No. 887,314. PATENTED MAY 12, 1908.

F. L. CROSS.

SHEET FEEDING MACHINE.

APPLICATION FILED APR. 3, 1905.

3 SHEETS—SHEET 1.

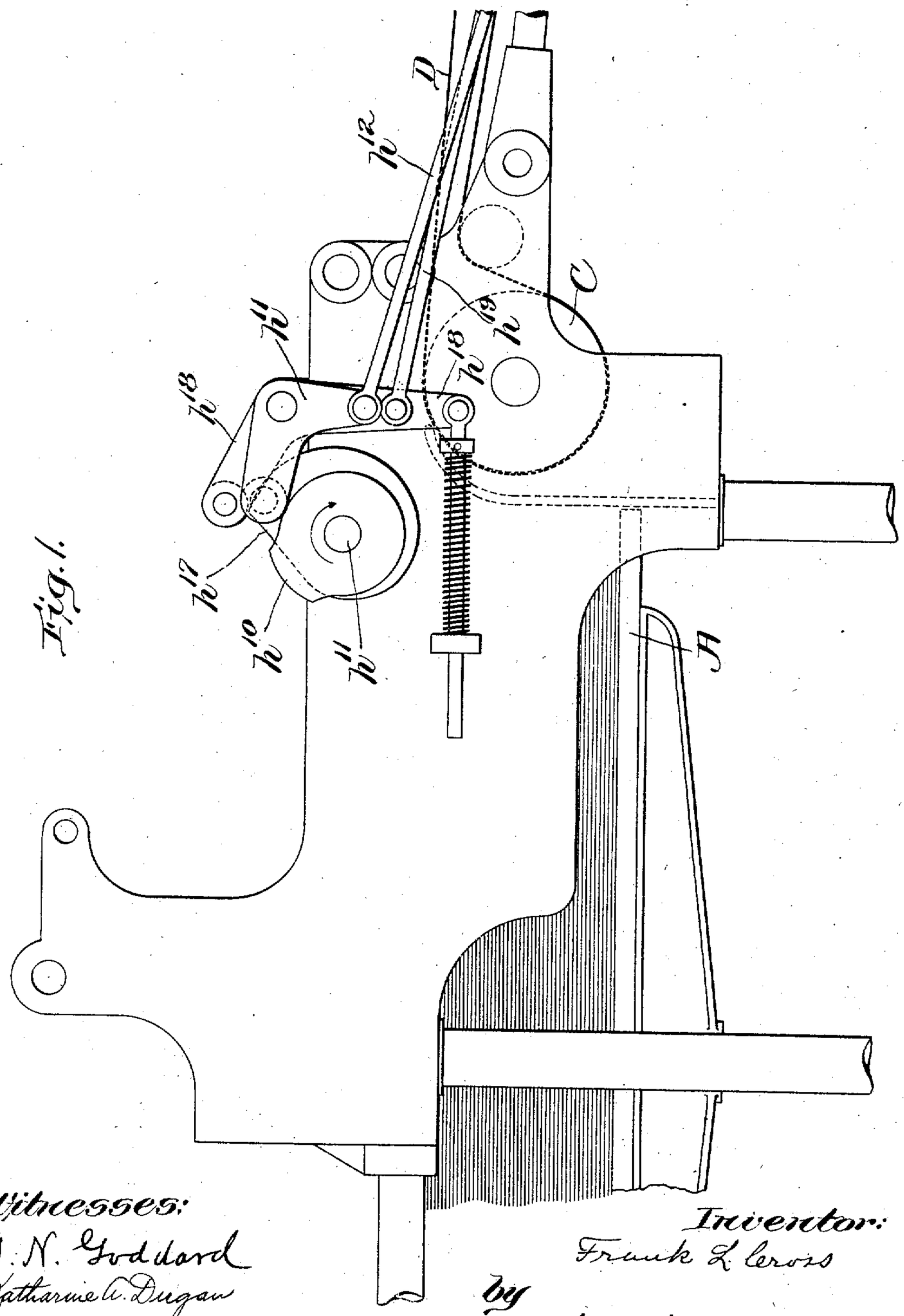

Fig. 1.

