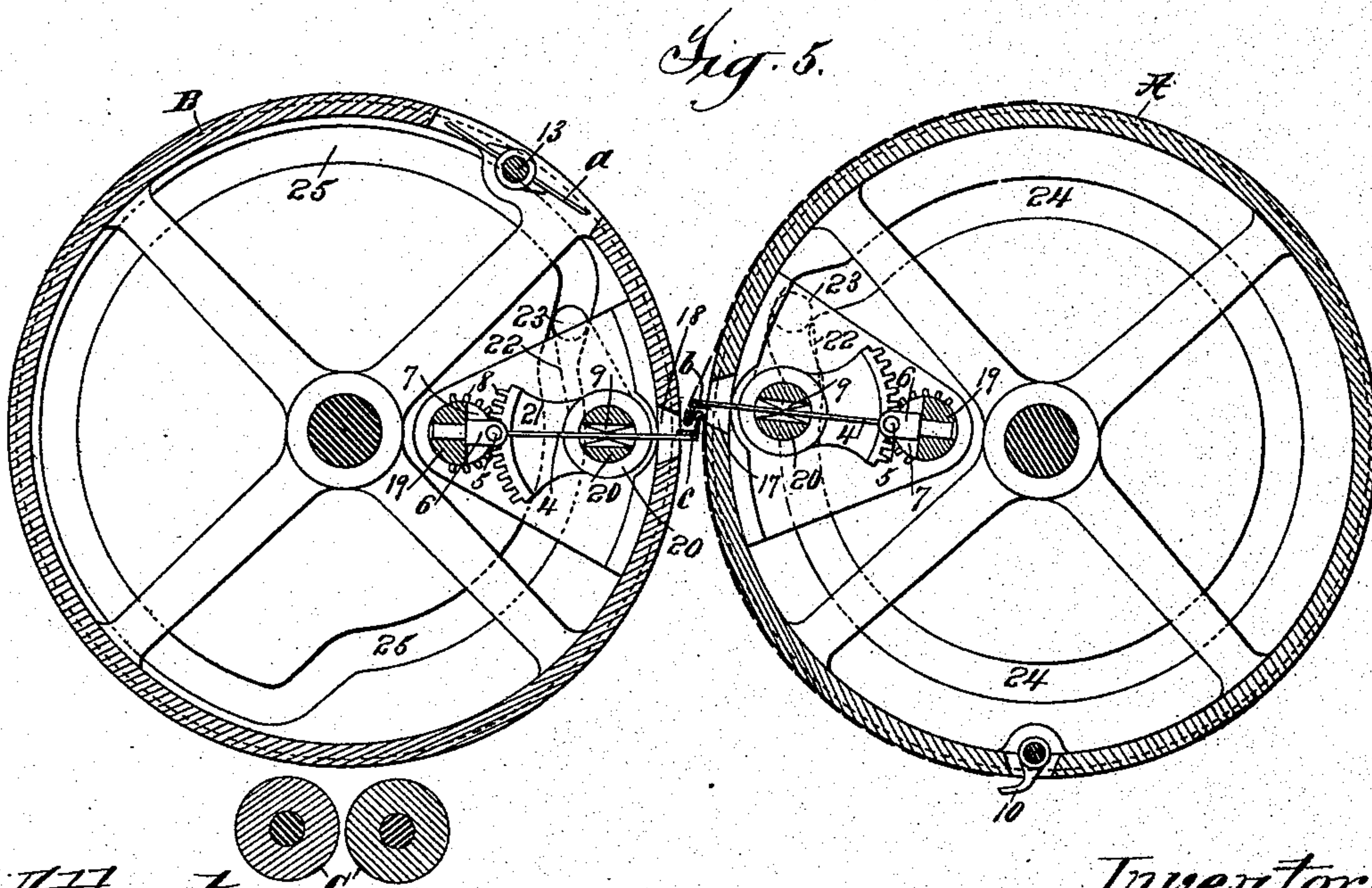
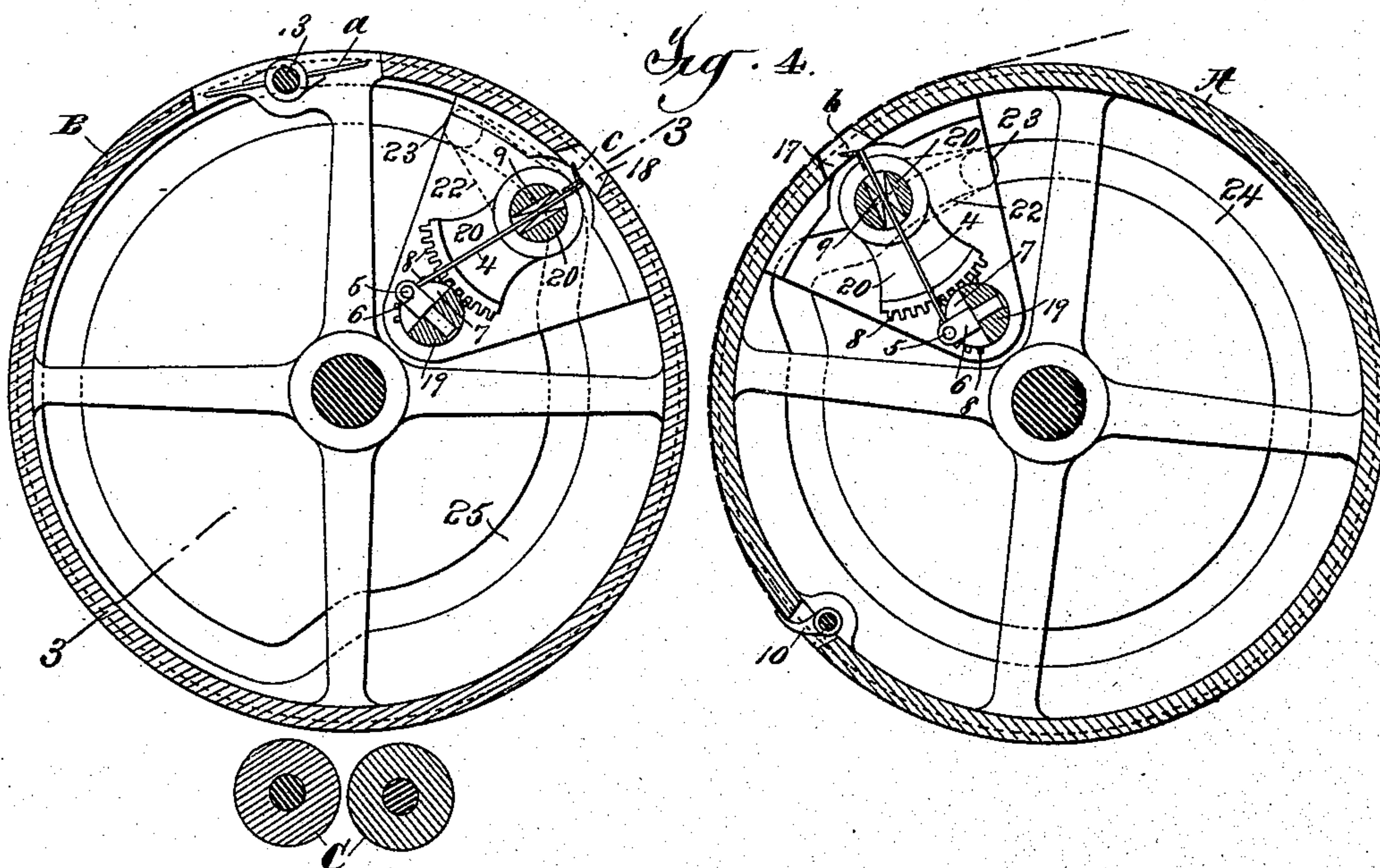
(No Model.)

