June 18, 1935. G. E. ANDERSON 2,005,124

AUTOMATIC FEED CONTROL FOR FOLDING AND OTHER MACHINES

Original Filed Feb. 3, 1930 4 Sheets-Sheet 1

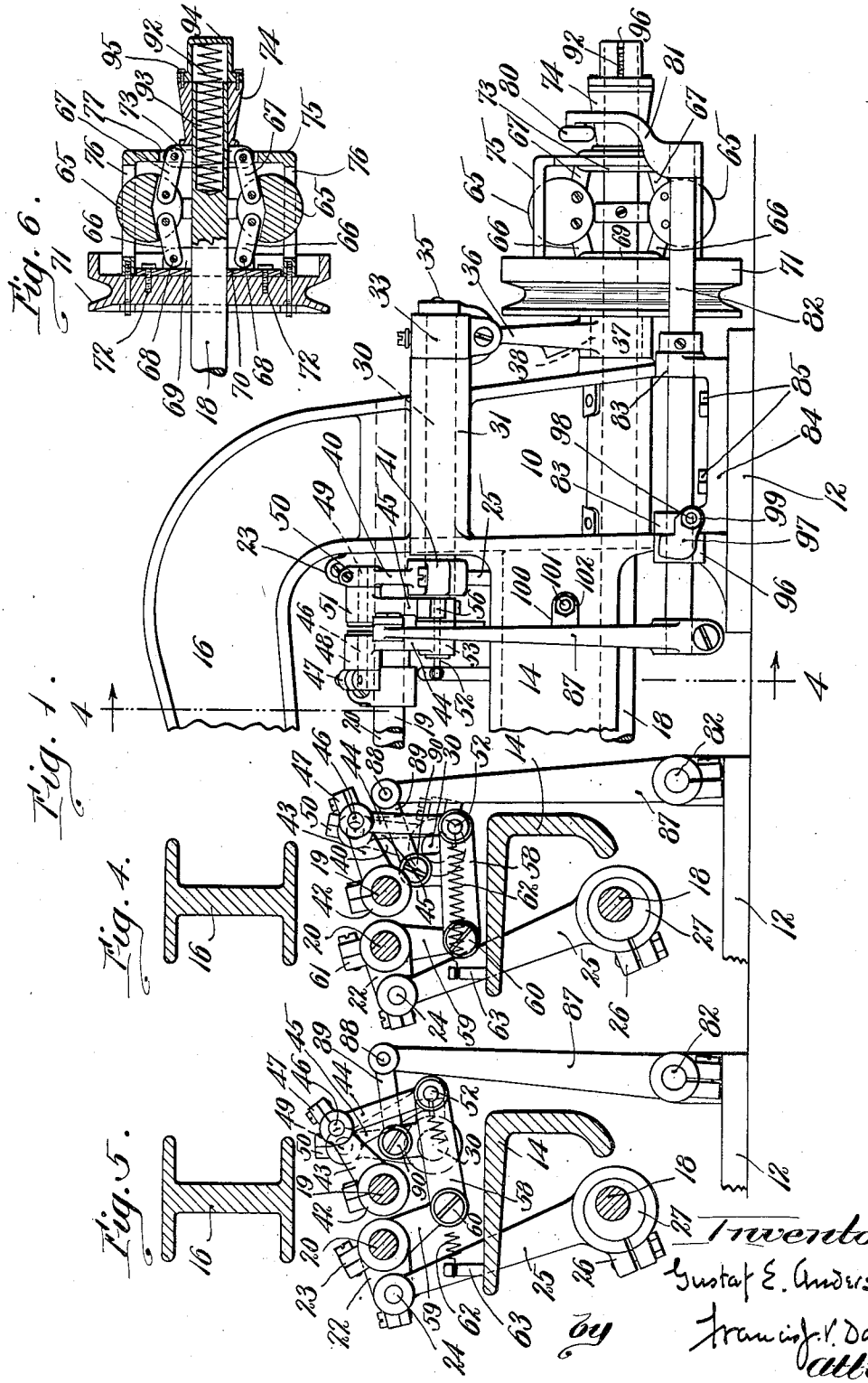


Fig. 6.

Fig. 1.

Fig. 4.

Fig. 5.

