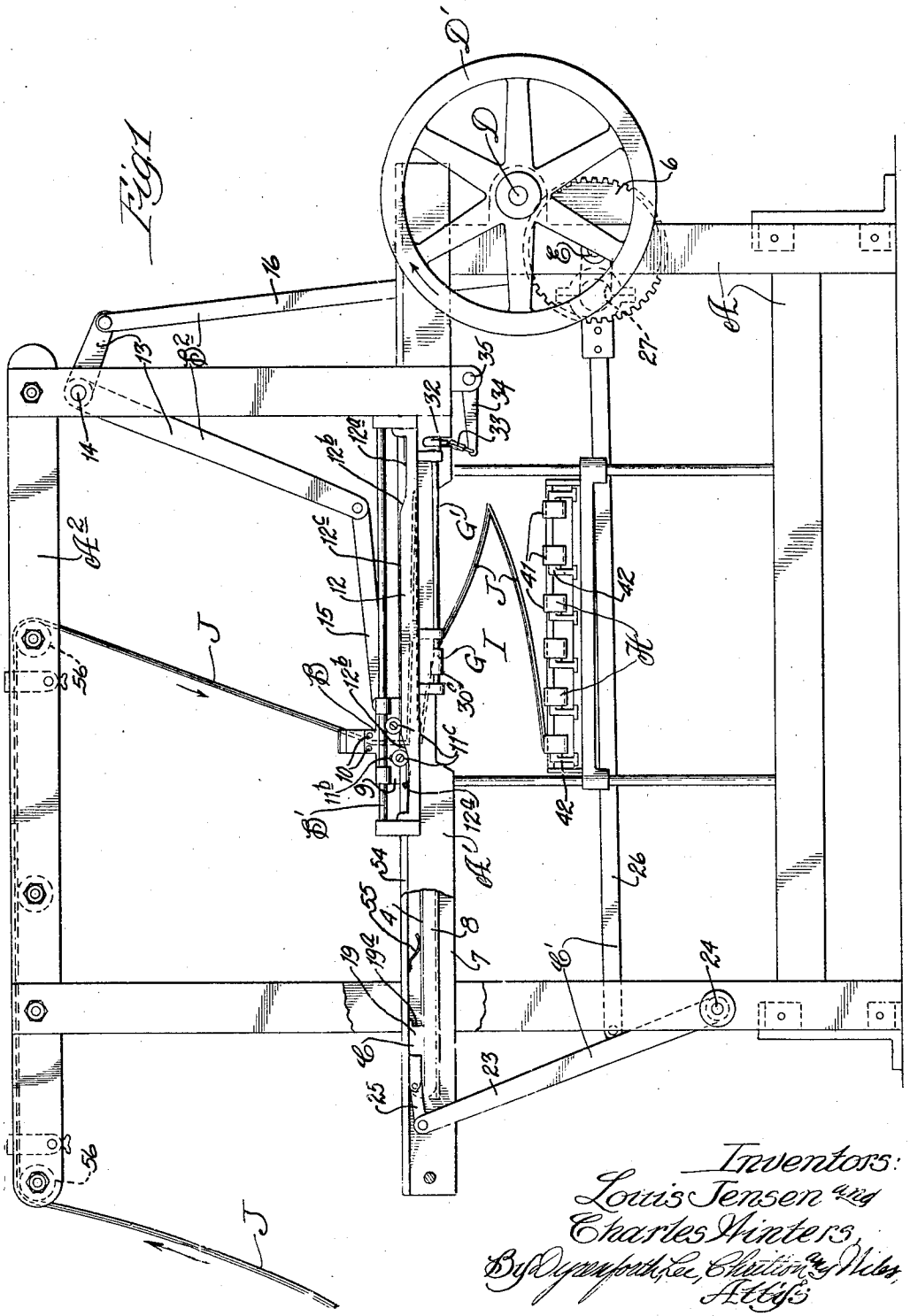
Nov. 17, 1931. L. JENSEN ET AL 1,832,556

WEB FOLDING MACHINE

Filed July 12, 1929 8 Sheets-Sheet 1

Fig. 1



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WEB FOLDING MACHINE

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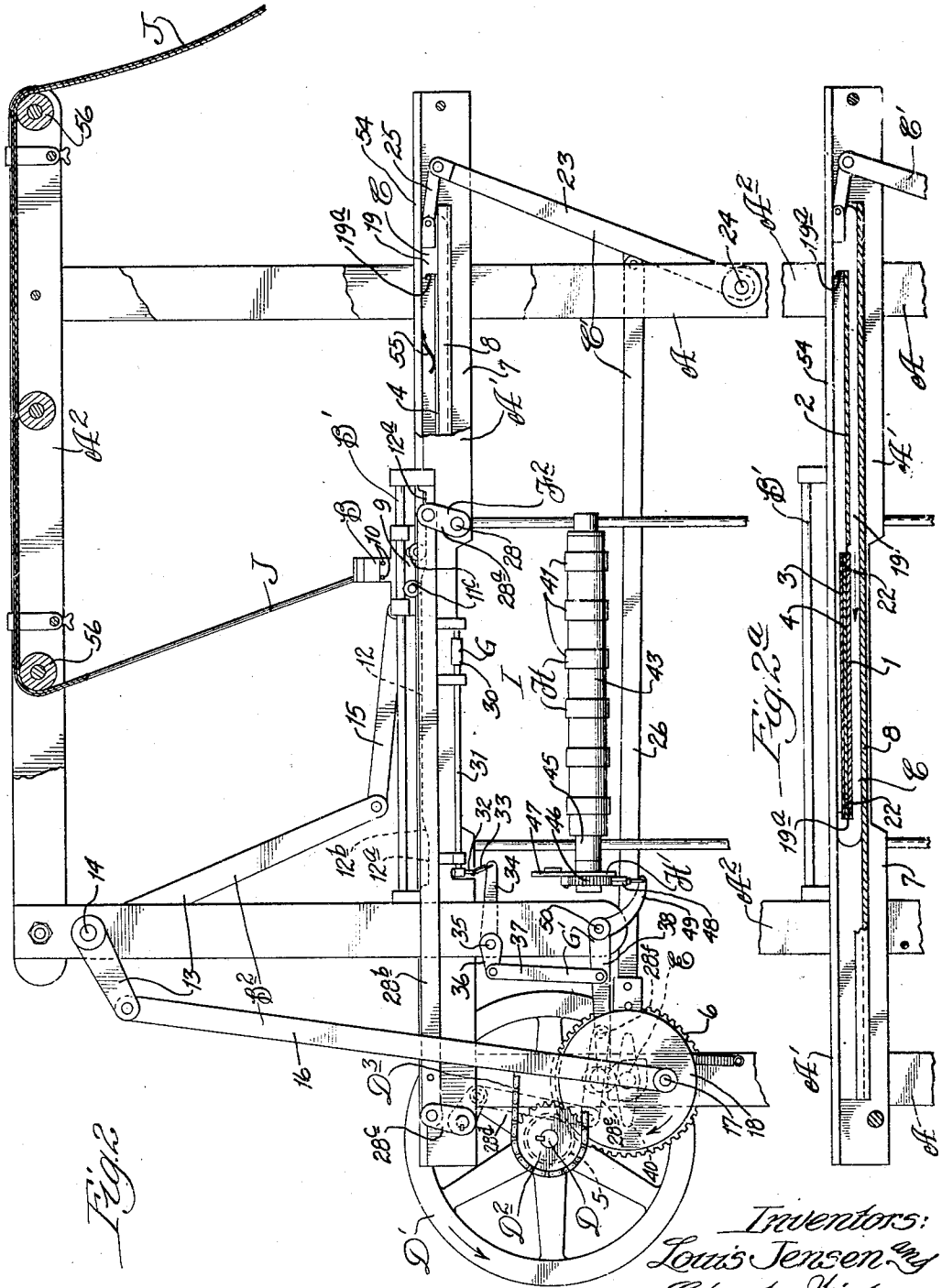


