Jan. 23, 1934. A. B. HASWELL 1,944,710

FLYING CUTTER

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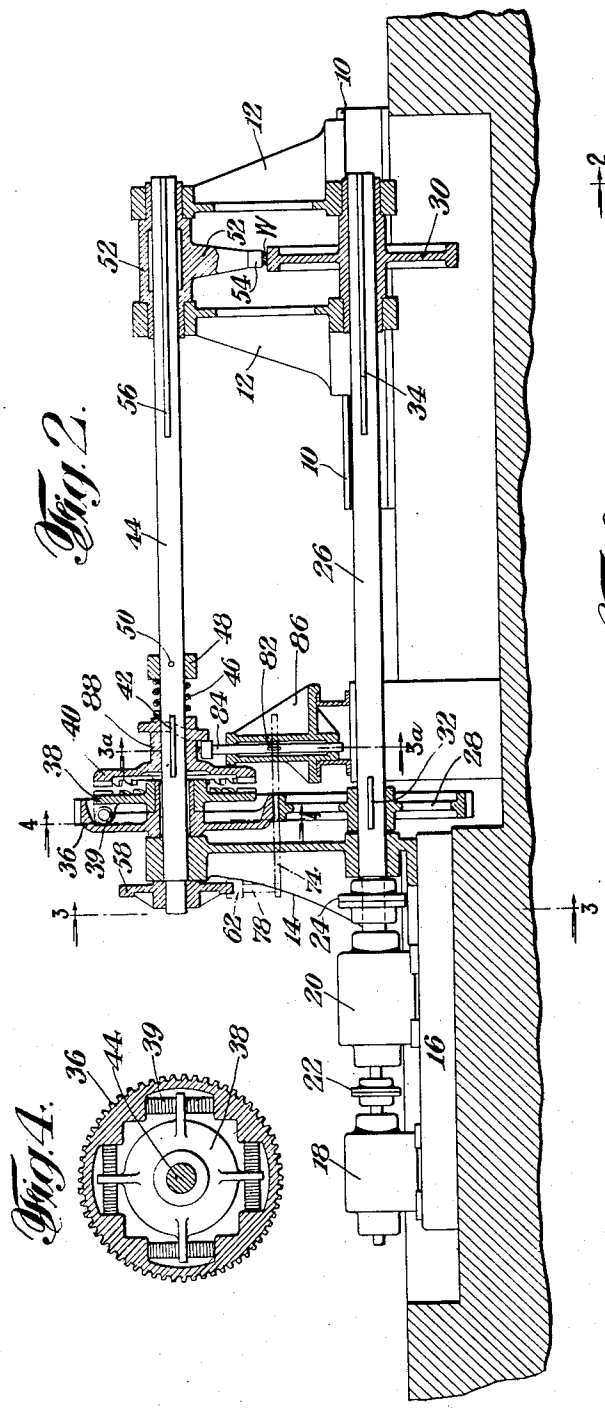

Fig. 2.

Fig. 4.

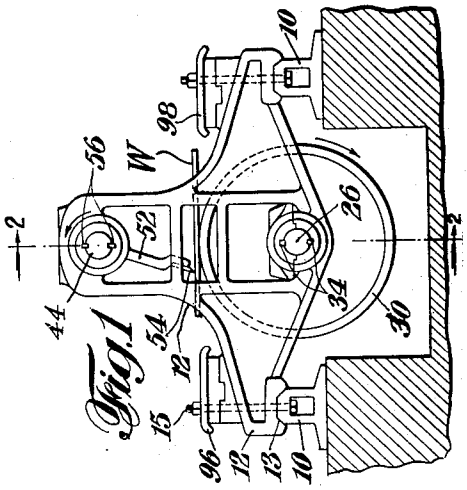

Fig. 1

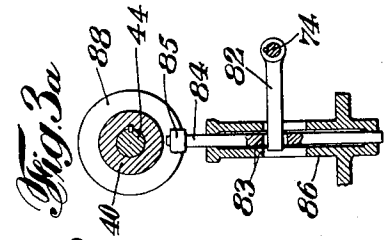

Fig. 3a

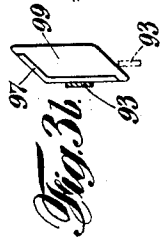

Fig. 3b.

