

[54] **APPARATUS FOR THE STEPWISE FEED OF WORKPIECES**

[75] Inventor: **August Thomas Portmann**, Arbon, Switzerland

[73] Assignee: **Bruderer AG**, Arbon, Switzerland

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[58] **Field of Search**..... 226/35, 158-163, 226/180, 183, 143, 146, 149, 162, 152, 154

[56] **References Cited**

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Primary Examiner—Richard A. Schacher

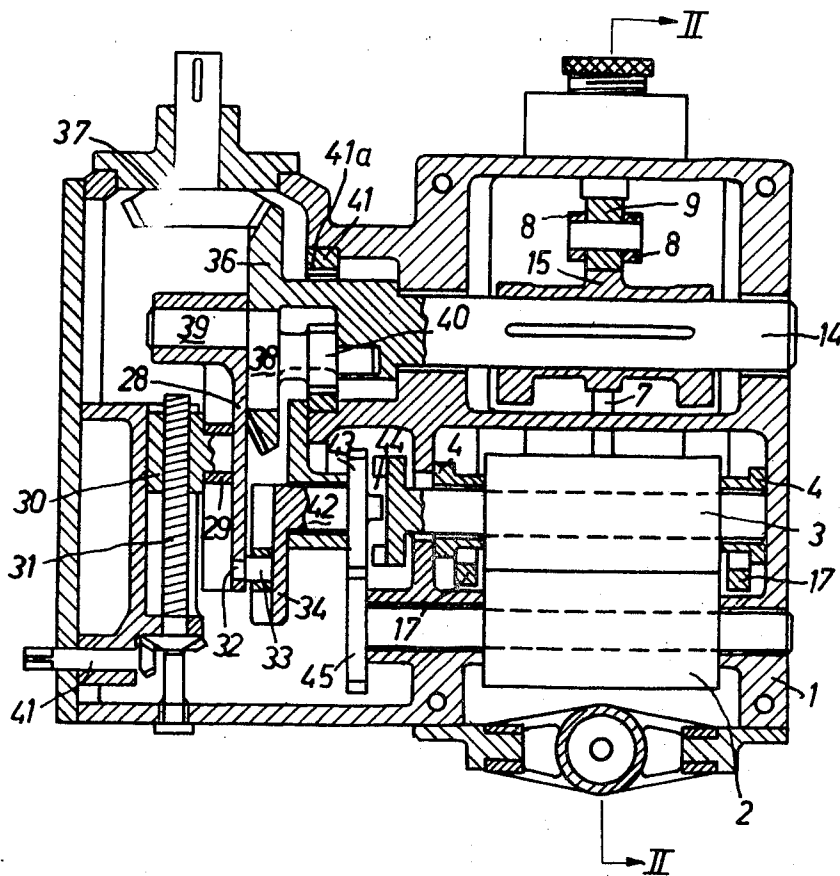
Assistant Examiner—Gene A. Church

Attorney—Ladas, Parry, Von Gehr, Goldsmith & Deschamps

[57] **ABSTRACT**

Apparatus for the stepwise feed of a workpiece comprising two contrarotating oscillating driven feed rollers which serve to receive the workpiece therebetween and which are respectively alternately movable at the point of time of reversal of their direction of rotation towards one another into a feed position and away from one another into an idle position. There is also provided a holding mechanism for the workpieces which can be synchronously switched-in or activated with the movement of the feed rollers from their feed position into the idling position and can be switched-out or inactivated when the rollers move from their idling position into the feed position.