Fig. 2.

Fig. 2a.

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WEB FOLDING MACHINE

Filed July 12, 1929 8 Sheets-Sheet 3

Fig. 4

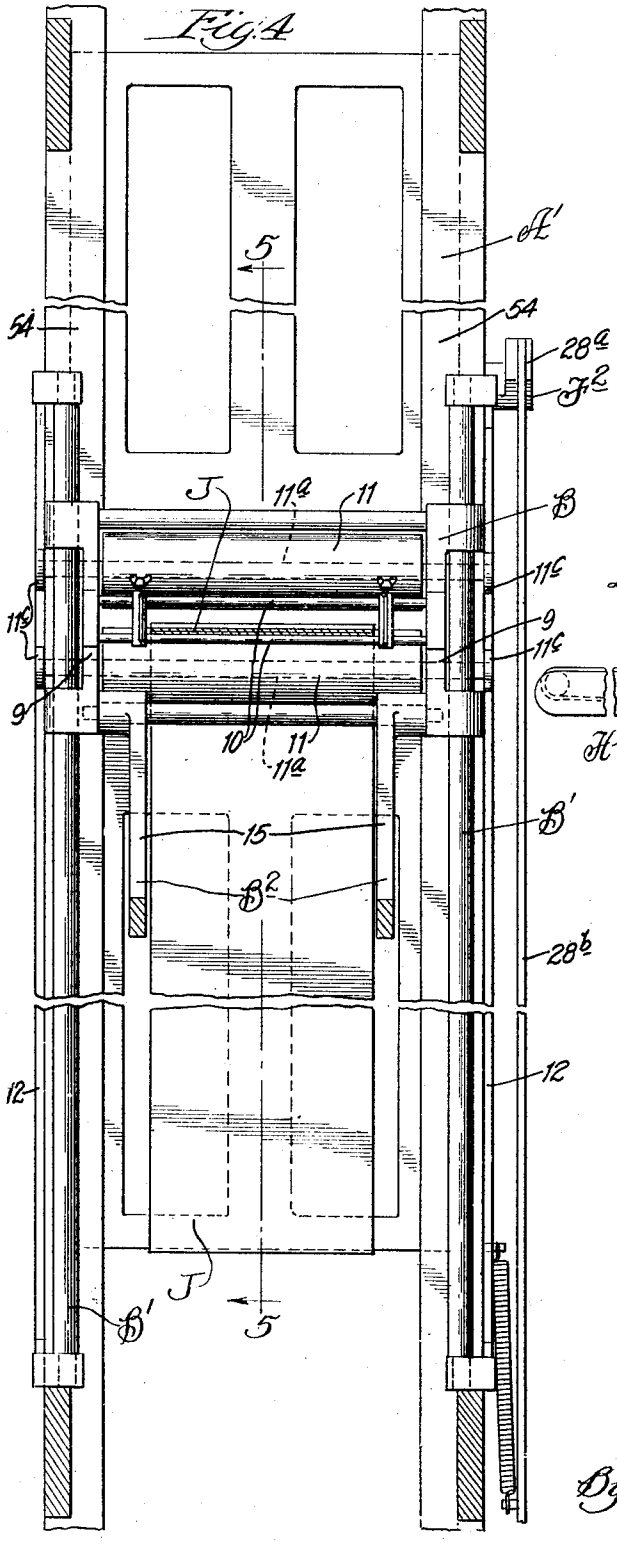
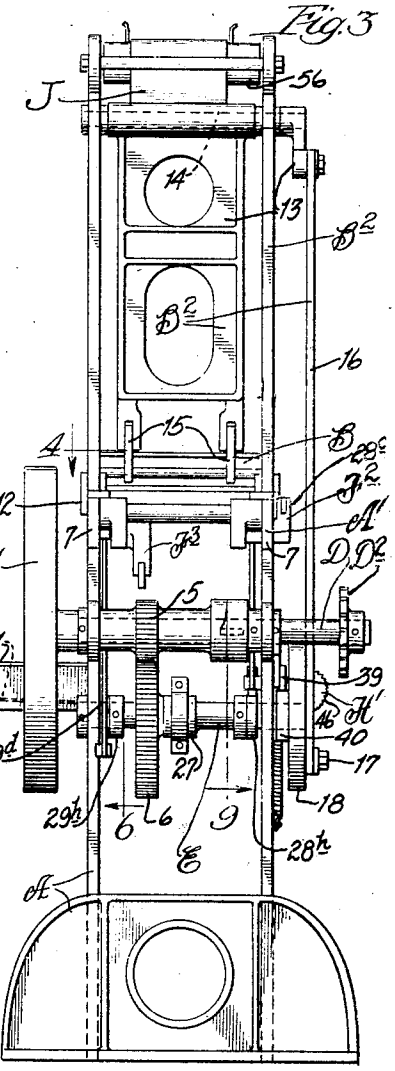