Witnesses:
G. N. Goddard
Katharine A. Dugan

Inventor:
Frank L. Cross
by
Ira L. Fish Attorney.

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3 SHEETS—SHEET 2.

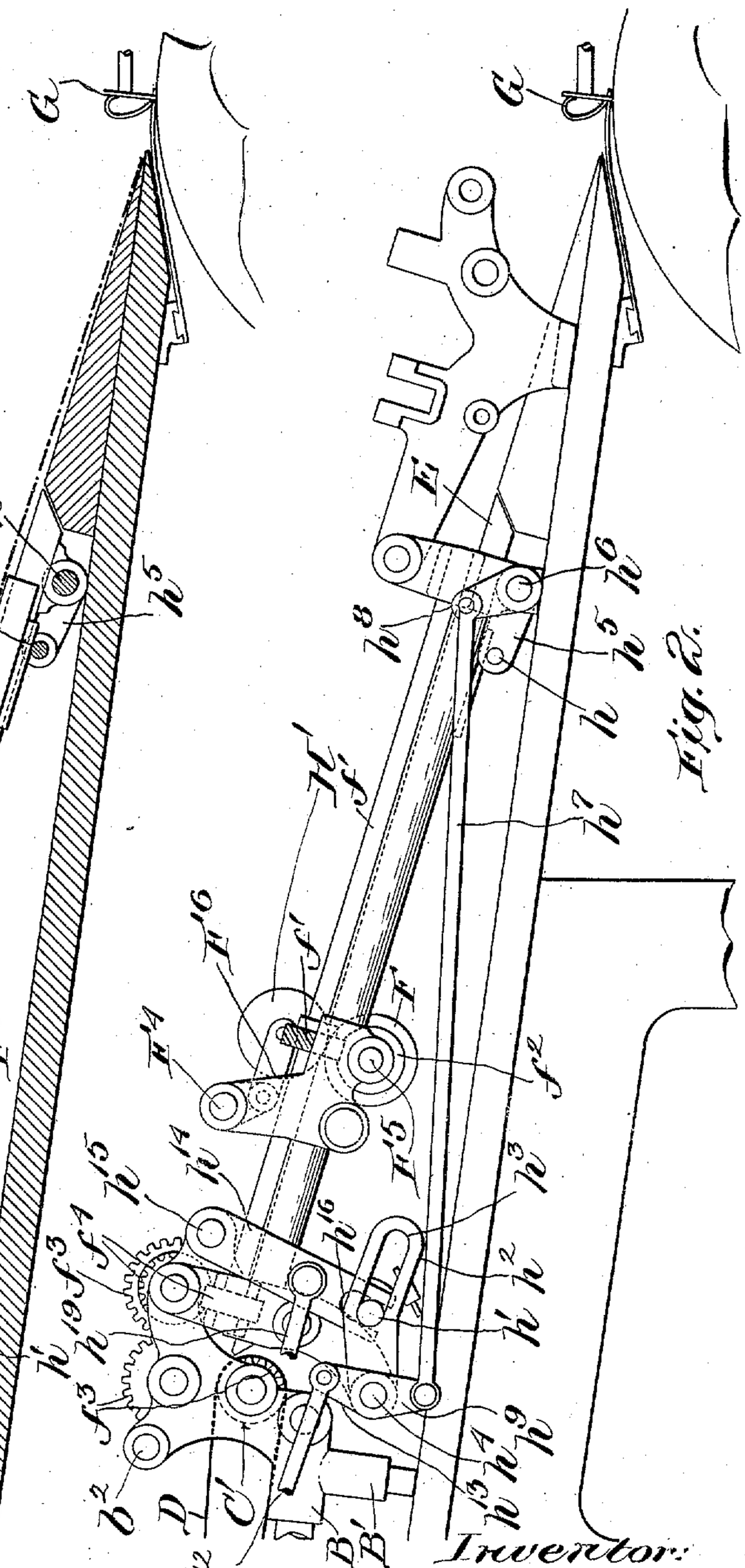

Fig. 3.

Fig. 2.

