June 25, 1935. E. V. CRANE 2,006,040

FEED FOR SHEET METAL WORKING MACHINES

Filed Feb. 17, 1932 4 Sheets-Sheet 1

Fig. 1.

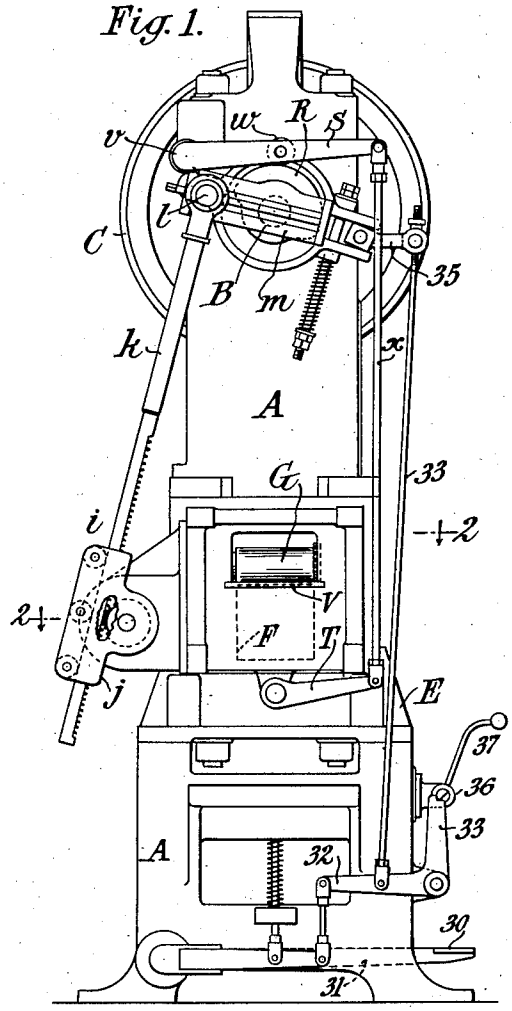


Fig. 6.

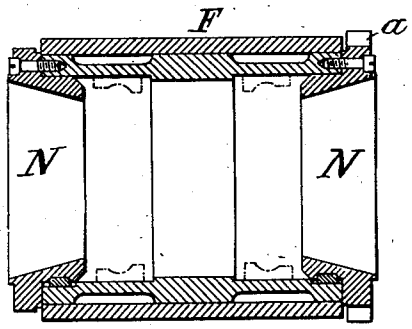
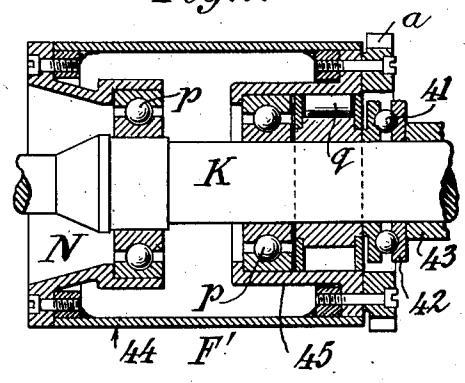


Fig. 7.



Inventor
Edward V. Crane,
By his Attorneys,
Fraser, Myers & Manley

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Filed Feb. 17, 1932 4 Sheets-Sheet 2