Fig. 3



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WEB FOLDING MACHINE

Filed July 12, 1929 8 Sheets-Sheet 4

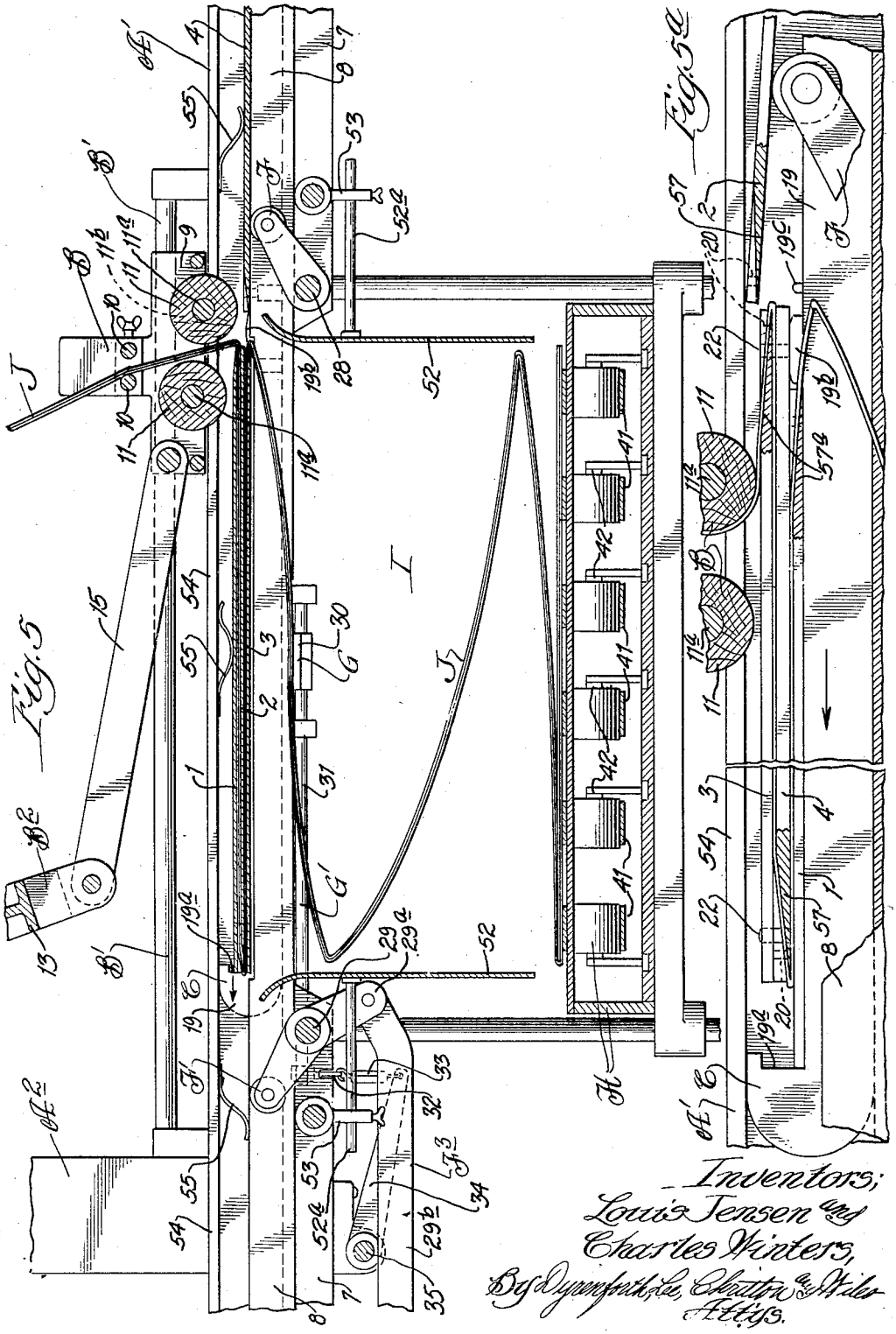


Fig. 5

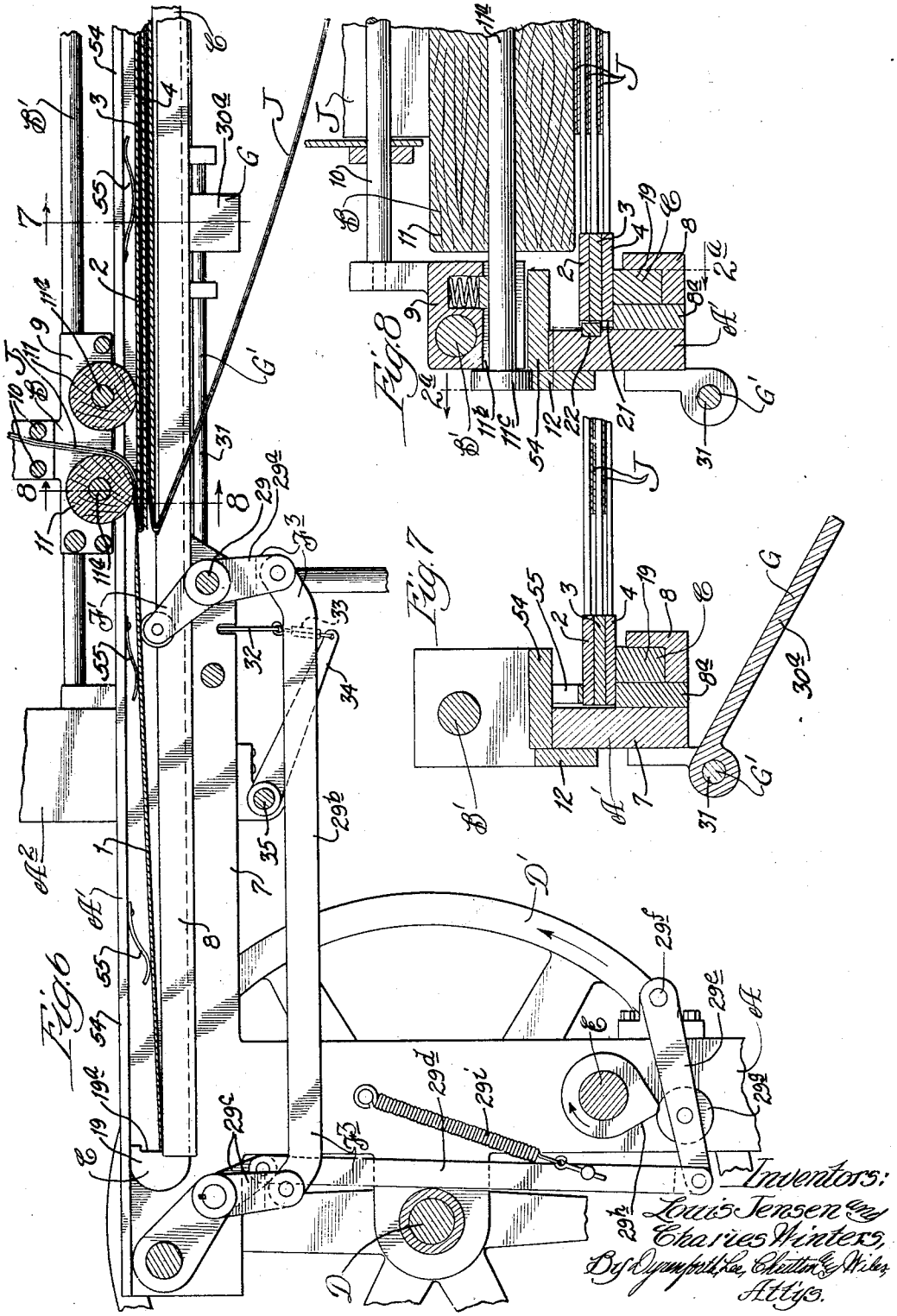
Fig. 5a

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WEB FOLDING MACHINE