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AUTOMATIC FEED CONTROL FOR FOLDING AND OTHER MACHINES

Original Filed Feb. 3, 1930 4 Sheets-Sheet 2

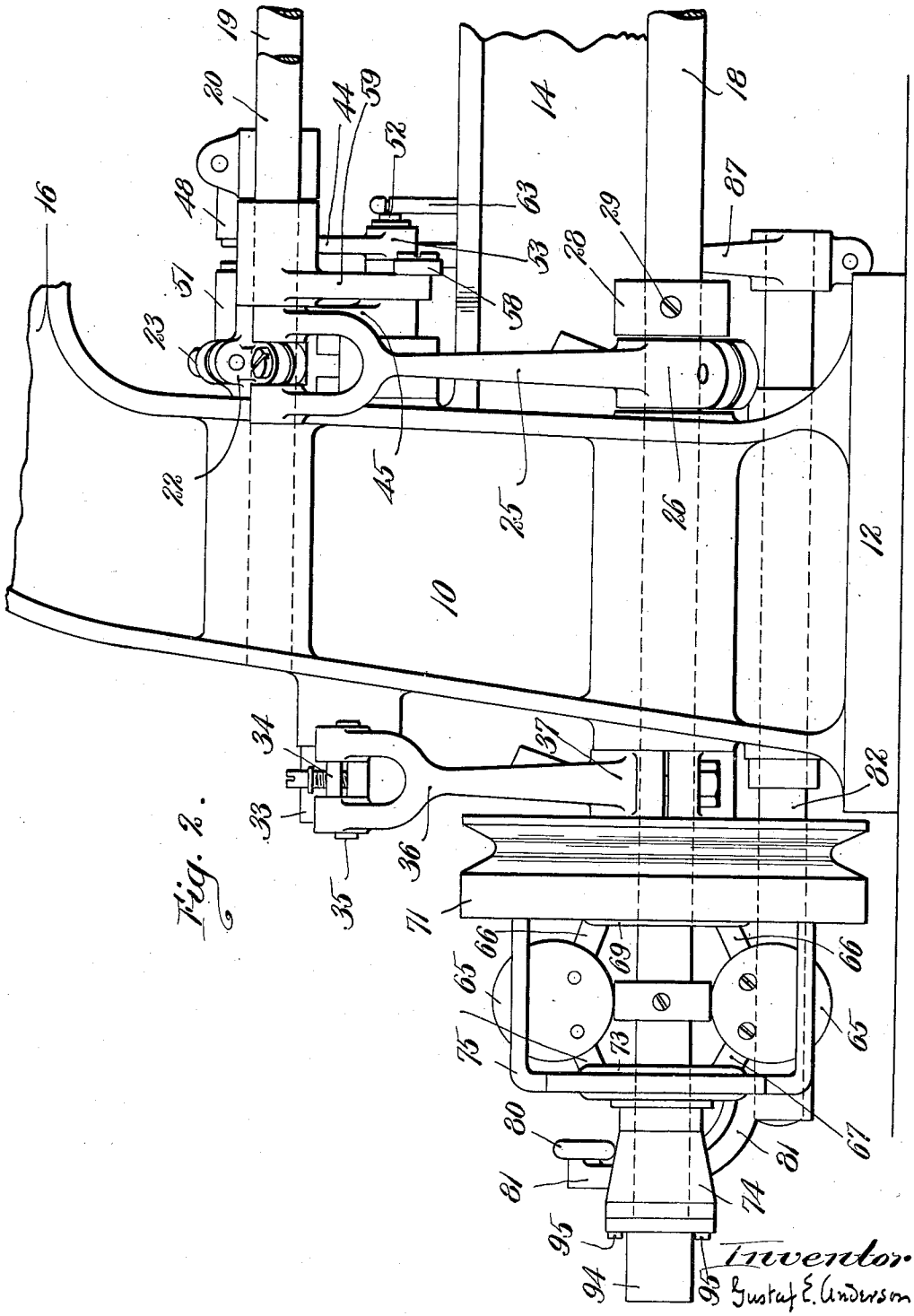


Fig. 2.

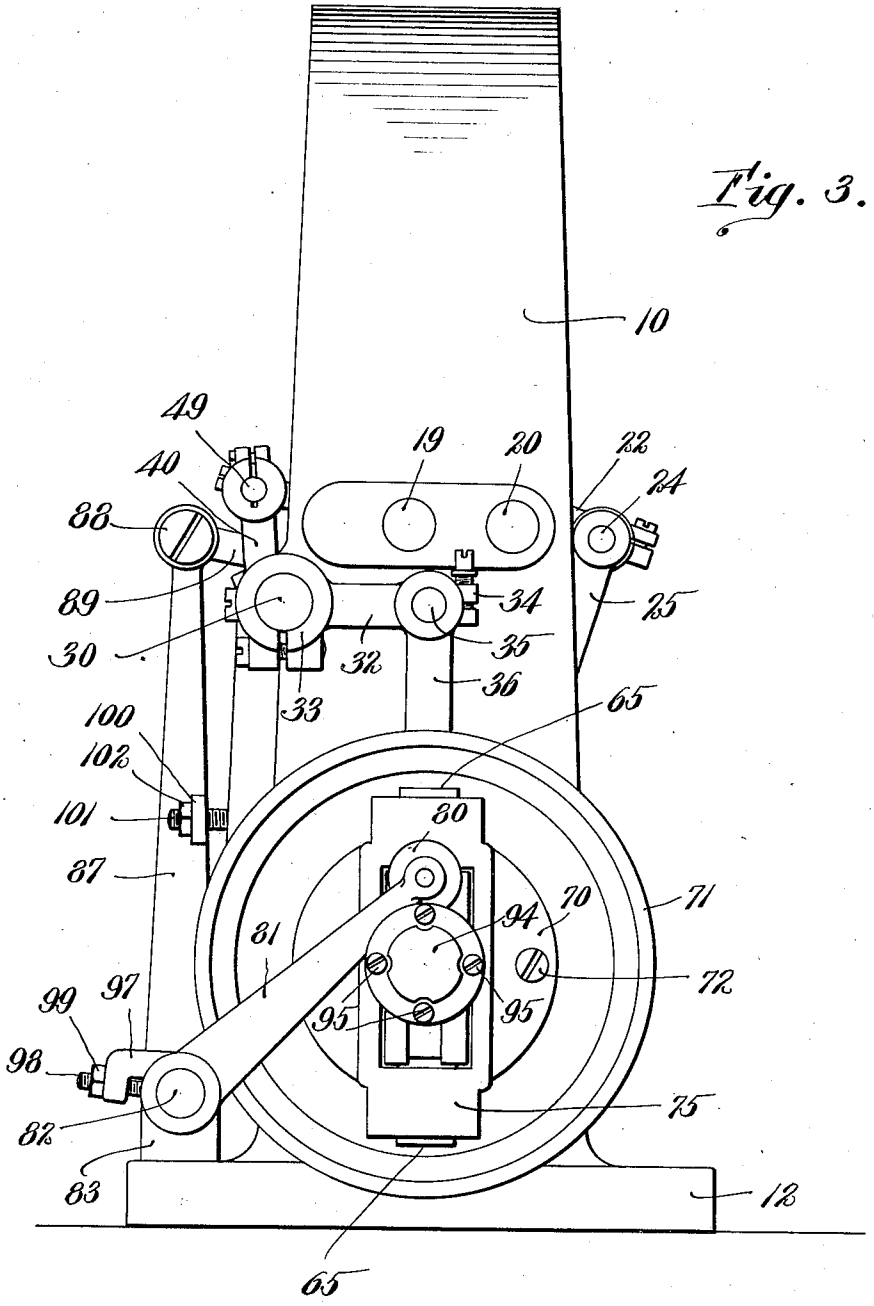
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AUTOMATIC FEED CONTROL FOR FOLDING AND OTHER MACHINES