Witnesses:

G. N. Goddard

Katharine A. Dugan

Inventor:

Frank L. Cross

by

Ira L. Fish Attorney.

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3 SHEETS—SHEET 3.

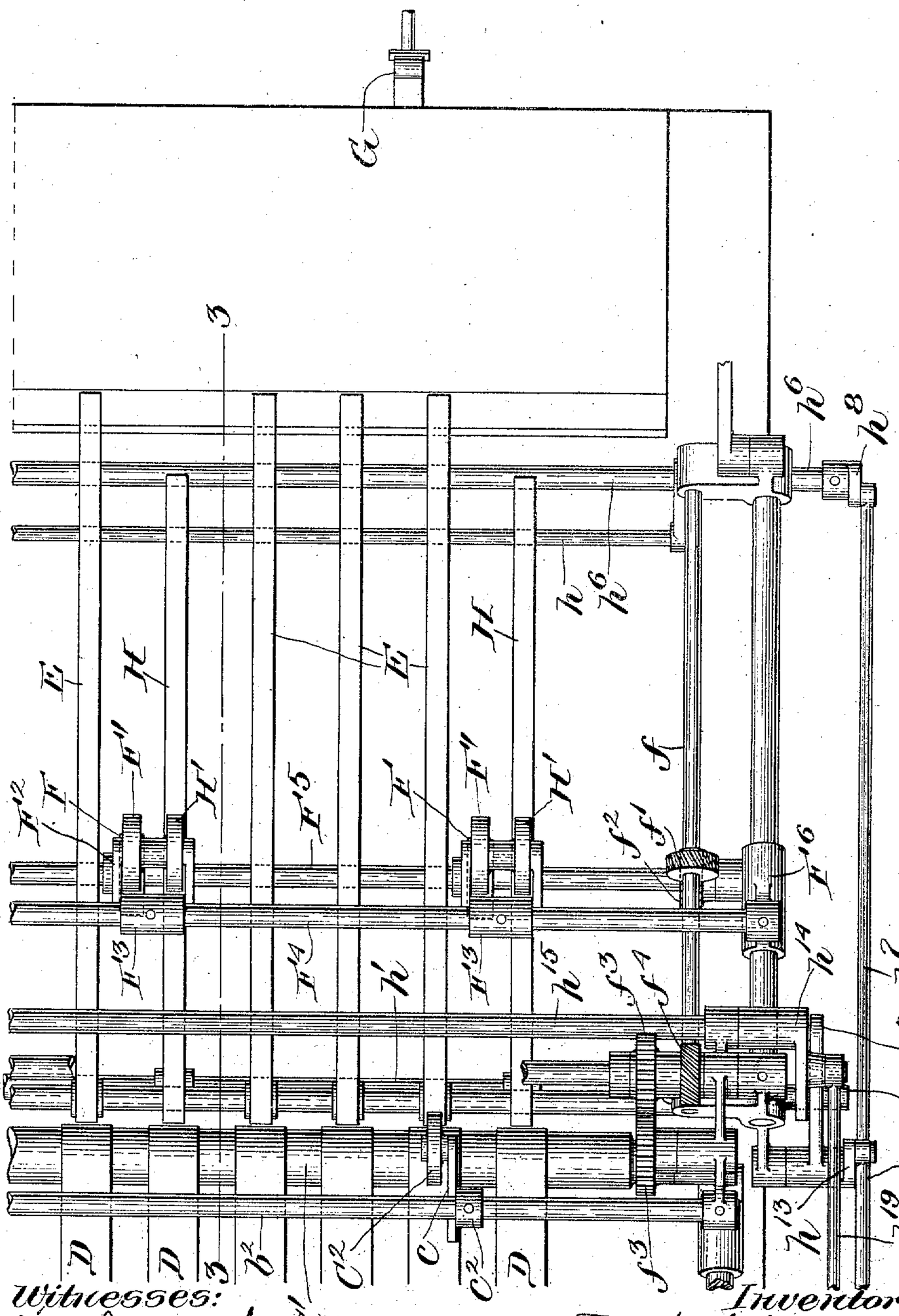

Fig. 4.