4 Sheets—Sheet 3.

L. C. CROWELL.  
FOLDING MECHANISM.

No. 484,142.

Patented Oct. 11, 1892.



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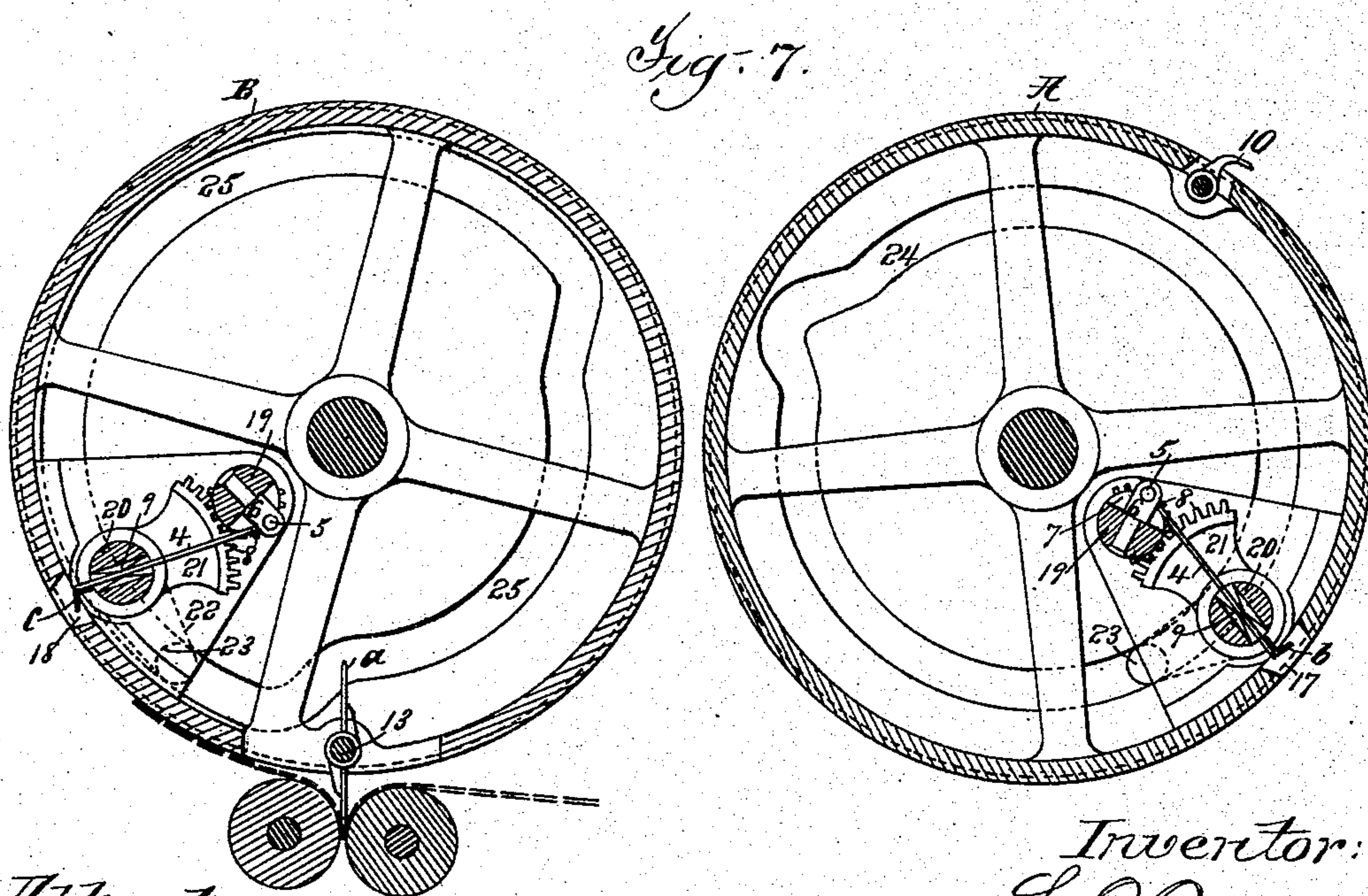
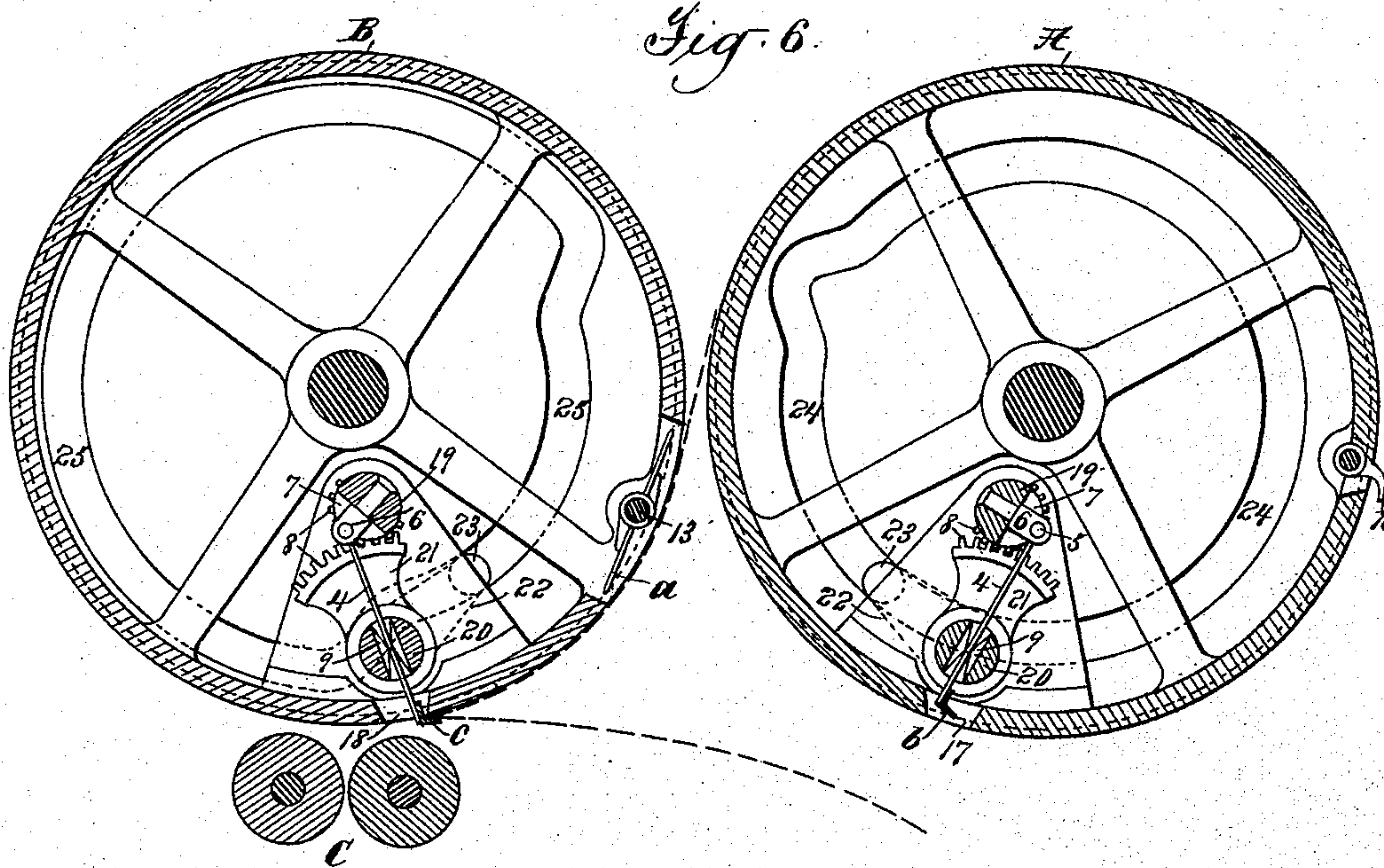
(No Model.)