Fig. 3.

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Fig. 5.

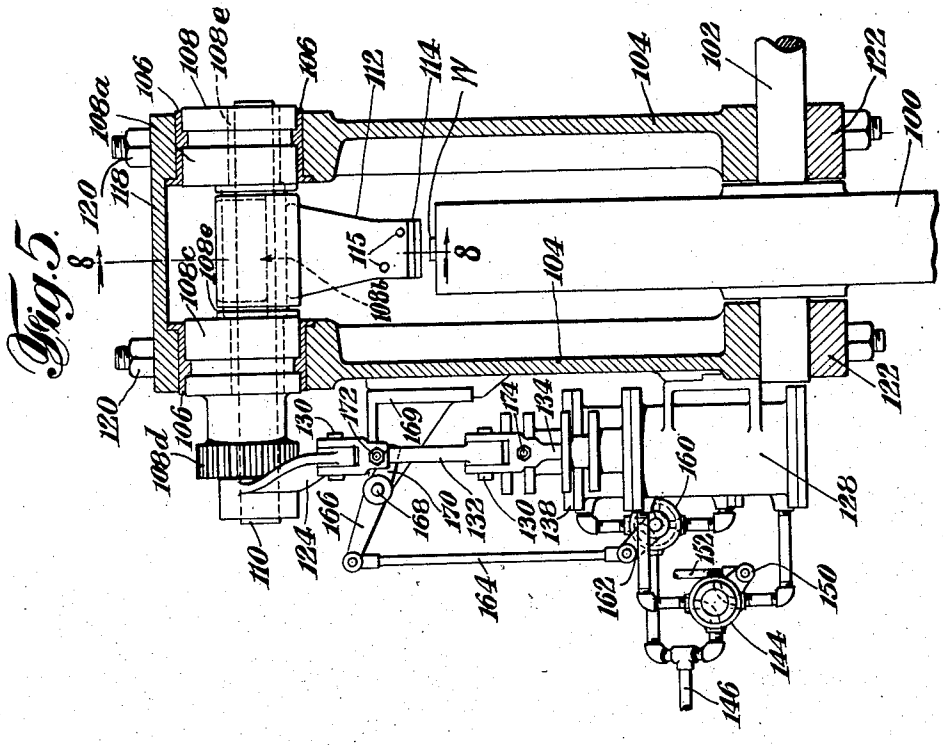
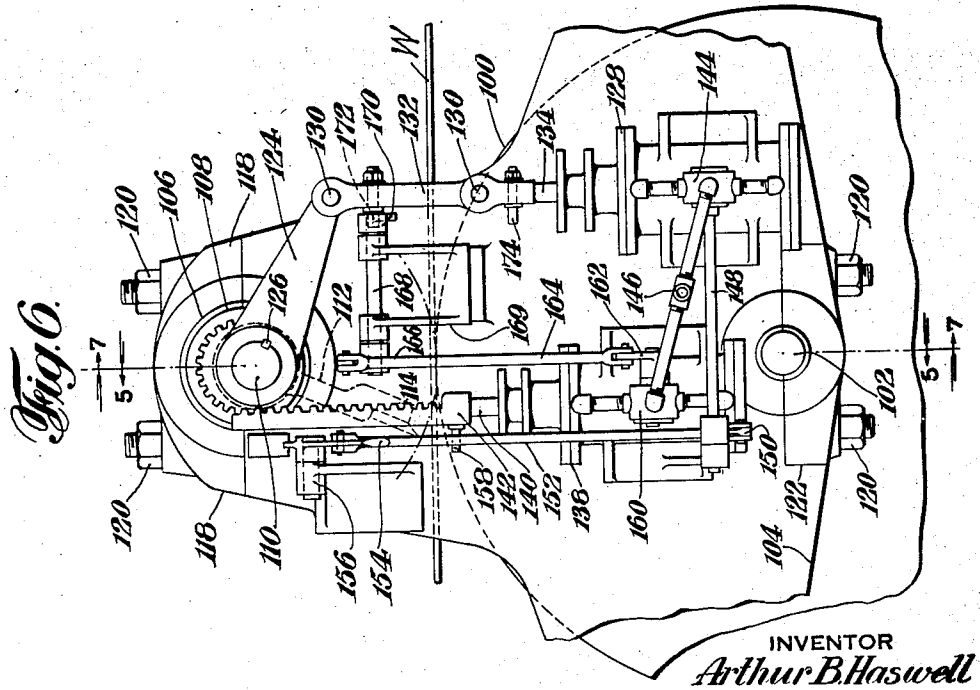


Fig. 6.