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Fig. 3.

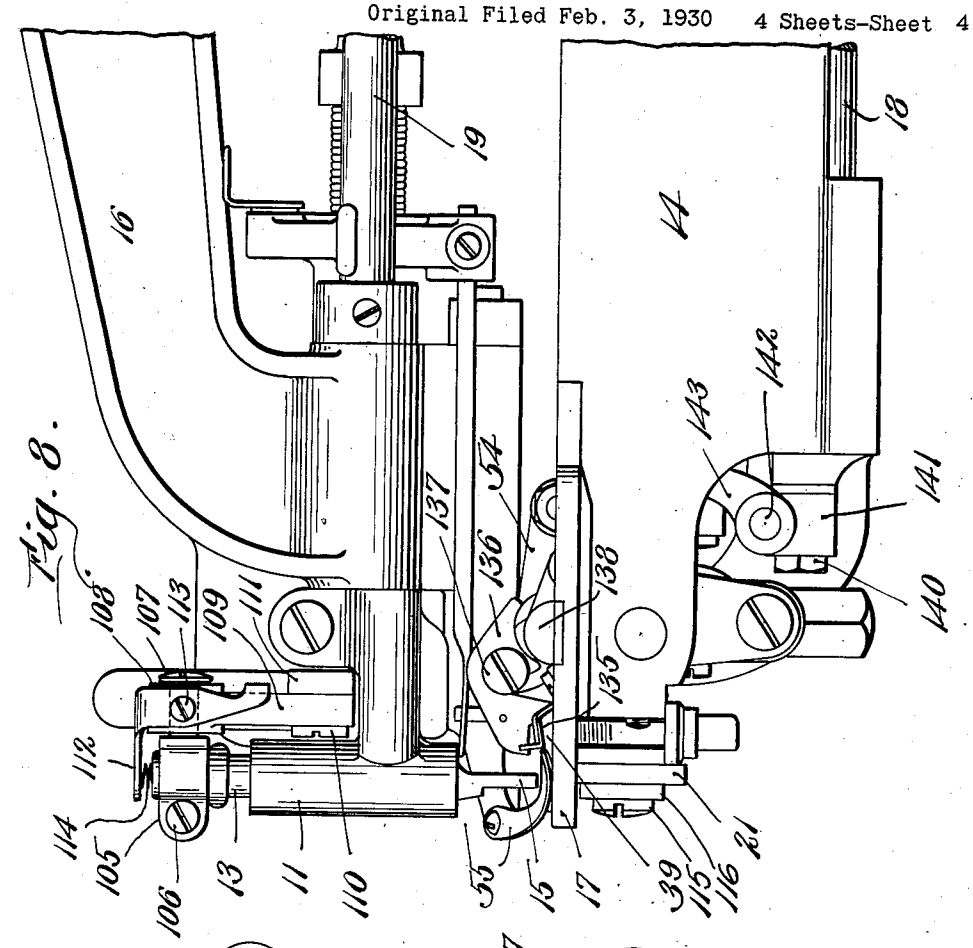


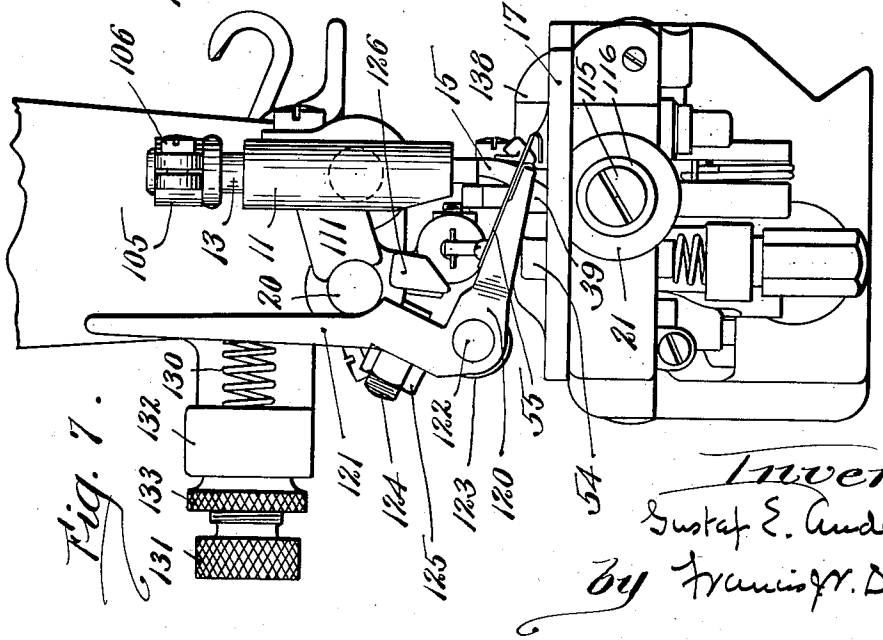
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AUTOMATIC FEED CONTROL FOR FOLDING AND OTHER MACHINES

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UNITED STATES PATENT OFFICE

2,005,124

AUTOMATIC FEED CONTROL FOR FOLDING AND OTHER MACHINES

Gustaf E. Anderson, Brockton, Mass.

