June 6, 1950 A. M. KELLER 2,510,232

BLOWPIPE MACHINE FOR SEVERING METAL STOCK

Filed April 19, 1946 3 Sheets-Sheet 1

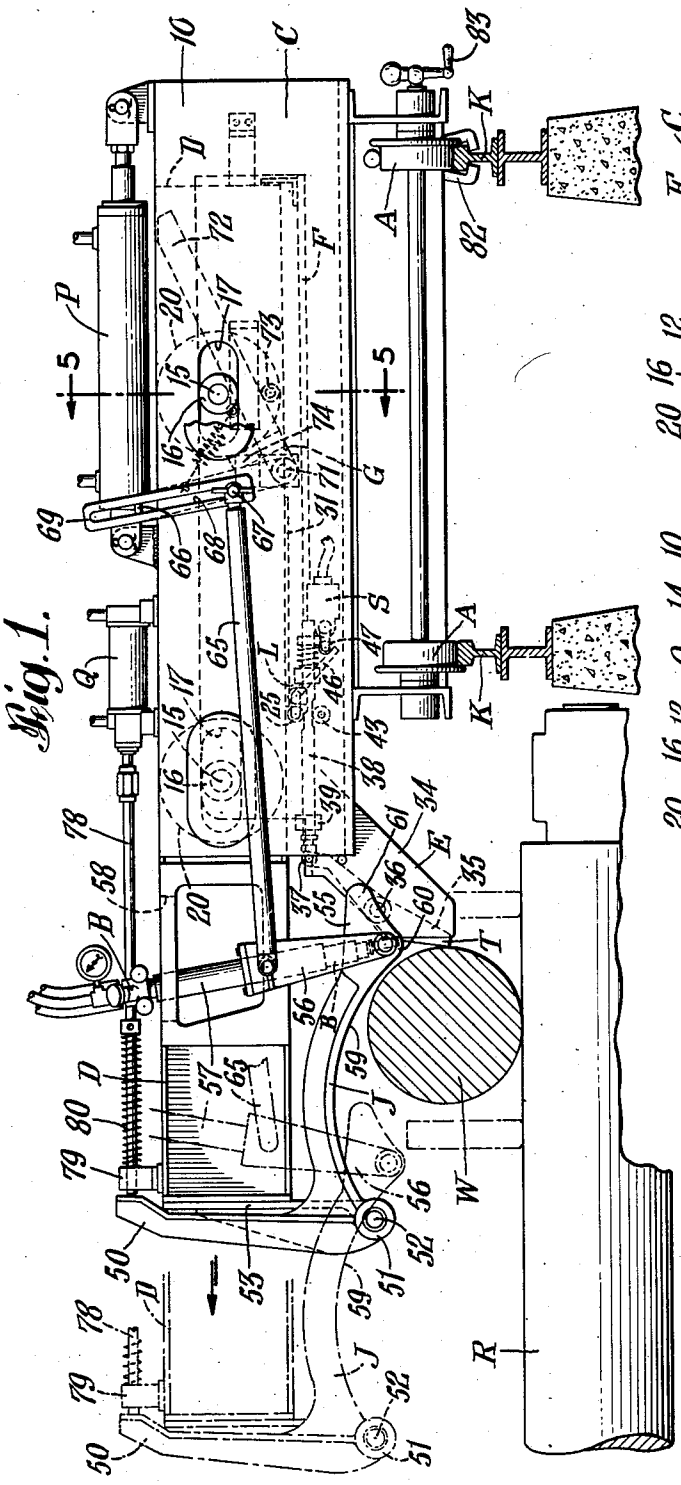

Fig. 1.

