

March 21, 1933.

L. JOHNSON ET AL

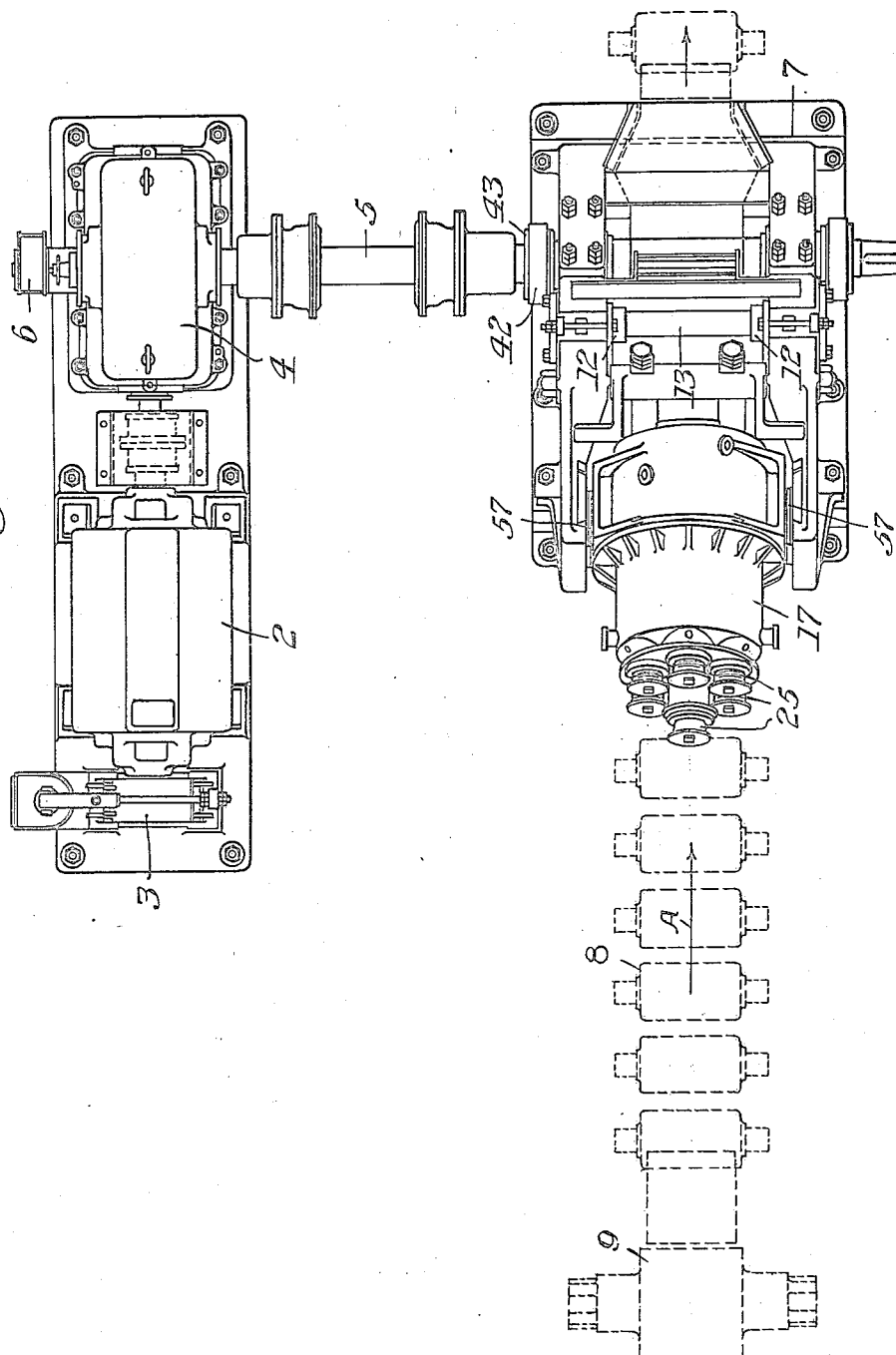
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7 Sheets-Sheet 1

Fig. 1.