Application February 3, 1930, Serial No. 425,375
Renewed November 8, 1932

28 Claims. (Cl. 271—2.5)

This invention relates to an automatic feed control for varying the length of feed in folding, perforating and similar machines which operate to feed work in a step-by-step manner.

One important object of the invention is the provision of an automatic feed control for machines of the foregoing character whereby the length of the feeding step is automatically regulated by the speed at which the machine is operated.

Another object of the invention is the provision of a feed control which is of simple construction, positive and uniform in operation, durable and of a low cost of construction.

Other objects of the invention will be more specifically set forth and described hereinafter.

In its preferred form, my invention contemplates the use of a governor adapted to be mounted on or operated by the main shaft of the machine which governor is adapted to control the length of feeding movement in accordance with the speed of the machine. When the machine is operated slowly the steps of feeding movement will be short but will increase in length as the machine is speeded up. This method of control is especially advantageous because the length of the feeding step is then automatically controlled and requires no attention. In using the machine on straight edges or feeding the work along straight lines, the operator can speed up the machine without slighting the work in which case the feeding steps will be long but on corners or curved portions, when the operator naturally slows up the machine to give greater care to those portions of the work, the feeding steps will be short. In consequence, since the attention of the operator is not diverted from the work by being required to operate means for varying the feed in addition to the treadle for controlling the operation of the machine, a higher grade of work is produced and the rate of production is increased.

In the accompanying drawings, for the purpose of illustration, there is shown one embodiment of the invention applied to a folding machine of the form of construction illustrated in United States Letters Patent to William F. Lautenschlager, No. 1,294,919, dated February 18, 1919, in which Figure 1 is a side elevation partly in section as viewed from the operator's seat of the main portion of the folding machine of the foregoing patent provided with an automatic feed control constructed and adapted to be operated in accordance with my invention; Fig. 2 is a rear elevation of the driving end of the folding machine on an enlarged scale; Fig. 3 is an end elevation looking from left to right in Fig. 2; Fig. 4 is a sectional view on line 4—4 in Fig. 1 looking from left to right showing the normal position of the link connections between the governing device and the feed shaft when the machine is at rest; Fig. 5 is a similar view showing the position of the parts when operated by the governor device to lengthen the feed; Fig. 6 is a vertical longitudinal sectional view of the governor; Fig. 7 is an elevation of that end of the machine carrying the operating instrumentalities and Fig. 8 is a front elevation of the operating end of the machine as viewed from the operator's seat.

In the drawings there is shown only those parts of the folding machine of the said Lautenschlager patent necessary for a proper understanding of my invention and its application to a machine of that character. For a more complete description of said machine, reference may be made to said Letters Patent.

Referring to the drawings, the frame of the folding machine comprises a standard 10 having a base 12 whereby it may be fastened to a bench or other support and two arms 14 and 16 extending in vertical alignment laterally from the standard, the upper arm 16 being a bent over curved continuation of the standard.

A main shaft 18 is rotatably mounted in the standard 10 and lower arm and two rock shafts are each rotatably supported at one end in the standard 10 and at the other end in the end of the upper arm 16, one of said rock shafts 19 being a feed shaft and the other 20 a lift shaft. Upon the end of the feed shaft is fastened a housing 11 within which is mounted for vertical reciprocation a feed bar 13 having a feed foot 15 for feeding the work, the feed shaft being rocked or oscillated from the main shaft to impart a feeding movement to the feed foot. The lift shaft 20 is rocked also from the main shaft to raise the feed bar at the end of the feeding movement and to lower it at the beginning of the movement and also to operate the presser foot.

The end of the lower arm carries a work support 17 and an idler roll 21 and the work is fed by the feed-foot cooperating with the idler roll, the edge of the work being turned over by a folder 39 mounted in position on the work-support after which the turned over edge is pressed down upon the body portion of the work by a fold presser 54 operated by the main shaft. For holding the work between feeding movements, a presser-foot 55 is operated by the lift shaft.

For imparting a vertical reciprocating movement to the feed bar 13 in the housing 11 from the lift shaft 20, the following means may be provided. A split collar 105 is secured to the upper end of the feed bar by a screw 106. In the collar is mounted a screw pin 107 carrying a block 108 adapted to ride in the upper yoked end of a link 109 pivotally connected at its lower end by a pin 110 to an arm 111 fixed on the end of the lift shaft 20. The rocking of the lift shaft imparts, through the foregoing means, a reciprocatory movement to the feed bar in the housing. In order to hold the feed bar in a lowermost position at all times, a hood 112 may be fastened by a screw 113 to the link 109, said hood extending over the upper end of the feed bar at a slight distance thereabove in order to permit a spring 114 to be inserted between the hood and the upper end of the feed bar, which end is recessed to receive the spring.

