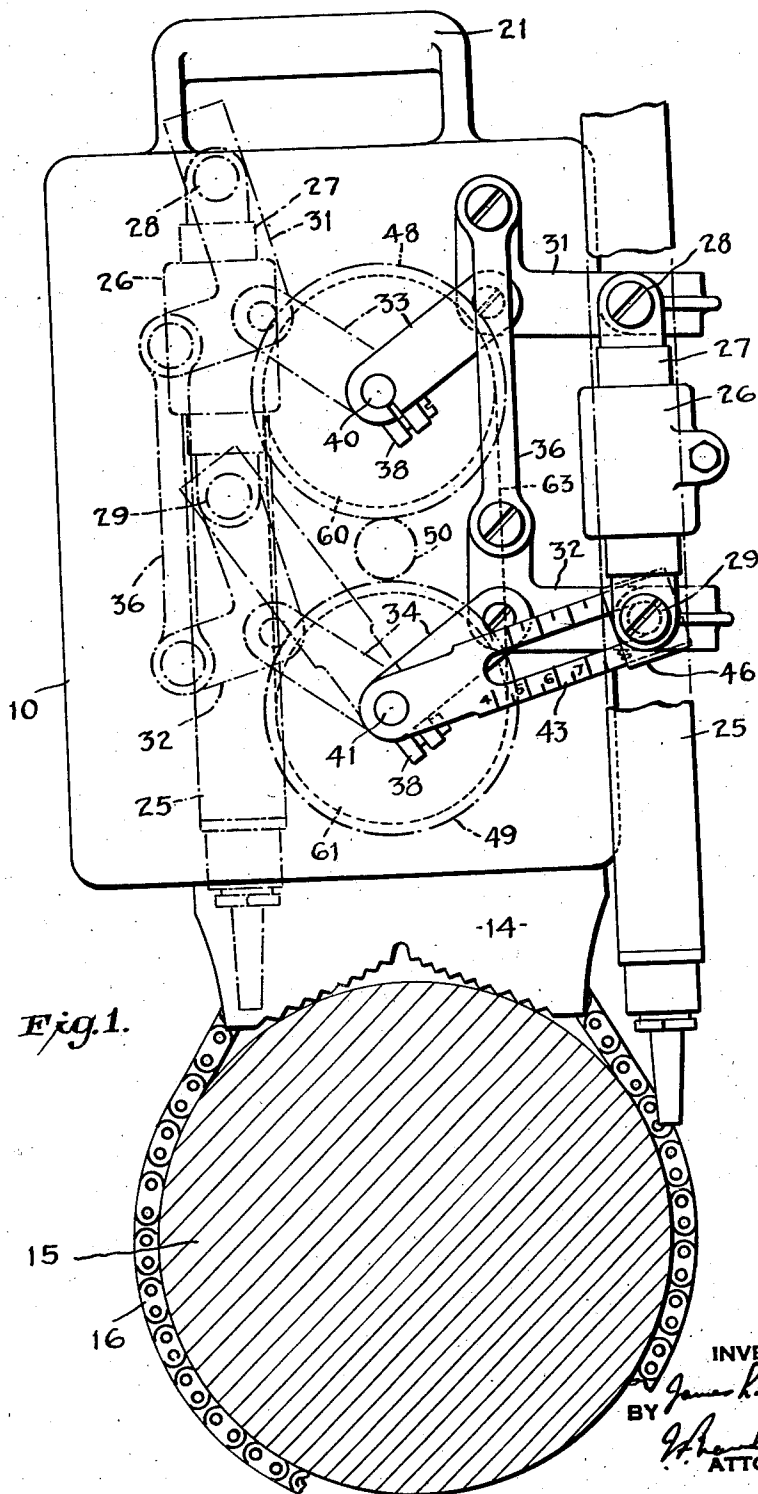


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J. L. ANDERSON
MACHINE FOR CUTTING BARS
Filed May 17, 1935