4 Sheets—Sheet 4

L. C. CROWELL.  
FOLDING MECHANISM.

No. 484,142.

Patented Oct. 11, 1892.



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# 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. 484,142, dated October 11, 1892.

Application filed January 22, 1892. Serial No. 418,945. (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.

10 This invention relates to folding mechanism of that class in which a transverse fold is imparted to the sheet by a folding-blade mounted in one rotating carrier that operates to force the line of fold into the nip of jaws or similar devices mounted in a companion carrier, as in my prior patents, Nos. 143,674 and 244,559, the object of the present invention being to provide an improved construction by which the sheet shall be folded with greater certainty and especially to provide a construction by which the folded sheet is gripped against the outer surface or periphery of the carrier, so that the folded edge of the sheet lies flat upon the cylinder and the bend of the paper just inside the fold-line produced by the mechanism of the patents above referred to is avoided.

With this object in view my invention consists, broadly, in the combination, with a rotating carrier having a gripper by which the folded edge is gripped against the periphery of the carrier, of a rotating carrier having a folding-blade operating to tuck the fold-line of a sheet between said gripper and the periphery of the carrier, and in various constructions and combinations of parts, all of which will be fully described in the following specification, and specifically pointed out in the claims.

40 My invention may be applied in various ways, and the constructions in which the same is used will vary with the number of folds which the folding apparatus is adapted to form.

45 In the accompanying drawings I have shown a preferred form of construction embodying my invention as applied in a folding apparatus for forming two transverse folds, and from the detailed description of this construction, which will now be given, the modi-

fications required for further folds will be apparent to those skilled in the art.