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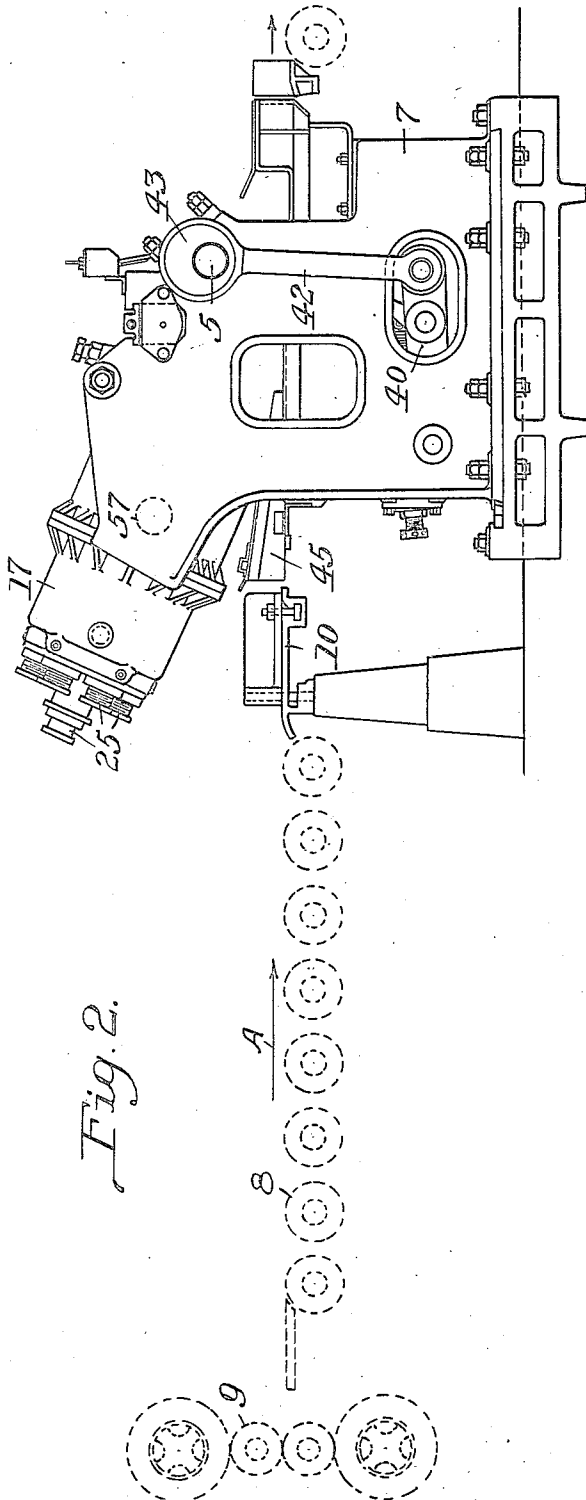
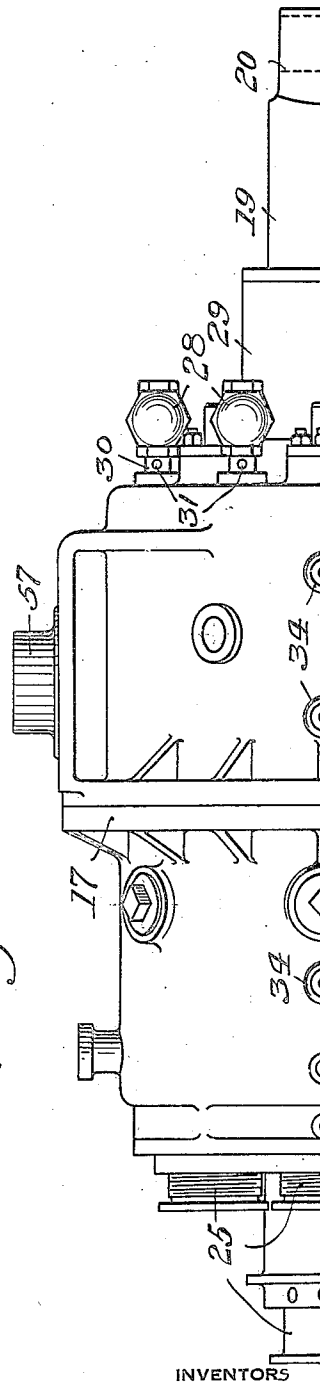