As a result of the foregoing construction and of the proper timing of the rocking movements of the feed shaft and the lift shaft respectively, the feed foot is given a four-motion movement. In its initial starting position the feed foot is down engaging the work. Its first movement from the initial or starting position is a forward feeding movement (away from the operator) thereby feeding the work one step in the machine, at the end of which the operation of the lift shaft causes the feed foot to be raised from the work and to be held in a raised position during the return movement toward the operator when the feed foot is permitted to descend and to engage the work again in its initial position. In feeding the material the feed foot cooperates with the idler roll 21 which is held loosely mounted on the end of the lower arm 14 by a screw stud 115 and a washer 116.

The presser foot 55 is mounted on the end of a presser arm 120 which may be made integral with a lever 121, the said lever and presser arm being mounted at their junction upon a short shaft 122 in a suitable bearing 123 in the upper arm 16. Threaded in the lever is a screw 124 with a check nut 125 to hold it in adjusted position. At its inner end, the screw 124 is adapted to engage a short arm 126 fixed on the lift shaft. Through the medium of these parts, the lever is rocked by the oscillation of the lift shaft to raise and lower the presser arm and the presser foot and the machine is so timed that the presser foot is down and holds the work between the feeding movements. To hold the lever in such position that the end of the screw bears at all times against the arm on the lift shaft, a spring 130 set in a hollow screw 131 bears against the upper portion of the lever. The screw is threaded through an arm 132 forming a part of the upper arm of the machine and the pressure exerted upon the lever 121 by the spring may be adjusted by turning the screw one way or the other and then locking it in adjusted position by a set nut 133.

The folder or plow 39 is of the usual form having a curved surface for turning over the edge of the material and a gage 135 is provided for guiding the work. If desired, a slitting member 136 mounted on a screw 137 may be used for slitting the edge of the work on curves.

The fold presser 54 is mounted upon a shaft set in suitable bearings 138 on the upper face of the lower arm and is operated from the main shaft by suitable connections. Eccentrically set in the end of the main shaft is a screw pin 140 carrying a collar 141 provided with ears whereby it is pivotally connected by a pin 142 to a yoked link 143, the upper end being pivotally connected to the rear end of the fold presser 54.

The lift shaft 20 is oscillated by the main shaft 18 through the following means. An arm 22 is secured to the lift shaft 20 by a clamp bearing 23 and having articulation with the arm on a pin 24 is a link 25 having a clamp bearing 26 about an eccentric 27 fastened on the main shaft 18 whereby the rotation of the main shaft accomplishes the oscillation of the lift shaft through the medium of the link 25 and arm 22. The link may be locked against lateral movement on the eccentric by a collar 28 fastened to the main shaft by a set screw 29.

For rocking the said feed shaft 19 to effect a feeding movement, a short rock shaft 30 is journalled in a bearing 31 formed on one side of the standard 10 so that said rock shaft is in an off-set relation to the feed shaft 19. On one end, an arm 32 is fastened to said rock-shaft by means of a clamp bearing 33 which arm is articulated at its other end by a clamp bearing 34 and pin 35 with a link 36 having a bearing 37 about an eccentric 38 secured to the main shaft whereby the rotation of the main shaft oscillates the rock-shaft 30 through the medium of the link 36 and arm 32.

Upon the other end of the rock shaft 30 is fastened an arm 40 by means of a clamp bearing 41 and on the feed shaft there is secured by a clamp bearing 42 an arm 43 and the free ends of these two arms are connected together by two links 44 and 45, the link 44 being articulated at one end with the arm 43 by means of a pin 46 mounted in a clamp bearing 47 on the end of said arm and in a collar 48 formed at one end of the link and the link 45 is articulated in a similar manner with the end of the arm 40 through a pin 49 in a clamp bearing 50 on the end of said arm and a collar 51 on the end of said link. At their other ends, the two links are articulated together by a pin 52 in a collar portion 53 of the link 44 and a clamp bearing 56 on the link 45. The two links 44 and 45 are substantially parallel with each other side by side with their pivotal axes at their respective ends substantially coincident.

When the pivotal connection 52 is in axial line with the axis of the rock shaft 30, the oscillation of the rock shaft has no effect on the feed shaft 19 consequently there is no feeding movement imparted to the feeding foot. If, however, the pin 52 is moved out of axial line with the rock shaft 30, then the oscillation of said shaft will through the arm 40 and link 45 impart movement to said pivotal connection or pin 52 and the extent of this movement will depend upon the distance of removal of the axis of said pin from the axis of said rock shaft or, in other words, upon the angular relation between the arm 40 and link 45. This angular relation therefore determines the length of the arc of oscillation of the feed shaft 19 and the length of the feeding movement. The forward limit of movement of the feeding-foot however remains the same irrespective of adjustment of length of feeding stroke of the feeding-foot, the adjustment affecting the retracting limits of said feeding-foot only. The feeding strokes therefore end in similar relations to the folding instrumentalities, irrespective of the lengths of feeding strokes, for always placing the material in definite relations to these parts.

To accomplish this end the beginning of the movement of the feeding foot is at its forward

limit of movement which is coincident with the position of the high point of the eccentric 38 in extreme upper position and the completion of this movement and consequent return of the feeding foot to initial position is coincident with the return, at the end of its revolution, of said high point of said eccentric to said uppermost position. When said eccentric is in said uppermost position, the pivotal axes of the pins 46 and 49 are in alignment and consequently the movement outward of the pivotal axis 52 at this time has no rocking effect upon the feed shaft. The rocking of the shaft 30 by the revolution of the eccentric, however, throws the pin 49 out of alignment with the pin 46 and when the high point of the eccentric is in an extreme lower position then the outward movement of the pin 52 will effect an increased rocking of the feed shaft and add to the length of the feeding movement at the beginning thereof consequently whenever the feeding movement is increased in length it starts further back but always ends at the same point irrespective of length thereby maintaining a proper relation between the feeding movement of the work and the other folding instrumentalities.

