May 1, 1934. H. T. NICHOLAS 1,956,807

PAPER FEEDING MECHANISM

Filed Oct. 12, 1932 3 Sheets-Sheet 1

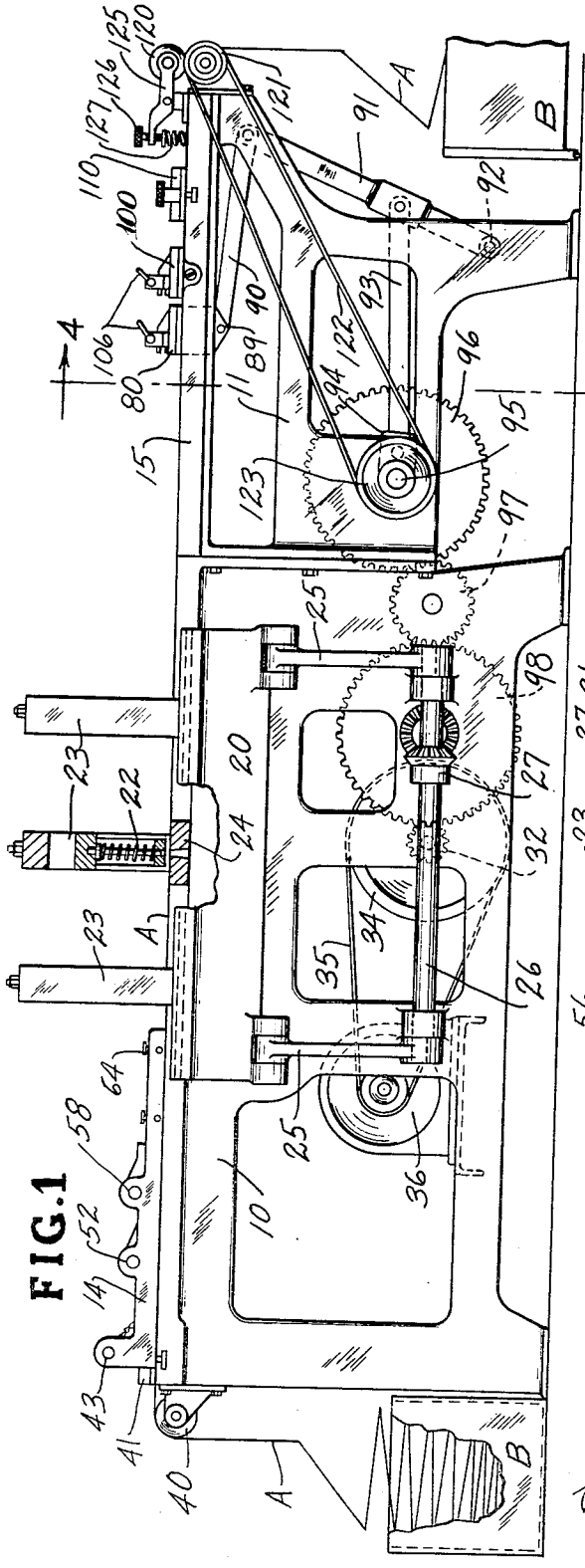


FIG. 1

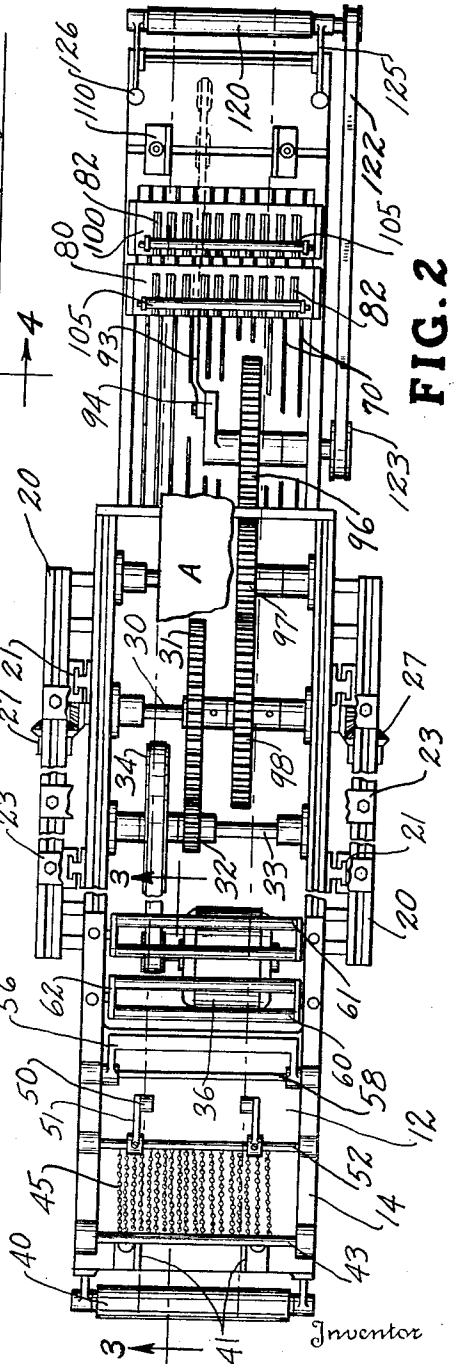