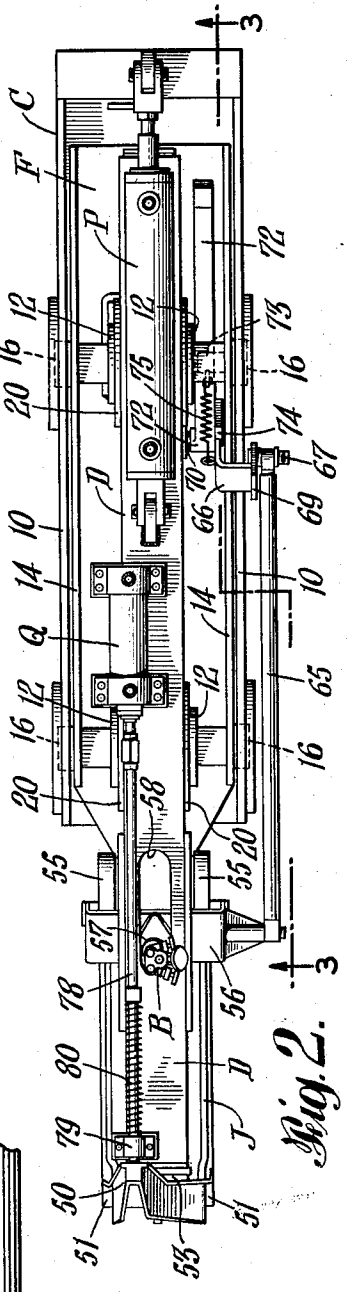

Fig. 2.

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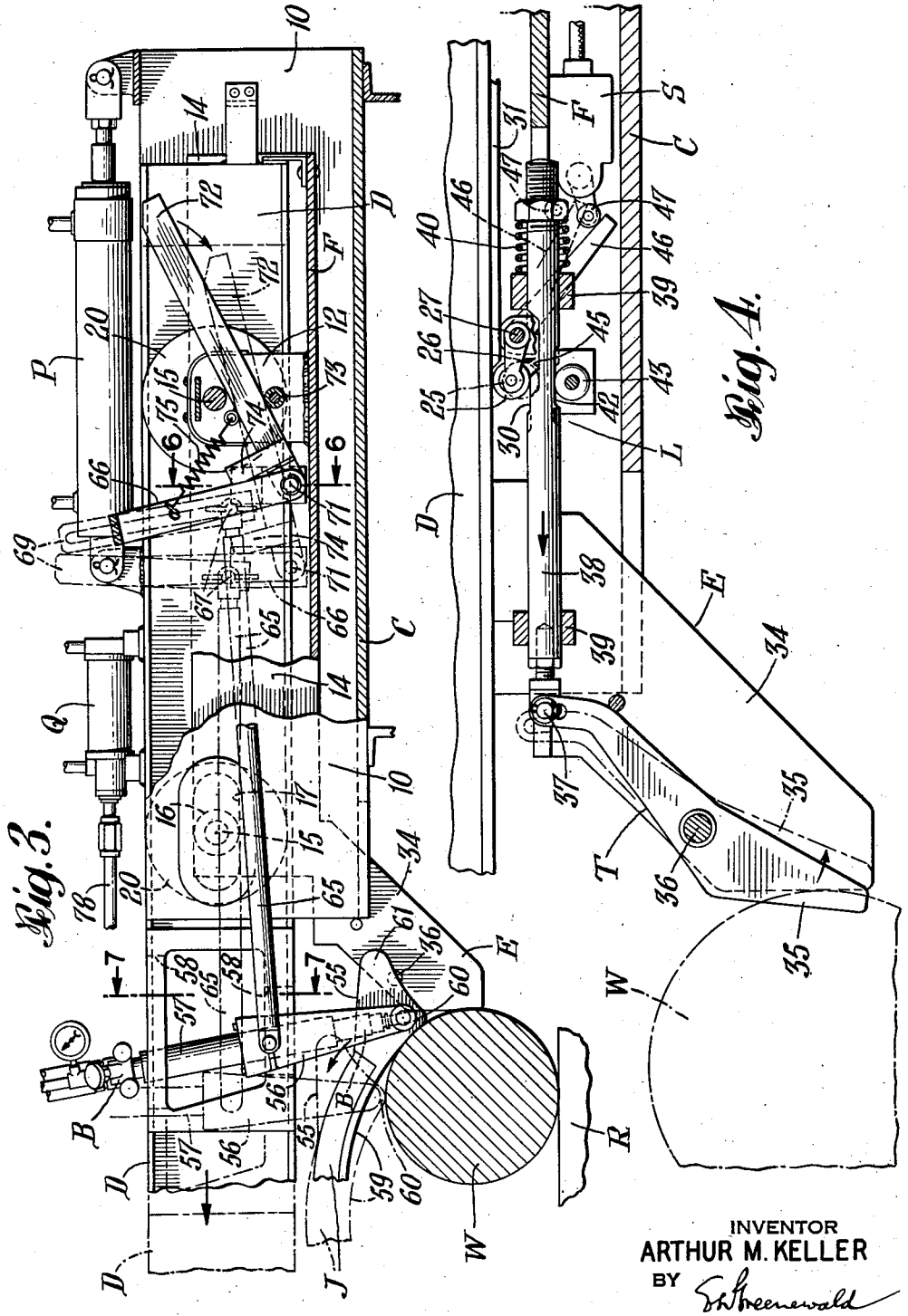

