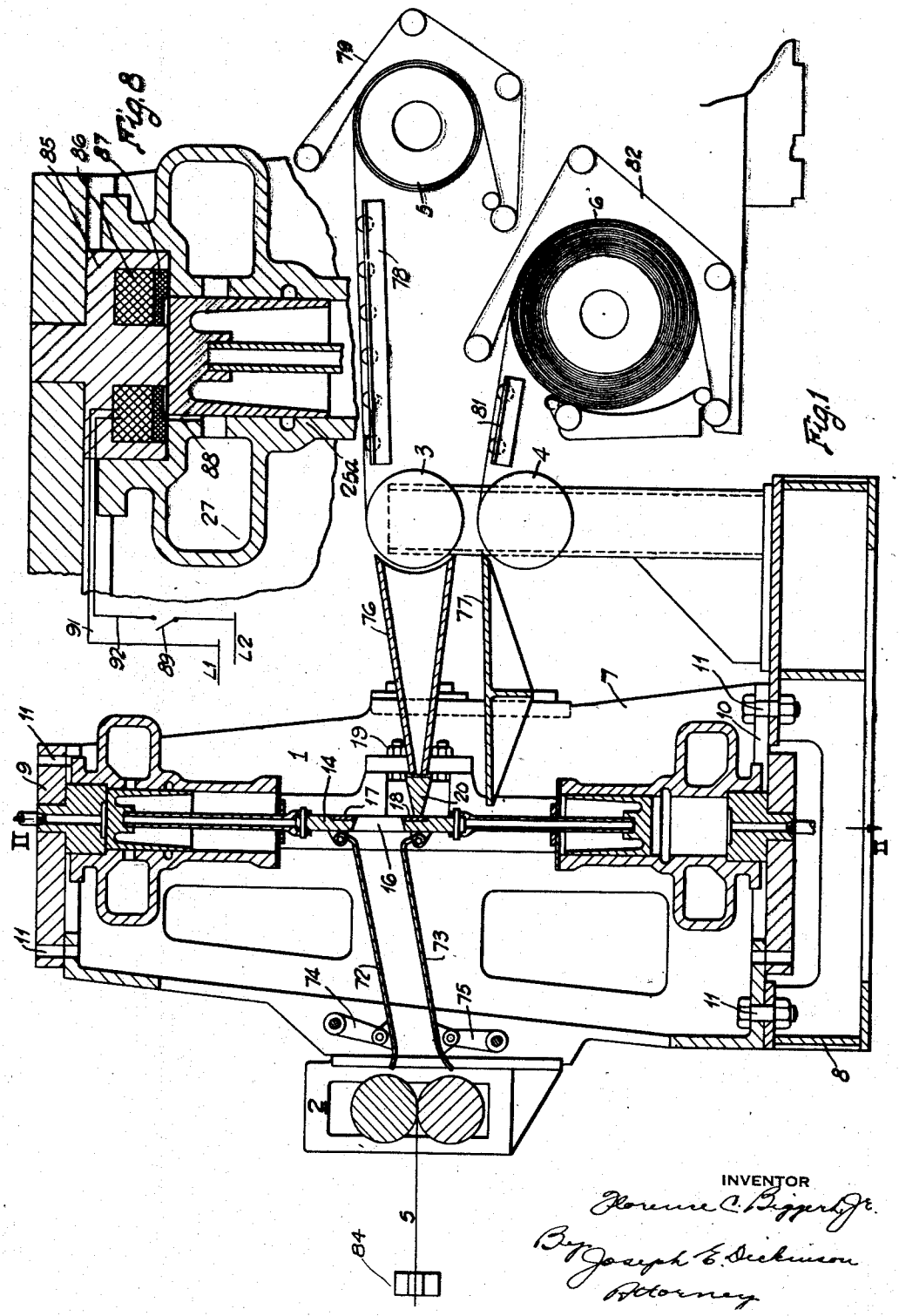
Oct. 7, 1941. F. C. BIGGERT, JR 2,258,348