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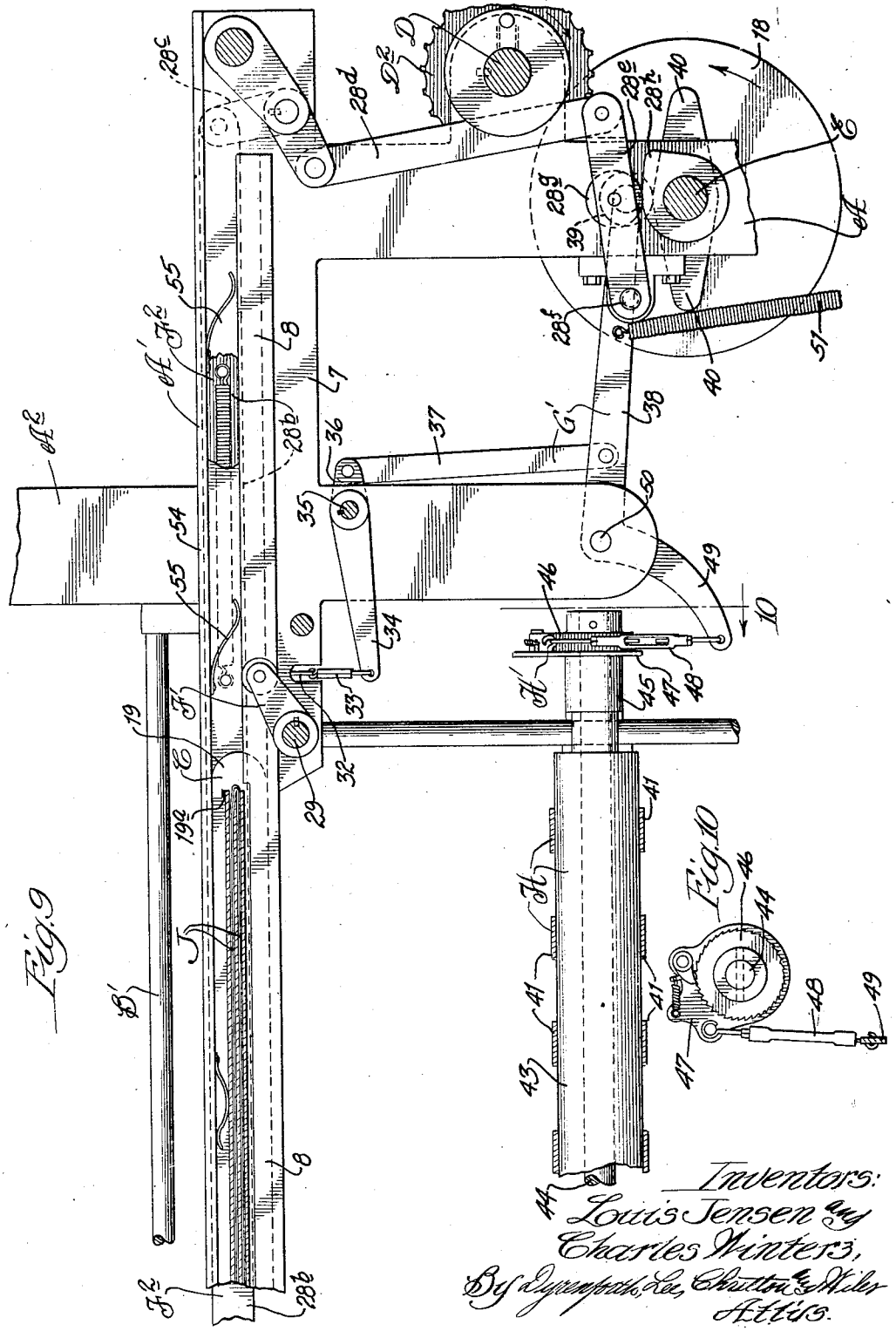


Fig. 9

Fig. 10

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WEB FOLDING MACHINE

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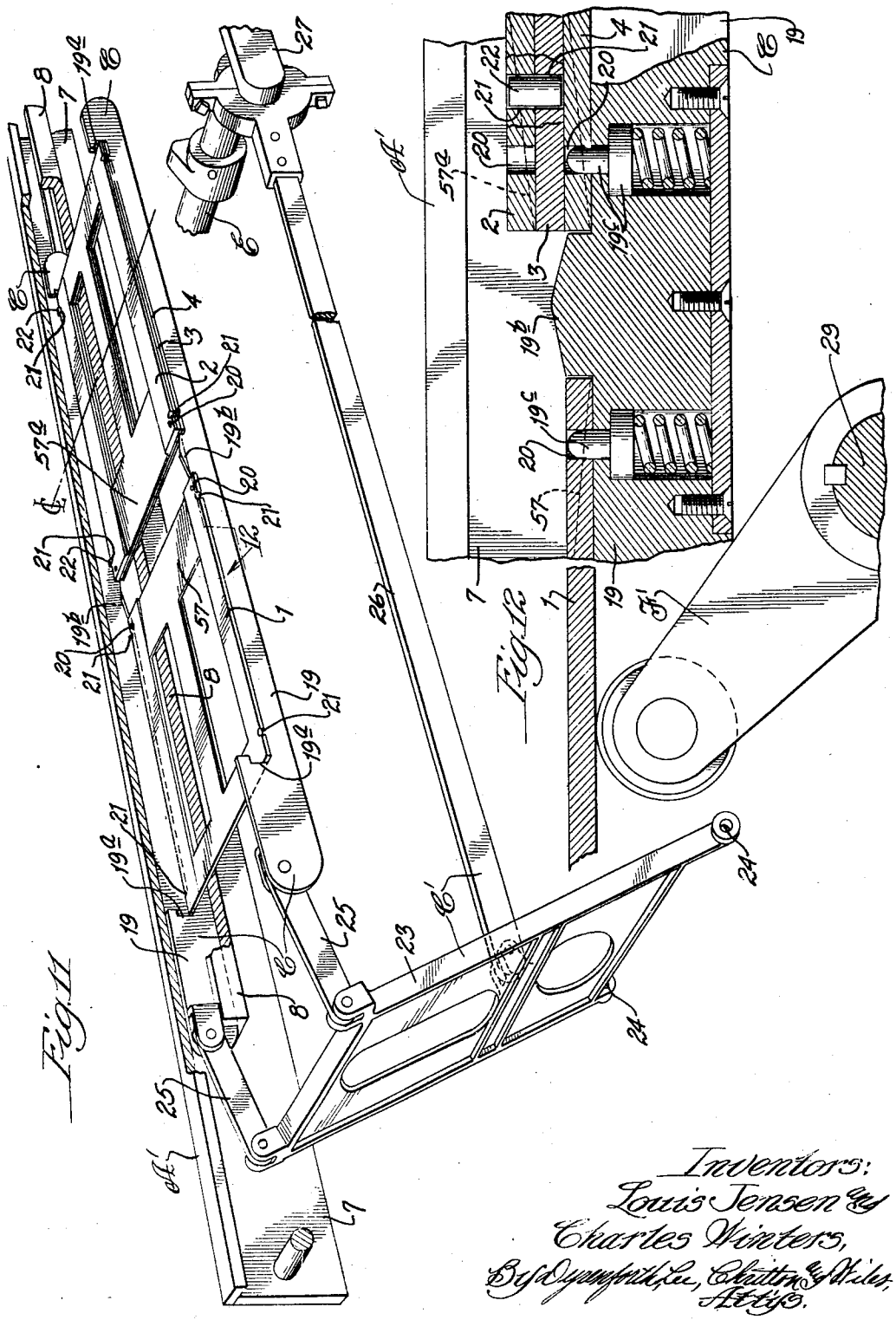