Referring to said drawings, Figure 1 is an end view of the folding mechanism. Fig. 2 is a plan view of the same. Fig. 3 is a longitudinal section of the receiving-carrier on the line 3 of Fig. 4. Figs. 4, 5, 6, and 7 are cross-sections of the folding apparatus, showing the different positions during the operation of folding. Fig. 8 is a similar section of the receiving-carrier, showing a modification.

Referring to said drawings, A is the carrier on which the sheet to be folded is carried, B the receiving-carrier onto which the sheet is folded from the carrier A, and C a pair of folding-rolls to which the sheet is folded from the carrier B.

The sheet on the carrier A is gripped at its leading end by the grippers 10, which may be of any common construction and operated in any suitable manner. As shown, these grippers consist of the ordinary gripping-fingers carried by a shaft which is provided with a crank-arm 11, carrying a bowl actuated by a stationary cam 12, mounted on the frame of the machine, as usual in such constructions. The sheet when folded onto the carrier B may be delivered therefrom unfolded or folded, as preferred, and the means for folding the sheet from the carrier may be of any suitable construction and operated in any suitable manner. As shown, this folding mechanism is of substantially the construction of my patent, No. 453,395, dated June 2, 1891. In this construction the shaft 13, carrying the double-edged folding-blade *a* and mounted in the opposite ends of the carrier B, is provided outside one of the heads of the carrier with a cross-arm 14, which has heart-shaped ends 1 and inside said ends carries bowls 2, which run upon the interior surface of an annular cam 15, so that the blade is held in the position shown in Fig. 1 during a large part of the revolution of the cylinder. In proper position for the protrusion of the blade, so as to guide the rear end of the sheet 1 between the rolls C, the annular cam 15 is curved outward, and this outward curve co-operates with an interior cam 16 to guide the blade outward from the carrier by engagement with the bowls 16, so that



the blade is first protruded from the carrier as the leading bowl passes outward under the control of the cams 15 16 and is then reversed and withdrawn as the bowl passes onward on the opposite side of the point of cam 16. The positive movement of the blade at the point of its greatest protrusion, which is just as the blade passes the point of the cam 16, is insured by engagement of one of the heart-shaped ends 15 with two stationary cams 19, mounted in the frame outside the carrier and preferably formed by projections from the inner face of the cam 15. With this construction a sheet is folded from the carrier B to the rolls C at each rotation of the carrier.

Referring now to the construction of the parts by which the sheet is folded from carrier A to carrier B and in which my invention is embodied, the carriers A B are provided, respectively, with slots 17 18, extending longitudinally of the carrier, through which the folding-blade *b* of carrier A and the gripper *c* of carrier B operate, these slots 17 18 being of sufficient width for the play of the blade and gripper. The blade *b* and gripper *c* are mounted in the same manner, and the operating mechanism therefor is the same with the exception of the cams by which the parts are actuated, so that the same reference-letters may be used for corresponding parts in the two constructions and a single description will apply to both.

The blade *b* consists, preferably, of a single plate extending substantially the full length of the sheet to be folded, as shown, although it will be understood that a series of plates forming a blade may be used, if desired. This blade differs from the ordinary folding-blade, in that its edge is bent so as to project in the line of movement of the carrier, this edge operating to tuck the fold-line under the gripper *c*, so as to insure its being grasped by the latter. The blade *b* is carried by a series of bars 4, forming stems entering the carrier and pivotally mounted at their inner ends on a rock-shaft 19, extending longitudinally through the carrier and forming a rocking support for the blades. The stems may be pivotally mounted on the rock-shaft in any suitable manner. As shown, they are loosely mounted on pivot-pins 5, carried by blocks 6, having stems riveted or otherwise secured to the shaft in recesses 7, which are formed by cutting away shaft 19 on one side, this construction being compact while giving free movement to the inner ends of the stems transversely to the shaft.

For the purpose of controlling the movement of the blade *b* during the rocking of shaft 19 it is necessary to provide guides between which the stems 4 move longitudinally, and to insure the proper action of the blade it is desirable that the guides should be as close together as is consistent with the free movement of the stems. To prevent the bending of the stems by the guides and to avoid friction, therefore, I prefer to employ narrow

guides which rock with the rock-shaft 19 and stems 4. These guides may be constructed and actuated in any suitable manner; but in order to secure the proper relative movement of the guides and stems I prefer to form the guides by slots 9 in a second rock-shaft 20, mounted in the carrier outside of the rock-shaft 19, and to connect the two rock-shafts so as to actuate one from the other. The slots 9, through which the stems pass and which form the guides, are preferably narrow edges, which are formed, preferably, by beveling the slots inward from opposite sides of the shaft 20, so that the stems are engaged only on a single line on each side, and the blade *a* is free to oscillate on the pivot thus formed, while being positively guided and controlled thereby as the stems slide through the shaft.