SHEAR

Filed Aug. 4, 1940 3 Sheets-Sheet 1



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SHEAR

Filed Aug. 4, 1940 3 Sheets-Sheet 2

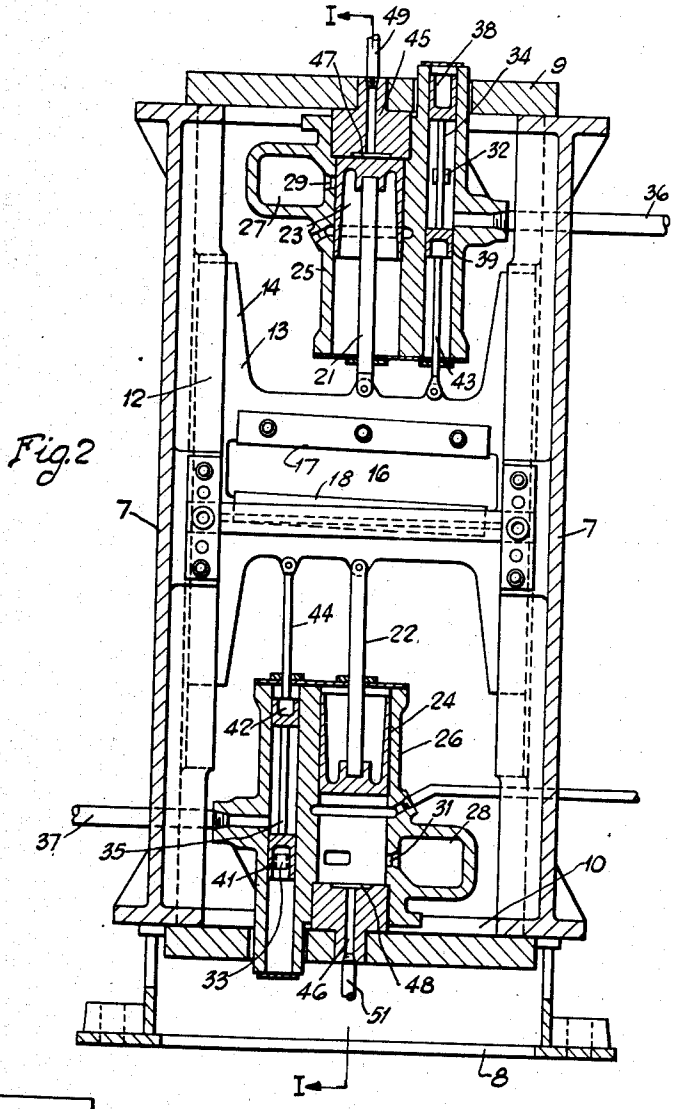

Fig. 2

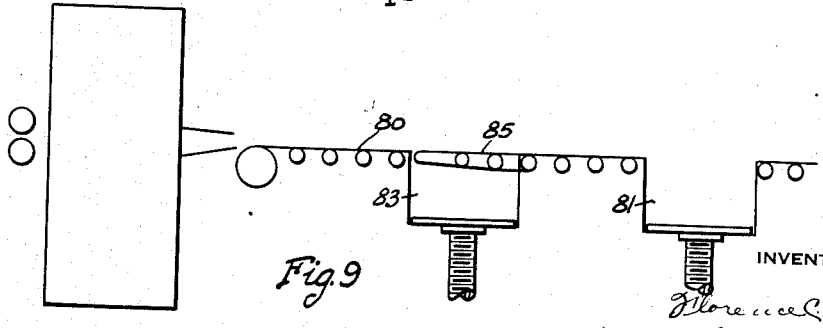

Fig. 9

INVENTOR

Florence C. Biggert Jr

By Joseph E. Dickinson

Attorney

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SHEAR

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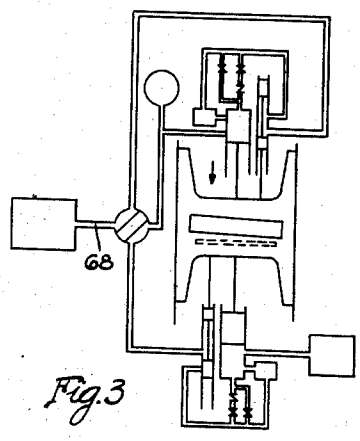