FIG. 2

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PAPER FEEDING MECHANISM

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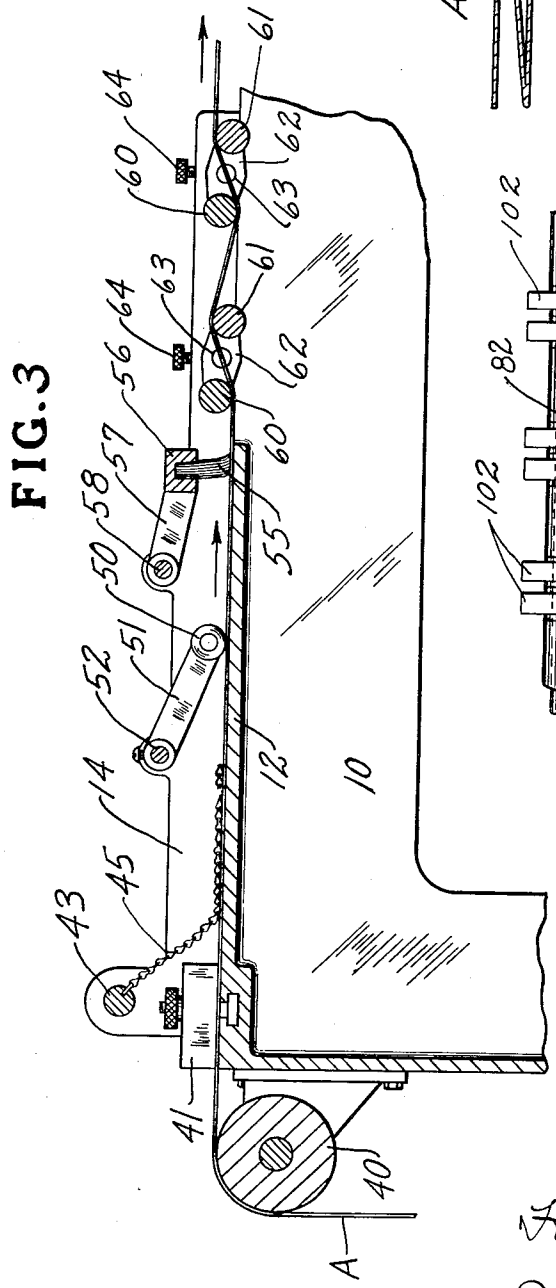