*Fig. 3.*



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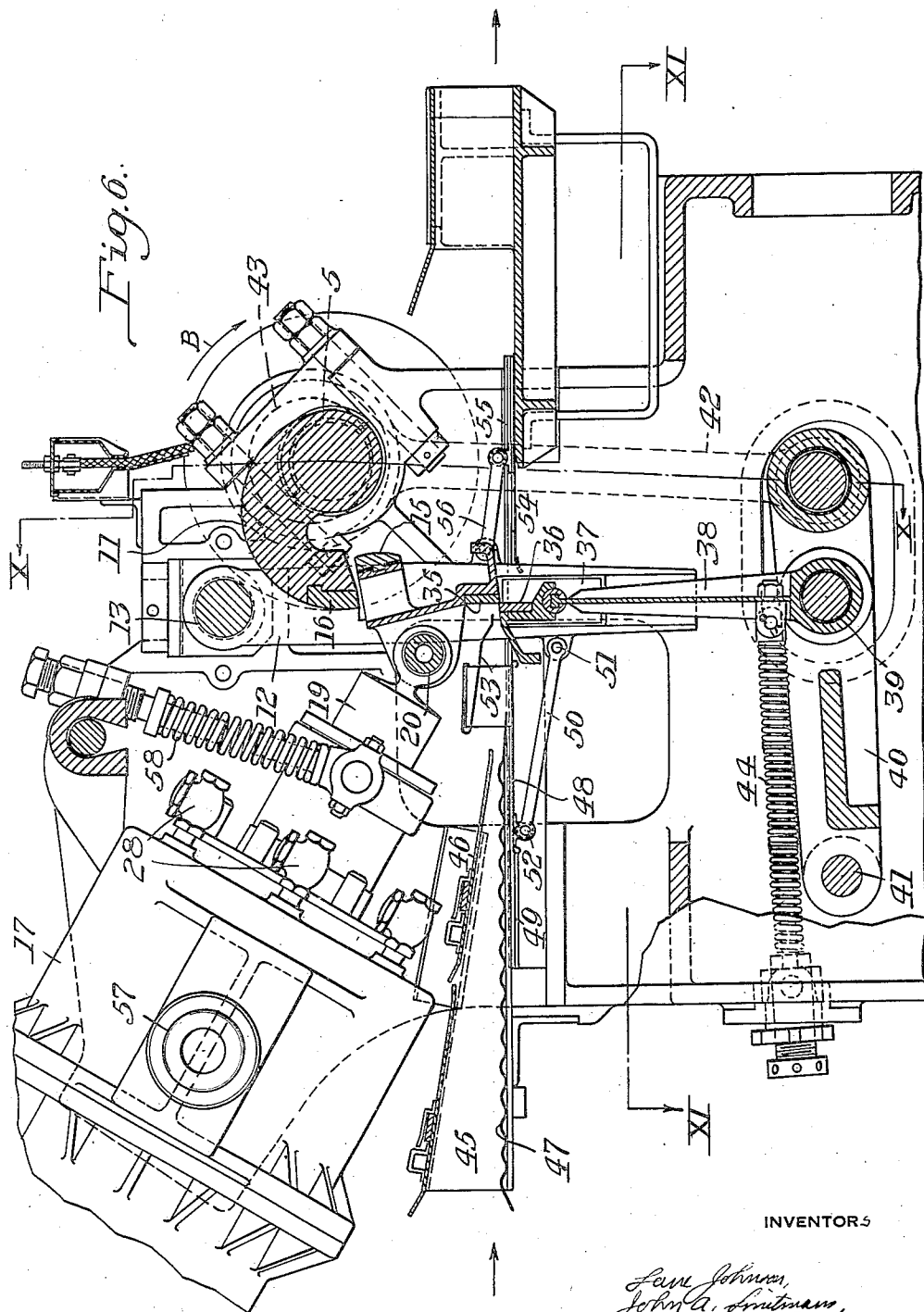
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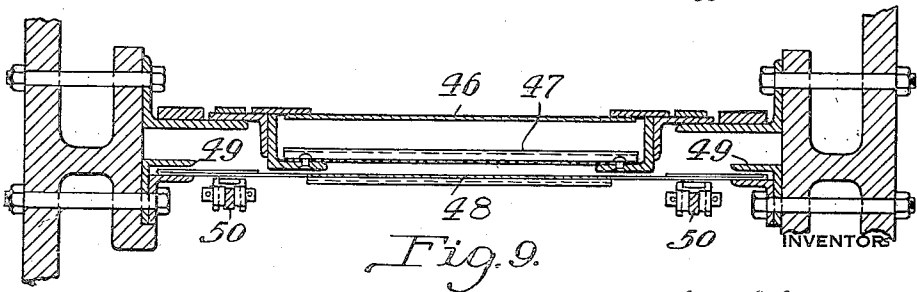
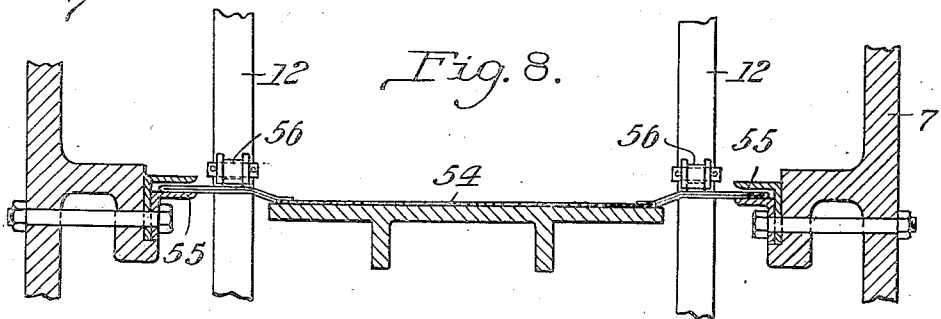
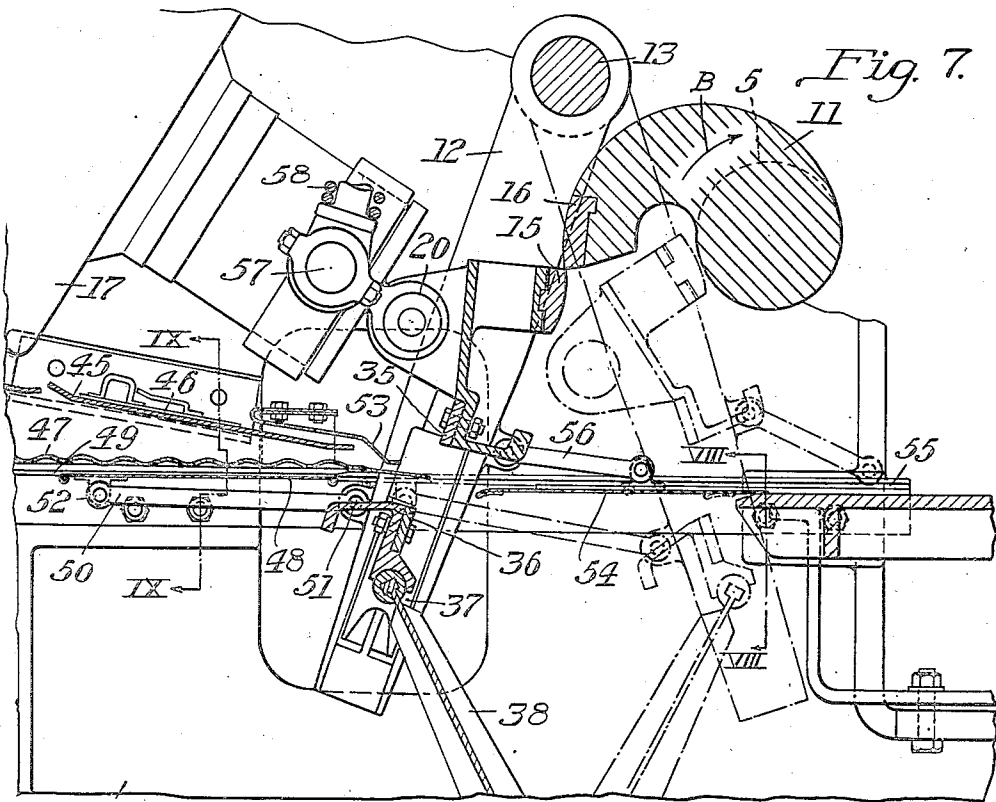