2,054,847

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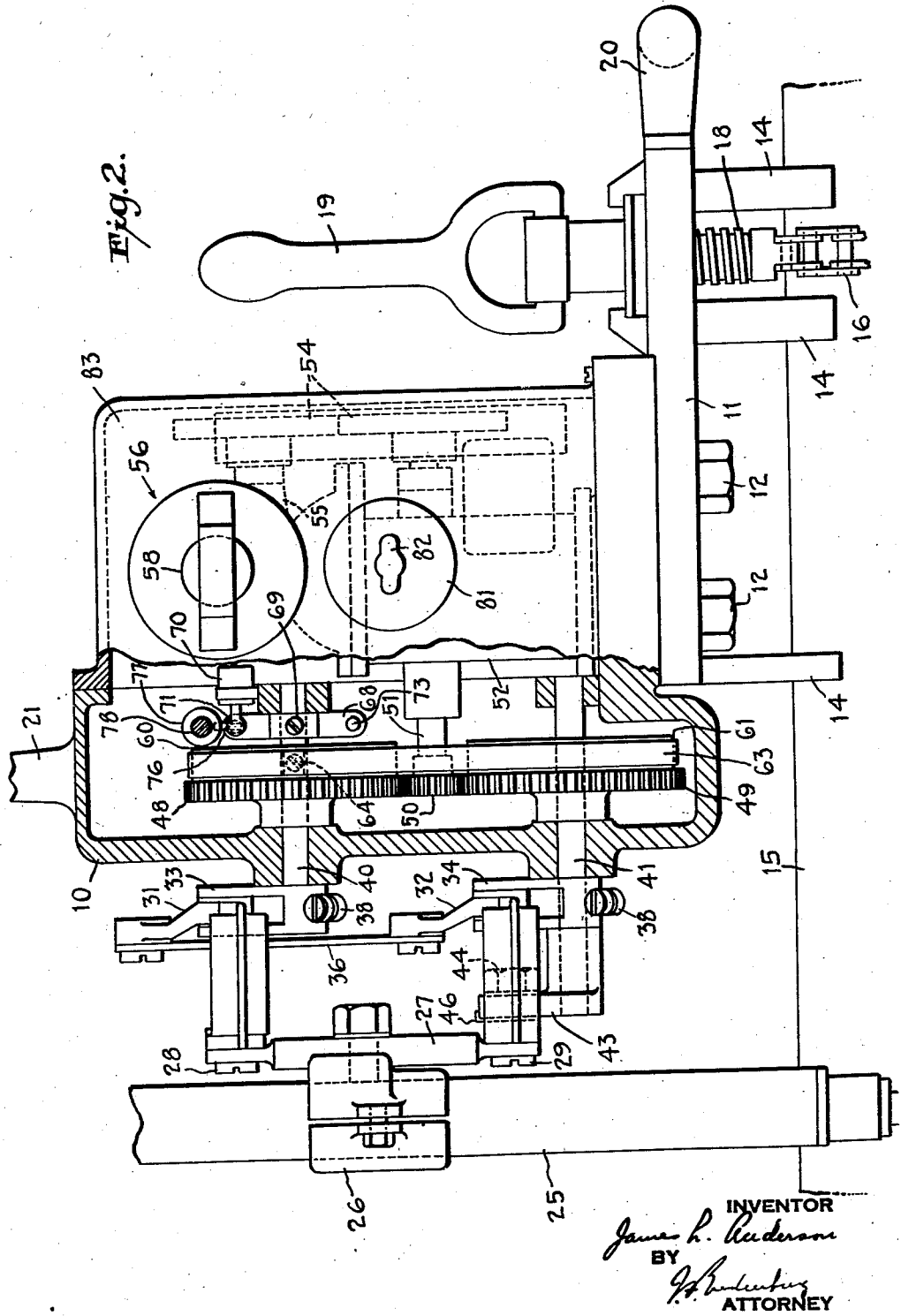