The pin 52 is shown as connected by a link 58 to an arm 59 by pin 60, said arm being mounted loosely on the lift shaft 20 by a clamp bearing 61. A spring 62 under tension attached at one end to the pin 52 and at the other end to a pin 63 set in the top surface of the lower arm 14 serves to hold the pin and links 44 and 45 in an inward position. All of the foregoing parts are fully shown and described in the said Lautenschlager patent hereinbefore referred to and for more detailed description of their exact construction and mode of operation reference may be made to said patent.

In applying my invention to a machine of the foregoing character, I employ a governing device adapted for operating suitable instrumentalities for moving the pivot pin 52 and the two links 44 and 45 outwardly away from the axis of the rock shaft 30 in order to increase the length of the feeding stroke as the speed of the machine increases and one form of this means is shown in the drawings comprising a governor mounted on the extended end of the main shaft 18 for moving a slidable cam designed through suitable connections to move the pivotal axis 52 of the links 44 and 45. The governor device may be of any suitable form but as shown comprises a pair of disk weights, each weight 65 being carried by a pair of links 66 and 67 pivotally connected thereto, the former of which is pivotally connected by a pin 68 to and between a pair of elongated ears 69 formed on a circular plate 70 fastened to the pulley wheel 71 by bolts 72 and the latter of which is connected to and between a pair of elongated ears 73 fastened to or forming an integral part of a truncated cone-shaped hollow cam 74 slidably mounted upon the extended end of the main shaft 18. A U-shaped frame 75 fastened to the pulley wheel is provided with lateral openings 76 for permitting outward movement of the disk weights and with an end opening 77 permitting inward movement of the cam, the frame serving to hold the parts in proper lateral position when the pulley is revolving at high speed.

Engaging the cone surface of the cam is a cam roll 80 carried by an arm 81 fastened on one end of a shaft 82 rotatably mounted in upright ears 83 formed on a bracket 84 fastened to the base 12 of the machine by bolts 85. Upon the other end of said shaft 82 is clamped an upwardly extending arm 87 pivotally connected at its upper end by a pin 88 to a link 89 which is in turn pivotally connected at its other end by a pin 90 to the link 58.

The cam 74 is normally held in an outward position by a spring 92 under compression mounted within a bore 93 formed in the end of the main shaft and abutting at one end the bottom of said bore and at the other end a hollow cap 94 fastened by screws 95 to the base of the cam, the bore in said cap being of sufficient size to receive the end of the main shaft when the cam is moved inwardly. The periphery of the cap has cut out longitudinal openings for accommodating the heads of the screws 95.

When the machine is operated at a high speed, the weights 65 are thrown outwardly by centrifugal force thereby drawing the cam 74 inwardly and throwing the arm 81 outwardly thereby rocking the shaft 82 and through the medium of the arm 87 moving the pin 52 outwardly to increase the length of the feeding movement. The range of increase in the feeding movement will depend upon the slope of the cam surface and this range may be increased or decreased by making the cam surface more inclined or less inclined to the axis of the main shaft. The speed at which the governing device will begin to work may be regulated by varying the compression of the spring 92; that is, by using springs of different compression. This may be accomplished by removing the cap 94 and changing the spring when necessary. It is desirable, of course, that the machine should be run at a low speed before the governor device increases the length of the feed.

In order to control the range of increase of the feeding movement, the shaft 82 may be provided with a stop in the form of a collar 96 fastened thereto and having a right-angled arm 97 carrying a screw 98 threaded therethrough and adapted to abut an ear 83 of the bracket 84 to limit the movement of said arm and thereby to permit the length of the longest feeding movement to be regulated. The screw 98 is provided with a set nut 99 to hold it in adjusted position. The arm 87 also may be provided with an ear 100 through which is threaded a stop screw 101 for engaging the side of the lower arm for limiting the inward movement of the arm 87 which screw is held in adjusted position by a set nut 102.

In Fig. 4, the link connections between the rock shaft 30 and the feed shaft 19 and the arm 87 operated by the governing device for moving the pin 52 outwardly are shown in their normal positions in which the feeding movement is short. In Fig. 5, however, the parts are shown in the various positions when the arm 87 has been thrown outwardly by the operation of the governing device to increase the length of the feeding stroke. It will be noticed that in this latter figure, the pin 52 has been moved outwardly and away from the axis of the rock shaft 30 thereby increasing the angle between the arm 45 and the arm 40 so that the rocking of the shaft 30 through the same length of arc produces a greater arc of oscillation of the feed shaft when the parts are in the position shown in Fig. 5 than when they are as shown in Fig. 4. These two figures illustrate the two extremes of length of the feeding movement but by varying the speed of the machine feeding movements of different lengths between these two extremes may be secured.

In a machine of the foregoing character, the

starting and stopping and speed of the machine is generally controlled by a foot treadle which is not shown because such treadles are old and well-known in the art. In the operation of such machines, it is customary for the operator, when curved or corner portions of the work are reached, to release the treadle slightly to slow down the machine because these portions of the work require more care and attention and for the performance of the best quality of work, the speed of the machine must be reduced. In operating upon straight portions of the work, the machine can be operated at a high speed and such portions require less careful attention on the part of the operator so that longer feeding movements are desirable. My invention automatically produces these results without requiring any attention from the operator who controls and operates the machine in the customary manner and the length of the feeding step is automatically varied in accordance with the variation in speed of the machine which increases the speed of the work and improves its quality.