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FLYING CUTTER

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Fig. 9.

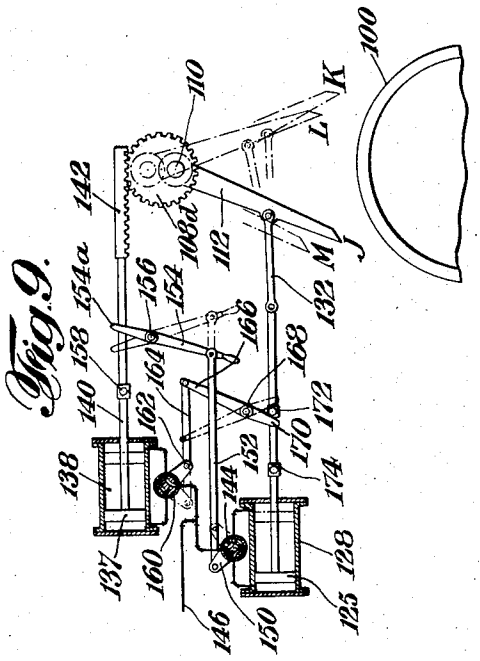

Fig. 8.

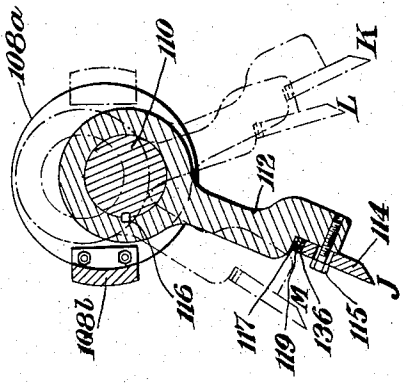

Fig. 7.

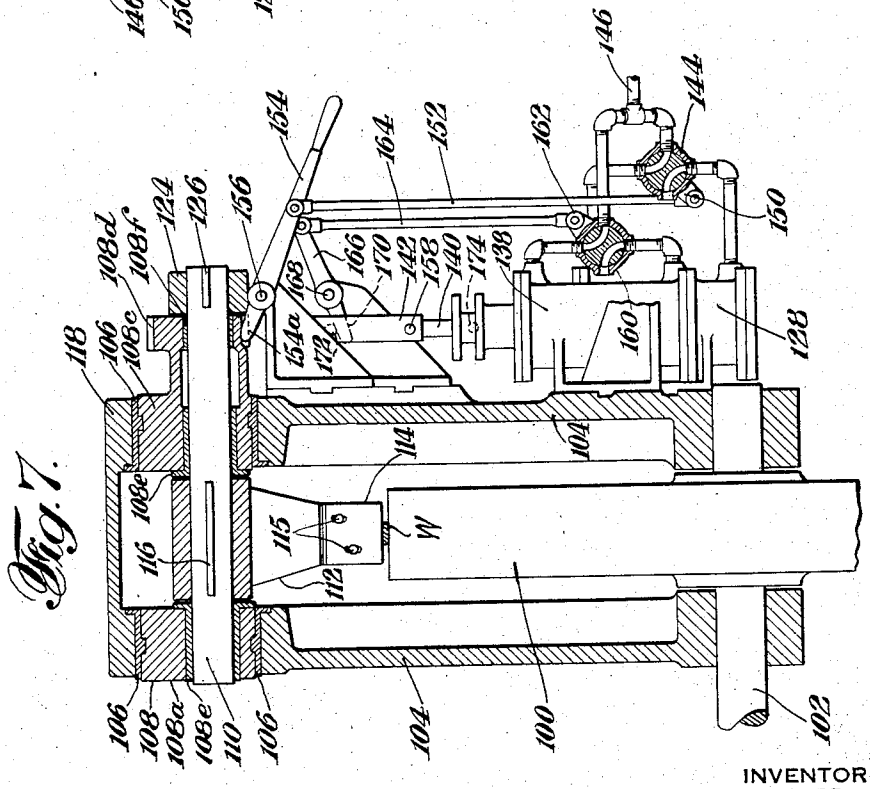

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Fig. 10.