Witnesses:
G. N. Goddard
Katharine A. Dugan

Inventor:
Frank L. Cross
by Ira L. Fish Attorney.

UNITED STATES PATENT OFFICE.

FRANK L. CROSS, OF MYSTIC, CONNECTICUT, ASSIGNOR TO CROSS PAPER FEEDER COMPANY, OF BOSTON, MASSACHUSETTS, A CORPORATION OF MAINE.

SHEET-FEEDING MACHINE.

No. 887,314. Specification of Letters Patent. Patented May 12, 1908.

Application filed April 3, 1905. Serial No. 253,649.

To all whom it may concern:

Be it known that I, FRANK L. CROSS, of Mystic, in the county of New London and State of Connecticut, have invented certain new and useful Improvements in Sheet-Feeding Machines, of which the following is a specification.

The present invention relates to a sheet feeding mechanism for conveying sheets in succession from an automatic feeding machine to a printing press or other machine for acting upon or manipulating the sheets.

It is frequently desirable in feeding sheets in succession to machines to advance the sheets into position to be acted upon at a high rate of speed and at the same time to deliver the sheets accurately in position to be seized or acted upon by the sheet manipulating devices of the machine to which they are being fed. For instance, in feeding sheets to a printing press running at a high speed, it is necessary to advance the sheets to the front gages of the press at a high rate of speed in order that the side register devices may have time to operate before the sheet is seized by the grippers of the press. If the sheets are brought against the front gages at full speed and the gages are relied upon to arrest the sheet in its proper position, it has been found that either the front edge of the sheet will be crumpled and injured or the sheet will bound away from the front gages and not be properly registered against them. In order to properly and accurately position the sheets against the front gages, various mechanisms and devices have been devised for slowing down the sheets just before the front edge reaches the front gages.

The present invention relates more especially to a sheet conveying mechanism which will act to advance the sheets at a high rate of speed until they are approximately in position and will then act to slow down the sheet and bring it into position against the front gages when the sheet is either approximately at a state of rest or traveling at so slow a speed that it will be properly positioned against the front gages. This sheet conveying mechanism comprises sheet conveying surfaces which are driven at a comparatively high speed to rapidly advance the sheet until its front edge is near the front gages or nearly in the desired position, and additional sheet conveying surfaces which take the sheet while traveling at the same surface speed and act to slow down the sheet after it has passed from the control of the high speed conveying surfaces to the control of the slowing-down surfaces. The sheet is under the control of one or the other or of both of the conveyers during the time it is being delivered and is therefore rapidly delivered and then slowed down without danger of getting the sheet out of alinement. During the greater part of the travel of the sheet, it is under the control of the high speed conveying surfaces. Just before the sheet reaches the front gages the slow-down conveying surfaces are brought into action upon the sheet and the sheet passes from the control of the high-speed conveying devices. When the slow-down surfaces are brought into action the sheet is still under the control of the high-speed conveying surfaces and there is an interval of greater or less length during which the sheet is being acted upon by both the high-speed and the slow-down surfaces. During this interval the slow-down surfaces have substantially the same speed as the high-speed surfaces. There is no danger therefore, of displacing the sheet during its transfer from one set of conveying surfaces to the other by reason of variation in the timing or action of the devices at either side of the sheet. After the sheet has passed from the control of the high-speed conveying surfaces and is under the control of the slow-down surfaces, the speed of these surfaces is gradually but rapidly retarded to slow down the sheet so that it is accurately positioned at the front gages.

The high-speed conveying surfaces may be of any suitable form such as rollers or tapes for instance, and for the sake of simplicity and convenience of adjustment I prefer to employ sheet conveying rollers as the high-speed conveying surfaces. The slow-down surfaces may also be of various forms such as tapes, rollers, or segments for instance. I prefer however, to employ traveling bars as the slow-down conveying surfaces and to arrange and operate these bars in accordance with certain further features of invention which will be more fully explained in connection with the detailed description of the mechanism in which I have embodied my invention.

The various features of invention will be understood from a detailed description of the feeding mechanism shown in the accom-

panying drawings, which embodies all the features in the form in which I prefer to employ them.