Although the invention is shown and described as applied to a folding machine of the Lautenschlager construction, yet I do not desire to be limited to that particular kind of machine since my invention is equally applicable to folding machines of other constructions utilizing a step-by-step manner of feeding and is equally applicable to various other kinds of machines utilizing the same principle of feeding the work and the invention may be applied to the foregoing kinds of machines by modifications which would be apparent to anyone skilled in the art.

It is to be understood that my invention is not to be limited to the form hereinbefore shown and described since the foregoing is merely for the purpose of illustrating the application of the invention and it may be embodied in various other forms of construction without departing from the spirit thereof and within the purview of the following claims.

What I claim is:

1. In a machine of the class described, the combination with means for feeding the work in a step-by-step manner comprising a feed shaft, a feed-bar carried on one end of said shaft and means for rocking said shaft, of means for automatically varying the length of said feeding movement in accordance with the variation in speed of the machine.

2. In a machine of the class described, the combination with means for feeding the work in a step-by-step manner comprising a feed shaft, a feeding member mounted on one end of said shaft transversely thereof and means for oscillating said shaft, of means for automatically increasing the length of the arc of oscillation of said shaft in proportion to the increase in speed of the machine.

3. In a machine of the class described, the combination with means for feeding the work in a step-by-step manner comprising a feed shaft and means for oscillating said shaft, of a main shaft and means carried by said main shaft for automatically increasing the length of the arc of oscillation of said feed shaft when the speed of the machine is increased.

4. In a machine of the class described, the combination with means for feeding work in a step-by-step manner including an oscillating feed shaft and a feeding member mounted thereon, of a governing device for increasing the length of the arc of oscillation of said feed shaft as the speed of the machine is increased.

5. In a machine of the character described, the combination with means for feeding work in a step-by-step manner comprising a feed shaft, a feeding member mounted on one end of said shaft and means for oscillating said feed shaft, of a main shaft, a governor mounted on said main shaft and means controlled by said governor device for varying the length of the arc of oscillation of said feed shaft in accordance with the speed of rotation of said main shaft.

6. In a machine of the class described, the combination with means for feeding work in a step-by-step manner, of a main shaft, a cam mounted on and movable longitudinally said shaft, a governor mounted on said main shaft, for controlling the movement of said cam and means operated by the movement of said cam for varying the length of said feeding steps in accordance with the speed of rotation of said main shaft.

7. In a machine of the character described, the combination with means for feeding work in a step-by-step manner, of a main shaft, a governor mounted on said main shaft, a cam slidably mounted on said shaft, the movement of which cam longitudinally said shaft is controlled by said governor, and means operated by the movement of said cam for varying the length of said feeding steps in accordance with the variation of speed of rotation of said main shaft.

8. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on the end of said shaft, means for rocking said shaft to feed work in a step-by-step manner, a main shaft, a governor mounted on said main shaft and means controlled by said governor for varying the length of the arc of oscillation of said feed shaft to vary the length of the feeding steps of said feeding member in accordance with the variation of speed of rotation of said main shaft.

9. In a machine of the character described, the combination of a feed shaft, a feeding member mounted on said feed shaft, a main shaft, means including link connections for rocking said feed shaft to feed work in a step-by-step manner, a governor mounted on said main shaft and means controlled by said governor for moving said link connections to vary the length of the arc of oscillation of said feed shaft in accordance with variations in speed of said main shaft.

10. In a machine of the class described, the combination of a main shaft, a feed-shaft, a feeding member mounted on said feed-shaft, means intermediate said main shaft and said feed-shaft for oscillating said feed-shaft to feed work in a step-by-step manner, said means including link connections having a movable pivotal point for varying the length of the arc of oscillation of said feed-shaft and a governor device for moving said pivotal point to increase the length of the feeding steps in accordance with the increase in the speed of the machine.

11. In a machine of the class described, the combination of a main shaft, a feed-shaft, a feeding member mounted on said feed-shaft, means intermediate said main shaft and said feed-shaft for oscillating said feed-shaft to feed work in a step-by-step manner, said means including link connections having a movable pivotal point for varying the length of the arc of oscillation of said feed-shaft, a governor device, a movable cam and means operated by the movement of said cam for varying the length of said

feeding steps in accordance with the speed of the machine.

12. In a machine of the class described, the combination of a main shaft, a feed-shaft, a feeding member mounted on said feed-shaft, means intermediate said main shaft and said feed-shaft for oscillating said feed shaft to feed work in a step-by-step manner, said means including link connections having a movable pivotal axis for varying the length of the arc of oscillation of said feed-shaft, a governor device, a cam slidable on said main shaft and means operated by the movement of said cam for moving said pivotal axis to vary the length of said feeding steps in accordance with the speed of the machine.

13. In a machine of the class described, the combination of a main shaft, a feed-shaft, a feeding member mounted on said feed-shaft, means intermediate said main shaft and said feed-shaft for oscillating said feed-shaft to feed work in a step-by-step manner, said means including link connections having a movable pivotal axis for varying the length of the arc of oscillation of said feed shaft, a governor device mounted on said main shaft, a cone shaped movable cam controlled by said governor device and means operated by the movement of said cam for moving said pivotal axis to vary the length of said feeding steps in accordance with the speed of the machine.

14. In a machine of the class described, the combination of a main shaft, a feed-shaft, a feeding member mounted on said feed-shaft, means intermediate said main shaft and said feed-shaft for oscillating said feed-shaft to feed work in a step-by-step manner, said means including link connections having a movable pivotal axis for varying the length of the arc of oscillation of said feed-shaft, a governor device mounted on said main shaft, a cone cam slidable on said main shaft and controlled by said governor device and a rock shaft for moving said pivotal axis, said rock shaft being operated by the movement of said cam for varying the length of said feeding steps in accordance with the speed of the machine.