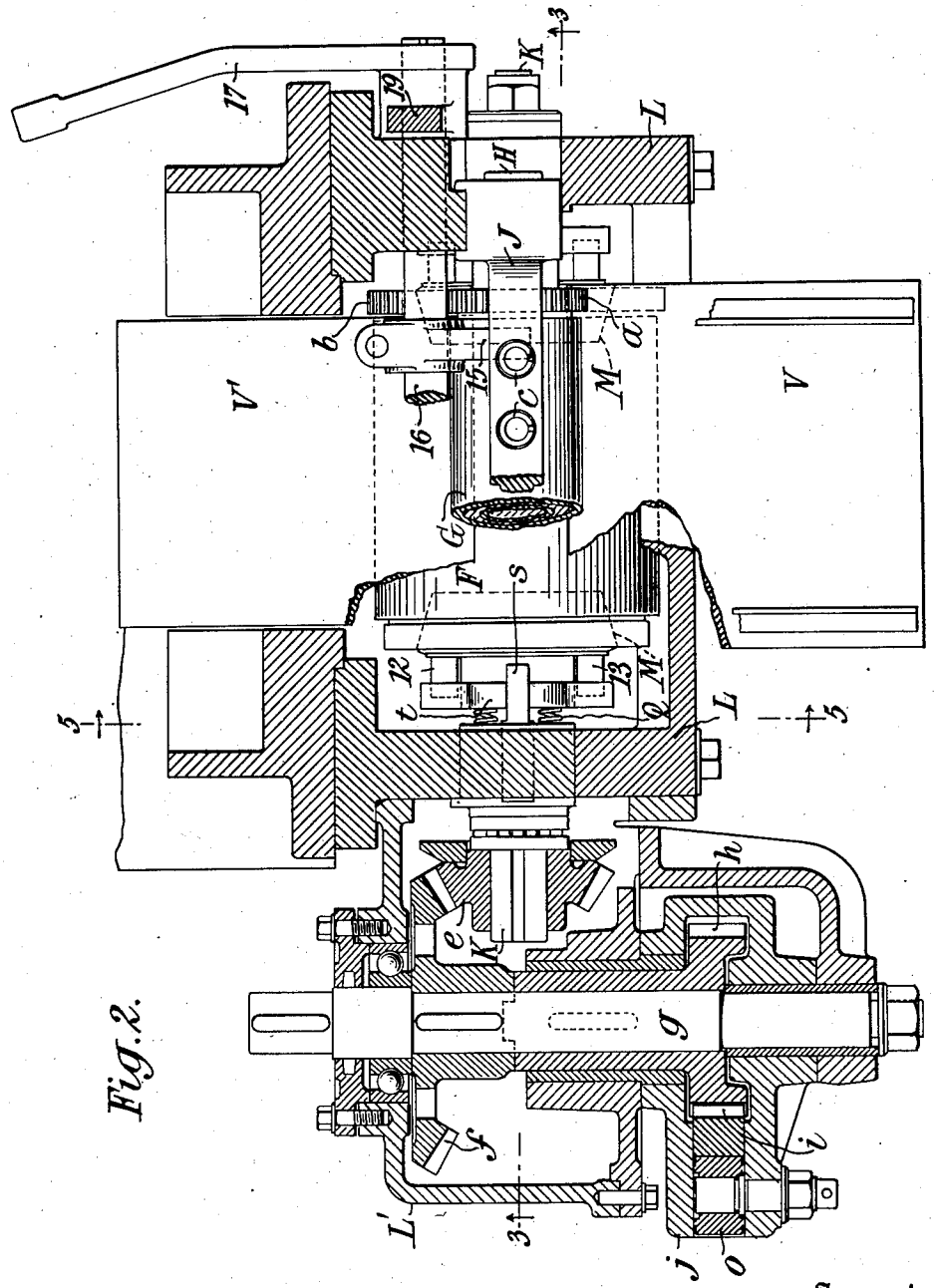

Fig. 2.