Fig.3

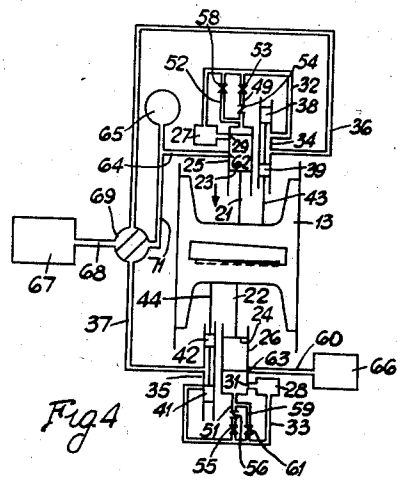

Fig.4

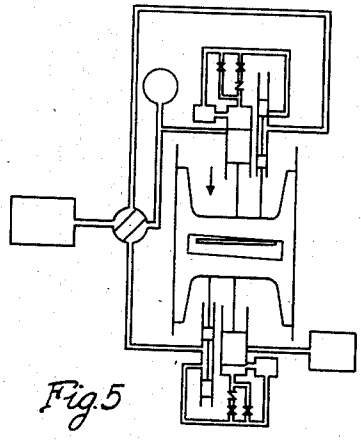

Fig.5

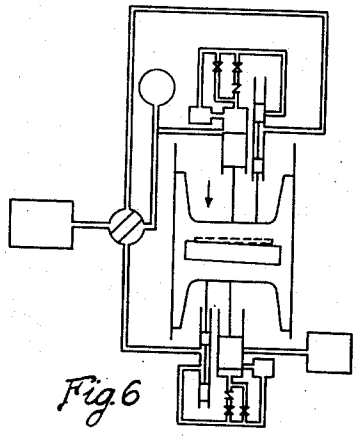

Fig.6

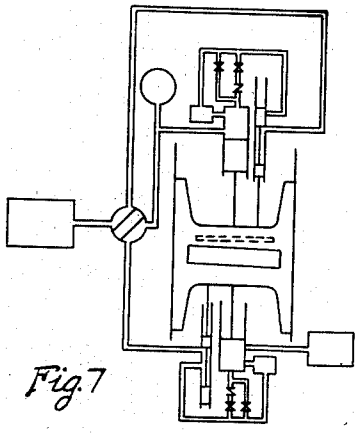

Fig.7

INVENTOR

Florence C. Biggert Jr.

By Joseph E. Dickinson

Attorney

Patented Oct. 7, 1941 2,258,348

UNITED STATES PATENT OFFICE

2,258,348

SHEAR

Florence C. Biggert, Jr., Pittsburgh, Pa., assignor to United Engineering and Foundry Company, Pittsburgh, Pa., a corporation of Pennsylvania

Application August 4, 1940, Serial No. 351,292

13 Claims. (Cl. 164—49)

This invention relates to the shearing and handling of strip material, and while not necessarily so limited, relates more particularly to shearing metal strip while in motion either for cropping purposes or for cutting preselected lengths and guiding the strip after it is sheared either into coiling or piling equipment without interrupting the general forward motion of the strip.

In the past considerable difficulty has been experienced and much time lost at the discharge end of strip producing and processing lines where it has been attempted to operate the lines continuously. To accomplish such objective, it is desirable to either coil the strip without interruption or shear into preselected lengths and pile it. To do this dual coiling or piling equipment is required and if excessive looping of the strip is to be avoided, the strip has to be cut and the coils begun on the fly.

An object of this invention is to provide a shear for use in such lines which is adapted to sever the strip without interrupting its forward motion and which is so operable and so equipped with guide means that it is adapted to either crop the strip ends, separate continuous strip into selected coil lengths or sheet lengths, and guide the strip leaving the shear into alternate coiling or piling apparatus depending on the way the strip passing through the shear is conditioned by it.