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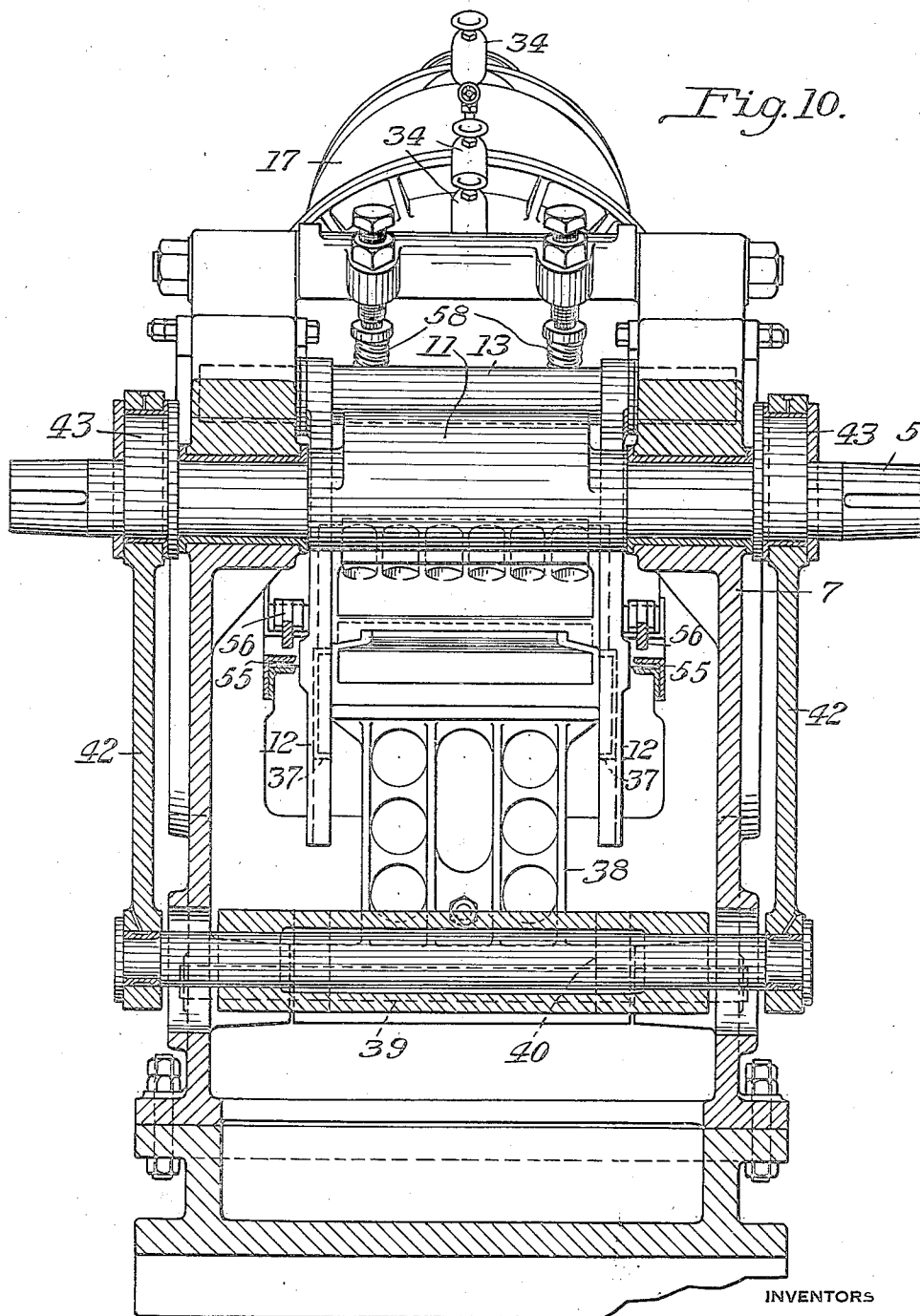
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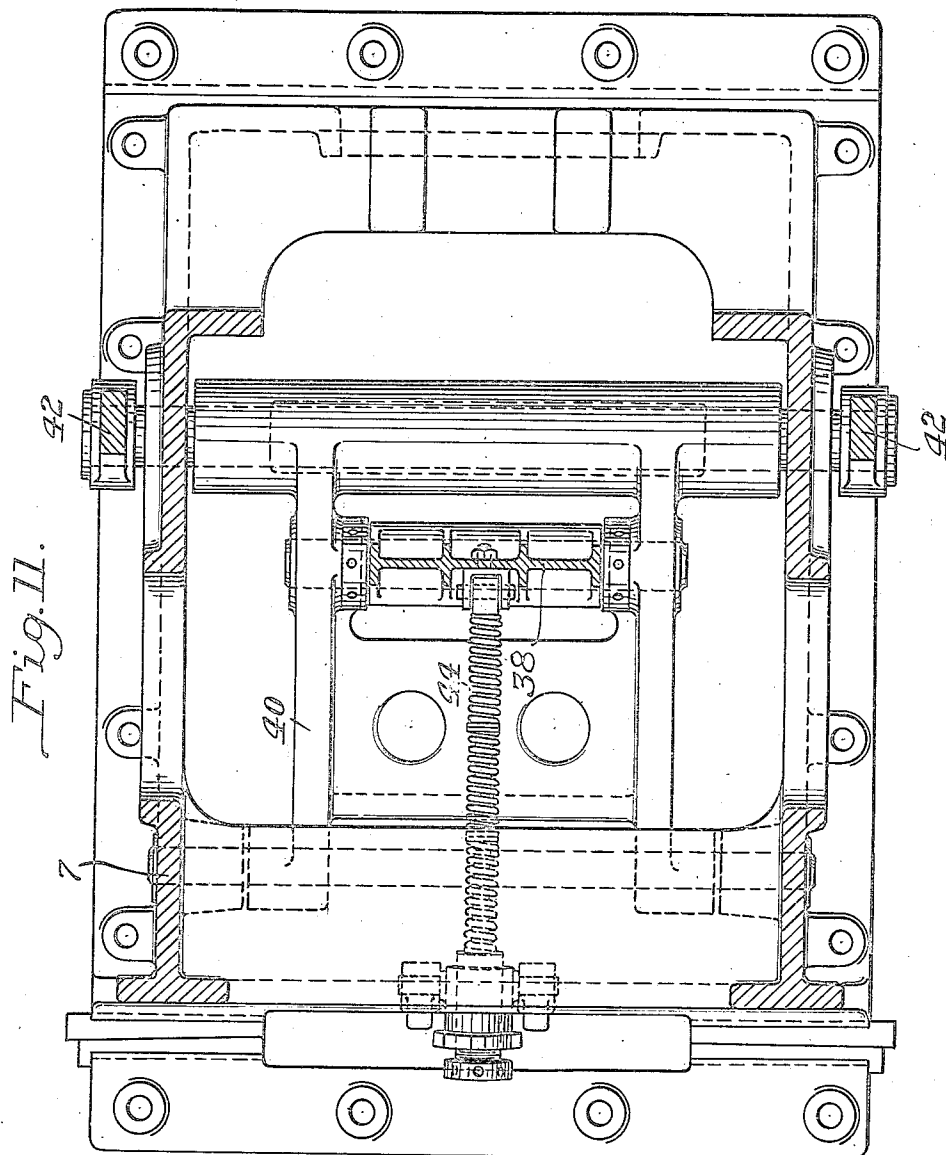
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7 Sheets-Sheet 7