The particular form of connections used between the shafts and the means for actuating both may be varied widely; but I have shown a simple construction which I have found efficient. The rock-shaft 19 is geared at the end just inside the carrier to an arm 22, secured upon the shaft 20, preferably adjustably, as shown, by segmental gears 8, carried, respectively, by the shaft and arm, and preferably cut thereon, as shown. Outside the carrier the shaft 21 carries a crank-arm 22, preferably adjustably secured thereto, as shown, this crank-arm being provided with a bowl 23, which runs in a fixed cam 24, secured to the frame of the machine, as shown, or mounted in a fixed position in any other suitable manner. It will be understood that the crank-arm and bowl may be carried by either rock-shaft; but I prefer to actuate the inner shaft from the outer, as shown.

The gripper *c* of carrier B is preferably formed, as shown, in the same manner as the blade *b*, consisting of a single plate extending the full or substantially the full length of the carrier, so that the sheet is gripped over the whole fold-line. It will be understood, however, that a series of plates may be used instead of a single plate, or that the gripper may be formed of a series of fingers, as usual in gripper constructions, although not with so good results. This gripper *c* may be mounted and actuated in any suitable manner and by any suitable mechanism to cause it to coact with blade *b* and the periphery of carrier B to seize the sheet on the fold-line; but I prefer to employ the same construction in both carriers; and my invention consists in part in the combination of two rotating carriers thus equipped. The gripper *c*, therefore, as above stated, is shown as mounted and actuated by exactly the same mechanism as the blade *b*; but the stationary cam 25, by which the shaft 20 of carrier B is actuated for the operation of the gripper, differs in form from cam 24, by which the blade *b* of carrier A is actuated. As shown in the drawings, the cam 24 is so constructed as to give the blade *b* an outward movement and quick return for the purpose of forcing the



sheet into the grasp of grippers *c*, and the cam 25 is so constructed as to close the gripper upon the sheet as it is received from the blade *b* and hold it closed to carry the sheet forward into position to be folded by the blade *a* between the folding-rolls C, and then to open the gripper to release the sheet and allow it to be folded from the carrier.

The operation of the folding mechanism will be understood readily from a brief description in connection with Figs. 4 to 7, which show the parts in different positions during the folding and delivery of a sheet. In Fig. 4 the carriers are shown in position with the blade *b* and gripper *c* approaching the folding-point and both withdrawn within the carriers, the sheet *x* to be folded being carried by the carrier A with its leading edge gripped by the grippers 10. As the carriers advance from the position shown in Fig. 4, the shafts 20 19 in the respective carriers are actuated by the cams 24 25, acting upon the bowls 23 through the connections previously described, so as to rock the shafts and carry the blade *b* and gripper *c* outward from the carrier, and as the blade *b* and gripper *c* are carried forward by their respective carriers the fold-line of the sheet is tucked by blade *b* under and within the grasp of the gripper *c*, so as to insure its being seized by the gripper *c* when the latter is closed, the gripper 10 being opened to release the head of the sheet, so that it may be transferred from carrier A to carrier B. This position is shown in Fig. 5. The blade *b* is now actuated by the cam 24, so as to release the sheet and be withdrawn within the carrier, and the gripper *c* is simultaneously actuated by the cam 25, so as to close and grip the folded edge of the sheet against the periphery of carrier B, the sheet thus being advanced with the carrier B on its continued rotation. The parts are shown in Fig. 6 with the folded sheet advanced from the folding-point and with the gripper *c* approaching the point of release for the delivery of the sheet from the carrier. The sheet may be delivered from the gripper *c* without folding in any suitable manner; but the construction shown is adapted to give two folds to the sheet, and as the carrier B advances from the position shown in Fig. 6 and the gripper *c* is opened by the cam 25 to release the leading end of the sheet the folding-blade *a* is simultaneously operated by the mechanism previously described to impart a second transverse fold to the sheet and deliver it between the folding-rolls C, by which it is delivered in the usual manner, as shown in Fig. 7, this operation being repeated on the next rotation of the carrier, a sheet having meanwhile been taken by the grippers 10 on carrier A. It will readily be understood that if another transverse fold is to be imparted to the sheet the carrier B may be provided with a folding-blade similar to the blade *b* in place of the common blade *a* and operate to fold the sheet onto another carrier similar to B, from which

the sheet may be again folded to folding-rolls or to another carrier similar to carrier B.