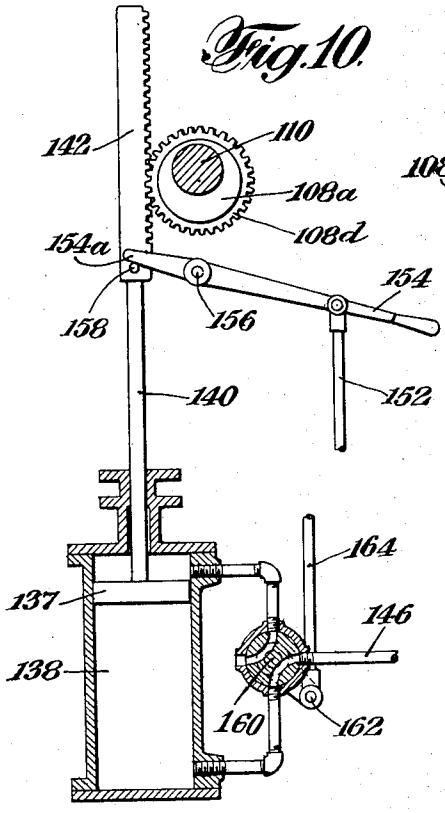


Fig. 11.

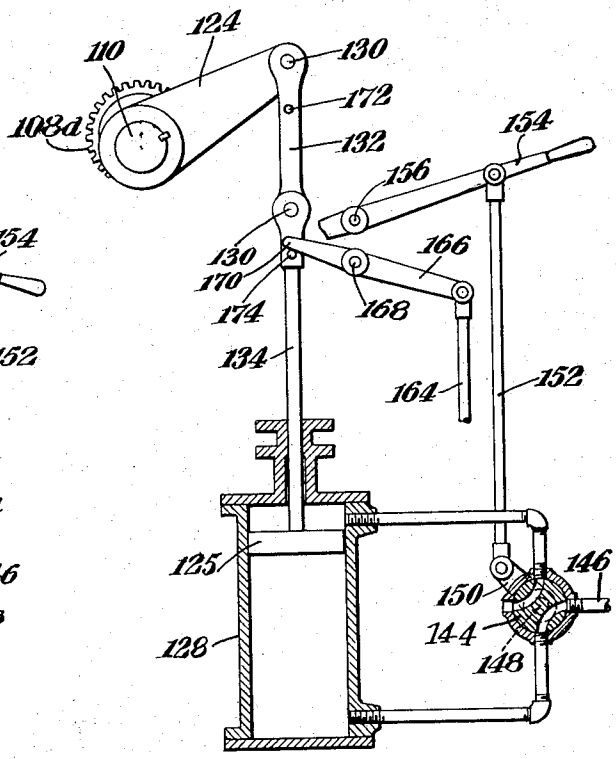
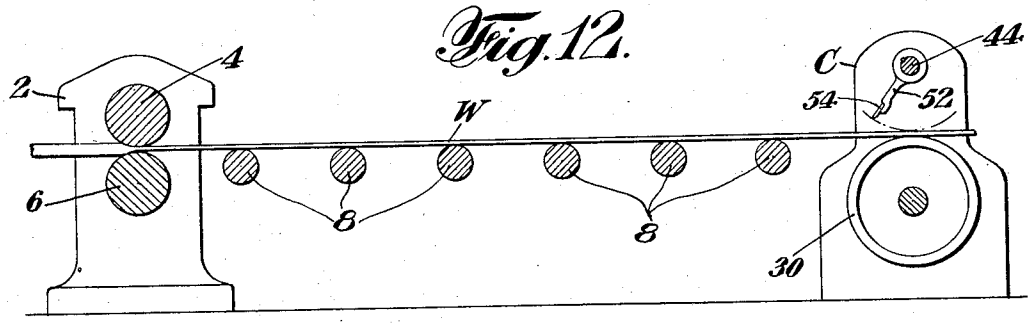


Fig. 12.