Inventor
Edward V. Crane,
By his Attorneys,
Fraser, Myers & Manley

June 25, 1935. E. V. CRANE 2,006,040

FEED FOR SHEET METAL WORKING MACHINES

Filed Feb. 17, 1932 4 Sheets-Sheet 3

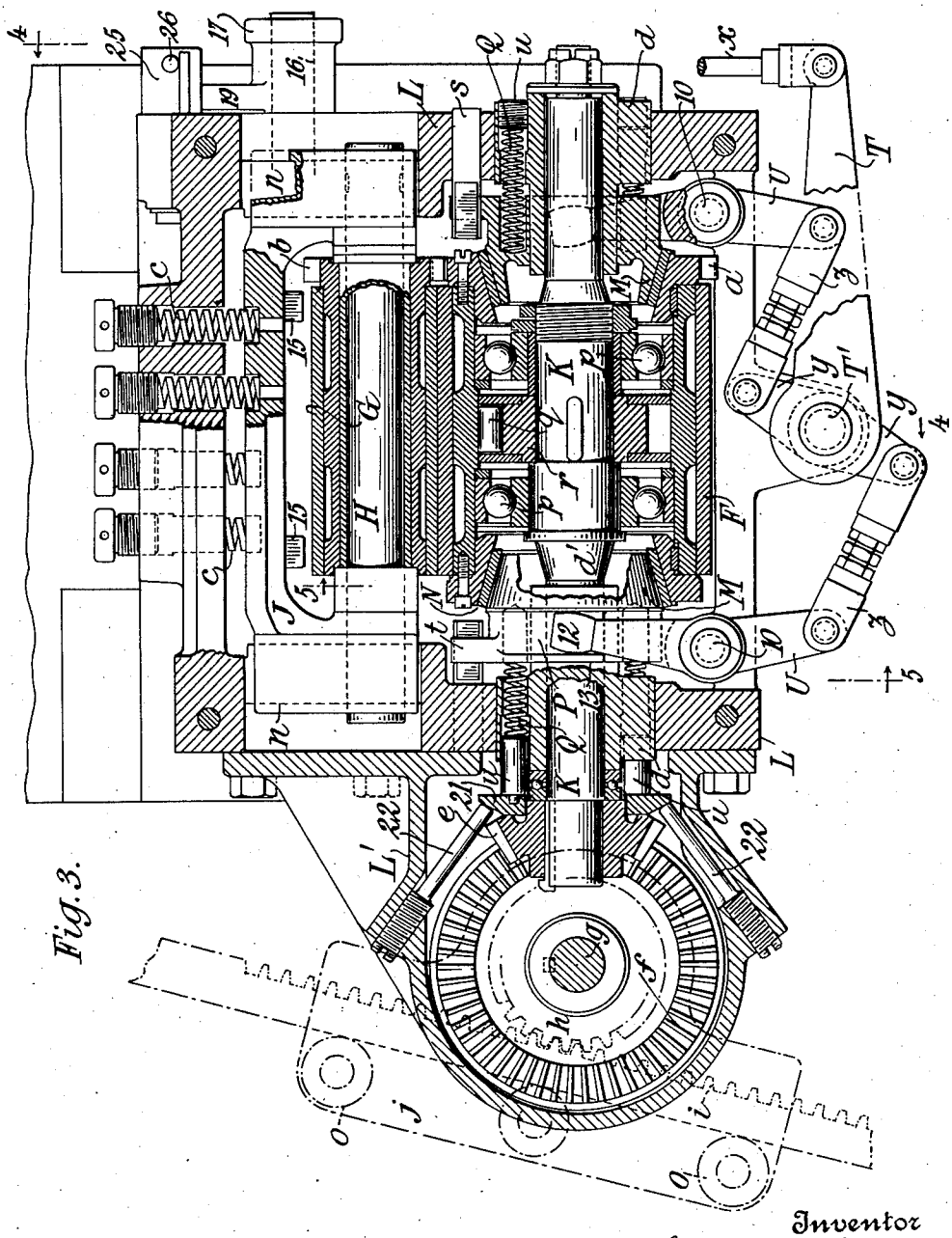

Fig. 3.

Inventor
Edward V. Crane,

By his Attorneys,
Fraser, Myers & Maney

June 25, 1935. E. V. CRANE 2,006,040

FEED FOR SHEET METAL WORKING MACHINES

Filed Feb. 17, 1932 4 Sheets-Sheet 4

Fig. 4.