In these drawings—Figures 1 and 2 show a side elevation of the feeding mechanism applied to the feed board of a printing press. Fig. 3 is a longitudinal section on line 3—3 Fig. 4. Fig. 4 is a plan view of the parts shown in Fig. 2.

In the mechanism shown in the drawings the sheets to be fed are supported upon a vertically moving table A which presents the top of the pile of sheets to combing devices by which the top sheets are separated and fed to delivery rolls.

The sheet separating mechanism and the means for controlling it so as to present individual sheets in succession to the delivery rolls may be of any suitable construction, such for instance as shown in Patent No. 690702 January 7, 1902, and the delivery rolls may be operated in any suitable manner, as for instance, as in the construction shown in said patent.

In the drawings the lower delivery roll to which the sheets are presented by the sheet separating devices, is indicated at C. The sheets separated from the pile on the table A are advanced by the delivery rolls and by a series of tapes D extending from the roll C around a second tape-roll or drum C'. The tape-drum C' is mounted at the front end of a frame B pivoted to the side frames of the feeder and supported at its front end by feet B' which rest upon the feed-board of the press. The sheets as they are carried along by the tapes D pass between the drum C' and presser rolls C^2 arranged to bear upon the sheets above the drum C' and thus insure their onward movement. The presser rolls are mounted in arms *c* pivoted to collars c^2 which are adjustably secured upon a transverse rod b^2. The collars c^2 may be adjusted on the rod b^2 to bring the pressure rolls into the desired position with relation to the tapes and tape roller. The tapes D deliver the sheets on to a series of supporting bars E and into the control of the delivery rollers F. The sheet is pressed against the delivery rollers F by coöperating pressure rollers F' which rest upon the delivery rollers. The rollers F' are mounted in arm F^2 pivoted to collars F^3 which are adjustably secured upon a transverse rod F^4. These rollers are supported by engagement with the delivery rollers F and are driven by frictional engagement with such rollers or with the sheets passing between them.

The delivery rollers F are driven at the same surface speed as the tapes D and while the sheet is in the control of the delivery rollers F it is rapidly advanced over the bars E toward the front gages G of the press. The sheet remains in the control of the delivery rollers F until the front edge of the sheet is near the front gages G and is then transferred from the control of the rollers F to the control of sheet conveying surfaces which slow down the sheet.

The conveying surfaces which act to slow down the sheets are the upper surfaces of the bars H arranged below the path of the sheet and adapted to be brought into engagement with coöperating pressure rollers H' which are connected with the pressure rollers F'. The bars H extend in the direction of movement of the sheet parallel to the supporting bars E and during the action of the delivery rollers F upon the sheet these bars H remain in position with their upper surfaces somewhat below the upper surfaces of the bars E and out of contact with the rollers H'. As the front edge of the sheet nears the front gages G the bars H are raised and at the same time moved forward with a surface speed substantially the same as the surface speed of the rollers F and of the sheet. As the bars rise they engage the under surface of the sheet, and press the sheet against the rollers H' so that the sheet is brought into the control of the moving surfaces of the bars and the coöperating pressure rolls H'. At the time the sheet is thus brought into the control of the bars H and coöperating rolls H', the bars are traveling at the same speed as the delivery rolls F which are also acting upon the sheet and there will therefore be no danger of swinging the sheet out of alinement even if one of the bars should engage its coöperating pressure roller slightly in advance of the engagement of the other bar with its pressure roller, nor will there be any danger of such displacing of the sheet due to any unequal slip of the pressure rolls H' as they begin to coöperate with the corresponding bars. The continued upward movement of the bars H lifts the pressure rollers F' away from the delivery rollers F so that the delivery rollers F cease to act upon or control the movements of the sheet. After the sheet has been thus transferred from the control of the delivery rollers F to the control of the bars H the speed of the bars is rapidly reduced, thus quickly slowing down the sheet as its front edge comes into position against the front gages.