This and various other objects, as well as the various other novel features and advantages of the invention, will be apparent when the following detailed description is read in conjunction with the accompanying drawings of which,

Figure 1 is a sectional view of a shearing line incorporating the invention, the view being taken on the line I—I of Figure 2;

Figure 2 is a sectional view taken on the line II—II of Figure 1;

Figures 3, 4, 5, 6, and 7 are a series of schematic views illustrating the sequence of operations of the shear shown in Figures 1 and 2 on the downward stroke of the knives;

Figure 8 is a vertical section on an enlarged scale illustrating a modified form of shear-actuating cylinder head which may be substituted for both the top and bottom main shear operating cylinders shown in Figures 1 and 2; and

Figure 9 is a view similar to Figure 1, but on reduced scale, illustrating a shear line in which sheet pilers are used instead of coilers.

Referring to the embodiment of the invention illustrated in Figures 1 to 8, the numeral 1 designates the shear as a unit and the numeral 2, a pair of pinch rolls for feeding the strip S into shear. At the delivery side of the shear there is located a pair of deflector rolls 3 and 4 and a pair of coilers 5 and 6, the latter being equipped with cooperating belt wrappers by means of which the coiling of the strip in the coilers are automatically inaugurated.

Referring in detail to Figures 1 and 2, the shear 1 is illustrated as comprising a housing made up of a pair of side frames 7 mounted on a base plate 8 and top and bottom caps 9 and 10 welded or otherwise secured to the side frames 7.

Supported within the housing and slidable in suitable guides 12 provided in side frames 7 is a cross-head like yoke or movable blade carrier 13. The side edges of this yoke have projecting arms 14 that engage the guides 12 and operate to strengthen the yoke as well as assist in maintaining the proper alignment thereof in its reciprocating movement.

In the central portion of this is a transverse slot 16 through which the strip to be severed is passed and to the upper and lower edges of which a pair of opposed cutting blades 17 and 18 are secured by means of screws 19. These blades cooperate in the up and down motion of the movable blade carrier 13 with a stationary bar or blade carrier 20 secured at its ends in recesses provided therefor in the end frames 7. For operating the movable blade carrier, it is connected at its upper and lower centers by connecting rods 21 and 22 to a pair of pistons 23 and 24 located respectively in power cylinders 25 and 26. Surrounding these cylinders 25 and 26 are annular pressure chambers 27 and 28 which communicate at peripherally spaced intervals by way of ports 29 and 31 with the sides of the cylinders 25 and 26 at points spaced a short distance from the closed ends of the cylinders.

These pressure chambers 27 and 28 are in turn connected by ducts 32 and 33 with a pair of valve cylinders 34 and 35 to which the operating pressure of any suitable type is supplied from pressure lines 36 and 37. For controlling the supply of operating pressure to the pressure chambers 27 and 28, and the power cylinders 25 and 26 spaced pistons 38 and 39, and 41 and 42, secured to rods 43 and 44 are mounted in the valve cylinders 34 and 35. These rods 43 and 44 are in turn connected to the movable blade carrier 13 whereby they are actuated with the blade carrier. The pistons 38 and 41 are so spaced on the rods 43 and 44 that they never obstruct the inlet to the casings 34 and 35 of the pressure lines 36 and 37. On the other hand

the pistons 39 and 42 are spaced on the rods 43 and 44 so that at the proper time on the out stroke of the pistons 23 and 24 they close the ducts 32 and 33 leading to the valve cylinders 34 and 35.

The heads of the power cylinders 25 and 26 are formed by blocks 45 and 46 secured to the top and bottom plates 9 and 10 and whereby the shearing pressures are imparted directly to the shear housings. In these head blocks recesses 47 and 48 are provided and to these are connected a pair of ducts 49 and 51 which are in turn connected to the ducts 32 and 33 connecting the pressure cylinders 27 and 28 with the pressure supplying valve cylinders 34 and 35. In the duct 49, next to the duct 32, an adjustable control valve 53 is provided and between it and the recess 47 a check valve 54. Likewise in the duct 51 there are provided an adjustable control valve 55 and a check valve 56. Between the duct 32 and 49 a by-pass duct 57 is connected in which is located another control valve 58. A by-pass duct 59 provided with a control valve 61 is likewise connected between the ducts 33 and 51 and the ducts 57 and 59 being connected to the ducts 49 and 51 between the check valves 54 and 56 and the cylinder recesses 47 and 48.