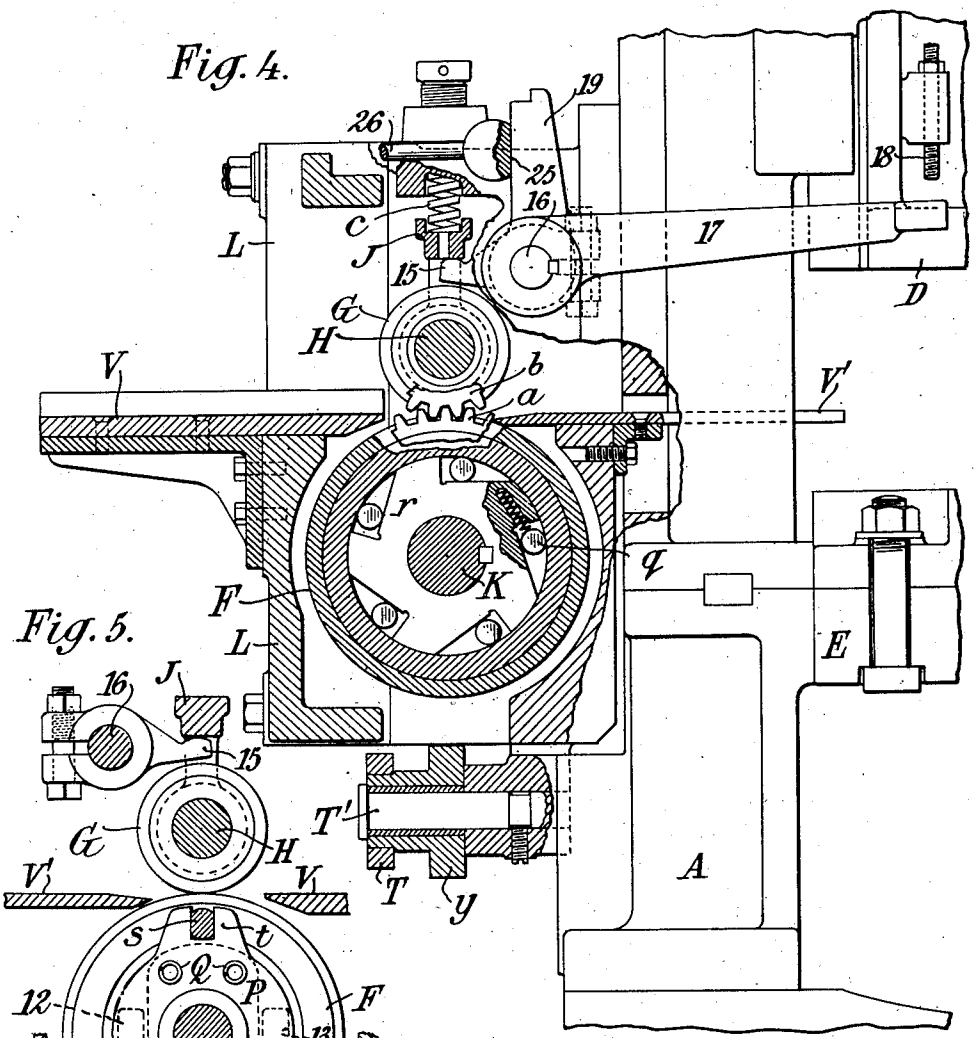

Fig. 5.

Inventor
Edward V. Crane,
By his Attorneys,
Fraser, Myers & Manley

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UNITED STATES PATENT OFFICE

2,006,040

FEED FOR SHEET METAL WORKING MACHINES

Edward V. Crane, Brooklyn, N. Y., assignor to E. W. Bliss Company, Brooklyn, N. Y., a corporation of Delaware

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5 Claims. (Cl. 271—2.4)

This invention relates to a mechanism applicable to power punching presses and other sheet metal working machinery for feeding a strip of metal (or other analogous material, such as cardboard) to such machine. The particular object of the invention is to provide a quick-motion feed for high-speed machines. The feed is a roller feed having intermittent forward feeding movements with intervening periods of rest. With such feeds, especially for metal working machines, the obstacle to quick movement has been the inertia due to the mass of the feed rollers and other intermittently moving parts which hinders quick starting of the feed and opposes the stoppage thereof at the end of each feeding movement.

The present invention provides a quick-action feed by reducing the mass and consequently the inertia of the feed rolls. Instead of providing a massive feed roll or cylinder fixedly mounted on a shaft carrying a ratchet wheel and brake collar,—so that the combined mass of the cylindrical roll and its shaft, brake collar, and ratchet wheel is effective to oppose each starting movement and tends to prolong each feeding movement,—this invention reduces the intermittently rotating part to the outer shell portion of the feed roll which moves independently of the shaft within it, this shaft being given alternately opposite rotating movements corresponding in extent to the length of feed, and the ratchet connection being within the feed roll; in addition an effective intermittent brake is provided, consisting preferably of opposed spring-pressed cones engaging the opposite ends of the tubular feed roll shell. Thus the mass of the moving portion of the feed roll is reduced to the minimum, so that it opposes the least practicable resistance to the starting of each feed movement; and the brake is effective to check its motion instantly at the end of the forced feeding movement.

The preferred embodiment of the invention is shown in the accompanying drawings as applied to a feed mechanism for a punching or stamping press of the upright type. It is to be understood, however, that the present invention is applicable to any kind of metal working or analogous machinery, its illustrated application being merely one example of its uses.