FIG. 3

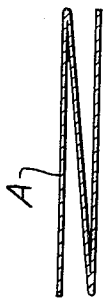


FIG. 7

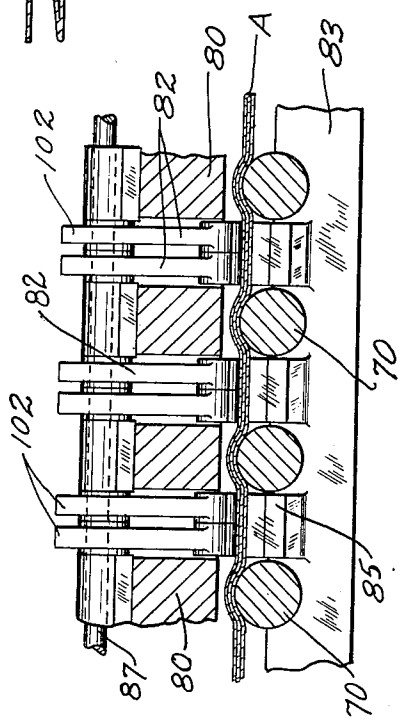


FIG. 6

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PAPER FEEDING MECHANISM

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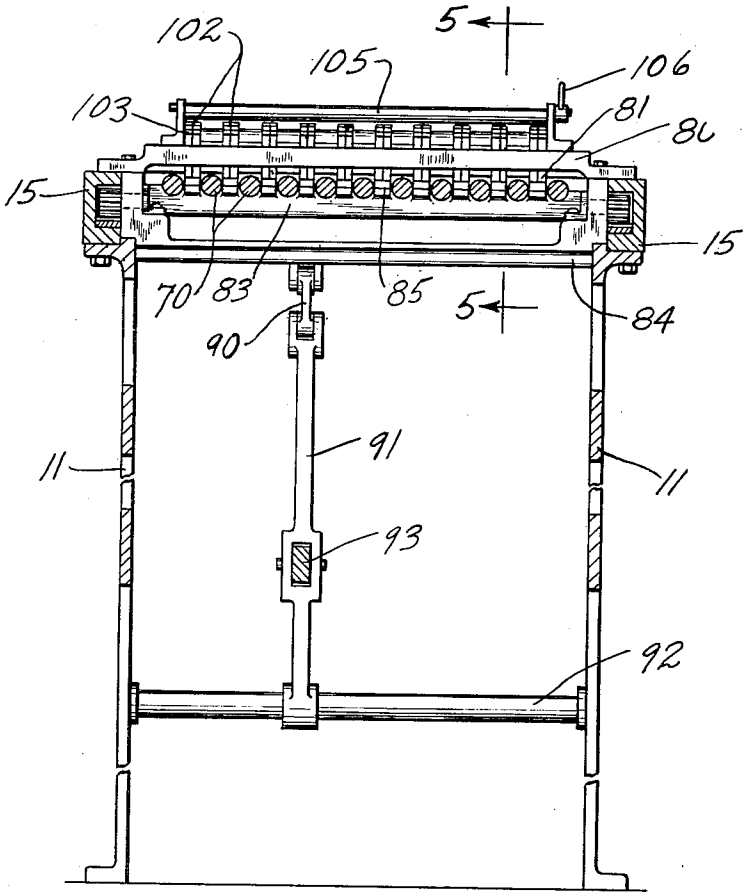


FIG. 4

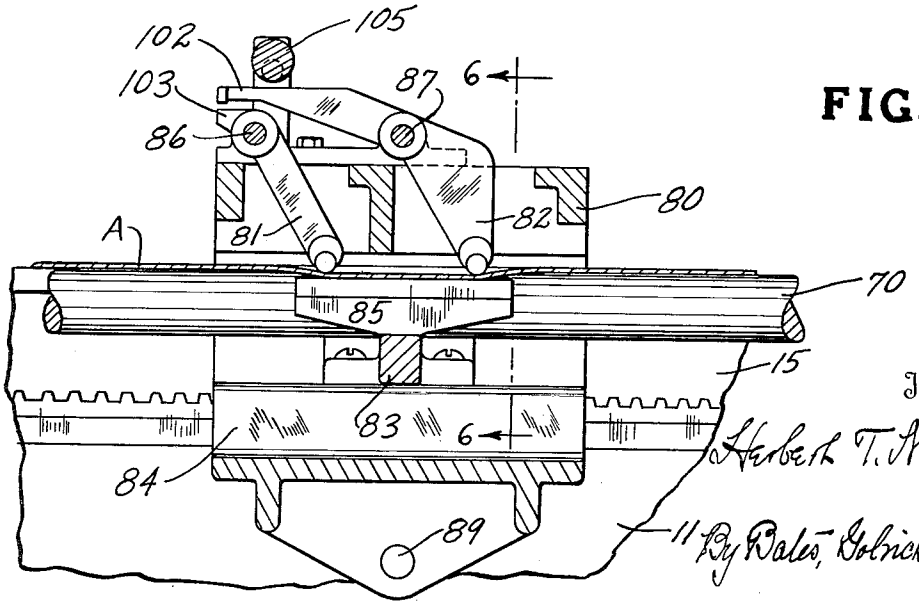


FIG. 5

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UNITED STATES PATENT OFFICE

1,956,807

PAPER FEEDING MECHANISM

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Application October 12, 1932, Serial No. 637,450

16 Claims. (Cl. 271—2.5)

This invention relates to a paper feeding mechanism adapted to periodically progress a continuous web of paper so that operations may be performed in accurate position on successive regions of the web.