Both the power cylinders 25 and 26 at points beyond the power strokes are provided with exhaust ports 62 and 63. The port 62 is connected by a duct 64 with and exhaust chamber 65 which functions as a muffler. The exhaust port 63, on the other hand, is connected by a duct 66 with a cushioning receiver 66. This latter element being provided to cushion the downstroke of the moving parts somewhat in the fashion of a counter balance to overcome the weight of gravity.

As shown, the pressure supply for the pressure lines 36 and 37 is furnished from a source 67 which is connected to these lines by means of a duct 68 through a two-way valve 69. The valve, when operated in one direction, connects the pressure supply to one pressure line and connects the other pressure line to the atmosphere through a duct 71 by way of the muffler 65.

By way of describing the operation of the shear, assume the various parts thereof are in the positions shown in Figure 3, that is, with the blade carrier 13 at the top of the upstroke. The valve 69 is turned to connect the pressure supply 67 with the upper pressure line 36 by means of which the pressure is communicated to the valve cylinder 34. The piston 38 at this time is above the port 9 and hence the pressure is supplied both to the pressure chamber 27 and the top of the cylinder by way of duct 49, the valve 53 being opened sufficiently to control the supply to the recess 47 that it will not move the piston 23 past the ports until the pressure is completely built up in the chamber 27; hence, when the other ports are uncovered, the carrier 13 will be driven down under full pressure and at a rapid speed to produce a good cutting operation. It is for this purpose that the initial movement of the piston 23 is delayed and the pressure chamber is provided.

To insure the two actions of the blade carrier being substantially the same where the same size cylinders 25 and 26 are used which is most efficient from a design standpoint, the fluid forced from this lower cylinder 26 is exhausted into a receiver 66 which functions as a cushion. However, after the port 63 to this receiver is covered by the lower piston 24, the remaining fluid is exhausted to the atmosphere by way of the pressure cylinder 28, ducts 33, valve casing 35, ducts 37, valve 69, duct 71, and muffler 65. That portion of the fluid, however, which is trapped in the cylinder after the piston 24 covers the port to the pressure chamber 28 is exhausted through the duct 59 and valve 61, the valve 61 being provided to regulate this escape to provide the proper cushioning effect for the piston 24 as it reaches the end of its stroke.

When the shear is operated in the opposite direction, the action of the parts are the same with the exception that on the upstroke the fluid in the upper cylinder 25 is exhausted directly into the muffler 65.

To insure the proper movement of the strip through the apparatus a pair of spaced guides 72 and 73 are pivotally connected to the carrier 13 at points adjacent the strip opening 16 and to links 74 and 75 pivotally connected to the shear housing opposite the pass line of the pinch rolls 2. At the discharge side of the shear a wedge-shaped guide 76 is secured between the housing 1 and the upper deflector roll 3 to insure the strip passing through the slot 16 passing over the upper roll 3 when the carrier 13 is in its upper position and under the upper roll when the carrier is in its lower position. Another guide 77 is mounted between the housing 1 adjacent the yoke 13 and the lower deflector roll 4 to insure the strip passing over the latter rolls when so deflected by the upper guide 76.

As shown in Figure 1 the strip S after leaving the upper deflector roll 3 passes over a guide table 78 about the coiler 5 being guided thereabout automatically by a belt wrapper 79. Likewise the strip leaving the lower deflector roll 4 passes over a deflector table 81 about the coiler 6 with the assistance of the belt wrapper 82.