9 Claims, 6 Drawing Figures



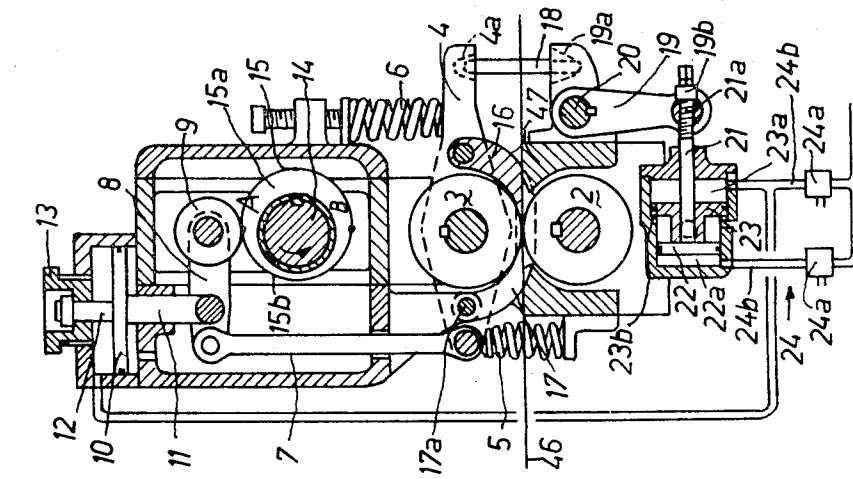


Fig. 1

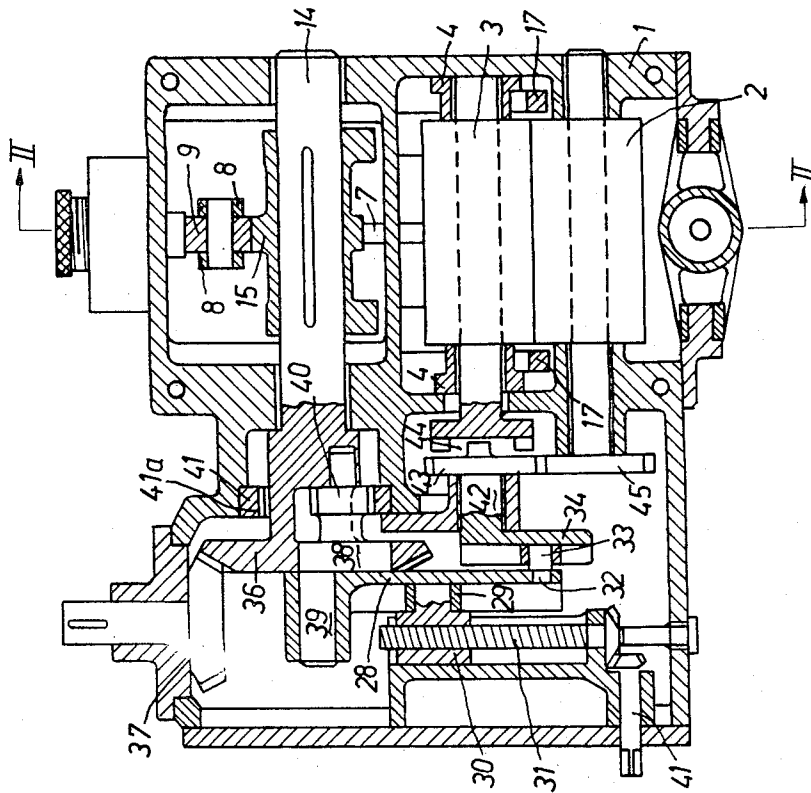


Fig. 2

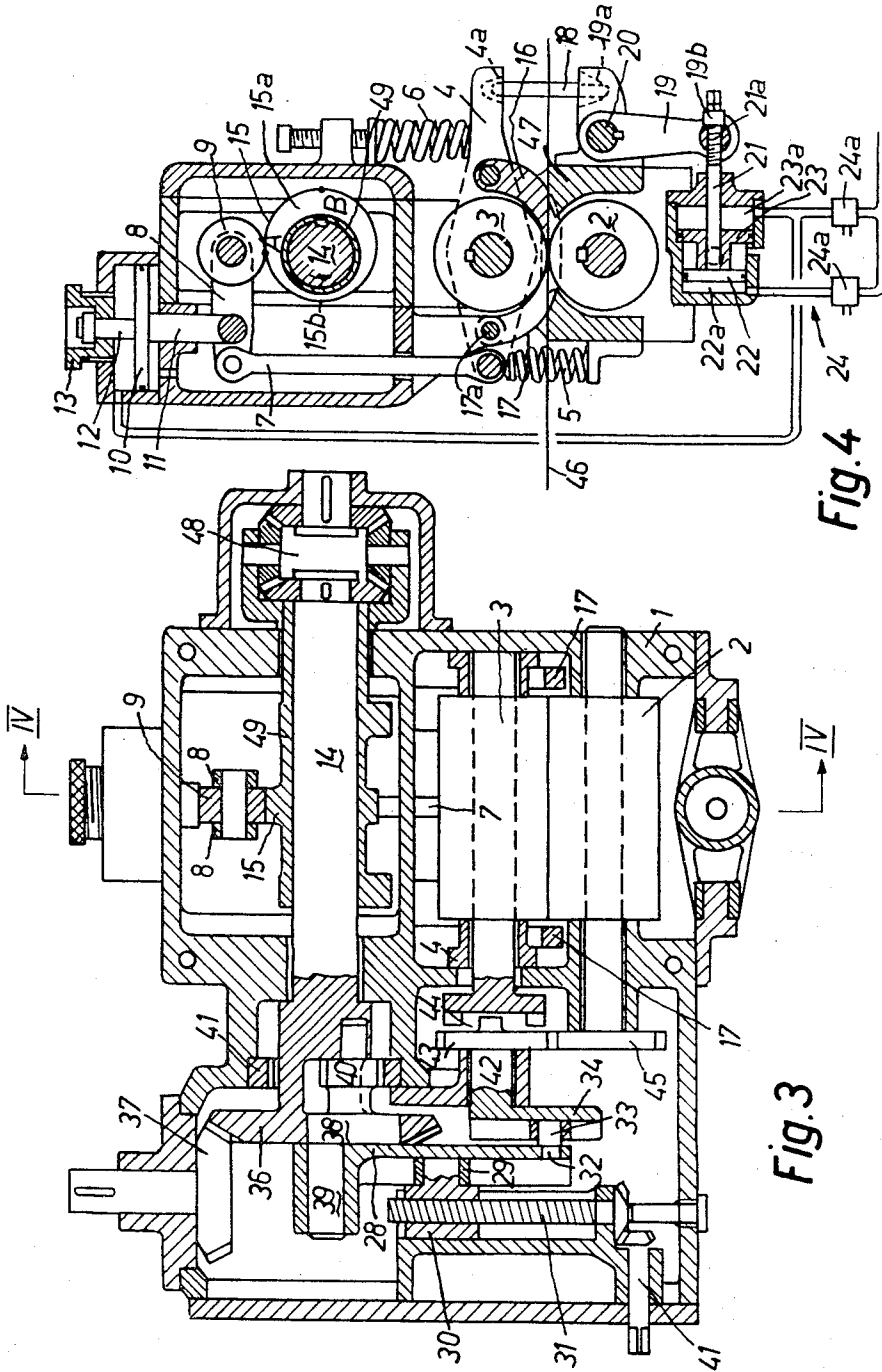


Fig. 4

Fig. 3

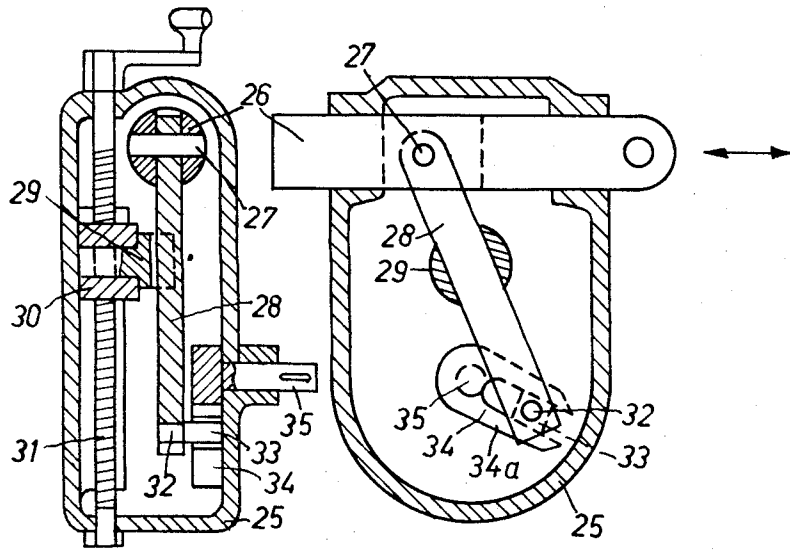


Fig. 5

Fig. 6

APPARATUS FOR THE STEPWISE FEED OF WORKPIECES

BACKGROUND OF THE INVENTION

The present invention relates to a new and improved apparatus for the stepwise feed or advance of workpieces.

For the stepwise feed or advance of workpieces, for instance, sheet metal into a stamping machine, presses and the like, there are primarily employed clamps and roller feed devices.

The known clamp feed devices in which a to-and-fro or reciprocating feed clamp entrains the workpiece during its feed movement and remains ineffectual during its return movement possess the drawbacks that the possible number of feed movements per unit of time is limited.