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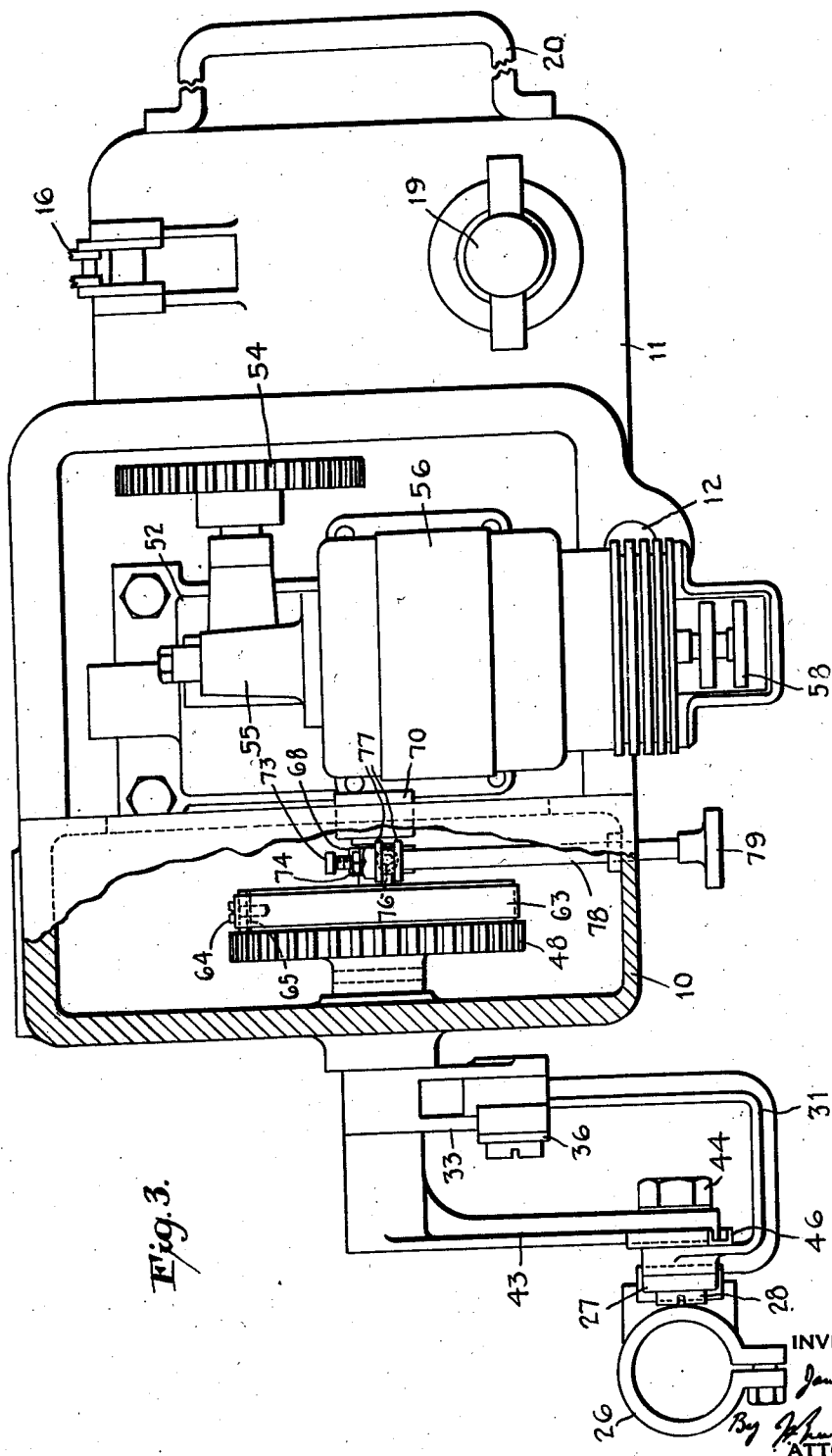
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Filed May 17, 1935

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J. L. ANDERSON
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Fig. 4.