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## UNITED STATES PATENT OFFICE

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## SHEAR

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The present invention relates broadly to the art of cutting traveling material, and more particularly to so-called flying shears for the cutting into predetermined lengths of strips, rods, bars and the like while traveling at a relatively high speed. Such material will hereinafter be referred to as "strips," it being understood that the term is used as a word of definition including any material having such a length compared to the width that it is adapted to be cut into a succession of shorter pieces.

In view of the gradual increase in the delivery speeds of strips, it has been necessary to provide shears effective during a much shorter period of time than those heretofore utilized. With intermittently operating shears, the problem of acceleration and deceleration has required special attention and has, in many cases, limited the speed of operation of the shears. With continuously operating shears, it has been difficult to properly time the speed of the shears with relation to the speed of travel of the material so as to enable the shearing of successive lengths of varying sizes as desired.

In accordance with the present invention there is provided a shear which may be either continuously or intermittently operated in such manner as to shear successive pieces of the desired length from a traveling strip, and in which special provision is made with respect to acceleration and deceleration of the moving parts.

In the accompanying drawings we have shown for purposes of illustration only, a preferred embodiment of the present invention.

In the drawings:—

Figure 1 is a top plan view of a shear constructed in accordance with our invention;

Figure 2 is a side elevation of the construction illustrated in Figure 1;

Figure 3 is a partial elevational view on an enlarged scale, of a portion of the shear operating mechanism;

Figure 4 is a longitudinal sectional view through an operating mechanism, as shown in Figure 3;

Figure 5 is a partial sectional view through a portion of the mechanism shown in Figure 4;

Figure 6 is a vertical longitudinal sectional view through the shear of Figure 1, certain of the parts being shown in elevation and the shear blades being shown in shearing relationship;

Figure 7 is a partial sectional view, similar to that of Figure 6, but on a slightly enlarged scale, and showing the blades in position for the reception of metal therebetween preparatory to a shearing operation.

Figure 8 is a detail sectional view, on an enlarged scale, on the line VIII—VIII of Figure 7, looking in the direction of the arrows;

Figure 9 is a detail sectional view, on an enlarged scale, on the line IX—IX of Figure 7, looking in the direction of the arrows;

Figure 10 is a vertical sectional view along the line X—X of Figure 6, looking in the direction of the arrows; and

Figure 11 is a horizontal sectional view along the line XI—XI of Figure 6, looking in the direction of the arrows.

In carrying out the present invention, there may be provided a suitable motor 2 with which cooperates a brake 3 preferably of the electro-magnetic type. The motor is effective through a suitable gear reduction enclosed within a housing 4 for driving the main shear shaft 5. Secured to the shear shaft, or to any other desired part of the driving mechanism, may be a limit switch 6 adapted to be used in known manner as, for example, breaking the circuit of the motor 2 and effecting application of the brake 3.