Fig. 11

Fig. 12

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WEB FOLDING MACHINE

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Fig. 13

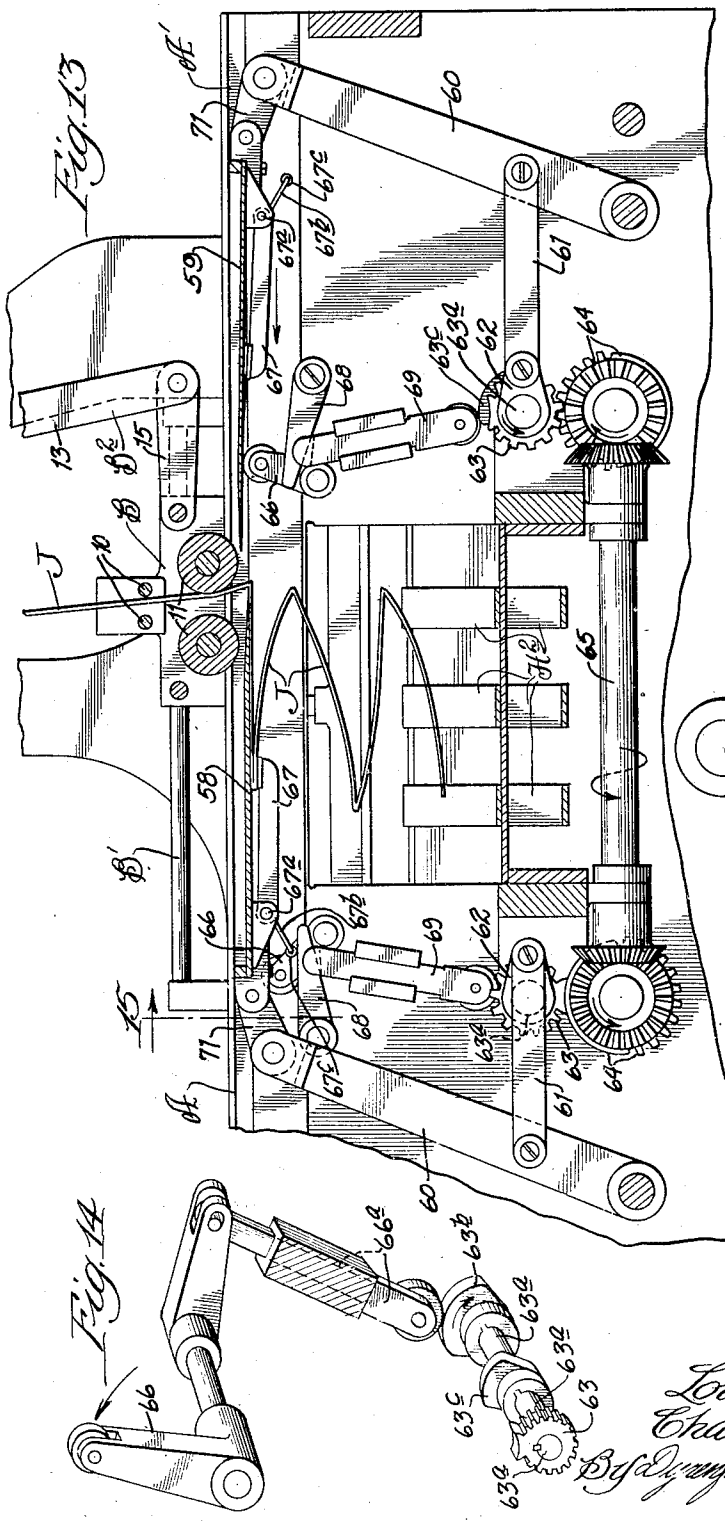


Fig. 15

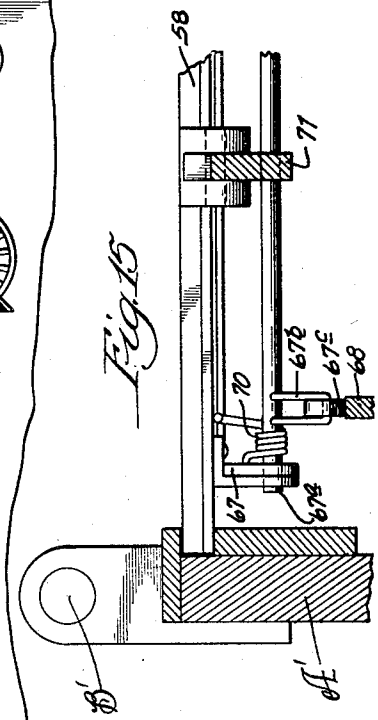


Fig. 14

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Patented Nov. 17, 1931 1,832,556

UNITED STATES PATENT OFFICE

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WEB-FOLDING MACHINE

Application filed July 12, 1929. Serial No. 377,802.

This invention relates particularly to a web-folding machine adapted to the purpose of folding, in zig-zag fashion, a strip of material.