Fig. 3.

Fig. 4.

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BLOWPIPE MACHINE FOR SEVERING METAL STOCK

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Fig. 5.

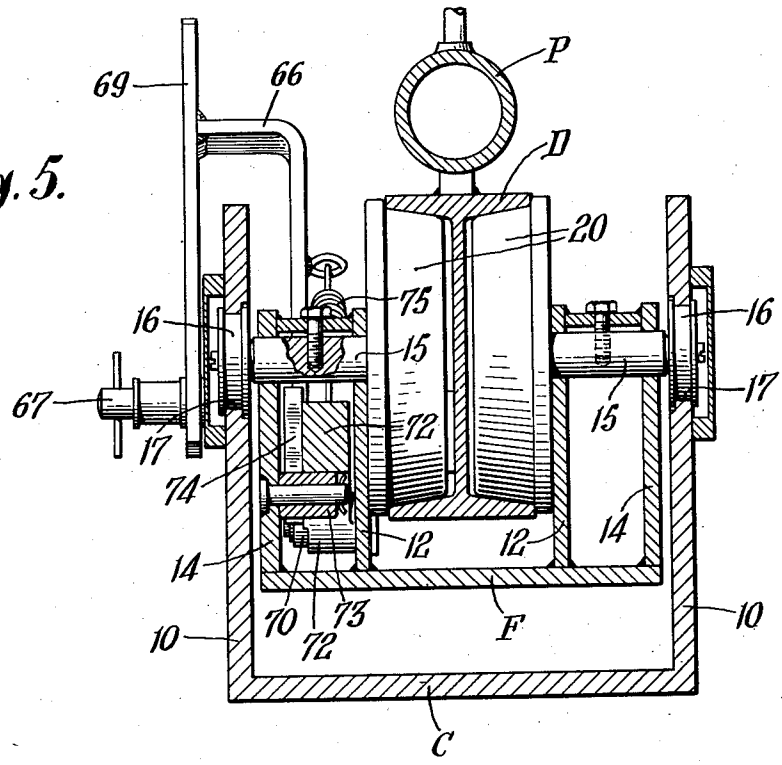
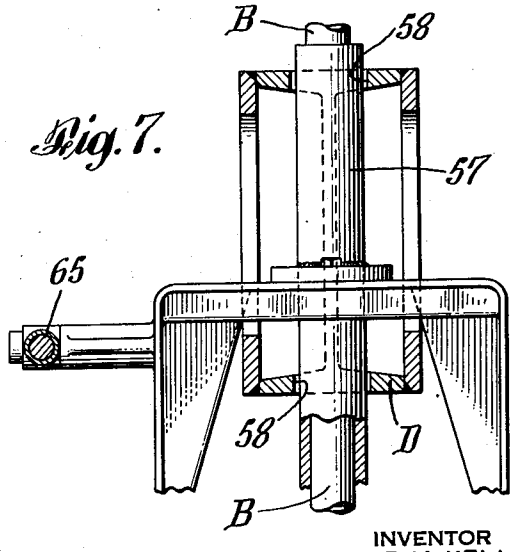


Fig. 7.