With the known roller feed devices the rollers for the stepwise feed of the workpieces are alternately driven and braked. For this purpose there must be provided brakes and free wheeling devices which, however, especially when working with large operating speeds, are subjected to high mechanical load, resulting in an appreciable reduction in their longevity.

SUMMARY OF THE INVENTION

Hence, from what has been discussed above, it should be apparent that this particular field of technology is still in need of an improved apparatus for the stepwise feed of workpieces which is not associated with the aforementioned drawbacks and limitations of the prior art proposals. Thus, it is a primary object of the present invention to provide an improved construction of apparatus for the stepwise feed or advance of workpieces which effectively and reliably fulfills the existing need in the art and is not associated with the aforementioned drawbacks and limitations of the prior art constructions.

Another and more specific object of the present invention relates to an improved construction of apparatus for the stepwise feed of a workpiece which while preventing the previously mentioned drawbacks permits feed of the workpiece always through an exactly defined distance or amount.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the apparatus of the present invention is manifested by the features that there are provided two contrarotating oscillating driven feed rollers which serve to receive therebetween the workpiece. These feed rollers are respectively alternately movable at a point of time of reversal of their direction of rotation towards one another into a feed position and away from one another into an idling position. There is also provided a holding or fixing mechanism for the workpieces which can be synchronously switched-in with the movement of the feed rollers from their feed position into the idling position and can be switched-out during movement of the rollers from their idling position into the feed position.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be better understood and objects other than those set forth above, will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

FIG. 1 is a sectional view of a first embodiment of feed mechanism designed according to the teachings of the present invention;

FIG. 2 is a cross-sectional view of the feed mechanism depicted in FIG. 1, taken substantially along the line II—II thereof;

FIG. 3 is a sectional view of a second embodiment of feed mechanism designed according to the teachings of the present invention;

FIG. 4 is a cross-sectional view of the feed mechanism of FIG. 3, taken substantially along the line IV—IV thereof; and

FIGS. 5 and 6 schematically illustrate a mechanism for the oscillatory drive of a shaft.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Describing now the drawings, the feed mechanism depicted in FIGS. 1 and 2, for instance for sheet metal, will be understood to comprise a lower first feed roll 2 mounted in a housing 1 and a second adjustably mounted feed roll 3 which is arranged neighboring the first feed roll 2. Both of the feed rolls 2 and 3 are driven in a manner still to be described so as to oscillate and counter-rotate. This second feed roll 3 is rotatably mounted at both of its ends in a rocker or balance 4 which is supported at both sides of the feed roll 3 at the housing 1 through the agency of a respective spring 5 and 6. The rocker 4 is hingedly connected at its end supported at the spring 5 through the agency of a rod 7 with lever pair 8 carrying at its free end a rotatably secured roller or roll 9. The lever pair 8 is pivotably connected intermediate its point of connection with the rod 7 and the roller 9 with a piston rod 11 secured to a piston 10. There is additionally mounted at the piston 10 a bolt 12 which cooperates with an adjustment nut 13 possessing an elevation or height scale and threaded into the housing. The roller 9 cooperates with a control disk or plate 15 mounted at a drive shaft 14. The drive of the drive shaft 14 is coupled with the drive of the feed rollers 2 and 3 and will be described more fully hereinafter. A contact or press-on rail or edge 16 is rotatably mounted at the rocker or balance 4, this contact rail 16 is laterally connected with two arms 17 which are rotatably secured at their ends 17a at the housing.

The rocker 4 is provided with a recess 4a at its end supported by the spring 6. A bolt 18 is intended to engage at one end with the recess 4a, this bolt engaging at its other end in a suitable recess 19a provided at an angle lever 19. The angle lever 19 is rotatably mounted at the housing by means of a shaft 20. Furthermore, the angle lever 19 is connected at its other end with a piston rod 21 having a threaded portion 21a by means of which it engages with a flange 19b at angle lever 19. The piston rod 21 is connected with a first piston 22. Slidably arranged upon the piston rod 21 is a second piston 23 which possesses a greater diameter than the first piston 22. The transition from the compartment 22a, within which moves the first piston 22, to the compartment 23a for the second piston 23 is constructed as a stop 23b for the second piston 23. Both compartments or chambers 22a and 23a are connected with the infeed lines or conduits 24b of a hydraulic system 24 with which also communicates the piston 10. Suitable control elements 24a are installed at infeed lines 24b.