The invention is shown embodied in a machine for folding manifold duplicating strips. Such strips may be provided, for example, by printing forms on a web of paper as it passes through a printing machine, and then folding the web in zig-zag fashion along longitudinal lines. The strips may be left in connected condition, or may be severed, as desired. Such a multiple ply strip may be folded transversely in zig-zag fashion by means of a machine embodying the present invention.

The primary object is to provide a machine which will operate with certainty to produce transverse folding of a continuous strip, or strips, thus producing a pile, or packet, in which the strip is folded in zig-zag fashion.

A further object is to produce a machine which will satisfactorily fold a large number of duplicate strips and be capable of large output.

In accordance with the present invention, two or more opposed folder-plates are employed for effecting the folding of the strips. In a simple embodiment of the invention, two folder-plates are employed for effecting folding, these plates being attached to actuating devices and being capable of rapid reciprocation. In a more complex embodiment, well adapted for folding a large number of plies, four folder-plates are shiftably mounted in a reciprocating slide, and suitable mechanism is provided for shifting the plates and effecting the folding operations.

In each case, it is preferred to provide a web-feeding and distributing device which co-acts with the folder-plates.

The invention is illustrated in preferred embodiments in the accompanying drawings, in which—

Fig. 1 is a broken side elevational view of a machine which is particularly adapted for folding a large number of plies; Fig. 2, a broken side elevational view, partly in section, showing the opposite side of the machine; Fig. 2ª, a broken longitudinal sectional view illustrating the manner in which two of the folder-plates are normally centered in the guides with which the main frame is provided; Fig. 3, a rear end elevational view; Fig. 4, an enlarged broken plan sectional view taken as indicated at line 4 of Fig. 3; Fig. 5, an enlarged broken longitudinal vertical section taken as indicated at line 5 of Fig. 4; Fig. 5ª, a broken longitudinal vertical section in which the thickness of the parts is exaggerated to facilitate an understanding of the folding operation; Fig. 6, a broken longitudinal vertical section taken as indicated at line 6 of Fig. 3; Fig. 7, a fragmentary transverse sectional view taken as indicated at line 7 of Fig. 6; Fig. 8, a fragmentary sectional view taken as indicated at line 8 of Fig. 6; Fig. 9, a broken longitudinal sectional view taken as indicated at line 9 of Fig. 3; Fig. 10, a detail view of the conveyor-actuating means, the view being taken as indicated at line 10 of Fig. 9; Fig. 11, a broken perspective view, diagrammatic in character, illustrating the manner in which the folder-plates are actuated; Fig. 12, a broken longitudinal sectional view, on an enlarged scale, the section being taken as indicated at line 12 of Fig. 11; Fig. 13, a broken vertical longitudinal sectional view showing a simplified form, or modification; Fig. 14, a perspective view of one of the folder-plate lifting devices; and Fig. 15, a broken sectional view taken as indicated at line 15 of Fig. 13.

It may be stated preliminarily that in the embodiment shown in Figs. 1–11, two of the folder-plates are centered normally in the position illustrated in Figs. 2ª and 5ª, the plates being provided at their lateral edges with notches which engage lugs carried by the fixed guide-rails in which the plate-shifting slide reciprocates. The action of the machine is such that when the slide is moved in one direction a third plate (at this time at the bottom of the pile) is withdrawn from beneath the pile, and a fourth plate is elevated and caused to ride over the pile, thus sliding over the paper as it is distributed by the distributing device. The lugs mentioned are short and are spaced

from the upper and lower walls of the guides, so as to afford room for the lower plate to be withdrawn and for the upper plate to be shifted into superposed position over the pile. It will be understood that the plates successively gravitate to the bottom of the guides and become disengaged from fixed lugs, thus permitting withdrawal.

In the preferred construction illustrated in Figs. 1–11, A designates a main frame having a bed A′ and having a superstructure A^2 equipped with guides, or supports, for the strips of paper; B, a paper-feeding and distributing device mounted on guide-rods B′ mounted on the bed A′; B^2, actuating mechanism for the distributor B; C, a folder-plate actuator in the form of a slide which moves in guides with which the bed A′ is provided, said actuator co-acting with a series of folder-plates 1, 2, 3 and 4, it being observed that the lateral margins of the plates project past the slide and overledges with which the guides in the bed A′ are provided; C′, actuating means for the slide C; D, a main drive shaft equipped with a balance wheel D′ and with a sprocket-wheel D^2 with which is connected a sprocket-chain D^3 which may be actuated from any suitable source (not shown); E, a counter-shaft actuated from the shaft D by means of a pinion 5 and a gear 6; F and F′, folder-plate lifters actuated, respectively, by actuating devices F^2 and F^3; G, strip-supporting means adapted to temporarily support the strip after the folding operation, the means G being equipped with a actuating device G′; and H, a conveyor upon which the folded strip is delivered, said conveyor being equipped with an actuating device H′ which is actuated through the medium of the device G′.

The frame A may be of any suitable construction. The bed A′ comprises longitudinal members 7 which are equipped at their inner sides with longitudinal guides 8 which support the plate-actuating slide C (see Figs. 7, 8 and 11).

The distributor B is shown as comprising slides 9 supported on the guide-rods B′, the slides 9 being connected by cross-rods 10 which afford a guide for the paper. The connected guides 9 constitute a carriage which is equipped with vertically movable rollers 11 which are adapted to distribute the paper and at the same time perform an ironing action upon it. As appears from Fig. 8, the rollers 11 are fixedly mounted on shafts 11^a which project loosely through bearings 11^b with which the carriage is provided, the extremities of the shaft being equipped with small wheels 11^c which travel on tracks 12 having the form shown in Fig. 1. The tracks are provided with reduced or lowered portions 12^a which are connected by means of inclines 12^b with the raised intermediate portions 12^c. The purpose of this arrangement is to permit a roller to drop in the manner illustrated in Fig. 5, so that when the carriage begins its reciprocation, the roller will ride upon the paper and fold it closely over the end of the folder-plate. In the remainder of the travel, the rollers lightly engage the paper as it lies upon the plate, performing an ironing action.

The actuating device B^2 comprises a rock-member 13 pivotally supported at 14; a link 15 connecting the member 14 to the carriage B; and a link 16 connected to a crank-pin 17 carried by a disk, or wheel, 18 which is fixedly mounted on one end of the countershaft E (Figs. 2 and 3).

The folder-plate actuator C, as appears from Fig. 11, comprises a pair of slide-bars 19 movable in the guides 8, said slide-bars having their upper portions cut away, thus affording recesses which accommodate the folder-plates. The bars 19 are provided near their ends with shoulders 19^a adapted to serve as pushers. The bars are further provided at intermediate points with raised portions 19^b (Figs. 11 and 12); and on opposite sides of the portions 19^b, the bars are equipped with spring-pressed plungers 19^c which are adapted to enter perforations 20 with which the folder-plates are provided near their point ends.