My machine has been specially designed for handling fan-folded webs such as are used in producing manifold forms. It is well adapted for the feeding of such webs periodically past perforating devices for example, which act on successive regions of the web.

It is an object of my invention to provide a mechanism of great accuracy for progressing the web, as this enables the perforating action to take place in the exact region desired.

Fan-folded webs, such as my machine is adapted to progress, frequently have printed forms thereon and are consecutively numbered, so that it is very important that the perforations determining the dividing line between one form and the next should be accurately placed. Any error in the progressing movement, though it may be very slight in one movement, would accumulate in the course of a large number of actions to bring the perforation so out of place as to make the production unutilizable.

Another difficulty which occurs in the use of the fan-folded webs is that air pockets are liable to develop between the folds, preventing the different plies of paper from lying smoothly on each other, resulting in creases at other places than along the folding lines.

My invention, as hereinafter described, provides means for eliminating the air pockets, for maintaining the paper smooth and properly tensioned as it passes through the perforator or other device to act on it, and provides grippers which engage the paper after such action and draw it along the desired distance. The machine has been designed for high speed operation and to that end I have developed a system of holding and gripping devices which is not thrown out of accuracy by the momentum of the parts.

My invention is hereinafter more fully explained in connection with a preferred embodiment illustrated in the drawings and the essential novel features are summarized in the claims.

In the drawings, Fig. 1 is a side elevation of my paper-feeding mechanism embodied with a suitable perforating device; Fig. 2 is a plan of such machine; Fig. 3 is a vertical section through the smoothing and tensioning portion on the machine, as indicated by the line 3—3 on Fig. 2; Fig. 4 is a vertical transverse section through the gripping portion of the machine, as indicated by the line 4—4 on Fig. 1; Figs. 5 and 6 illustrate the movable gripping device on a larger scale and with the distorted position of the paper exaggerated; Fig. 5 being a vertical cross-section on the line 5—5 of Fig. 4, and Fig. 6 a vertical section on the line 6—6 of Fig. 5; Fig. 7 is an illustrative cross-section of a fan-folded web, which may be used in this machine.

As shown in Figs. 1 and 2, 10 indicates the frame of the paper smoothing and tension and perforating mechanism and 11 the frame of the gripping and holding mechanism which is rigidly secured to the frame 10. These frames consist of upright side members with suitable cross bars.

I will first describe the perforating mechanism shown in Figs. 1 and 2, though it is to be understood this is merely illustrative of any mechanism acting periodically on the web. Mounted on opposite sides of the frame 10 are horizontal rails 20, guided to move vertically by suitable guides 21, coacting with the sides of the frame. Extending across the machine from one rail 20 to the other are one or more cross frames 23 (three being shown) which carry the perforating punches 22, adapted to coact with die-openings in cross bars 24 below the paper web A.

Each rail 20 is shown as connected by links 25 to eccentric portions of shafts 26, one on eacn side of the machine, the shafts being connected by bevel gears 27 with a cross shaft 30. Rigid on this shaft is a gear 31 shown as meshing with the pinion 32 on a drive shaft 33, carrying a driving pulley 34. The latter is connected by a belt 35 with a driving motor 36.

It will be seen that the mechanism described operates to raise and lower the perforating heads periodically. During the lowering movement the punches pass through the paper into the openings in the supports 24. The punching heads may be shifted into any desired position on the rails 20, and the cross bars 24 correspondingly placed. Accordingly when the machine operates, a series of perforations may be made in selected locations in the paper web A.