The pinch rolls 2 and the reels 5 and 6 are, of course, provided with suitable driving means not shown and if desired automatic means may be provided for controlling the operation of the shear. One such means is indicated at 84 and which may take the form of any of a number of well-known types of flying micrometers, a specific example of which is illustrated and described in Patent No. 1,963,397 issued on June 19, 1934 to Mr. Carl E. Bedell. Such a unit may be employed to advantage when strip is welded together to automatically operate the shear each time a weld passes through the micrometer, thus making new coils the same size as may be coming to the shear.

With such an arrangement as soon as one coil is built up to a satisfactory size the shear may be operated without interrupting the strip, the operation of the shear being practically instantaneous, and a new coil started. While one coil is being furnished the other can be unloaded so that the coilers are at all times ready for service when needed. Consequently, through the use of this assembly, all obstructions to the movement of the strip is eliminated and no looping of the strip is required.

As shown in Figure 9 the assembly can be modified to handle sheets. This is done by employing only a single runout table 80 at the delivery side of the shear and a pair of sheet pilers 83 and 84. The first of these is disposed below a gate 85 in the table which is raised when the first piler is in use and lowered when the second is being used.

As shown in Figure 8, which is a modification of the cylinder head for the main working cylinders, the head 85 is made of steel or an alloy having highly magnetic properties, and is provided with

an annular groove on the pressure side into which a suitable solenoid 86 is inserted and held in place by a ring 87 of non-magnetic material such as copper or the like. A groove 88 in the main working cylinder 25a permits leakage of the fluid from the high pressure chamber 27 so that the full effective pressure may be built up in the space at the top of the piston 23. When a cut is to be effected, a switch 89, previously closed to energize solenoid 86 by connecting it to a source of power designated generally as L_1 and L_2 through connecting wires 91 and 92 to set up an electromagnetic field, is opened, the solenoid deenergized and the piston freed from the restraining magnetic force. Of course, the restraining force must necessarily be greater than the effective fluid pressure tending to actuate the piston, in order to prevent its pulling away from the electromagnetic field at a time during which no cut is to be made. As an alternative, instead of providing a manually operable switch 89 as shown, automatic time delay relays may be substituted to cooperate with the flying micrometer for making and breaking the electric circuit at proper intervals to cut the moving strip into predetermined lengths, the valve 65, however, being controlled as before.

When this modified cylinder head is incorporated in my invention, it is desirable not to energize the solenoids of either the top or bottom cylinder heads until the shear has come to rest. Otherwise, the cushioning effect of the fluid trapped behind the piston would be overcome due to the attracting force of the magnetic field on the pistons and pounding would result.

According to the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A shear for cutting continuous moving strip material into shorter lengths comprising a supporting frame, a yoke supporting a plurality of cutting means, means associated with said yoke for controlling the movement in a path substantially perpendicular to that of a continuously moving web of material to be sheared into shorter lengths, a stationary cutting means adapted to cooperate with the movable cutting means and guide means associated with said yoke for restraining the web to pass within the yoke.

2. A shear for cutting continuous moving strip material into shorter lengths comprising a frame, a vertically reciprocable yoke supporting a plurality of cutting means, a stationary cutting means adapted to cooperate with the movable cutting means, and guide means associated with said yoke for restraining the web to pass within the yoke.

3. A shear for cutting continuous moving strip material into shorter lengths comprising a supporting frame, a yoke for supporting a plurality of cutting means, control means comprising a flying micrometer for energizing a solenoid valve to admit fluid under pressure to a hydraulic motor for actuating and controlling the movement of said yoke in a path substantially perpendicular to that of a continuously moving web of material to be sheared into shorter lengths, a stationary cutting means adapted to cooperate with the movable cutting means and guide means associated with said yoke for restraining the web to pass therethrough.

4. A shear for cutting continuous moving strip material into a plurality of shorter lengths comprising a supporting frame, a movable yoke supporting a plurality of cutting means, control means comprising a strip engaging means for periodically actuating a valve to admit fluid under pressure to a hydraulic motor for actuating and controlling the moving of said yoke in a path substantially perpendicular to that of the moving strip, a stationary cutting means adapted to cooperate with the movable cutting means and guide means associated with said yoke for restraining the web to pass within the yoke.