The lateral portions of the plates are thickened, as appears from Figs. 7 and 8. The lateral margins of the plates project past the slide-strips 19 and extend over the ledges afforded by the members 8^a of the fixed guides.

The plates are provided near their ends at their lateral edges with vertical slots 21 which are adapted to engage fixed lugs 22 carried by the bed A′. The lugs 22 are spaced from the bottoms and tops of the guides to permit withdrawal of the lower plate and then superimposing upon the pile of the first plate.

The actuating means C′ is shown as comprising a beam, or lever, 23 pivotally supported at 24 and connected by links 25 with the slide-bars 19; and a connecting rod 26 joining the intermediate portion of the member 23 to a crank 27 formed integrally with the countershaft E.

The main drive shaft D may be actuated from any suitable source. For example, the sprocket-chain D^3 for driving the main shaft may be driven from the machine (not shown) which effects the longitudinal folding of the strip; and the machine for effecting the longitudinal folding of the strip may, in turn, be driven from the press which prints the forms upon the strip.

The plate-lifter F (Figs. 2–5 and 9) is in the form of an arm equipped with a roller, the arms being mounted on a rock-shaft 28 which is equipped with an actuating arm 28^a

which constitutes part of the actuating device F^2 (Figs. 2 and 9) connected by a link 28^b with a rock-member 28^c which has one arm connected by means of a link 28^d with a lever 28^e which has one end pivoted to a stationary support at 28^f. The intermediate portion of the lever 28^e is equipped with a cam-roller 28^g which engages a cam 28^h on the counter-shaft E.

The plate-lifter F′ is in the form of an arm mounted on a rock-shaft 29 equipped with an actuating arm 29^a which forms a part of the actuating device F^3. The arm 29^a is connected by a link 29^b to a rock-member 29^c which has one arm joined by a link 29^d to a lever 29^e which is fulcrumed at 29^f. The lever 29^e is equipped with a cam-roller 29^g which engages a cam 29^h with which the counter-shaft E is equipped. A spring 29^i connects the member 29^b to the frame (Fig. 6) and holds the roller 29^g against the cam 29^h.

The means G for temporarily supporting the strip in the position shown in Fig. 5 comprises a pair of arms 30 and 30^a (Figs. 5 and 7) which are carried by rock-shafts 31 which form portions of the actuating means G′. The rock-shafts are equipped with actuating arms 32 which are connected by links 33 (Figs. 2 and 9) with arms 34 fixedly secured to a rock-shaft 35 which is equipped with an actuating arm 36, connected by a link 37 to a cam-actuating lever 38 which carries a cam-roller 39 which engages a cam 40 on the counter-shaft E. The strip-supporting arms 30 and 30^a are periodically dropped to permit the strip to drop on the conveyor H, as will be understood from Fig. 5.

The conveyor H is in the form of an endless conveyor, which, as appears from Fig. 3, projects laterally from one side of the machine. The conveyor extends transversely across the machine in a plane at a suitable distance below the bed A′, and provides a traveling bed upon which the folded portions of the strip drop. The folded strip is thus conveyed laterally from the machine after being dropped from the folding devices, and may drop from the conveyor into a suitable container (not shown). The conveyor comprises parallel belts 41 which are mounted at the discharge-end on suitable bearings 42, and at the opposite end on a drum 43 (Fig. 9) which has a projecting shaft 44 upon which is secured a sleeve 45 equipped with a ratchet-wheel 46. Journalled upon the sleeve is an oscillating member 47 equipped with a pawl 48 which engages the ratchet-wheel. The member 47 is actuated by a connecting rod 48 which is connected with an actuating arm 49 which forms an extension of the lever 38, the lever 38 being fulcrumed on a pivot 50. A spring 51 serves to hold the lever 38 against its cam 40. Thus, the device 47 is caused to oscillate and actuate the wheel 46 and thus the endless conveyor.

As appears from Fig. 5, a space, or chamber, I is located between the folding devices and the endless conveyor. Adjustable vertically disposed guide-plates 52 afford hopper-like walls disposed over the lateral portions of the conveyor. These plates are carried by stems 52^a which are adjustaly secured to supports 53 carried by the main frame.

The upper walls 54 of the guides afforded by the bed A′ are equipped with leaf-springs 55 under which the folder-plates ride.

The paper strip J may be assumed to be composed of several plies. This strip is brought to the machine over guide-rollers 56 carried by the substructure A^2 of the main frame. From one of these guide-rollers, the strip is fed downwardly and passes between the guides 10 and the distributing rollers 11, as will be understood from Figs. 2 and 5.

The operation of the machine may be described briefly. The paper may be introduced between the folder-plates in any suitable manner. The threading of the paper between the folder-plates is illustrated in Fig. 5^a. The folder-plates are provided at their point ends with bevel surfaces 57 and 57^a, as shown in Fig. 5^a. It will be noted that the plates 2 and 4 constitute a pair of plates working from one end of the machine, while the plates 1 and 3 constitute a pair of plates working from the other end of the machine. It may be assumed that Fig. 5^a shows the plate 1 being withdrawn from beneath the pile from the position shown in Fig. 2^a, while the plate-actuator C moves in the direction indicated by the arrow in Fig. 5^a. During this movement, the distributor B moves in the same direction, and the plate 2 acts as a follower-plate. In this movement, the pointed end of the plate 2 is elevated by the lifter F, so that as the actuator C moves to the left, the plate 2 will fall over the paper being distributed and iron it against the underlying plate 3.

As the plate 1 is withdrawn during this movement, the plates 3 and 4 drop downwardly, and the lateral notches of the plate 2, coming into registration with the stationary lugs 22, drop down over said lugs and thus the plate 2 is actuated in a central position with reference to the stroke of the plate-actuator C.

It may be assumed that the action just described has brought the folder-plate 2 to the superposed position shown in Fig. 11 and has withdrawn the lowermost folder-plate 1 from beneath the pile. In the next movement of the actuator to the right, as viewed in Fig. 11, the advance end of the folder-plate 1 will be lifted by the arm F′ (Fig. 12); and at the conclusion of this movement, the actuator and folder-plates will be in the po-

sition shown in Fig. 5. In the operation of retracting the lowermost folder-plate, the spring-pressed studs 19[c] engage the perforations near the point end of the folder-plate, as seen in Fig. 12. It will be understood however, that the plate-lever will nevertheless elevate the point end of the plate in the manner described above. It may be added that sufficient friction and binding action is exerted by the folder-plates upon the strip being folded to cause the strip to be drawn through the distributor B in the operation of the machine.