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Patented Jan. 23, 1934 1,944,710

UNITED STATES PATENT OFFICE

1,944,710

FLYING CUTTER

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Application July 16, 1930. Serial No. 468,376

3 Claims. (Cl. 164—68)

This invention relates to flying cutters adapted to cut metal into desired multiple lengths while such material is moving. The cutter of my invention is particularly adapted for use in combination with a rolling mill and a roller table associated therewith, the improved flying cutter being movable in an arcuate path and coacting with a rotating anvil roll, which in coaction with the cutter is effective to simultaneously feed the metal lengthwise and sever it transversely.

My improved flying cutter does away with the necessity of providing top and bottom members, both of which move in the line of travel of the work to be cut.

The invention will be apparent from the following specification when read in connection with the accompanying drawings in which:

Fig. 1 is an end view illustrating one embodiment in the invention;

Fig. 2 is a longitudinal section on line 2—2 thereof;

Fig. 3 is a transverse section taken substantially on line 3—3 of Fig. 2;

Fig. 3^a is a detail view on line 3^a—3^a of Fig. 2;

Fig. 3^b is a detail part of parts shown in Fig. 3;

Fig. 4 is a detail view taken on line 4—4 of Fig. 2;

Fig. 5 is a transverse section illustrating an alternative embodiment of the invention, the section being taken on line 5—5 of Fig. 6;

Fig. 6 is an elevation viewed from the left side of Fig. 5;

Fig. 7 is a section on line 7—7 of Fig. 6;

Fig. 8 is a detail section on line 8—8 of Fig. 5 with various positions of the flying cutter shown in dotted lines;

Fig. 9 is a diagrammatic view illustrating the mode of operation of the embodiment of the invention shown in Figs. 5 to 8 inclusive;

Fig. 10 is a detail skeleton view with parts shown in section illustrating certain mechanism shown in Figs. 5 to 7 for effecting a lifting or lowering movement of the cutter operating shaft;

Fig. 11 is a similar view illustrating mechanism for imparting a swinging movement to the cutter operating shaft;

Fig. 12 is a somewhat diagrammatic view on a small scale showing my improved flying cutter combined with a conventional type of rolling mill and roller table.

Referring in detail to the drawings, 2 represents a roll housing of a rolling mill having rolls 4 and 6 which are adapted to act on the work W so as to reduce it to the desired size of cross sectional shape. As the work leaves the rolling mill, it is fed out by the rolls on to a roller table of known type comprising a multiplicity of rollers 8 which are mechanically driven in the conventional manner by suitable means not shown. The work is fed by the rollers of the mill and by the rollers 8 to my improved cutting machine, indicated as a whole at C.

The cutter includes a rotatably mounted anvil which is adapted to be driven at a peripheral speed substantially or approximately equal to the speed of the work W. This anvil roll cooperates with a rotatable or swingable cutter driven by means to be presently described in such manner that the cutter and the anvil roll coact to simultaneously feed the work forward and sever it transversely.

Referring first to the embodiment of the invention illustrated in Figs. 1 to 4 inclusive, I provide shoe plates 10 which rest on suitable foundations as indicated in Fig. 1. These shoe plates support housings 12, the latter being provided with groove portions 13 which slidingly engage the shoe plates in order that the housing may be aligned with any desired pass of the mill rolls. The housings when once adjusted to the desired position are held by means of suitable bolts 15. A mechanism supporting housing 14 is provided which rests on a base plate 16 carried by the foundation. A motor 18 secured to the base plate drives suitable speed reducing transmission gears housed within the casing 20 through a suitable flexible coupling 22. A similar coupling 24 connects the speed transmission mechanism with a shaft 26. This shaft has keyed near one end thereof a driving gear 28 and at its other end, it carries an anvil roll 30 which is slidably secured thereto by means of a spline 34. This arrangement permits the anvil roll to slide lengthwise of the shaft when the housings 12—12 are adjusted along their supporting shoes 10.