The bars H extend forward from the coöperating rolls H' and the forward extension of the bars forms a sheet support which moves with those parts of the bars which act as sheet conveying surfaces. The sheet is therefore supported during the slowing down operation upon a support which moves with the slow-down sheet conveying surfaces, with a resulting increase in the accuracy with which the sheet may be rapidly slowed down and positioned at the front gages. The accurate positioning of the sheet against the front gages may be further insured by so operating the bars H that they continue to

move forward after the rear edge of the sheet has passed from between the rollers H′ and the bars H. This continued movement of the bars may be utilized to give the final forward movement to the sheet in bringing it against the front gages or may be depended upon merely to insure the engagement of the front edge of the sheet with the gages in case of imperfect action of the slow-down surfaces in positioning the sheet. In operating upon large sheets, bars H, in addition to those which coöperate with the pressure rolls H′, may be employed, the additional bars being connected to move with the bars which cooperate with the pressure rolls and forming a part of the traveling sheet support. The bars H are supported and operated from two transverse rods h, h' arranged at opposite ends of the bars. The rear ends of the bars H are provided with downwardly projecting arms H^2 by which they are secured to the transverse rod h'. In order that the bars may be readily removed or adjusted the arms H^2 are provided with jaws embracing the rod h' and with set screws H^3 for clamping the jaws to the rod. The rod h' is raised and lowered to carry the bars H toward and away from the pressure rollers H′ and is also moved forward and back to give the bars H advancing movements and to return them to normal position. The front ends of the bars H rest upon the rod h and this rod is raised and lowered in unison with the rod h' to cooperate therewith in raising and lowering the bars H, the bars sliding backward and forward over the rods h as they are advanced and retracted.

The rod h' is raised and lowered to move the bars H toward and from the pressure rolls by means of arms h^2 provided with slots h^3 in which the opposite ends of the rod h' are mounted. These arms h^2 are secured to a rock shaft h^4 which is rocked at proper intervals. The rod h is mounted in arms h^5 secured to a rock shaft h^6 which is rocked in unison with the rock shaft h^4 through a link h^7 connecting arms h^8 and h^9 secured to the shafts h^6 and h^4 respectively. The rock shaft h^4 is rocked at proper intervals by the action of a cam h^{10} secured to a shaft h^{11} which makes one revolution for each sheet fed to the machine. The connections between the cam h^{10} and the rock shaft h^4 consist of a lever h^{11} one end of which engages the cam and the other end of which is connected by a link h^{12} with an arm h^{13} secured to the rock shaft.

The rod h' is operated to give the advance and return movements to the bars H by means of two arms h^{14} secured to opposite ends of a rock shaft h^{15} and provided with slots h^{16} engaging the rod h'. The arms h^{14} and rock shaft h^{15} are operated at proper intervals by the action of a cam h^{17} secured to the shaft h^{11} The connections between this shaft and the arms h^{14} and rock shaft h^{15} consists of a lever h^{18} connected by means of a link h^{19} with one of the arms h^{14}.

The cams h^{10} and h^{17} are so formed and timed that the rod h' and bars H will start forward as the rods h', h are raised and will be moving at the same speed as delivery roller F and the sheet when the bars H engage the coöperating pressure rollers H′. The cam h^{17} is also so shaped that when the bars H have been raised to their highest position and while they are maintained in this position, the speed with which the bars are advanced will be quickly retarded until the bars are at rest. The cam h^{10} will then act to lower the rods h, h' and the bars H, after which the cam h^{10} will retract the rod h' and the bar H to return them to normal position. This construction of supporting and operating mechanism for the bars H enables the bars to be readily and conveniently introduced or removed from the machine, and also enables the ready adjustment of the bars to suit any width of sheet. It also enables additional bars to be readily inserted or removed as occasion requires. The shaft F^5 on which the delivery rollers F are secured and the rod F^4 to which the pressure rollers are connected, are mounted in brackets F^6 which may be adjusted toward or from the front gages in order to bring the delivery rollers and the pressure rollers into proper relation to the front gages in accordance with the size of the sheet being acted upon.