In the simplified modification illustrated in Figs. 13–15, parts corresponding with previously described parts are similarly designated. In this modification, two folder-plates 58 and 59 are employed. These plates are linked to actuating levers 60 which are operated by links 61 connected with cranks 62 operated by mutilated gears 63 of a Geneva movement equipped with co-acting mutilated gears 64 which are actuated by a common shaft 65.

The gears 63 are mounted on shafts 63[a] which are equipped with cams 63[b] which serve to actuate plate-lifters 66 through the medium of slides 66[a] in the manner illustrated in Fig. 14. It will be understood that there is a plate-lifter associated with each of the folder-plates 58 and 59.

Each folder-plate has connected with the lower side of its base end a gripper-member 67 which is mounted on a pivot 67[a] and equipped with an actuating arm 67[b]. The arm 67[b] carries a roller 67[c] which is adapted to travel upon a movable cam-arm 68 which is adapted to be lifted by means of a slide 69 actuated by a cam 63[c] with which the gear 63 is equipped. It will be understood that this mechanism is duplicated at each folder-plate. The gripper 67 is adapted to grip a fold of the strip of paper before the opposed folder is withdrawn, as will be understood from Fig. 13. In Fig. 13, the folder-plate 59 is in a position to follow the distributor B and ride over the folder-plate 58.

It will be understood that the folder-plates are suitably timed in their movements to cause first one and then the other to act as a follower, the other one serving for the time being as a stationary plate over which the moving plate irons the paper as it is laid down by the distributor. As the folder-plate 59 moves to the left, the cam-roller 67[c] rides upon the lifted cam 68 and swings the gripper 67 down, so that the point of the plate 58 and the folded strip will enter between the gripper and the plate 59. As shown in Fig. 13, a creasing action previously occurred with respect to the plate 58 and its associated gripper 67. Springs 70 (Fig. 15) serve to throw the grippers 67 to the gripping position. Links 71 connect the levers 60 to the folder-plates. In the modification, the conveyor is designated H[2]. It may be of any suitable form and operated in any desired manner. In each construction described, the strip passes downwardly through a distributor and through what may be termed a well in the frame; and in its passage, the strip is engaged by opposed folder-plates which act alternately as stationary supporting-plates. In the first described construction, the folder-plates are loosely and shiftably mounted in a sliding actuator, while in the second described construction the folder-plates are attached to independently movable actuators. In each construction, the folded strip drops upon a conveyor, preferably. The conveyor has a step by step movement and carries the portions of the strip from beneath the locality of the folder-plates as the operation proceeds.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible, in view of the prior art.

What we regard as new and desire to secure by Letters Patent, is:

1. In a machine of the character set forth, opposed reciprocable folder-plates, and means for actuating said plates and bringing them alternately into superimposed position.

2. In a machine of the character set forth: a frame equipped with guides and having a well or opening therethrough; liftable, reciprocating folder-plates mounted in said guides; and means for conducting a strip of material to said folder-plates.

3. In combination: opposed reciprocating folder-plates; and a reciprocating web-distributor associated therewith.

4. In combination: opposed reciprocable folder-plates; means for reciprocating said plates and effecting alternate tilting of the plates; and means for conducting a web to said plates.

5. In combination: opposed reciprocable folder-plates; means for reciprocating said plates and effecting alternate lifting of the plates; means for conducting a web to said plates; and means for collecting the folded portions of the web as they drop from the folder-plates.

6. In combination: a frame provided with guides; folder-plates movably mounted on said guides; means for reciprocating said plates and bringing them alternately into superposed position; means for conducting a web to the folder-plates; and a conveyor disposed beneath the folder-plates.

7. In combination: opposed reciprocating folder-plates; periodically actuated lifters associated with said plates; and means for conducting a web to said folder-plates.

8. In combination: opposed reciprocable folder-plates; means for reciprocating said

plates and elevating them in alternation; and a distributor comprising a carriage equipped with rollers co-acting with the uppermost folder-plate.

9. In combination: a frame equipped with a guide; a sliding plate-actuator mounted therein; and pairs of opposed shiftable folder-plates mounted in said actuator.

10. A machine as specified in claim 9 in which the guide is equipped with means for holding certain of said folder-plates temporarily in centered position where they act for the time being as stationary plates.

11. A machine as specified in claim 9 in which the guide is equipped with means for holding certain of said folder-plates temporarily in centered position and the actuator is equipped with means for withdrawing the lowermost plate and has associated therewith a lifter whereby the plates may be brought successively into position over the center plates.

12. In combination: a frame provided with a guide; an actuator reciprocating in said guide; pairs of opposed folder-plates mounted in said actuator, the actuator being of sufficient length to admit plates in end to end relation; means for centering certain of said plates with reference to said guide; and lifters associated with said actuator and co-acting with the actuator to bring the plates, in succession, into superposed position above the centered plates.

13. A machine as specified in claim 12 in which the guide is equipped with short centering lugs and the plates are equipped with co-acting lateral notches, spaces being provided in the guides above and below said lugs to permit passage of the uppermost and lowermost plates to and from the centered position.

14. A machine as specified in claim 12 in which the plates and guide are provided with co-acting lugs and notches for temporarily holding the plates in centered position; and springs associated with said guides adapted to press downwardly upon the plates.

15. A machine as specified in claim 12 in which the actuator is equipped with spring-held plungers and the plates are provided near their point ends with recesses co-acting with said plungers.

16. In combination: opposed reciprocating folder-plates; a reciprocating web-distributor over said plates; and an intermittently retracted web-support beneath said plates.

17. In combination: opposed reciprocating folder-plates; a reciprocating web-distributor over said plates; an intermittently retracted web-support beneath said plates; and an endless conveyor beneath said web-support.

18. In combination: a frame provided with a guide; a transverse conveyor below the plane of said guide; opposed folder-plates reciprocable in said guide; means for reciprocating said plates and bringing them, in alternation, to superposed position; and means for conducting a web to said folder-plates.

19. In combination: opposed reciprocable folder-plates; means for reciprocating said plates and bringing them alternately into superposed position; and a co-acting reciprocating carriage equipped with movably mounted distributing and ironing members.

20. In combination: opposed reciprocable folder-plates; means for reciprocating said plates and bringing them alternately into superposed position; a co-acting reciprocating carriage equipped with movably mounted distributing and ironing members; and tracks having depressed end-portions permitting the ironing members to co-act with the point ends of the folder-plates.

21. In combination: a frame provided with a well; reciprocating folder-plates operating over said well; and web-distributing means reciprocating over said well above said folder-plates.

22. The method of folding a web, which comprises: distributing the web back and forth over a plurality of folders, and successively bringing the folders into superposed position to permit the web to be folded thereover.

23. The method of folding a web, which comprises: distributing the web back and forth over a stack of folders, and successively bringing the folders into superposed position alternately from opposite sides of the stack to permit the web to be folded thereover.

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