Figure 1 of the accompanying drawings is a side elevation of the press with its feed mechanism.

Fig. 2 is a horizontal section taken approximately in the plane of the line 2—2 in Fig. 1.

Fig. 3 is a vertical section in the plane of the line 3—3 in Fig. 2,—that is, in the plane of the axes of the feed rolls.

Fig. 4 is a vertical section through the feed mechanism in the plane of the line 4—4 in Fig. 3.

Fig. 5 is a vertical section in the plane of the lines 5—5 in Figs. 2 and 3.

Fig. 6 is a diametrical section of the feed roll alone.

Fig. 7 is a fragmentary longitudinal section on the same plane as Fig. 3, showing a modified construction of the feed roll and its ratchet and brake.

In Fig. 1 A is the main frame of the press, which serves also generally as the main support of the feed mechanism. The particular press shown has an upper shaft B, which may be the crank shaft operating the plunger of the press and on which is a flywheel or pulley C. A fragment of the plunger is shown in Fig. 4 at D. The press has a bed E, which may carry dies against which the punches or tools carried by the plunger are to work. These mentioned features of the press, however, are unessential to the present invention.

The feeding mechanism comprises a pair of feed rolls,—namely, a master roll F and an idler roll G,—preferably geared together by gears *a*, *b*. The idler or driven roll G is carried on a spindle H hung in bearings in a vertically sliding frame J which is pressed down by springs *c*, *c* to afford the requisite traction upon the sheet metal which is fed between the feed rolls F and G.

The feed roll F, which is shown separately in Fig. 6, consists of an essentially cylindrical shell made of as light weight as is consistent with the requisite strength, and is supported on an internal shaft K which turns in fixed bearings *d* and is provided with suitable means for imparting to it alternately opposite rotary movements or oscillations. For this purpose it has fixed on its outer end a pinion *e* which meshes with a bevel gear *f* on a transverse shaft *g* on which is fixed a spur gear *h* engaged by the teeth of a rack *i* which slides in a guiding casing *j* and is formed as part of a connecting rod *k* to which reciprocating motion is imparted from any suitable driving means, illustrated as being a crank *l* carried on a cross-head *m* fixed on the shaft B of the press. The cross-head has a radial slideway in which the base or block carrying the crank stud is adjustably fastened so as to be able to vary the throw of the crank, this being a usual construction in such machines. In the construction shown the connecting rod *k* and rack *i*, being integrally or rigidly connected, they both neces-

sarily participate in the crank movements and, consequently, it is necessary to provide the guiding frame *j* with a rocking bearing whereby it may turn around the axis of the shaft *g*, as shown,—this also being a well-known expedient in such mechanical movements.

The bearings *d* for the shaft K are housed in a frame L serving for the feeding mechanism, which frame has slideways *n* for guiding the slide frame J which carries the bearings of the shaft H. The same frame L also supports a frame L', providing bearings for the shaft *g* and for the oscillating frame *j*. The latter frame is shown with guide rollers *o*, *o* for the rack bar *i*.

The hollow shell constituting the feed roll F may have any suitable bearing support upon the shaft K. The bearing shown consists of two ball bearings *p*, *p* located symmetrically on opposite sides of the middle of the roll. The ratchet connection between the roll and shaft is preferably of the roller ratchet type, as shown in section in Fig. 4,—the same consisting of rollers *q* held in angular recesses in a hub *r* keyed on the shaft K, and pressed out by springs to make a wedging engagement with the tangential faces of these recesses—all in the well-known manner as applied to friction pawls of this roller type.

Opposed brakes are applied against the opposite ends of the feed roll F. These are shown as cones M, M which enter internal cones N, N formed in the opposite ends of the feed roll. These internal cones are best formed as separate rings keyed to the main shell of the feed roll, as shown, one of which rings is formed with the gear *a*. The cones M, M are movable toward and from the middle of the feed roll and are mounted in effect as slides with guiding means for holding them against rotation. For this purpose the cones M, M are formed on or attached to slide blocks P having a sliding engagement with a tubular extension *d'* on each of the bearings *d* and having a notch or fork *t* engaging on opposite sides of a fixed pin *s*, as best shown in Figs. 3 and 5. The cone blocks P are pressed toward the middle of roll F by springs Q housed in the bearings *d* and seated against adjusting plugs *u*. The springs are shown as four in number. By means of these cone blocks, the stress of which is balanced the one against the other, the feed roll is stopped instantly at the end of each feeding movement. Although brakes of a conical form have been selected for purposes of illustration, it will be obvious that the invention is not necessarily limited in its application to the use of brakes of that particular form.