The main shear housing 7 is illustrated in Figures 1 and 2 as being located to cooperate with a roll table 8 constituting part of the delivery mechanism of the last stand of rolls 9 of a mill of any desired type herein illustrated as of four-high construction. The strip delivered by the mill travels over the roll table 8 in the direction indicated by the arrow A of Figures 1 and 2, onto a suitable guide plate 10 supported at the entering side of the shear housing.

Suitably mounted within the housing, and

extending transversely of the upper portion thereof, is a cam 11, adapted to be rotated in the direction indicated by the arrow B upon operation of the drive shaft 5. The cam 11 constitutes means for effecting movement of a shear carrier in one direction.

The shear carrier preferably comprises a swinging frame 12 carried by a pivotal mounting 13 in the upper portion of the shear housing and movable from the full line position of Figure 7 through the full line position of Figure 6 into the broken line position of Figure 7 during each shearing operation. In Figure 7 the carrier is illustrated in full lines in the position to which it is moved by the cam 11 and in which it is ready for the commencement of a shearing operation. Such movement is conveniently obtained by a wiper plate or shoe 15 on the swinging frame 12 and adapted to cooperate with the periphery of the cam 11, the high point of the cam preferably being provided with a hardened insert 16 for cooperation with the shoe 15.

Mounted in the shear housing on the side of the frame 12 opposite the cam 11 is a second actuating mechanism illustrated in detail in Figures 3, 4, and 5. This mechanism is shown as comprising a cylinder 17 within which travels a piston 18 carrying a piston rod 19. This piston rod has a pivotal connection 20 at its outer end with the shear frame 12.

Within and extending lengthwise of the cylinder 17 is a series of rods 21, herein illustrated as being circumferentially arranged with respect to the cylinder and as extending through the piston 18. Cooperating with each of the rods 21 is a spring 22 loosely surrounding the same and adapted to abut at one end against a suitable plate 23 carried by the piston and at the opposite end against a shoulder 24 on the rod. For purposes of varying the relative positions of the shoulders 24, the rods may have a threaded mounting 25 in the cylinder to permit them to be adjusted with respect thereto or to be easily inserted or removed.

The springs 22 are preferably of such length with respect to the length of the cylinder and the stroke of the piston 18 as to be freely movable along the rods 21 when the piston is in its extreme outer position.

Cooperating with the spring assemblies just referred to is a second assembly comprising a rod 26, herein illustrated as being centrally located, but of a construction generally similar to that of the rods 21. Surrounding the rod 26 is a spring 27 preferably of greater length than the springs 22 so as to exert some influence on the piston 18 throughout its complete travel. This spring is also of preferably lighter construction than that of the springs 22, so as

to exert a relatively smaller influence on the piston and at the same time present a relatively smaller resistance to the return movement of the piston.

Carried by the cylinder 17 is a suitable number of valves 28 effective for controlling the air pressure conditions between the piston 18 and the head 29. Each of the valves, where more than one is employed, preferably comprises a connection 30 to the interior of the cylinders which connection is formed with a calibrated opening 31, offering a definite resistance to the flow of air therethrough and thereby a definite cushion action to the movement of the piston toward the head 29. During movements of the piston in the opposite direction, air is permitted to pass not only through the openings 31 in the opposite direction to that just described, but also through the intake 32 of each of the valves, such flow being permitted by the ball checks 33. By reason of this construction it will be apparent that the piston 18 has a relatively greater freedom of movement from its position of Figure 4 to its position of Figure 5 than it has in the reverse direction.

The cylinder 17 may also be provided with suitable lubricating devices 34 for maintaining the desired conditions therein with respect to lubrication of the working parts.

With the shear carrier 12 in the full line position of Figure 7, the piston 18 is in the position illustrated in Figure 5. Upon rotation of the cam 11 in the direction of the arrow B so that the cam passes out of engagement with the shoe 15, the springs 22 and 27, which are illustrated in Figure 5 as under compression and acting upon the piston 18, will effectively initiate movement of the piston 18 to the right, as viewed in Figure 5, and will effectively accelerate the speed of travel thereof.

In this manner, the shear frame 12 is almost instantaneously brought from the full line position of Figure 7 to the shearing position of Figure 6. At this time the upper shear blade 35 carried by the shear frame 12 is in shearing relationship with the lower shear blade 36, carried by a slide 37 movable lengthwise of the shear frame, so that any material intermediate the shear blades is almost instantaneously severed.

Either slightly before, at, or slightly after the parts assume the position of Figure 6, the springs 22 cease to exert any further influence on the piston 18, they having then served their function of the desired acceleration so that at the time of shearing the blades have a speed of travel of the desired order with respect to the speed of travel of the material being sheared.

The spring 27, however, continues to act in conjunction with the inertia of the parts

and in opposition to the gradually accumulating air pressure between the piston 18 and the head 29. The size of the openings 31 is such that the desired deceleration of movement of the piston 18 and its associated parts, including the carrier 12, is effected.

Upon the conclusion of movement of the piston 18, the carrier 12 is in the broken line position of Figure 7, the shoe 15 at this time being in such position as to be engaged by substantially the low portion of the cam 11 upon rotation thereof.