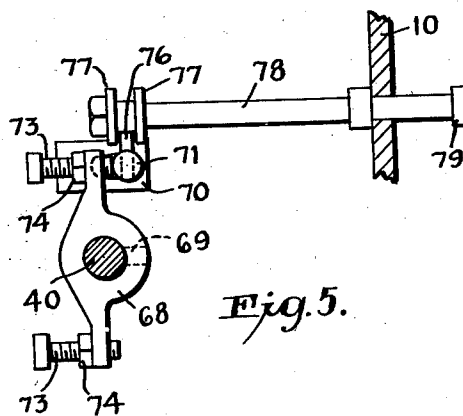
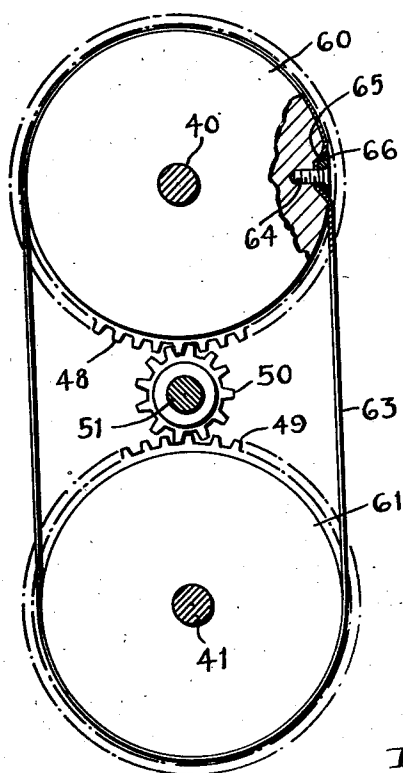
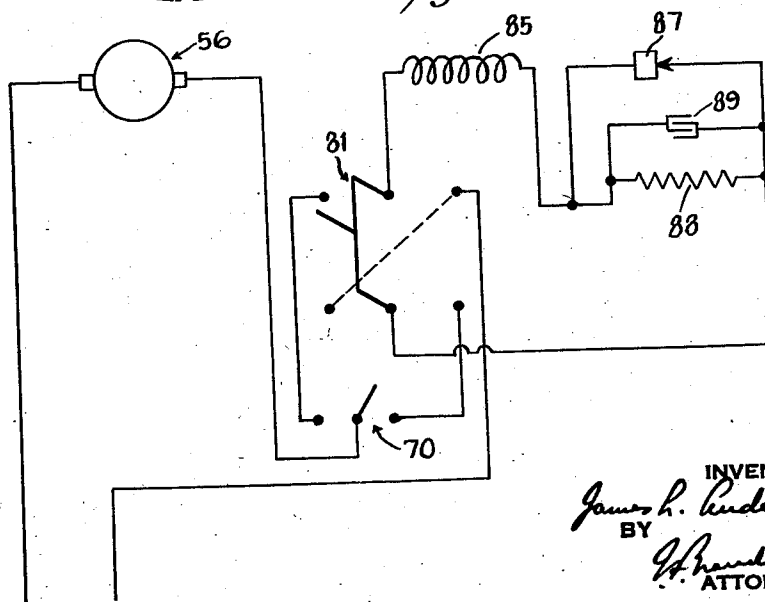


Fig. 5.

Fig. 6.



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MACHINE FOR CUTTING BARS

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14 Claims. (Cl. 266—23)

This invention relates to machines for cutting round bars or the like by means of a gas cutting torch.

Certain features of the invention relate to cutting machines of the type in which parallel crank arms support the torch and cause it to move parallel to itself while the tip follows an arc, the center of which lies on or close to the axis of the bar. I have found that it is important, in such machines, in which the arms pass through positions of dead center to prevent even small departures of either arm from its parallel relation with the other arm, and it is an object of this invention to provide an improved cutting machine of the character indicated with means for preventing lost motion between the parallel arms, and for preventing toggle forces on the bearings.

When certain links of the torch-supporting structure come into toggle relation they may cause excessive loads on some pivots of the linkage with resulting wear and lost motion. According to one feature of this invention power is applied to both of the shafts to which the parallel crank arms are connected, so that each arm is moved by the torque of its connected shaft instead of being moved by the other arm through a connecting link which has variable mechanical advantage that may approach infinity in toggle positions of the parts.

The invention includes novel motion transmitting connections between the shafts with means for preventing lost motion in the connections. The preferred embodiment of the invention includes an electric motor for operating the machine, but reference to "power operated means" in the description and claims relates to mechanism operated by hand power as well as motor power unless expressly limited to the latter.

Other features of the invention relate to motor-operated bar cutting machines. The invention includes a combination of automatic and manual control switches for stopping the torch-supporting means at the end of a given arc of movement, and for shifting the motor circuits to cause the motor to move the torch-supporting means in a reverse direction when the motor is next started. A motor governor on the high speed side of reduction gearing maintains the speed of the torch uniform. It may be said that another object of the invention is to provide an electric motor-operated, bar cutting machine with improved control means which make the machine more satisfactory in operation and more convenient to use.

Another object of the invention is to provide a bar cutting machine of the type having parallel crank arms for moving the torch with improved torch-supporting means which can be set for cutting bars of different radius without disconnecting any of the pivots of the supporting linkage.

Other objects, features and advantages of the

invention will appear or be pointed out as the specification proceeds.