A clutch operating gear 36 meshes with the gear 28 and is connected with a shock absorbing member 38 by means of a plurality of springs 39 as indicated in Figs. 2 and 4. The member 38 has suitable clutch teeth thereon which are adapted to coact with similar teeth formed on a clutch member 40 which slidably engages a spline 42 carried by the cutter supporting shaft 44. A spring 46 is interposed between one end of the clutch member 40 and a collar 48 which is secured to the shaft 44 by means of a pin 50. As thus arranged, it is clear that the shaft 44 is operatively connected with anvil carrying shaft 26 through the gearing 28 and 36 and shock absorbing member 38 and the clutch member associated therewith.

A cutter arm 52 is mounted on the shaft 44 for sliding engagement with the splines 56 thus permitting adjustment of the housings 12—12 lengthwise of the shaft 44.

At one end shaft 44 carries the disc 58 provided with a locking tooth 59 which coacts with a locking pawl 62 pivoted on a rocker arm 64 by means of a pin 66. The arm 64 is pivoted at 68 to a suitable fixed bracket and a spring 70 se-

cured at one end to the rocker arm and at the other end to an adjustable spring anchorage bolt 72 that normally tends to hold the arm against a stop 73. A rocker shaft 74 is pivotally mounted in suitable bearings formed in the housing 14 and carries an arm 76, one end of which is connected by means of a link 78 with the pawl 62. The rocker shaft 74 also carries another arm 82 (Figs. 3ª and 2). This arm works through a slot 83 formed in a rod 84 which is slidably mounted in a vertical bracket 86. At its upper end, the rod 84 carries a roller 85 which is adapted to enter a cam groove 88 formed in the hub of the clutch member 40.

The arm 76 is connected at its outer end 77 with a core 90 of a solenoid 92. Instead of rocking the shaft 74 by means of the solenoid as described, it will be understood that the same may be manually moved by means of a foot treadle not shown. When the solenoid is included as part of the installation, I will preferably provide a switch 93 normally held in open circuit position by a suitable spring. After the work has travelled a predetermined distance past the cutter it will strike an arm 95 and thus close the circuit through the solenoid, as indicated by the diagram in Fig. 3. The arm 95 as shown is mounted for pivotal movement and a spring normally holds it against a fixed stop. This arm carries a contact blade 93 which wipes over a contact 97 which is electrically connected with a suitable source of current. The contact 97 is mounted on a block of insulation 99 having an inclined under surface. When the work strikes the arm 95, the contact 93 wipes over the contact 97 and momentarily closes the circuit through the solenoid. As long as the work W presses against the arm 95, the contact member 93 will dwell in the dotted line position indicated approximately in Fig. 3ᵇ. When the work rides off the arm 95, the spring will return the arm to the full line position of Fig. 3. During this movement, the contact blade 93 will wipe over the insulation 99, hence there will be no circuit closed through the solenoid during the return stroke of the contact blade 93.

Energization of the solenoid will cause the pawl 62 to trip the tooth 59 and will at the same time cause the removal of roller 85 from groove 88 whereupon spring 46 will cause clutch members to engage and thus a driving connection will be established from the motor 18 through the gears 28 and 36 and through shock absorbing member 38 and clutch member 40 to shaft 44. The solenoid is energized only sufficiently long to unlock shaft 44 and to establish the said driving connection and when the solenoid is de-energized the reverse rocking movement of the shaft 74 will place the roller 85 in position for coaction with the cam carried by the clutch member. After the shaft 44 and the cutter supported thereby has completed one revolution, the roller 85 coacting with the cam on the clutch member 40 will disengage the clutch and the parts will come to rest with the pawl 62 in engagement with the locking teeth 59 as shown in Fig. 3. As thus arranged, it will be understood that the cutting mechanism is automatically started when the material to be cut reaches a desired length and that the cutter makes one revolution and automatically comes to rest in position for another cycle of operation.