The mechanism for driving the delivery rollers F at the same surface speed as the tapes D comprises a shaft f extending along the line of adjustment of the rollers toward and from the front gages and connected with the roller shaft F^5 by means of spiral gears f', f^2 mounted on the shafts f and f^3 respectively. The spiral gear f' is connected with the shaft f so that it revolves with the shaft, while being free to slide thereon as the delivery rollers are adjusted toward or from the front gages. The shaft f is driven from the tape drum C′ through a series of spur gears f^3 and spiral gears f^4 one of which is secured to one of the gears f^3 and the other of which is secured to the shaft f.

In adjusting the mechanism for a given length of sheet, the delivery rollers F and the pressure rollers F′, H′, are adjusted so that the rear edge of the sheet will pass from between the rollers as the front edge of the sheet comes to the front gages or slightly before the sheet reaches this position. The delivery rollers F will therefore act upon the sheet through the greater part of its length and the bars H will act upon the rear part of the sheet to quickly slow it down as the front edge comes to the front gages, the advance movement of the bars continuing after the rear edge of the sheet has passed from beneath the pressure rolls.

The specific form of the sheet conveying surfaces employed in practicing the invention may be varied as desired and the details of construction and arrangement and of the operating mechanisms may also be varied, without departing from the invention.

Without attempting to specify the variations and modifications which may be made, what I claim and desire to secure by Letters Patent is—

1. A sheet conveying mechanism having in combination high speed sheet conveying surfaces for advancing the sheet, slow-down conveying surfaces, and mechanism operatively connected to give the slow-down surfaces substantially the same speed as the high speed surfaces as they come into action and a retarded speed after the sheet has passed from control of the high speed surfaces.

2. A sheet conveying mechanism having in combination high speed sheet conveying surfaces for advancing the sheet, slow-down conveying surfaces, mechanism operatively connected to give the slow-down surfaces substantially the same speed as the high speed surfaces and then retard said speed, and means for transferring the sheet from the control of the high speed surfaces to the control of the slow-down surfaces when both have substantially the same speed.

3. A sheet conveying mechanism having in combination high speed sheet conveying surfaces for advancing the sheet, slow-down conveying surfaces and mechanism operatively connected to give the slow-down surfaces substantially the same speed as the high speed surfaces and then retard the speed, and mechanism connected to operate the slow-down surfaces to transfer the sheet from the control of the high speed surfaces to the control of the slow-down surface when both have substantially the same speed.

4. A sheet conveying mechanism having in combination high speed sheet conveying surfaces, slow-down conveying surfaces, coöperating rollers for holding the sheet against said surfaces, and mechanism for operating the slow-down surfaces to press the sheet against the coöperating rollers and release the hold of the rollers coöperating with the high speed surfaces.

5. A sheet conveying mechanism having in combination high speed sheet conveying surfaces, slow-down conveying surfaces, coöperating rollers for holding the sheet against said surfaces, mechanism for giving the slow-down surfaces substantially the same speed as the high speed surfaces and then retarding the speed, and mechanism for operating the slow-down surfaces to press the sheet against the coöperating rollers and release the hold of the rollers coöperating with the high speed surfaces when both conveying surfaces are moving at substantially the same speed.

6. A sheet conveying mechanism having in combination high speed conveying surfaces, slow-down conveying surfaces, pressure rollers for coöperating with the high speed surfaces, connected pressure rollers for coöperating with the slow-down surfaces, mechanism for moving the slow-down surfaces towards and away from the coöperating rollers to transfer the sheet from the control of the high speed surfaces to the control of the slow-down surfaces.

7. A sheet conveying mechanism having in combination high speed conveying surfaces, slow-down conveying surfaces, pressure rollers for coöperating with the high speed surfaces, connected pressure rollers for coöperating with the slow-down surfaces, mechanism for giving the slow-down surfaces substantially the same speed as the high speed surfaces and then retarding the speed, and mechanism for moving the slow-down surfaces towards and away from the coöperating rollers to transfer the sheet from the control of the high speed surfaces to the control of the slow-down surfaces when both conveying surfaces are moving at substantially the same speed.

8. A sheet conveying mechanism having in combination high speed conveying surfaces for acting upon the sheet through the greater part of its length, slow-down surfaces arranged to act upon the rear part of the sheet, and mechanism for operating said slow-down surfaces to take the rear part of the sheet from the high speed surfaces when moving at substantially the same speed and then slow down the sheet.