My machine may take a fan-folded web, for instance of the cross-section shown in Fig. 7, either from a roll or from a transversely fan-folded supply, and feed it to the mechanism illustrated by the perforating machine, and thereafter discharge it. Assuming that a longitudinally and transversely fan-folded supply A, contained in a suitable box B, is to be fed to the perforating machine shown, the first operation is to insure the elimination of air pockets between the folds and insure the paper being

smoothly presented to the perforating machine. Means by which the web is thus prepared, as well as properly tensioned for the feeding action, is illustrated in Figs. 1, 2 and 3, which I will now describe.

At one end of the frame 10 is a roller 40, over which the fan-folded web passes. Beyond this roller the web lies between laterally adjustable guides 41. It then passes along a table 12 forming the top of a frame 10. On opposite sides of this table are standards carrying a cross rod 43 and from this rod depend a large number of chains 45, which extend diagonally downward and then lie by gravity in horizontal position directly on top of the paper web over the table 12. These chains are comparatively close together and their forward ends are free, so that the paper drags under them as it progresses in the direction of the arrow in Fig. 3. These chains thus form light weights bearing down on much of the paper and have the effect of smoothing down the paper and forcing out any air pockets from between the folds.

Beyond the chains 45, the paper web encounters a pair of pressing members 50, mounted on the lower ends of the inclined arms 51, which are adjustably clamped on a cross rod 52. These members 50 are so placed that they engage the web directly over its folding line and thus serve to crease it properly.

Beyond the creasing members 50, the web encounters a brush 55, carried by a cross bar 56, held by arms 57 on the cross rod 58. This brush further serves to smooth out the paper as it progresses.

Beyond the brush are one or more tension devices. I have shown two of these devices; each comprises a pair of parallel rods 60, 61, mounted at their ends on plates 62, intermediately secured to the frame. The web passes under the first rod 60 and over the second rod 61 of this frame, as shown in Fig. 3. The end plates 62 are provided with studs 63, journalled in the machine frame and clamped by set screws 64. Accordingly, these tension frames may be set at any angle desired to vary the tension on the paper. This variable tension device cooperates with the paper advancing mechanism on the other side of the perforator, as hereinafter described.

It is convenient to mount the different shafts 43, 52, 58 and 63 all in the same brackets, which comprises comparatively long plates 14, secured to the top of the side plates of the frame 10.

After the smoothed, creased and tensioned paper has been acted on by the perforating device, it is gripped and fed forward a definite amount by the feeding mechanism which will now be described.

The extension frame 11 carries in its upper portion a series of parallel, horizontal stationary rods 70, which lie side by side with spaces between them, these rods forming therefore, an open table for supporting the perforated form. Carried by the side portions of the frame 11 is a longitudinally movable cross head 80, comprising a top frame, which carries the gripping fingers to be described and a bottom frame 84, which extends transversely beneath the rods 70 and carries a cross rod 83 on which are individual supporting blocks 85 between the rods with which the fingers coact.

The set of gripping fingers is arranged in units, one for each space between two adjacent rods 70. Each unit comprises a forward pair of fingers 81, shown as pivoted on a cross rod 86, and a rear pair of fingers 82 pivoted on a cross rod 87, both rods being carried by the top frame of the cross head. The supports 85 stand beneath the four fingers of the corresponding unit.

It results from the construction described that the fingers 81 and 82 rest by gravity on the paper web A between supporting rods 70, and thus press the paper down against the supports 85. Now the entire cross head 80 is slidably guided on horizontal guideways 15, secured along the upper edge of the frame 11. The lower end of the cross head is shown as connected at 89 to a link 90, the other end of which is connected to a lever 91, pivoted at 92 to the frame 11. Connected to an intermediate portion of the link 91 is a link 93, the other end of which is connected to a crank pin on a crank 94 on a shaft 95. This shaft is shown as connected by gears 96 and 97, with a gear 98 on the shaft 30, heretofore described.

It will be seen that as the shaft 30 rotates under the action of the motor 36, the cross head will be reciprocated along its guideways, so that it may move toward the perforating machine and grip the paper and draw it away from the perforating machine. In this movement the fingers 81 and 82 trail idly over the paper in the movement toward the paper, but accurately engage the paper to cause it to be drawn with the cross head when the movement is in the reverse direction.