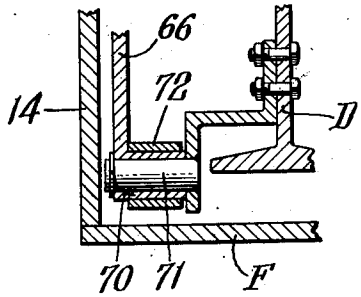


Fig. 6.

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UNITED STATES PATENT OFFICE

2,510,232

BLOWPIPE MACHINE FOR SEVERING METAL STOCK

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Application April 19, 1946, Serial No. 663,510

7 Claims. (Cl. 266—23)

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This invention relates to blowpipe machines of the bar cutter or slab cutter type, for moving a blowpipe transversely of the stock to effect a thermochemical severing operation.

Blowpipe machines of this character are subjected to rough usage in steel mills and fabrication plants, and their operation is coordinated with other machines or other operations in production. The main objects of this invention are therefore to provide a blowpipe machine of rugged construction to withstand mill abuse, and rapid in operation to keep up with the mill schedule.

Previous bar cutting machines have had either a raising and lowering mechanism or a pivoted boom to swing from inoperative to operative position. A further object of this invention is to provide a blowpipe machine in which the blowpipe travels in a straight line from inoperative to operative position, and travels in an extension of the same straight line for the cutting stroke.

Another object is to provide a machine of this character in which the operating mechanism and driving means are readily accessible for maintenance.

Other objects are to provide remote control as well as local control for the operation of the machine, to start the cut at a lagging angle and conclude with a leading angle, to provide improved centering or locating means, and otherwise simplify and improve the construction and operation of machines of this character.

Further objects and features of novelty will be apparent from the following description and the accompanying drawings in which

Fig. 1 is a side elevation of a blowpipe machine according to the preferred embodiment of the present invention;

Fig. 2 is a plan of the machine shown in Fig. 1;

Fig. 3 is a section taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged detail of the latch and trip mechanism shown in Fig. 1;

Fig. 5 is a section taken along the line 5—5 of Fig. 1;

Fig. 6 is a section taken along the line 6—6 of Fig. 3; and

Fig. 7 is a cross-section taken along the line 7—7 of Fig. 3.

In the drawings the workpiece or elongated metal stock is represented by a steel billet W of round cross-section, but which may be rectangular or of other shape. The workpiece W may be supported by and propelled into position by a conveyor or worktable represented by a series of rolls R.

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In general the blowpipe machine comprises a carriage C resembling a large channel, which constitutes the primary and supporting member of the machine. The carriage C is mounted on wheels A rolling on tracks K parallel to the longitudinal axis of the workpiece W.

Mounted within the channel frame of the carriage C is an inner frame F, which has a limited longitudinal reciprocating movement relative to the carriage frame, this movement being between the operative and inoperative positions of the blowpipe B. Within the inner frame F is slidably mounted a blowpipe propelling or feed boom D, which has a longitudinal reciprocating movement between the starting and finishing ends of the blowpipe cutting stroke.

The feed boom D projects beyond the inner and outer frames a sufficient distance to accommodate a blowpipe supporting and nozzle protecting arm J, which is pivoted on the forward end of the feed boom D. The end of the trailing arm J extends rearward from such pivotal connection and is formed to receive the blowpipe B in such a manner that blowpipe tilting is possible. This trailing arm and blowpipe tilting are broadly disclosed in my co-pending application, Serial No. 538,015, filed May 30, 1944, now Patent No. 2,443,251 issued June 15, 1948. A small fluid pressure cylinder Q is mounted on the feed boom D for raising the trailing arm J at the completion of the cut.