At this point and on the basis of FIGS. 5 and 6 there will be schematically described the mode of operation of the drive for the oscillating drive of a shaft.

A shaft 26 mounted so as to be lengthwise displaceable in a housing 25, which is moved to-and-fro in suitable manner, for instance by means of a crank drive, drives a lever 28 which is pivotably connected therewith through the agency of a pin 27. This lever 28 is guided in a guide 29 which is rotatably mounted at a nut 30 provided with an internal threading. Nut 30 is threaded upon a spindle 31 and is secured against rotation at the housing 25. Upon rotation of this spindle 31 the nut 30 together with the guide 29 displaces, so that the point of rotation or pivot point of the lever 28 can be adjusted. A bolt 32 is mounted at the free end of the lever 28, this bolt 32 carrying a sliding block 33 or the like which is guided between the legs 34a of a substantially U-shaped constructed lever 34 defining a rocker arm. The lever 34 is connected with the oscillating shaft 35 to be driven.

If the shaft 26 is moved to-and-fro in a translatable fashion, then, the lever 28 is rotated to-and-fro with the axis of the guide 29 serving as the axis of rotation. The pivotal movement of the lever 28 is transmitted to the lever 34 via the bolt 32 and the sliding block 33 sliding between the legs 34a of the lever 34, so that the shaft 35 is driven in oscillating fashion.

As already mentioned, through rotation of the spindle 31, it is possible to adjust the axis of rotation of the lever 28, so that the magnitude of the deflection of the end of the lever 28 carrying the sliding block 33 and therefore the amplitude of the oscillatory movement of the shaft 35 can be adjusted.

In this regard it is important that the translatable movement of the shaft 26 and the movement of the pin 27 is always the same independent of the aforementioned deflection of the lever 28 and the pin 27 always assumes the same terminal positions at which its direction of movement is reversed.

Due to the arrangement of the sliding block 33 at the lever 28, there is achieved the result that the force exerted by the sliding block 33 upon the lever 34 always acts perpendicular to the lever 34. Hence the lever 34 can move through a region of 180°.

Referring once again to FIGS. 1 and 2, there will now be described how the above explained mode of operation can be employed for the drive of both feed rolls 2 and 3. The drive shaft 14 carries a gear 36 at its end, this gear 36 meshing with a drive gear 37 driven by any suitable and therefore not particularly illustrated main drive. A disk 38 is rotatably guided in the gear 36, this gear 36 however being arranged eccentrically. The disk 38 carries at one side or face an eccentrically arranged bolt 39 which corresponds to the pin designated by reference character 27 in FIGS. 5 and 6, and at its other side or face a gear 40 arranged coaxially with respect to the disk 38. The gear 40 engages with a ring 41 inserted in the housing, the ring 41 being provided with internal teeth 41a and such gear 40 during rotation of the drive shaft 14 rolls upon these internal teeth 41a. The pitch circle diameter of the gear 40 and the ring 41 are in a relationship to one another of 1:2.

Analogous to FIGS. 5 and 6 there is rotatably mounted at the bolt 39 the lever 28 which is guided in the guide 29 which is rotatably mounted at the nut 30. This nut 30 is threaded upon the spindle 31 which can be rotated through the agency of the adjustment mech-

anism 41. At its lower end the lever 28 possesses the sliding block 33 secured to the bolt 32, which sliding block 33 cooperates with the lever 34 in the manner described in conjunction with the discussion of FIGS. 5 and 6. The lever 34 is connected with a shaft 42 which is turn is connected with a gear 43. The gear 43 is connected through the agency of a suitable coupling 44 with the feed roll 3 and via a further gear 45 with the feed roll 2.

If the drive shaft 14 is driven through the agency of the gears 36 and 37, then the gear 40, guided by the disk 38 at the gear 36, rolls upon the ring 41. Owing to the already discussed pitch circle diameter ratio of the gear 40 and ring 41 of 1:2, the bolt 39 just as the pin 27 of FIGS. 5 and 6 will be moved to-and-fro between two terminal points or positions, wherein this movement, just as was the case for the drive described with regard to FIGS. 5 and 6, always remains the same independent of the position of the axis of rotation of the lever 28.

The oscillatory rotational movement of the shaft 42 is therefore transmitted to both feed rolls 2 and 3, which therefore are driven in an oscillating contrarotating manner, wherein during rotation of the drive shaft 14 the feed rollers 2 and 3 carry out a to-and-fro movement.