15. In a machine of the class described, the combination with means for feeding the work in a step-by-step manner, of a main shaft and means carried by said main shaft including a cam mounted on and movable longitudinally said shaft for automatically varying the length of said feeding movement in accordance with the variation in speed of the machine.

16. In a machine of the class described, the combination with means for feeding work in a step-by-step manner, of a governing device, a movable cone cam controlled by said governing device and means operated by the movement of said cam for varying the length of said feeding steps in accordance with the variation in speed of the machine.

17. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on the end of said shaft, means for rocking said shaft to feed work in a step-by-step manner, a governing device and means controlled by said governing device for varying the length of the arc of oscillation of said feed shaft in accordance with the variation in speed of the machine.

18. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on one end of said shaft, means for rocking said shaft to feed work in a step-by-step manner and a governing device for varying the length of the arc of oscillation of said feed shaft in accordance with the variation in speed of the machine.

19. In a machine of the class described, the combination with means for feeding work in a step-by-step manner, of a main shaft, means intermediate said feeding means and said main shaft adapted for varying the length of step of said feeding means, a governing device and a movable cone cam operated by said governing device for operating said intermediate means to vary the length of said feeding steps in accordance with a variation in the speed of the machine.

20. In a machine of the class described, the combination with means for feeding work in a step-by-step manner, of a main shaft, means intermediate said feeding means and said main shaft adapted for varying the length of step of said feeding means, a governing device mounted on said main shaft and a movable cone cam operated by said governing device for operating said intermediate means to vary the length of said feeding steps in accordance with a variation in the speed of the machine.

21. In a machine of the class described, the combination with means for feeding work in a step-by-step manner, of a main shaft, means intermediate said feeding means and said main shaft adapted for varying the length of step of said feeding means, said intermediate means including link connections having a movable pivotal axis and a governor device for controlling the movement of said pivotal axis for varying the length of step of said feeding means in accordance with any variation in the speed of the machine.

22. In a machine of the class described, the combination with a main shaft and means for feeding the work in a step-by-step manner, of means for automatically varying the length of said feeding movement in accordance with the variations in speed of the machine, said means including a governing device comprising a weighted member pivotally attached to said shaft, a cone-cam slidably mounted on said shaft and pivotal connections between said member and said cam whereby the latter is moved inwardly on said shaft when the former is thrown outwardly by centrifugal force.

23. In a machine of the class described, the combination with a main shaft and means for feeding the work in a step-by-step manner, of means for automatically varying the length of said feeding movement in accordance with the variations in speed of the machine, said means including a governing device comprising a pair of weighted members pivotally attached to said shaft, a cone-cam slidably mounted on said shaft and pivotal connections between said members and said cam whereby the latter is moved inwardly on said shaft when the former are thrown outwardly by centrifugal force.

24. In a machine of the class described, the combination with a main shaft and means for feeding the work in a step-by-step manner, of means for automatically varying the length of said feeding movement in accordance with the variations in speed of the machine, said means including a governing device comprising a weighted member pivotally attached to said shaft, a cone-cam slidably mounted on said shaft, pivotal connections between said member and said cam whereby the latter is moved inwardly on said shaft when the former is thrown outwardly by

centrifugal force and a spring for holding said cam in outward position.

25. In a machine of the class described, the combination with a main shaft and means for feeding the work in a step-by-step manner, of means for automatically varying the length of said feeding movement in accordance with the variations in speed of the machine, said means including a governing device comprising a pair of weighted members pivotally attached to said shaft, a cone-cam slidably mounted on said shaft, pivotal connections between said members and said cam whereby the latter is moved inwardly on said shaft when the former are thrown outwardly by centrifugal force and a spring for holding said cam in outward position.

26. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on said shaft for feeding the work when said feed shaft is oscillated, a main shaft, a rock shaft operated by said main shaft, link connections between said rock shaft and said feed shaft for oscillating said feed shaft when said rock shaft is rocked, said link connections having a pivotal axis which is movable to vary the arc of oscillation of said feed shaft, and a governor mounted on said main shaft for controlling the movement of said pivotal axis to vary the length of said arc of oscillation in accordance with the speed of the machine.

27. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on said shaft for feeding the work when said feed shaft is oscillated, a main shaft, a rock shaft operated by said main shaft, link connections between said rock shaft and said feed shaft for oscillating said feed shaft when said rock shaft is rocked, said link connections having a pivotal axis which is movable to vary the arc of oscillation of said feed shaft, a cam mounted on and movable longitudinally said main shaft, a governor carried by said main shaft for controlling the movement of said cam and means operated by the movement of said cam for controlling the movement of said pivotal axis to vary the length of said arc of oscillation in accordance with the speed of the machine.

28. In a machine of the class described, the combination of a feed shaft, a feeding member mounted on said shaft for feeding the work when said feed shaft is oscillated, a main shaft, a rock shaft operated by said main shaft, link connections between said rock shaft and said feed shaft for oscillating said feed shaft when said rock shaft is rocked, said link connections having a pivotal axis which is movable to vary the arc of oscillation of said feed shaft, a cone shaped cam mounted on and movable longitudinally said main shaft, a governor carried by said main shaft for controlling the movement of said cam and means operated by the movement of said cam for controlling the movement of said pivotal axis to vary the length of said arc of oscillation in accordance with the speed of the machine.

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