The feed roll brakes are released at the beginning of each feeding movement by retracting the cones M, M against the stress of the springs Q. These retractile movements are controlled by a cam which may conveniently be fixed on the main shaft B of the press, as shown in Fig. 1, where the cam is lettered R. For effecting this movement any convenient mechanism may be provided, that shown consisting of a lever S fulcrumed to the frame at *v* and carrying a roller *w* bearing against the contoured cam surface, the free end of the lever connecting by a rod *x* to a lever T turning on a stud T' (Fig. 4) and carrying opposite arms *y* (Fig. 3) which connect through adjustable links *z* to levers U, U (Figs. 3 and 5) turning on studs 10 fixed in the frame (see Fig. 5), the upper arms of the levers U being forked, as shown in Fig. 5, the forks passing to opposite sides of the respective sliding blocks P and terminating in fingers 12 which bear against flanges 13 on the blocks P, as shown in Figs. 3 and 5. The cam R is so shaped that it acts to lift the lever S and separate the brake cones M, M coincident with the beginning of each feed movement and to drop the lever and permit the cones to be pressed against the feed roll F just before the end of each feed movement, to prevent over-running as the impelling ratchet slows down toward the end of the feed stroke, whereby to stop the feed roll coincident with the end of each feed movement.

Thus it will be understood that the feed roll F, constructed as a shell of minimum weight, is mounted to rotate around its supporting shaft K; this shaft is oscillated in successive forward and backward movements; on each forward oscillation, acting through the friction roller pawls *q*, it engages the feed roll and carries it forward in its feeding movement with the shaft, during which time the brakes are retracted, leaving the roll free; and toward the end of the feeding movement the brakes close in and grip the feed roll, thereby stopping it instantly and holding it during the return oscillation of the shaft. The construction is such as to permit of a very rapid and exact feed, the diminished mass of the feed roll so reducing its inertia that it is started and stopped instantly and without either lagging or overfeeding, even at speeds heretofore unattainable.

The adjustment of the length of the feed stroke is attained as heretofore explained by varying the throw of the crank stud *l* in the slotted crosshead *m* on the main shaft B.

Some mechanical details of minor importance may be briefly described.

For separating the feed rolls in order to feed in a new sheet of material, the frame J carrying the upper roll G is lifted against its springs *c* by lever arms 15 projecting under it, fixed on a horizontal shaft 16 on which is fixed an external lever 17, the outer end of which projects, as shown in Fig. 4, in front of the press head or platen D where it may be engaged by an adjustable screw 18 carried by the platen in order to lift the frame and upper roll upon the downstroke of the press. The shaft 16 has an upwardly projecting arm 19. When it is desired to hold the upper roll elevated, as for introducing a new sheet into the machine, the operator may turn a cam head 25 having a flat which ordinarily permits free movement of the arm 19, but which when turned, by raising the arm 26, opposes its rounded surface to hold back the arm 19 and thereby keep the frame J and roll G elevated.

For convenience a feed table is provided, comprising an outer section V and an inner section V'.

The machine is controlled by a treadle 30, the lever 31 of which connects through lever 32 and rod 33, with a lever 35 hung on the main frame near its top and adjacent the main shaft B. This lever 35 operates the starting clutch and the brake for controlling the starting and stopping of the main shaft in the well-known manner. The lever 32 has an upwardly projecting arm 33 engaged by a catch 36, having an operating arm 37 by which the operator may lock the treadle in its depressed position without having to hold it down with his foot. In operation the pressing of the treadle starts the press at a determined point in the rotation of the main shaft, and the press continues to operate the feed automatically so long as the treadle remains depressed; upon releasing the treadle the press stops at the end of a press revolution, in position ready for the next

starting,—all as is well understood in machinery of this class.

In Fig. 3 the brake retracting springs Q, Q reacting against the adjusting plugs *u* are adjustable in tension in two ways,—the plugs *u* on the right are shown as screw plugs, while those on the left are shown as sliding cylinders seated outwardly against a collar **21** which is set up by screws **22** passing through the frame. This makes the adjustments at both ends readily accessible, since the screw plugs at the right are exposed and the heads of the adjusting screws **22** may be turned from the exterior of the frame.