In order to provide proper clearance between the blades 35 and 36 during the return movement thereof, it is desirable to effect a bodily separation of the blades at or about the time of commencement of the return stroke. Such an operation may conveniently be accomplished by the provision of a pitman 38 controlling the movement of the slide 37 and having a pivotal connection 39 to a carrying lever 40. This carrying lever in turn has a pivotal mounting 41 in the shear housing, adjacent one end, and adjacent its opposite end it cooperates through a link 42 pivotally connected thereto at one end, with the eccentric 43 on the driving shaft 5. As clearly illustrated in Figure 10, there is preferably an eccentric on each side of the shear housing, each of which cooperates with a similar link 42, whereby the lever 40, as illustrated in detail in Figure 11, may be of bifurcated construction having the pitman 38 mounted therebetween.

The relationship of the eccentrics 43 with respect to the cam 11 is such that the lever 40 is moved bodily downward at the desired time with respect to the commencement of the return movement of the parts, thereby insuring sufficient separation of the shear blades to permit the return movement thereof without interference with the material being sheared.

A suitable spring or series of springs 44 may be provided for cooperation with the pitman 38 for assisting in acceleration of the parts and for more effectively urging the blades into shearing relationship.

At the commencement of the return movement of the parts, after a shearing operation, it is merely necessary for the cam 11 to overcome the opposition exerted by the spring 27. Thereafter, as acceleration occurs, the springs 22 are picked up and compressed preparatory to a succeeding shearing operation. It will thus be apparent that not only is the spring construction such that it effectively cooperates with the moving parts during the decelerating period, but that it also permits and insures proper acceleration both during the return movement and during the shearing movement of such parts.

For insuring proper movement of the material into position between the shear blades,

we have illustrated a guide 45, in Figures 6 and 7, which guide preferably comprises a downwardly inclined upper deflecting plate 46, and a corrugated supporting or base plate 47. Adjacent the entering side of the shear blades is a slide 48 comprising a supporting plate mounted in the path of travel of the strip to be sheared and supported at its opposite edges in guide ways 49, illustrated in detail in Figure 9. This supporting plate is moved in synchronism with the movement of the shear carrier 12 by the provision of links 50 secured at one end through pivotal connections 51 with the shear carrier, and at their opposite ends through similar connections 52 with the supporting plate.

Mounted on the plate, as illustrated diagrammatically in Figure 6, and in detail in Figure 7, is a deflecting guide 53 which thus always maintains a predetermined relationship with the shear carrier, and insures proper movement of a strip into position between the blades.

On the discharge side of the shear is a similar mechanism including a supporting plate 54, guided at its side edges in suitable slideways 55 and operated through links 56, similar to the links 50.

These supporting plates are always effective on both the leading and trailing edges of material at all times so as to prevent any movement thereof in such manner as to interfere with the proper shearing operation.

In order to permit the necessary swinging movement of the cylinder 17 as required by the oscillation of the carrier 12, the cylinder may be formed with trunnions 57, suitably supported in the shear housing, and may be counterbalanced and held against undue movement by suitable springs 58, as indicated more particularly in Figure 6 of the drawings.

From the foregoing it will be apparent that we have provided a flying shear including a blade carrier adapted to be oscillated in one direction and at one speed by one means, and in the other direction and at another speed by other means. The means effective for moving the carrier into shearing position is such as to insure an almost instantaneous movement thereof under such conditions as to provide for proper deceleration after the shearing operation and to permit proper acceleration during the return movement of the parts preparatory to a succeeding shearing operation without any undue shock or load on the machine or its driving connections.

There is also provided a shear which may be continuously or intermittently operated at will, and which at the time of shearing has such a speed as not to interfere with the proper travel of the material being sheared. By mounting one of the blades in such

manner that it may be bodily moved with respect to the other blade, any desired clearance between the blades for the return movement thereof may be obtained.

5 The provision of movable guide means cooperating with the movable blade carrier also insures an adequate support and guide for the material at all times, both before, during, and after a shearing operation.

10 While we have herein illustrated the preferred embodiment of our invention, it will be apparent to those skilled in the art that nothing herein shall be construed as limiting the construction or manner of operation of the parts within the support of the invention and scope of the broader claims here-  
15 to appended.

We claim:—

1. In a flying shear, a blade carrier, power  
20 means for moving said carrier in a direction opposite to the direction of feed, a piston having a piston rod pivotally connected to said carrier, and spring means cooperating with said piston for moving the carrier in  
25 the direction of the feed.

2. In a flying shear, a blade carrier, power means for moving said carrier in a direction opposite to the direction of feed, a piston having a piston rod pivotally connected to  
30 said carrier, and spring means cooperating with said piston for moving the carrier in the direction of the feed, said spring means comprising springs effective throughout different time intervals.

3. Accelerating means for flying shears provided with cooperating cutting blades, comprising a cylinder, a piston therein oper-  
35 ably connected to the blades, means for variably controlling the speed of travel of said piston in opposite directions, and a spring  
40 assembly cooperating with said piston, said spring assembly comprising a plurality of springs arranged to effect the movement of the piston in the direction of the feed and  
45 effective at different points in the movement of the piston.

4. Accelerating means for flying shears, comprising a cylinder, a piston therein oper-  
50 ably connected to the blades, means for variably controlling the speed of travel of said piston in opposite directions, and a spring assembly cooperating with said piston and  
arranged to effect the movement of the piston in the direction of the feed.

5. Accelerating means for flying shears, comprising a blade carrier, means pivotally  
55 connected thereto for moving the carrier in the direction of feed, a spring effective throughout the entire movement in such direction, and another spring effective  
60 throughout a portion only of such movement.