The rapid approach motion of the feed boom D and the inner frame F is driven by a long stroke fluid pressure cylinder P, attached to the carriage C and having its piston rod attached to the feed boom D. Both cylinders P and Q and their associated devices are mounted on top of the machine where they are readily accessible for maintenance.

In order to permit rapid approach by each unit independently, so as to minimize the cutting cycle and quickly locate each cutting blowpipe regardless of bar camber, a stop device E is attached to the inner frame F in such a manner that, when the stop device engages the bar, the blowpipe centerline is approximately in the starting position.

For stopping the rapid approach motion a trip mechanism T is associated with the stop device E and connected to a latch mechanism L which releases the feed boom D from the inner frame F and simultaneously actuates a limit switch S for

stopping the rapid approach motion and initiating the adjustable preheat time delay cycle.

For changing the angle of the blowpipe, a blowpipe tilting mechanism G is provided, which is adjustable to permit starting angles with a lag of up to ten degrees and finishing angles with a lead of up to ten degrees. This tilting mechanism includes a gravity release action such that sufficient force is produced to tilt the blowpipe under normal conditions, but in event of misadjustment or other interference with the free motion of the blowpipe holder the tilting mechanism is released.

The carriage C as shown in Fig. 5 comprises side plates 10, between which the inner frame F moves. The frame F has inner brackets 12 and outer side plates 14 at each side, in which are mounted stub axles 15, on the outer ends of which are journaled rollers 16 which run in slots 17 in the carriage side plates 10, and thereby support the frame F for a limited longitudinal movement between the side plates of the carriage C.

For supporting the feed boom D in the frame F, large flanged wheels 20 are journaled on the inner ends of the stub axles 15 between the inner brackets 12 of the frame F. The feed boom D in the form shown comprises a standard I beam, and the wheels 20 extend between the upper and lower flanges on each side and just clear of the central web.

The locking mechanism L for locking the frame F and the feed boom D together for simultaneous longitudinal movement, as shown in Fig. 4, comprises a roller 25 located under the bottom flange of the feed boom and above the carriage floor. The roller 25 is journaled on the end of a lever 26 pivoted at 27 on the inside of the carriage. When held in elevated position by a stop 30 as hereinafter described, the roller 25 engages a cam 31 on the inside of the lower flange of the feed boom D, so that longitudinal movement of the feed boom D carries the inner frame F with it.

The stop device E for locating the blowpipe in position to start cutting consists of two bar-engaging brackets 34 attached to the floor of the inner frame F, as shown in Fig. 4, and extending downwardly and forwardly therefrom and having straight vertical front faces which become tangent to the bar at the end of the rapid approach motion and locate the blowpipe centerline in approximate position to start cutting.

The trip mechanism T for stopping the rapid approach motion comprises two pivoted arms 35 having the same general contour as the bar-engaging brackets 34 and pivoted on an axle 36 extending transversely therebetween. The upper and rearward ends of the arms 35 are pivoted at 37 to the front end of a trip bar 38 longitudinally slidable in a pair of tandem sleeve bearings 39 mounted inside the inner frame F, and the trip bar 38 is urged forwardly by a spring 40. The under side of the trip bar 38 is slabbed off as at 42 to receive a roller 43 journaled on the inner frame F, in position to back up the bar against pressure of the roller 25 which engages the flattened portion of the stop 30 thereabove.

For actuating the limit switch S, the bar 38 has a deeper depression 45 beyond the stop portion 30 into which the roller 25 is cammed by the cam 31 when the bar is pulled forward, and when the motivating cylinder P is being forced in a forward direction. The action of rod 38 is to allow the roller to be lowered into the flat depression when the mating roller is forced downward by the cam 31, moving the lever 26 about its pivot 27 so that the rear extension 46 of the lever rises and lifts the trip roller 47 of the limit switch S.