Fig. 7 shows a modified and somewhat lighter construction of the feed roll F, here lettered F′, with a slightly different construction of the shaft K. This is designed for the use of a brake at only one end of the feed roll instead of balanced brakes as hereinbefore described. The brake cone N is here shown at the left-hand end only of the feed roll, and the friction ratchet with its rollers *q*, instead of being in the middle between the ball bearings *p*, *p*, is placed to the right in approximately the location of the right-hand cone N in Fig. 6. Since the brake effect here is not balanced, but exerts an end thrust against the feed roll and thence through the ball bearings upon the shaft, the latter requires an end-thrust bearing, which is here shown as a ball bearing **41**, the outer race **42** of which seats against a portion of the frame, here shown at **43** as a part of the frame L, or it may be an extension of the shaft bearing *d*. The feed roll F′ is shown as having an outer shell **44** fastened on its opposite ends by screws, and preferably by welding, to the brake cone N at the left and to an inner shell **45** at the right which carries the race for the right-hand ball bearing *p* and receives the thrust of the ratchet rollers *q*.

While the constructions herein shown and described are preferable, it is to be understood that the invention is not limited to the details of construction shown, since the mechanism may be varied according to requirements by the exercise of the skill of engineers or mechanics familiar with this art.

What I claim is:

1. A high-speed feeding mechanism for a metal working machine, comprising a feed-roll in the form of a hollow cylindrical shell, an oscillating driving means for said roll in the form of a shaft passing through and concentric with the shell, a one-way driving connection between said roll and its driving means including anti-friction bearings and a one-way clutch mounted in the annular space between the inner surface of the shell and the shaft, whereby the roll may be intermittently driven in one direction only, and friction braking means for said roll including a pair of elements in combination with means whereby they may be forced towards each other against the opposite end portions of the shell to render the braking means sufficiently effective on the roll, throughout substantially all of the retarded portion of each effective driving period of the roll-driving means, to prevent the overrunning of the roll during such periods, and means whereby the effectiveness of the brake-applying means may be varied to any desired extent throughout the accelerated portion of each such driving period to permit the roll to run substantially free.

2. A high-speed feed mechanism for a metal working machine, comprising a feed-roll in the form of a cylindrical shell, oscillatory driving means for said roll comprising a shaft extending through and concentric with said shell and means for intermittently rotating said shaft in opposite directions, a driving connection between said shaft and said roll comprising anti-friction bearings and a one-way clutch mounted in the space between the inner surface of the shell and the shaft through which the roll may be intermittently driven in one direction only, and friction braking means comprising a pair of braking elements in combination with brake-operating means for forcing them towards each other into frictional engagement with the opposite ends of the shell to render the braking means effective and additional brake-operating means for forcing them in opposite directions to render the braking means ineffective, the said brake-operating means including yieldable pressure applying means as the part by which the braking elements may be biased to move in predetermined directions, and mechanism driven in a predetermined, timed relation with respect to the driving of the feed-roll as the part to be used as the means for opposing such pressure applying means and moving the braking elements in the opposite directions, the timing relation being such that the braking means will be effective while the roll is at rest and ineffective throughout the period during which it is being accelerated by the driving means.

3. A feeding mechanism, as defined by claim 2, of which the shell has a pair of inwardly flaring, annular, conical surfaces in its opposite ends and of which the braking elements comprise a pair of rings having complementary conical surfaces to be moved into and out of frictional engagement with the surfaces in the ends of the sleeve by the brake-operating means.

4. A feeding mechanism, as defined by claim 2, of which the oscillatory shaft of the driving means is mounted in bearing blocks located near the ends of the shell in positions such that they may serve as mounting means for the braking elements, the said braking elements having slidable but non-rotative engagement with their respective mounting blocks.

5. A feeding mechanism, as defined by claim 2, of which the operating means for forcing the braking elements towards each other into frictional engagement with the opposite ends of the shell comprise a pair of springs of approximately equal resilience and the operating means for forcing them in the opposite directions against the efforts of the springs comprises a mechanism timed to operate in a predetermined relation with respect to the movements of the roll-driving means.

EDWARD V. CRANE.