Directly beyond the movable cross head 80 described is a stationary cross head 100, similar to the cross head 80 and carrying a similar set of inclined gripping fingers and supporting blocks. Instead, however, of being mounted to slide on the guide 15, it is rigidly bolted to the frame. The fingers of this stationary head accordingly operate as detents to prevent the paper moving toward the perforator as the cross head 80 is moved in that direction.

It will be seen, therefore, that when the cross head 80 moves toward the perforator, the fingers carried by the cross head 100 hold the paper absolutely stationary. When, however, the cross head 80 is on its return movement away from the perforator, its fingers pinching the paper on the supports 85, firmly grip the paper and operate to pull it through the perforator across the tension bars 60, 61, heretofore described, and under the smoothing and creasing devices.

To enable the web to be readily threaded through the machine at the start of the operation, or to enable the fingers for any other reason to be moved to idle position, I provide the construction shown in Fig. 5, which is applicable both to the stationary and movable cross heads. As shown in this figure, the rear finger 82 has, beyond its pivot, a long extension 102, which overlies a short forward extension 103 on the finger 81. Above the extensions 102 is an eccentrically journalled shaft 105 on the end of which is a small hand lever 106. When this hand lever is turned, the eccentric journalled in the shaft causes the body of the shaft to come down on the extensions 102, which shove down on the extensions 103, and thus all the fingers of that cross head are raised from the paper.

Beyond the stationary cross head 100 the paper web comes between laterally adjustable guides 110 and then passes beneath a roller 120 and over a roller, not shown, but which is directly below the roller 120 and coaxial with the pulley 121 shown in Fig. 1. The pulley 121 is connected by a belt 122 to a pulley 123 on the shaft 95. The roller 120 is mounted in a swinging frame 125,

adjusted by set screws 126, which bear downwardly on springs 127, so that the roller 120 presses lightly on the roller beneath it. The result is that the pulley 121 is continuously rotated, which rotates the roller coaxial therewith, and this by friction rotates the roller 120 through the paper to feed the paper only as fast as supplied by the return movement of the gripper and discharge it into the receiving box B^1.

The grip of the roller 120 and its mate is not sufficient to pull the paper from the tensioning devices 60, 61, but is enough to feed the paper as delivered by the grippers. Accordingly, these rollers have no action on the paper during the stroke of the grippers toward the perforator, and during that stroke the rollers simply turn idly past the paper.

The machine of this invention is in the nature of an improvement on the machine shown in my copending application Serial No. 575,736, where the gripping was effected by solenoids. I found, however, that the action of such solenoids was not always reliable, particularly with high-speed operation. The present invention was developed to overcome the difficulties encountered with the solenoids and improve the accuracy of the feed. It is to be understood that suitable means will be provided for adjusting the stroke of the reciprocating gripper, and this stroke may be manually varied during the operation of the machine, for instance, by such mechanism as illustrated in my prior application mentioned.

I claim:

1. In a paper feeding mechanism, the combination with means for supporting a folded web of paper, means for feeding such web over its support, a series of weights acting on the web to press out air pockets between the folds, and members in advance of the weights comprising a pair of rollers allowed by gravity to ride on each side of the web fold and coact with the edges thereof.

2. In a paper feeding mechanism, the combination with means for supporting a folded web of paper, means for feeding such web over its support, a series of chains side by side resting on the web to press out air pockets between the folds, a pair of rollers allowed by gravity to press on the edges of the web fold and means in advance of the rollers adapted to smooth out the web.

3. In a paper feeding mechanism, the combination of means for supporting a web of paper, of a reciprocatory cross head over the web, having a series of gravity actuated trailing fingers adapted to engage the web at spaced points in a direction extending longitudinally of the web and on the same side thereof and draw it when the cross-head moves in one direction, but to move freely over the web when the cross-head moves in the other direction.

4. In a paper feeding mechanism, the combination of means for operating on a fan-folded web of paper by a series of steps, said means comprising a reciprocatory cross-head having trailing fingers, which grip a lineal portion of the paper in a longitudinal direction thereof when the cross-head moves in one direction but do not grip it when the cross-head moves in the opposite direction, mechanism for applying tension to the web, and means for reciprocating said cross head.

5. In a machine of the character described, the combination with means for supporting a web of paper, of a gripping device comprising a cross-head having a set of pivoted fingers depending in an inclined direction from their pivots solely by the action of gravity to engage the paper and supports movable with the cross-head to engage the underside of the paper when the fingers engage the upper side.