As the work W moving along the rollers 8 (Fig. 12) of the roller table comes into engagement with the anvil roll 30, it will preferably be moving at substantially or approximately the same speed as the peripheral speed of the anvil roll. When the cutter blade 54 engages the work, it will be understood that because of its rotary motion both the cutter and the anvil roll will coact to simultaneously feed the work lengthwise and sever it transversely. In severing the work, the cutter blade 54 reacts against the smooth flat circular surface of the anvil roll and when the outer extremity of the cutter blade coincides with the surface of the anvil roll, the work will have been severed. By employing such a chisel-like action, the work can be simultaneously fed lengthwise and severed transversely without the necessity of providing cutting mechanism which must partake of horizontal movement in the direction of the line of travel of the work.

My improved cutter has another advantage, in that it requires only a single cutting blade as distinguished from cutters heretofore used which employ two blades to exert a shearing action as they move lengthwise of the work in a straight line.

It is desirable to have the cutter move in an arcuate path so as to coact with an anvil roll which contributes to the cutting operation and also to the feeding operation. However, it is not necessary that the flying cutter rotate continuously through 360°. In some cases, the cutter may partake of a swinging movement through a predetermined angle during which movement the cutting and feeding is effected. It may then be raised to inoperative position and returned to starting position while clear of the work. Such an alternative embodiment of the invention is illustrated in Figs. 5 to 11 inclusive. Referring in detail to these figures, the flying cutter shown therein is preferably actuated by air or other suitable motive fluid. In this embodiment of the invention, I provide a rotating anvil 100 carried by a shaft 102 which is driven so that its peripheral rotating speed is approximately equal to that of the material to be cut.

The shaft 102 is supported by housings 104 which at their upper portions carry bearings 106. These bearings rotatably support a rocker indicated as a whole at 108. This rocker comprises members 108ª and 108ᶜ which are connected to one another by a bridge piece 108ᵇ. As thus arranged, the two rocker members will be turned in unison within the bearings 106. Formed integral with or secured to the rocker meber 108ᶜ, there is a gear 108ᵈ which is adapted to be partially rotated by a vertically movable rack hereinafter referred to. The rocker member 108 carries bearing bushings 108ᵉ and 108ᶠ which are eccentrically located as shown. These bushings form eccentric bearings for the shaft 110, referred to herein as an eccentric shaft for ease of description. This eccentric shaft carries a cutter arm 112 having a blade 114 which is secured to the arm by means of bolts 115. The arm is provided with a shoulder 117 between which and the inner edge of the blade are inserted a number of shims 119 so as to allow for adjustment of the position of the cutter blade. The latter may be provided with elongated slots as shown in Fig. 7. By adding or removing shims, it will be understood that a radial adjustment of the position of the cutting edge of the blade may be readily secured. Thus as the blade wears in use it can be resharpened and shims inserted to compensate for this wear.

The housings 104 are joined at the top by spacer or cap 118 and suitable thru bolts 120 are

provided to secure this cap and also the bottom bearings 122 in place.

At one end, the eccentric shaft 110 carries an operating crank arm 124, the arm being secured by a key 126 as shown. A piston 125 operating within a cylinder 128 is connected with the crank arm 124 by means of pins 130, link 132 and piston rod 134. Thus it will be clear that movement of the piston will rock the shaft 110 and thus swing the arm 112 and its cutter 114 in an arcuate path.

The rocker member 108 is adapted to be turned 180° so as to lift the eccentric shaft 110 from its lower or cutting position to its high or retracting position. When the eccentric shaft is in its lower position, the cutter is adapted to be swung in an arcuate path so that the blade 114 coacting with the anvil roll simultaneously moves the work lengthwise and severs it transversely. After this is accomplished, the rocker member is given a half turn. This lifts the eccentric shaft so that after a completion of the cut, the cutter arm can be swung backward out of contact with the work.

For effecting the 180° movement of the rocker, I employ an air operated piston 137 which works in a cylinder 138. The piston is connected by means of a rod 140 with a gear rack 142 which meshes with the above mentioned gear 108^d secured to the rocker member.

A four way valve 144 controls the supply of air from a pipe 146 to the cylinder 128. This valve is connected by means of a shaft 148 and crank 150 and link 152 to a starting lever 154 which is pivoted at 156 to a suitable bracket carried by the housing 104. The starting lever has an extension 154^a which is adapted to coact with a pin 158 secured to the gear rack 142.