There will now be considered hereinafter the stepwise feed or advance of a workpiece, for instance the sheet metal 46, which is arranged between both feed rolls 2 and 3. For improving the understanding of the invention, the control disk 15 has been subdivided into two sections 15a and 15b, wherein the subdivision occurs by means of diametrically opposite situated points A and B. Furthermore, there will be assumed that the drive shaft 14 rotates in counterclockwise direction.

If the roller 9 at point A travels upon the section 15a of the control disk 15, then the roller 9 will be raised by the control disk section 15a, which, in turn, brings about that the rod 7 will be moved downward and against the force of the spring 5 pushes the rocker or balance 4 downwards. By virtue of the force exerted upon the end of the rocker 4 supported upon the spring 5 by means of the rod 7 the rocker 4 is pivoted about the connection point of the rod 7 at the rocker 4. The upper feed roller 3 is pressed against the lower stationary mounted feed roller 2 and the contact rail 16 is raised. Both of the feed rollers 2 and 3, which rotate during this period of time in the feed direction, engage with the sheet metal 46 and displace it forwards. After a rotation of the drive shaft 14 through 180°, during which the control disk section 15a acts upon the roller 9, the control disk section 15b begins to act at point B upon the roller 9. The springs 5 and 6 now bring about a rocking of the rocker or balance 4 about the axis of the feed roller 3 and raising of the rod 7 which, in turn, brings about a rotation of the lever pair 8 and a lowering of the roller 9. Lowering of the roller 9 is possible since the spacing of the control cam of the section 15b from the axis of the drive shaft 14 is smaller than that of the control cam of the section 15a. The aforementioned rocking of the balance or rocker 4 leads to a lowering of the contact rail 16 which presses the sheet metal against stop 47 and thus fixedly clamps same. After fixedly clamping the sheet metal 46 the upper feed roller 3 is raised. Both of the feed rolls 2 and 3 no longer act upon the sheet metal 46 and during the rotation of the drive shaft 14 they carry out through a fur-

ther 180° their return movement which is opposite the feed movement. If at point A after a complete revolution of the drive shaft 14, the control disk section 15a again acts upon the roller 9, then, as above described, owing to pressing together of the rollers 2 and 3 and raising of the contact rail 16 the feed cycle is again initiated.

The control disk 15 must be constructed in such a way that the feed rollers 2 and 3 are respectively pressed against or towards one another and away from one another exactly at the point of reversal of the oscillatory movement and specifically in synchronism with the respective raising and contact movement of the contact or holding rail 16.

In order to insure for a correct functioning of the feed mechanism with different thicknesses of the workpieces which are to be advanced or fed, the point of rotation of the lever pair 8 can be elevationally adjusted by adjusting the adjustment nut 13.

The feed length can be changed by altering the amplitude of the oscillatory movement of the feed rollers, that is to say, as mentioned by displacing the nut 30 along the spindle 31.

For introducing the workpiece which is to be advanced or fed, the balance or rocker 4 at its end secured to the rod 7 is raised by the latter by lifting or raising the piston 10. As a result, the feed roll 3 is raised. During further lifting of the rocker or balance 4 such comes to bear by means of its end supported at the spring 6 against the bolt 18 which engages with play in the recess 4a of the balance 4 during operation does not come into contact with the balance or rocker. Upon contact of the balance or rocker 4 at the bolt 18 the latter is pushed downwardly against the angle lever 19. If the compartments 22a and 23a are pressurized, then the pistons 22 and 23 assume the position depicted in FIG. 2. It is therefore not possible to carry out a rotation of the angle lever 19 under the effect of the pressure of the bolt 19a and the end of the bolt 18 which is located at the recess 4a functions as a point of rotation for the pivotal movement of the rocker or balance 4. Consequently, during lifting of the rod 7 apart from raising the feed roll 3 there is also raised the contact rail 16.

On the other hand, if the compartment 22a is without pressure, then, the piston 22 and the piston rod 21 can move and the angle lever 19 rotates as soon as the rocker 4 bears upon the bolt 18. Consequently, during lifting of the rocker or balance 4 there will be raised the upper feed roll 3, but on the other hand the contact rail 16 will not be raised and presses the workpiece 46 against the stop 47.

The embodiment of FIGS. 3 and 4 corresponds to that of FIGS. 1 and 2 with exception that the control disk 15 is not seated directly at the drive shaft 14 rather upon a hollow shaft 49 guided thereby and driven through the agency of a speed reduction drive or transmission 48. It is further to be understood that the corresponding components of FIGS. 3 and 4 have been designated with the same reference numerals as have been employed in FIGS. 1 and 2.