The folding-blade *b* and gripper *c* have been described only in connection with means by which they are operated at each revolution of the carriers. It will be understood, however, that the constructions common in connection with folding-blades and grippers of other forms may be used with my improved blade and grippers, so as to cause them to operate only at certain revolutions of the carriers, and any of the common constructions for throwing the folding blade or gripper out of operation may be used when this is desired.

While I have shown the blade and gripper as operated positively in both directions by closed cams, it will be understood that other means may be used for actuating them, and that the constructions of shaft-rocking devices common with folding-blades and grippers of other forms are applicable also in my improved construction. Thus I have shown in Fig. 8 a common construction in which the shaft 20, carrying the cam-operated bowl 23, is provided with a second crank-arm 26 on the opposite side of the shaft from the bowl 23, and pivotally connected to a spring-pressed rod 27, sliding in supports in the carrier, the gripper thus being opened by the cam 25 and closed by spring-pressure.

While I prefer to mount the rock-shaft 19, forming the support by which the stems of the blade and gripper are carried inside the shaft 20, forming guides for the stems, as the movement of the blade and grippers transversely to the cylinder may thus be reduced largely below the in-and-out movement and a large capacity with a very small transverse movement be thus secured, it is evident that the support may be located outside the guides and some of the advantages of the preferred construction be obtained.

It is evident that many other modifications in the construction shown may be made without departing from my invention, and I do not mean to limit myself to the exact form of any of the devices shown. The gripper mechanism above described is not claimed herein, but in my application, Serial No. 401,652, filed August 4, 1891.

What I claim is—

1. The combination, with a rotating carrier provided with a gripper coacting with the periphery of the carrier to seize the sheet, of a rotating carrier provided with devices for seizing a sheet, and a folding-blade, and means for actuating said blade to tuck the fold-line of a sheet carried by the blade-carrier between said gripper and the periphery of the gripper-carrier and withdrawing said blade during the rotation of the carrier, substantially as described.

2. The combination, with a rotating carrier provided with a gripper coacting with the periphery of the carrier to seize the sheet, of a folding-blade, a rotating carrier for said blade, and means for actuating said blade to



tuck the fold-line of a sheet between said gripper and the periphery of the gripper-carrier and withdrawing said blade during the rotation of the carrier, substantially as described.

3. The combination, with a rotating carrier provided with a gripper coacting with the periphery of the carrier to seize a sheet, of a rotating carrier provided with a folding-blade, a movable support carried by said carrier on which the blade is pivotally mounted, and means for simultaneously rocking said blade and moving the support to and from the surface of the carrier, whereby the blade is operated to tuck the fold-line of a sheet between said gripper and the periphery of the gripper-carrier, substantially as described.

4. The combination, with a rotating carrier provided with a gripper coacting with the periphery of the carrier to seize a sheet, of a rotating carrier provided with a folding-blade, movable supports carried by the carriers on which the gripper and blade are pivotally mounted, and means for simultaneously rocking said gripper and blade and moving the supports to carry the axes of the gripper and blade to and from the surface of the carriers, whereby the blade is operated to tuck the

fold-line of a sheet between said gripper and the periphery of the gripper-carrier, substantially as described.

5. The combination, with carriers A B, of folding-blade *b* and gripper *c*, carried by said carriers, respectively, rocking supports in said carriers on which the blade and gripper are pivotally mounted by stems 4, guides between which said stems move, and means for rocking said supports to operate the blade and gripper to fold the sheet from carrier A to carrier B, substantially as described.

6. The combination, with carriers A B, of folding-blade *b* and gripper *c*, carried by said carriers, respectively, rocking supports in said carriers on which the blade and gripper are pivotally mounted by stems 4, rocking guides between which said stems move, and means for rocking said supports to operate the blade and gripper to fold the sheet from carrier A to carrier B, substantially as described.

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

LUTHER C. CROWELL.

Witnesses:

L. E. HOWARD,  
J. J. KENNEDY.