Another four way valve 160 is also connected to an air supply pipe 146. This latter valve controls the supply of air to a cylinder 138 within which the piston 137 operates. The valve 160 has an operating crank 162 which is connected by a link 164 to a lever arm 166 which is keyed to a rock shaft 168 mounted in the bracket 169 carried by the housing 104. The rock shaft 168 carries at one end an arm 170 which is adapted to coact with striker pins 172 and 174 secured respectively to the link 132 and piston rod 134.

Figs. 8 and 9 illustrate several positions of the cutter arm 112 during its cycle of operation, Fig. 9 being merely a diagram illustrative of various parts while making one complete stroke. In operation, the starting lever 154 is lifted manually, or by solenoid as illustrated in Fig. 3, from the position of Fig. 7 to the position shown in Fig. 11. This will reverse the position of the valve 144 and will turn ports to the position illustrated in Fig. 11. Air will be admitted from pipe 146 to the bottom of cylinder 128. This will rock the shaft 110 and cause the cutter to move from the full line position indicated at J in Fig. 8 to the dotted line position indicated at K. This movement constitutes the operative or working stroke of the cutter and it will be understood that the blade in coaction with the anvil roll will simultaneously move the work lengthwise and sever it transversely.

The cutter arm 112 is then slightly elevated because the pin 174 near the end of the upward movement of piston 125, strikes the lever arm 170 and moves it from the position of Fig. 7 to the position illustrated in Fig. 11. This movement reverses the valve 160 (Fig. 10) and admits air from the supply pipe 146 to the bottom of the cylinder 138 thereby lifting the piston 137, which in turn through gear rack 142 and gear 108^d turns the rocker member 108 through approximately half a revolution. This lifts the eccentric shaft 110 together with the cutter arm 112 and cutter 114. During this movement, the cutter moves from the dotted position at K to the position indicated at L in Fig. 8.

The cutter arm subsequently makes a backward swing from the position L toward position M because near the end of the upward movement of the piston 137, the pin 158 strikes the end 154^a of the starting lever and restores the same to the position illustrated in Fig. 7 with the consequent movement of the rod 152, crank 150 and shaft 148. This act resets the valve 144 to the position of Fig. 7 and admits air to the top of the cylinder 128. This forces the piston 125 downward, thus causing the cutter to swing from the position indicated at L to that indicated at M in Fig. 8.

Finally the cutter arm 112 is lowered because near the end of the downward movement of piston 125 the pin 172 strikes the lever arm 170 and moves it to the position of Fig. 7 with consequent movement of the shaft 168, link 164, and crank 162. This sets the valve 160 to the position of Fig. 7, thus admitting air to the top of the cylinder 138 and causing the piston 137 and its rod 140 and gear rack 142 to move vertically downward so that the rocker member 108 makes a half revolution and resets the eccentric shaft 110 and the cutter carried thereby to the starting position indicated at J in Fig. 8 whereupon the parts are ready for another cycle of operation to make another cut.

While I have described in considerable detail certain specific embodiments of the invention illustrated it is not to be construed that I am limited thereto since various modifications and substitutions of the mechanical equivalents may be made without departing from the invention as defined in the appended claims.

What I claim is:—

1. A machine for cutting moving metal comprising a cutter swingable back and forth in arcuate paths and a rotary anvil which in coaction with said cutter is operative to simultaneously feed the metal lengthwise and sever it transversely, and means effective to cause said cutter to engage and cut the work upon its forward movement and to clear the work upon its rearward movement.

2. A machine for cutting moving metal comprising a cutter swingable in an arc, a shaft supporting said cutter, an anvil rotatably mounted for coaction therewith, means for rocking said shaft and means for periodically raising and lowering said shaft whereby the cutter coacts with said anvil during a cutting stroke and clears the anvil during the return stroke.

3. A machine for cutting moving metal comprising a cutter swingable in an arc, a shaft supporting said cutter, an anvil rotatably mounted for coaction therewith, fluid pressure actuated means for rocking said shaft, fluid pressure actuated means for periodically raising and lowering said shaft, and respective control valves for each of said fluid pressure actuated means, and respective devices for automatically actuating each of said valves.

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