In the accompanying drawings, forming part hereof:

Fig. 1 is an end view of a cutting machine embodying the invention;

Fig. 2 is a side elevation, partly broken away and partly in section, of the machine shown in Fig. 1;

Fig. 3 is a top plan view, partly in section, showing the machine of Figs. 1 and 2;

Fig. 4 is a detail sectional view showing a part of the driving mechanism of the machine illustrated in the preceding views;

Fig. 5 is an enlarged detail view of the automatic switch-operating mechanism; and

Fig. 6 is a wiring diagram showing circuits and control switches of the machine.

A main frame 10 is fastened to a base 11 (Fig. 2) by screws 12. Supports 14 extend downward from 20 the base for contact with the surface of a bar 15. The faces of the supports 14 in contact with the bar are toothed, as shown in Fig. 1, and sloped like the jaws of a pipe vise for holding the base in set position on round bars of different diameter. A chain 16 holds the machine firmly against the bar 15. Both ends of the chain 16 are fastened to the base, one end through a swivel connection with a screw 18 (Fig. 2) which can be turned by a handle 19 to tighten the chain against the bar. The main frame 10 and base 11 have handles 20 and 21 for use when moving the machine to a new location.

A torch 25 is clamped in a torch holder 26 having a link 27 pivotally connected by screws 28 and 29 to upper and lower bell-cranks 31 and 32, respectively. The bell-cranks 31 and 32 are pivotally connected at their angles to upper and lower crank arms 33 and 34, respectively, and the short arms of the bell-cranks are joined by a link 36. Split clamps 38 at the ends of the crank arms 33 and 34 fasten these arms securely to the shafts 40 and 41, respectively. The arms 33 and 34 pass through their dead center positions when they cross a line passing through the axes of the shafts 40 and 41. Unless both of the arms 33, 34 reach dead center at the same time, the connecting link 36 will be compressed or tensioned, depending upon which of the arms is ahead of the other, with force of toggle magnitude, with the result that the bearings of the shafts 40 and 41 will be subjected to excessive loads and the other parts of the structure strained and possibly broken.

The positions of the bell-cranks 31 and 32 with respect to the crank-arms 33 and 34 are fixed by a slotted link 43 which is pinned to the shaft 41 and is connected to the bell-crank 32 by a nut 44 (Fig. 2) threaded on the end of the screw 29.

The arms and links described cause the torch 25 to move parallel to itself, so that it always re-

mains in a vertical position, while the torch tip moves along an arc having a radius equal to the distance between the axes of the screw 29 and shaft 41. This distance can be changed by moving the screw 29 to different locations in the slot of the link 43. The screw 29 extends through a rider 46 which slides on the link 43. A scale on the link 43 indicates the radius of bar which the machine is set to cut when the edge of the rider 46 registers with the various divisions on the scale.

The torch and its supporting structure are shown in position to start a cut by full lines in Fig. 1. The positions of the parts toward the end of the cut are shown in dotted lines.

The shafts 40 and 41 turn in bearings in the main frame 10. Gears 48 and 49 are fastened to the shafts 40 and 41 and are driven in the same direction by a pinion 50 located between them. The pinion 50 is on a shaft 51 of a reduction gearing 52. The high speed shaft of the reduction gearing 52 is driven through gears 54 and another reduction unit 55 (Fig. 3) from a motor 56. This motor is of the governor-controlled type and has a knob 58 accessible from the outside of the machine for controlling the speed of the motor and the consequent speed of the torch.

Referring again to Fig. 2, there are drums 60 and 61 extending from the sides of the gears 48 and 49, respectively. A metal ribbon 63 passes around the drums and is connected with the upper drum by a screw 64, shown in Fig. 4. There is a groove 65 in the drum and the screw 64 extends through a block 66 and the ribbon 63 and threads into a hole in the bottom of the groove. The block 66 fits the groove 65 and depresses the ribbon 63 into the groove to shorten the length of the ribbon and maintain it taut.

Turning the screw 64 to tighten the ribbon 63 tends to rotate the drums 60 and 61 and their connected gears 48 and 49 in opposite directions and causes teeth of these gears to contact with different sides of teeth on the driving pinion 50. For example, if the gear 48 is considered as in contact with the front of a tooth of pinion 50, then the gear 49 is in contact with the back face of a tooth of the pinion. There is, therefore, no lost motion in the gearing no matter how freely the gear teeth of the pinion may fit those on the gears.