The trailing arm J comprises an upward bell crank extension 50 which is integral at the top, but which is forked at the bottom to provide a pair of bosses 51 journaled on a pin 52 carried by the lower extension of a front plate 53 rigidly secured on the front end of the feed boom D.

The rear end of the trailing arm J provides a pair of laterally spaced lugs 55 which pivotally support a yoke 56 of a blowpipe holder 57. A slot 58 is provided in the upper flange of the feed boom D to permit limited tilting of the blowpipe B about the pivot of its yoke.

The lower surfaces of the trailing arm J and its legs 55 are hard-surfaced with a wear-resistant material such as a tungsten-cobalt-chromium alloy, or other material which is highly resistant to heat, wear, and abrasion. A curved approach cam surface 59 is adapted to engage the stock ahead of the blowpipe in the initial part of the cutting stroke. A skid 60 substantially aligned with the blowpipe B rides on the surface of the stock during the cutting stroke. An upwardly and rearwardly curved portion 61 rides down the far side of the stock during the final stage of the cutting stroke.

The blowpipe tilting mechanism G comprises a pull rod 65, the forward end of which is pivoted to the blowpipe holder yoke 56. The rear end of the pull rod 65 is connected to a forked rocker arm 66 by means of a clamping screw 67 adjustable in a slot 68 in an outer fork 69 of the rocker arm.

As shown in Fig. 6, the main rocker arm 66 has a hub 70 journaled on a pin 71 rigidly mounted on the feed boom D. A rearward extension 72 of the arm 66 is journaled on the hub 70 in the space between the feed boom and the inner frame F, to form a cam spring pressed against a roller 73 journaled on the adjacent outer bracket 14 of the inner frame F. The rocker arm extension 72 has a stop 74 which is held against the rocker arm 66 by a spring 75.

The small fluid pressure cylinder Q for raising the trailing arm at the completion of the cut, is mounted on the feed boom D and has a piston rod 78 passing through a slide bearing 79, and opposed by a compression spring 80. The front end of the piston rod 78 is extended to bear against the bell crank arm 50.

For maintaining the carriage C in kerf locating position, a brake 82 is mounted on the carriage in position to engage one of the rails of the track K and is actuated by a handwheel 83.

In operation, assuming that the bar is in cutting position, and that the cutting unit is retracted, the small cylinder Q is operated, causing the blowpipe to lower, and the larger cylinder P is operated, causing the feed boom D to move forward. The cam 31 on the feed boom D engaging the roller 25, causes the inner frame F to move with the feed boom. Both move forward at high speed until the brackets 34 of the stop E contact the bar W.

Meantime the arms 35 of the trip T engage the bar W and pull the trip bar 38 forward, releasing the roller 25, and the cam 31 engaging the roller swings the rear extension 46 to trip the limit switch S.

During the initial portion of the cutting stroke, the curved portion 59 of the trailing arm J engages the bar W and as the arm moves forward the surface 59 rides up on the stock until the skid portion 60 engages the stock. At the beginning of this stroke, the rocker arm 66 and the

pull rod 65 hold the blowpipe inclined at a lagging angle.

During the main portion of the cutting stroke, the skid 60 rides on the stock, and the weight of the rocker arm extension 72 rides down on the roller 73, thus tilting the rocker arm 66 which through the rod 65 gradually tilts the blowpipe holder 56 about its pivot on the trailing arm J.

During the final part of the cutting stroke, the skid 60 rides off the stock and the upwardly curved portion 61 rides down the stock. By this time the rocker arm extension 72 has completed its tilting action so that the blowpipe has now reached a leading angle.

After the completion of the cutting stroke, the gases are cut off and the small cylinder Q is operated to lift the blowpipe. Then the large cylinder P is operated to retract the feed boom D, which through reverse operation of the roller 25, picks up the inner frame F and returns it to retracted position. The cut bar is now moved away on the roll table.