6. Accelerating means for flying shears, comprising a blade carrier, means pivotally  
65 connected thereto for moving the carrier in

the direction of feed, a spring effective throughout the entire movement in such direction, another spring effective throughout a portion only of such movement, and means  
70 cooperating with said springs for exerting a predetermined cushioning action thereon.

7. In a flying shear, a blade carrier, motive means for oscillating said blade carrier in one direction, other motive means for oscillating said blade carrier in the opposite di-  
75 rection, both motive means being on the same side of the shearing plane, one of said motive means comprising an assembly of spring means effective for swinging said blade carrier in the general direction of  
80 travel of the material through the shear and shearing blades carried by said carrier.

8. In a flying shear, a blade carrier, motive means for oscillating said blade carrier in one direction, other motive means for oscillating said blade carrier in the opposite  
85 direction, both motive means being on the same side of the shearing plane, one of said motive means comprising an assembly of spring means effective for swinging said blade carrier in the general direction of  
90 travel of the material through the shear and shearing blades carried by said carrier, one of said blades being fixedly attached to the carrier, and the other movable in the carrier and relatively thereto.  
95

9. In a flying shear, a blade carrier, positively driven means for oscillating said carrier in a direction opposite to the direction  
100 of feed, other means for oscillating said carrier in the direction of the feed when completely disengaged of the positive driving mechanism, and shearing blades carried by said carrier.

10. In a flying shear, a blade carrier, positively driven means for oscillating said carrier in a direction opposite to the direction  
105 of feed, spring means for oscillating said carrier in the direction of the feed when completely disengaged of the positive driving mechanism, and shearing blades carried by said carrier.  
110

11. In a flying shear, a blade carrier, positively driven means for oscillating the said carrier in a direction opposite to the direc-  
115 tion of feed, other means for oscillating said carrier in the direction of the feed when completely disengaged from the positive driving mechanism, and shearing blades carried by said carrier, one of said blades being  
120 fixedly attached to the carrier, and the other movable in the carrier and relatively thereto.

12. In a flying shear, a blade carrier, positively driven means for oscillating the said carrier in a direction opposite to the direc-  
125 tion of feed, spring means for oscillating said carrier in the direction of the feed when completely disengaged from the positive driving mechanism, and shearing blades carried by said carrier, one of said blades  
130

being fixedly attached to the carrier, and the other movable in the carrier and relatively thereto.

13. In a flying shear, a blade carrier, a cam for oscillating said carrier in a direction opposite to the direction of feed, a spring assembly including a plurality of springs of different characteristics for oscillating said carrier in the direction of the feed, both oscillating means being on the same side of the shearing plane, and shearing blades carried by said carrier.

14. In a flying shear, a blade carrier, a cam for oscillating said carrier in a direction opposite to the direction of feed, a spring assembly for oscillating said carrier in the direction of the feed when disengaged from the cam, and shearing blades carried by said carrier.

15. In a flying shear, a frame, means operatively cooperating with said frame for swinging the same in the direction of feed, a shear blade carried by the aforesaid frame, and fixedly attached thereto, a second blade mounted for sliding movement relatively to said fixed blade, a pitman operatively connected to said relatively movable blade, a lever carrying said pitman, a fixed mounting for said lever, and means for rocking said lever for controlling the relative movement of the last-mentioned blade.

16. In a flying shear, a frame, means operatively cooperating with said frame for swinging the same in the direction of feed, a shear blade carried by the aforesaid frame, and fixedly attached thereto, a second blade mounted for sliding movement relatively to said fixed blade, a pitman operatively connected to said relatively movable blade, a lever carrying said pitman, a fixed mounting for said lever, and positively driven means for rocking said lever for controlling the relative movement of the last-mentioned blade.

17. A flying shear, comprising a pivotally mounted cutter frame provided with a blade, an oscillating arm provided with a blade slidably mounted in said frame, means for oscillating said frame to cause both blades to move in the general direction of travel of material through the shear, and means independent of the oscillation of said frame for reciprocating one of the blade carriers transversely of said line of travel to separate the blades on their return strokes.

18. A flying shear, comprising a pivotally mounted cutter frame provided with a blade, an oscillating arm provided with a blade slidably mounted in said frame, means for oscillating said frame to cause both blades to move in the general direction of travel of material through the shear, and means independent of the oscillation of said frame for reciprocating said arm transversely of

said line of travel to separate the blades on their return stroke.

19. A flying shear comprising a pivotally mounted cutter frame, a blade mounted on said frame, a second blade mounted on a support separate from and arranged to be actuated separately of said cutter frame and first blade and to be guided into cooperative relation with the latter by the cutter frame, means for oscillating said frame and blades in the line of travel of material through the shear, and means for reciprocating one of said blades transversely of said line of travel.

20. In a flying shear, a frame with a blade mounted therein, means operatively cooperating with said frame for swinging the same in the general direction of travel of the material through the shear, a second shear blade adapted to come into shearing relation with said first mentioned blade, a pitman operatively connected to said second blade, a lever carrying said pitman pivotally mounted separate from said frame to cause the pivotal point of said lever and pitman to approach and recede from the path of travel of material passing through said shear.

21. In a flying shear, a frame carrying a blade, means operatively cooperating with said frame for swinging the same in the general direction of travel of the material through the shear, a second shear blade adapted to come into shearing relation with said first blade at a certain point in the path followed by each blade, a pitman operatively connected to said blade, a lever carrying said pitman, a pivotal support for said lever separate from said frame, and means for rocking said lever for controlling the movement of said second blade.

In testimony whereof we have hereunto set our hands.

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