Referring to Figs. 2 and 5, a switch trip 68 is secured on the shaft 40 by a set screw 69. This switch trip operates a double-throw snap-switch 70 which is fixed within the frame of the machine and has an operating lever 71 with a ball end in the path of the switch trip 68.

The construction of the switch trip 68 is best shown in Fig. 5. The arms of the switch trip extend from opposite sides of its hub, but the angular limits through which the trip turns before operating the switch can be controlled by screws 73. These screws thread through the arms of the switch trip in position to contact with the ball end of the lever 71, and the screws are held in any set position by lock nuts 74.

A pin 76 extends upward from the ball end of the lever 71, and between collars 77 on a rod 78 which extends through frame 10. There is a knob 79 on the outer end of the rod 78 for sliding the rod axially when an attendant wants to operate the switch 70 manually.

A snap switch 81 (Fig. 2) has a handle 82 outside of a cover 83 which encloses the motor, reduction gear units, and other structure not enclosed by the main frame 10.

Fig. 6 is a wiring diagram for the machine. The

switches 70 and 81 are represented diagrammatically as pole switches in order to make the diagram clearer and more easily understood. The switch 70 is the equivalent of a single pole, double-throw switch, and the switch 81 is the equivalent of a double pole, double-throw switch. Both are snap switches and remain closed one way or the other. They never stop in open positions such as shown in Fig. 6, but they are shown open in order to illustrate the contacts and circuit relations more clearly.

The switches 70 and 81 are connected in series between the armature of the motor 56 and the field coil 85 of the motor. The switch 81 is connected in the circuit as a reversing switch. When the switches are in positions to close the circuit through the motor, operation of either switch will cut off the power and stop the motor. The motor can be started again by operating either switch, and it will rotate in the same direction as it was turning before it stopped, if started by operating the switch used to stop it, but the rotation will be in a reverse direction if started by the other switch.

The motor governor 87 is connected in parallel with a resistor 88 which by-passes a portion of the current around the governor. The usual condenser 89 is connected across the governor to reduce arcing.

In the operation of the machine the attendant ordinarily uses the switch 81 and lets the switch 70 operate automatically as a limit switch to stop the machine at the end of a cut. Since the motor circuit is opened by the switch 70, the operation of the switch 81 by the attendant to start the machine causes the mechanism to move in opposite directions for alternate cuts. This is a convenience and effects considerable saving of time. After completing a cut through a bar, it is not necessary to set the machine back to its starting position because the torch is in position to start another cut in a reverse direction.

Various changes and modifications can be made in the illustrated embodiment of the invention, and some features can be used alone without departing from the invention as defined in the claims.

I claim:

1. In a machine for cutting round bars and the like, a torch-holder, a supporting arm rotatable about a fixed axis, a link having pivot connections with the free end of said arm and with the torch-holder, releasable means for preventing pivotal movement of the connections between the supporting arm and link when said arm and link are set at various angles to one another to control the distance of the torch-holder from the center of rotation of said arm, and means for causing the torch-holder to move parallel to itself during the operation of the machine.

2. In a cutting machine having parallel crank arms for supporting a torch and for causing it to move parallel to itself through an arc of predetermined radius, links comprising a folding parallelogram, pivot connections between two of the links of the folding parallelogram and the respective crank arms, a torch-holder connected with one link of the parallelogram, and means holding said pivot connections against movement, but releasable to permit the folding parallelogram to be shifted to control the spacing of the torch holder from the crank arms.

3. In a machine for cutting round bars and the like, two parallel arms supported by shafts for movement about relatively fixed axes, a bell-cran

at the end of each arm, a pivot connection between each arm and one of the bell-cranks adjacent the angle of the bell-crank, links connecting corresponding ends of the bell-cranks to form a folding parallelogram, means for securing a torch to one of the connecting links, a radius-controlling link extending from one of the shafts to a point on one of the bell-cranks spaced from the connection of the bell-crank to its associated arm, and releasable clamping means for clamping the bell-crank to said radius-controlling link at various distances from the shaft for causing a torch secured to the connecting link of the parallelogram to move through arcs of different radii.