6. The combination with paper supporting members spaced apart, of a movable head having pivotally supported fingers extending diagonally downwardly onto the paper between the supporting members and at points spaced apart in a direction extending longitudinally of the paper, and an under support rigid with the movable head adapted to engage the underside of the paper between said members and beneath said finger.

7. The combination of a paper support comprising a series of parallel rods, a cross-head having a series of fingers adapted to bear downwardly on the paper between the rods, and supports lying below the level of the rods rigid with the cross-heads adapted to engage the underside of the paper between the rods and beneath the fingers.

8. In a machine of the character described, the combination of a series of parallel rods adapted to support a web of paper, a reciprocatory gripping device comprising supports for the underside of the paper extending between the rods, and fingers, one behind the other, pivoted to the cross head and extending diagonally downward to engage the paper directly above the support.

9. In a machine of the character described, the combination of a series of parallel rods adapted to support a web of paper, a reciprocatory cross head having individual supports between the rods adapted to engage the underside of the paper, and gripping units, one for each support, each unit comprising a forward pair of fingers and a rear pair of fingers all pivoted to the cross head and extending diagonally downward to engage the paper directly above the support.

10. In a paper feeding mechanism, the combination of means for supporting a web of paper, means adapted to act on successive regions of the paper as it is progressed, means on one side of such periodically acting mechanism to tension the web, and gripping and holding devices on the other side of the periodically acting mechanism, the holding device being adapted to prevent the web moving toward said periodically acting mechanism, and the gripping device reciprocating between the holding device and the periodically acting mechanism and having inclined fingers disposed in tandem relationship and constantly bearing on the paper and adapted to grip the paper on the stroke toward the holding device, but not on the opposite stroke.

11. In a machine for progressing a web of paper the combination of means for supporting the web, two cross-heads extending over the web, one stationary and the other reciprocatory, gravity actuated trailing fingers disposed in tandem relationship and carried by each cross-head, the fingers on the stationary cross head holding the web when the movable cross head moves away from the stationary cross head, and the fingers on the movable cross head gripping the paper when it moves toward the stationary cross head.

12. In a paper feeding mechanism of the character described, the combination of means to support a web of paper, a cross-head extending over the paper, fingers pivoted to the cross-head and depending in an inclined direction to engage the paper, and a throw-out device adapted to move the fingers free from the paper.

13. In a paper feeding mechanism of the character described, the combination of a series of parallel rods adapted to support a web of paper,

a cross-head, pairs of fingers, one behind the other longitudinally, said fingers being pivoted to the cross-head and depending in an inclined direction to engage the paper, one of the fingers having an extension lying over the other finger, and a throw-out device adapted to engage said extension and move it to move both fingers free from the paper.

14. In a device of the character described, the combination, with a paper support, of a cross-head above the support, a pair of fingers carried by the cross-head, one behind the other, each adapted to engage the paper, said fingers being pivoted to the cross-head and extending in an inclined direction downwardly to the paper, said fingers having extensions beyond their pivots, the extension of one finger overlying that of the other, an eccentrically journalled shaft extending across said overlying extensions and adapted when turned to press down such overlying extensions and thereby press down the extensions of the other fingers, whereby the turning of the shaft may raise all of the fingers.

15. In a paper feeding mechanism, the combination of means for operating on a fan-folded web of paper by a series of steps, said means comprising a reciprocatory cross-head having trailing fingers, which grip the paper when the cross-head moves in one direction but do not grip it when the cross-head moves in the opposite direction, a stationary cross-head having a similar set of trailing fingers for holding the web beyond the movable cross-head when the latter moves in the last named direction, mechanism for applying tension to the web, and constantly rotating pinching rolls engaging the web with a light grip beyond the stationary cross-head.

16. In a paper feeding mechanism the combination with means for supporting a folded web of paper, means for feeding such web over its support, a series of chains side by side resting on the web to press out air pockets between the folds, a pair of rollers allowed by gravity to press on each edge of the fold, means for smoothing out the web comprising a brush acting transversely on said web, and means for applying tension to said web comprising bars arranged to cause the web to deviate from its normal path.

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