What is claimed is:

1. A machine for supporting and propelling a blowpipe across a metal body in order to perform an oxygen cutting operation upon the latter, which comprises the combination of an outer frame mounted adjacent one side of said body and extending toward said body and transversely thereto but terminating short thereof, an inner frame movably mounted within said outer frame, a device mounted on said inner frame for supporting and propelling said blowpipe whereby said outer frame, inner frame, and blowpipe supporting device are all supported solely from one side of said body, said inner frame being movable lengthwise relatively to said outer frame to move said blowpipe from idle position away from the stock to active position adjacent the stock, and said device being movable lengthwise relatively to said inner frame to propel said blowpipe for the cutting stroke, and cooperating guides on said blowpipe supporting device and said inner frame and aligned longitudinally of said inner frame for restraining relative movement thereof to rectilinear movement.

2. A machine as claimed in claim 1, in combination with power actuated means for propelling said inner frame relative to said outer frame to move the blowpipe from idle to active position, and a trip mechanism actuated by arrival of the blowpipe at active position for releasing said power actuated means for propelling said device relative to said inner frame to propel the blowpipe for the cutting stroke.

3. A machine as claimed in claim 1, in combination with a fluid pressure cylinder for propelling said inner frame relative to said outer frame to move the blowpipe from idle to active position, and for propelling said device relative to said inner frame to propel the blowpipe for the cutting stroke.

4. A machine for supporting and propelling a blowpipe across a metal body in order to perform an oxygen cutting operation upon the latter, comprising a boom for supporting the blowpipe, a support located entirely at one side of said body and on which support said boom is movably mounted, and cooperating guides on said boom and said support and aligned longitudinally of said boom for restraining movement of said boom to rectilinear movement in a straight horizontal path, a driving device for said boom for moving the blowpipe from an idle position away from the stock to an active position adjacent the stock during an initial part of said rectilinear movement and for moving said boom during a final part of said rectilinear movement in a straight horizontal extension of said path to propel said blowpipe for the cutting stroke.

5. A machine for supporting and propelling a blowpipe across a metal body in order to perform an oxygen cutting operation upon the latter, comprising a carriage rolling on tracks parallel to said body but entirely at one side thereof, a frame supported entirely on said carriage and movable thereon transverse to said body, a boom movably mounted on said frame for supporting the blowpipe, cooperating guides on said frame and boom for restraining relative movement thereof to rectilinear movement longitudinally of both, and a driving device for said boom for propelling the blowpipe for movement in a straight horizontal path from an idle position away from the stock to an active position adjacent the stock, and for moving said boom further in a straight horizontal extension of said path to propel said blowpipe for the cutting stroke.

6. A machine for supporting and propelling a blowpipe across a metal body, comprising a carriage rolling on tracks parallel to said body but entirely at one side thereof, a frame supported entirely by said carriage for movement transversely to said body, a device mounted on said frame for supporting and propelling the blowpipe, and cooperating guides on said blowpipe supporting device and said frame for restraining relative movement thereof to rectilinear substantially horizontal movement, said carriage being movable along said tracks to locate the kerf to be cut, driving mechanism for moving said frame from an idle position away from said body to an active position adjacent said body, and for causing said rectilinear substantially horizontal movement of said device relative to said frame to propel the blowpipe for the cutting stroke.

7. A machine for supporting and propelling a blowpipe across a metal body, comprising an outer frame adapted to be mounted adjacent one side of said body and extending transversely thereto, an inner frame movable in said outer frame toward and away from said body, a boom movable longitudinally in said inner frame, cooperating guides on said boom and frame and aligned longitudinally of both for restricting relative movement thereof to rectilinear movement, blowpipe supporting means on said boom, means for moving said boom to move said supporting means from idle to active positions and to propel the blowpipe for the cutting stroke, and means for locking said inner frame to said boom to move therewith from idle to active positions of the blowpipe.

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