By means of the speed reduction drive transmission 48 there is achieved the result that the hollow shaft 49 only revolves half as quickly as the drive shaft 14.

In this case the control disk 15 is not subdivided as was the case for the embodiment of FIGS. 1 and 2 into two sections 15a and 15b which each extend through

the region of 180°, rather the section 15a, during its action upon the roller 9, as described, when there is carried out the feed of the workpiece, extends only over a region of 90°, whereas the section 15b extends through a region of 270°.

During rotation of the hollow shaft 49 through 90°, the rollers 2 and 3 are pressed against one another and the contact rail 16 is raised and during the remaining 270° the roller 3 is raised and the contact rail 16 is pressed against the stop 47.

The switch-over or reverse control operation occurs in the manner described in conjunction with FIGS. 1 and 2 at the points A and B of the control disk 15 and at the points of reversal of the oscillatory movement of the rollers 2 and 3. During one revolution of the hollow shaft 49, the drive shaft 14 rotates, as mentioned, twice, and the feed rollers 2 and 3 likewise carry out two oscillatory movements, wherein one of the movements occurs with raised upper feed roller 3.

While there is shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practiced within the scope of the following claims. Accordingly,

What is claimed is:

1. An apparatus for the stepwise feed of a workpiece, comprising two contrarotating oscillatingly driven feed rollers intended to receive therebetween a workpiece to be advanced, means for respectively alternately moving said feed rollers at a point of time of reversal of their direction of rotation towards one another into a feed position and away from one another into an idle position, a holding mechanism for the workpiece which can be respectively synchronously rendered effective with the movement of the feed rollers from their feed position into their idle position and ineffective during movement of the feed rollers from their idle position into their feed position, and wherein one of the feed rollers is stationarily mounted, a rocker for rotatably mounting the other feed roller, there being also provided a first spring member and a lever element, the rocker being supported at one of its ends opposite the axis of the other feed roller upon the first spring and connected with the lever element, a second spring acting opposite the first spring, the other end of the rocker cooperating with the second spring, an actuation mechanism for moving the lever element in the direction of action of the first spring and which during rotation of the feed rollers in the feed direction displaces the lever element against the action of the first spring in order to press said other feed roller against said one feed roller.

2. The apparatus as defined in claim 1, wherein the actuation mechanism comprises a pivotably mounted lever means connected with the lever element, a driven rotating shaft, a control disk seated upon said driven rotating shaft, said lever means cooperating with the control disk so that said control disk as a function of its rotational position determines the pivotal position of said lever means.

3. The apparatus as defined in claim 2, further including means for adjusting the pivot axis of the lever means for adjusting the spacing between the feed rollers in their feed position.

4. The apparatus as defined in claim 2, further including a drive for the control disk and a drive for the feed rollers, wherein the drive of the control disk is coupled with the drive of the feed rollers in such a man-

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ner that the control disk for each period of the oscillation movement of the feed rollers carries out a complete revolution.

5. The apparatus as defined in claim 2, further including a drive for the control disk, a drive for the feed rollers, the drive of the control disk being coupled with the drive of the feed rollers in such a manner that the control disk per two periods of oscillatory movement of the feed rollers carries out a complete revolution, wherein during one of said two periods the feed rollers are retained in their idle position.

6. The apparatus as defined in claim 1, further including a contact mechanism located at the rocker between the point of attack of the second spring and the other feed roller, the contact mechanism in the idle position of the feed rollers serving to press the workpiece against a stationary counter-element.

7. The apparatus as defined in claim 1, further including an angle lever having a pair of lever arms, the

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rocker at its end which is under the action of the second spring bearing upon one lever arm of said angle lever, a blocking mechanism, the other lever arm of said angle lever being connected with said blocking mechanism which optionally releases for rotation the other lever arm.

8. The apparatus as defined in claim 7, wherein the blocking mechanism comprises a cylinder and a piston guided in the cylinder, the piston being secured at one piston surface with a piston rod connected with the other lever arm of the angle lever and at the other piston surface there acts a pressure medium for preventing rotation of the angle lever.

9. The apparatus as defined in claim 3, wherein the pivot axis of the lever means is connected with a piston which can be actuated for raising the other feed roller from the one feed roller.

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