5. A shear for cutting continuous moving strip material into a plurality of shorter lengths comprising a supporting frame, a movable yoke supporting a plurality of cutting means, control means comprising a strip engaging means for periodically actuating a valve to admit fluid under pressure to a hydraulic motor for actuating and controlling the movement of said yoke in a path substantially at right angles to that of a continuously moving web of material to be sheared, a stationary cutting means associated with the movable cutting means, guide means associated with said yoke for restraining the web to pass within the yoke, and means for slowly bringing to rest said moving yoke.

6. A shear for cutting continuous moving strip material into a plurality of shorter lengths comprising a supporting frame, a movable yoke supporting a plurality of cutting means, control means comprising a strip engaging means for periodically actuating a valve to admit fluid under pressure to a hydraulic motor, separate means comprising an electromagnet for engaging the piston of said hydraulic motor and means for deenergizing said magnet to release said piston at proper intervals to impart movement to said yoke in a path substantially at right angles to that of the moving strip to be severed, guide means associated with said yoke for restraining the web to pass within the yoke, and a stationary cutting means adapted to cooperate with the movable cutting means and to guide the strip issuing from the yoke.

7. A shear for cutting continuous moving strip material into a plurality of shorter lengths, comprising a supporting frame, a yoke supporting a plurality of cutting means, control means comprising a strip engaging means for periodically energizing a solenoid valve to admit fluid under pressure to a hydraulic motor for actuating and controlling the movement of said yoke in a path substantially perpendicular to that of said continuous strip, guide means associated with the entry side of said yoke for restraining the web to pass within the yoke and a stationary cutting means adapted to cooperate with the movable cutting means and to serve as a guide for the strip issuing from said yoke.

8. A shear comprising a frame, a movable yoke supporting a plurality of cutting means, a hydraulic motor associated with said yoke, a fluid pressure supply system, control means engaging a web of continuously moving material for actuating a valve to admit fluid under pressure to the hydraulic motor through a plurality of valves to slowly accelerate said yoke, a hydraulic balance for supporting the weight of said yoke, means for applying full line pressure to quickly accelerate said yoke, means to decelerate and bring said yoke to rest, a stationary cutting means adapted

to cooperate with said movable cutting means, and guide means associated with said yoke for restraining the web to pass within the yoke.

9. A shear assembly including strip feeding means, a reciprocating shear adapted to sever strip on both its up and down stroke being provided with two reciprocating and a common stationary blade for this purpose, means for guiding the strip cut on the downstroke along one plane and along another plane when cut on the upstroke, a plurality of coilers for winding the strip delivered from the shear, and automatic means for guiding the strip into different coilers.

10. A shearing assembly for severing continuously-moving strip material comprising a supporting frame, a yoke member arranged for reciprocating movement in said frame and having an opening therein through which the material may pass, cutting elements provided on opposite edges of said opening, a stationary element supported in said frame to cooperate with said yoke-supported cutting elements to effect severing of the strip when the yoke is moved in opposite directions, means for actuating said yoke in opposed directions, said stationary-cutting element being shaped to deflect the severed material in different directions, and means for delivering the strip material through the opening in said yoke.

11. A shearing assembly according to claim 10 provided with a plurality of means for storing the material delivered from the shear and means automatically guiding the material to said storage means.

12. A shearing assembly according to claim 10 in which a stationary-cutting element is provided which is equipped with opposite cutting edges and so designed that the support therefor in the plane of the cut has a minimum cross-sectional thickness.

13. A shear assembly for intermittently shearing elongate material into shorter lengths and automatically handling the sheared sections comprising stationary-shearing elements and cooperating-reciprocating elements, means for actuating the reciprocating elements in opposite directions to effect severing of the strip as the reciprocating elements are actuated in said opposed directions, means for feeding the strip between said fixed and reciprocating cutting elements, a plurality of means for storing the strip delivered from the shearing means, and means for automatically and selectively guiding the strip delivered from the shear into said storage means.

FLORENCE C. BIGGERT, JR.