4. In a cutting machine of the class having spaced shafts, parallel crank arms on said shafts, and a connecting link between said crank arms with means for supporting a torch for movement parallel to itself through an arc while said crank arms move through angles extending on both sides of their dead-center positions in which the crank arms are in alinement, the combination with said crank arms and torch-supporting structure, of means connecting each crank arm with its shaft, and mechanism for applying power to both shafts to drive the two shafts positively and in unison.

5. In a machine of the character described, means for supporting a torch for movement parallel to itself including two parallel crank arms, shafts for rotating the crank arms through various angular positions including dead-center positions in which one crank arm is nearest to the axis of rotation of the other, power driving mechanism connected with both shafts, and means for taking up any lost motion in the driving connections.

6. A machine for cutting metal bars and the like, comprising a torch-holder, means supporting the torch-holder for movement parallel to itself and along the arc of curvature of the metal bar, said means including two crank arms which move through dead-center positions during said movement of the torch-holder, connections between the crank arms for maintaining them in parallel relation, and means for taking up any lost motion in the connections.

7. A machine for cutting metal bars and the like, comprising a torch-holder, means supporting the torch-holder for movement parallel to itself and along the arc of curvature of the metal bar, said means including two crank arms which move through dead-center positions during said movement of the torch-holder, shafts connected to the crank arms, a gear on each shaft, and a pinion located between said gears and meshing with both of them, and mechanism for rotating the pinion.

8. A machine for cutting metal bars and the like, comprising a torch-holder, means supporting the torch-holder for movement parallel to itself and along the arc of curvature of the metal bar, said means including two crank arms, shafts connected to the crank arms, driving gearing for at least one of the shafts, a drum connected with each shaft, and a ribbon connecting said drums so that they turn together.

9. In a machine for cutting metal bars and the like, the combination with a torch-holder and supporting means for causing a torch in the holder to occupy parallel positions as it follows the curvature of a metal bar, said means includ-

ing parallel crank arms connected to spaced parallel shafts, of a gear and drum secured to each shaft, a pinion located between the gears and meshing with both of said gears, mechanism for driving the pinion in either direction, a metal ribbon extending around both drums, and means for taking up slack in the ribbon to maintain it taut and take up any lost motion in the driving mechanism.

10. A machine for cutting metal bars and the like, comprising a torch-holder and supporting means for causing a torch in the holder to occupy parallel positions as it follows the curvature of a metal bar, said means including spaced parallel shafts and parallel crank arms connected to the shafts, an electric motor, an adjustable, centrifugal governor for controlling the speed of the motor, and means for transmitting the motion of the motor to said parallel shafts, including speed-reduction gearing driven by the motor and operatably connected with each of said shafts.

11. A bar cutting machine comprising a torch-holder, a supporting frame for the torch-holder including link means for causing a torch carried by the holder to move parallel to itself while its tip describes an arc adjacent the surface of the bar, power mechanism for moving the torch-supporting frame including an electric motor, and switch means responsive to the movement of the frame for stopping the motor after the frame has moved a given distance corresponding to a predetermined arc of movement of the torch tip.

12. A bar cutting machine comprising a torch-holder, a supporting frame for the torch-holder including link means for causing a torch carried by the holder to move parallel to itself while its tip describes an arc adjacent the surface of the bar, driving mechanism including an electric motor for moving the frame and torch-holder, switch means for controlling the supply of electricity to the motor, a manually-operated control for said switch means, and a limit control, responsive to movement of the torch-supporting frame, for operating the switch means when the frame reaches a given limit of movement.

13. In a bar cutting machine having mechanism for moving a cutting torch half-way around a bar while maintaining the positions of the torch parallel, an electric motor for driving said mechanism, a reversing switch for the motor, a double-throw snap-switch in the circuit of said reversing switch and connected so that operation of the reversing switch when the motor is running stops the motor and operation of said double-throw switch is necessary to start the motor running in the opposite direction.

14. In a bar cutting machine having mechanism for moving a cutting torch half-way around a bar while maintaining the positions of the torch parallel, an electric motor for driving said mechanism, two switch means both of which control the supply of electricity to the motor, said switch means being connected with the motor and with each other in such a manner that operation of either switch to stop and start the motor causes the motor to rotate in the same direction as it was turning before that switch was operated, but stopping of the motor by one switch and subsequent starting with the other switch reverses the direction of rotation.

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