9. A sheet conveying mechanism having in combination high speed conveying surfaces for acting upon the sheet through the greater part of its length, slow-down surfaces, mechanism for giving said surfaces substantially the same speed as the high speed surfaces and then a retarded speed, and means for transferring the rear part of the sheet from the control of the high speed surfaces to the control of the slow-down surfaces when both are moving at substantially the same speed.

10. A sheet conveying mechanism having in combination sheet conveying surfaces driven at a constant speed, sheet conveying surfaces driven at a variable speed, and mechanism for transferring the rear part of the sheet from the control of the constant speed surfaces to the control of the variable speed surfaces.

11. A sheet conveying mechanism, having, in combination, high speed sheet conveying surfaces, sheet engaging means including slow down conveying surfaces and sheet supporting devices moving therewith, rollers for

holding the sheet against the slow down surfaces of said means, and mechanism for continuing the movement of the sheet supporting devices of said means after the sheet has passed the rollers.

12. A sheet conveying mechanism having in combination sheet conveying surfaces, bars arranged at one side of the path of the sheet, coöperating rollers, mechanism connected to move the bars towards and away from the rollers and to advance and retract the bars.

13. A sheet conveying mechanism having in combination sheet conveying surfaces driven at a constant speed, coöperating pressure rollers, connected pressure rollers, bars arranged to coöperate with said connected rollers, and mechanism connected to move the bars towards and away from the pressure rollers and to give the bars a variable forward movement and a return movement.

14. A sheet conveying mechanism having in combination sheet conveying surfaces, bars arranged below the path of the sheet, rollers arranged to coöperate with said bars, and mechanism connected to move said bars vertically and to advance and retract the bars.

15. A sheet conveying mechanism having in combination sheet conveying surfaces driven at a constant speed, bars arranged below the path of the sheet, connected rollers arranged to coöperate with the sheet conveying surfaces and the bars, mechanism connected to move the bars vertically and to advance said bars with a variable speed and to retract the bars.

16. A sheet conveying mechanism having in combination, sheet conveying surfaces, bars arranged below the path of the sheet, mechanism connected to move the bars vertically to advance and retract the bars, rollers arranged to coöperate with the bars when raised and to release the sheet before the advance of the bars is completed.

17. A sheet conveying mechanism having in combination, sheet conveying surfaces driven at a constant speed, bars arranged below the path of the sheets, mechanism connected to move the bars vertically, to advance the bars with a variable speed and to retract the bars, rollers arranged to coöperate with the bars when raised and to release the sheet before the advance of the bars is completed.

18. A sheet conveying mechanism having in combination delivery rollers, coöperating pressure rollers, connected pressure rollers, sheet conveying surfaces arranged to coöperate with said connected rollers, and mechanism for operating said surfaces to press the rear part of the sheet against the connected rollers.

19. A sheet conveying mechanism having in combination delivery rollers, coöperating pressure rollers, connected pressure rollers, sheet conveying surfaces arranged below the path of the sheet in position to coöperate with said connected rollers, mechanism for bringing said surfaces into engagement with said connected rollers and advancing said surfaces at a variable speed.

20. A sheet conveying mechanism having in combination delivery rollers, bars arranged below the path of the sheets, connected pressure rollers coöperating with the delivery rollers and bars, and mechanism connected to move the bars vertically and to advance and retract the bars.

21. A sheet conveying mechanism having in combination, bars arranged below the path of the sheet, transverse rods carrying said bars, devices for securing the bars to one of said rods, and mechanism connected to raise and lower said rods and to advance and retract the rod to which the bars are secured.

22. A sheet conveying mechanism having in combination bars arranged below the path of the sheets, transverse rods carrying said bars, devices for detachably securing the bars to one of said rods, and mechanism connected to raise and lower the rods and to advance and retract the rod to which the bars are secured.

In testimony whereof I have affixed my signature, in presence of two witnesses.

FRANK L. CROSS.

Witnesses.
IRA L. FISH,
KATHARINE A. DUGAN.