March 5, 1957 A. H. ADAMS 2,784,293

ELECTRODE HOLDER

Filed April 22, 1954

2 Sheets-Sheet 1

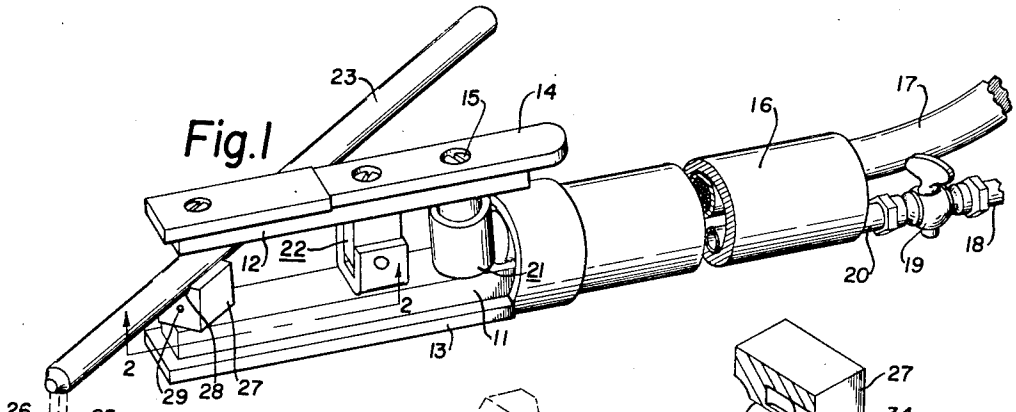


Fig.1

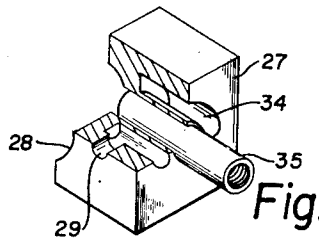


Fig.4

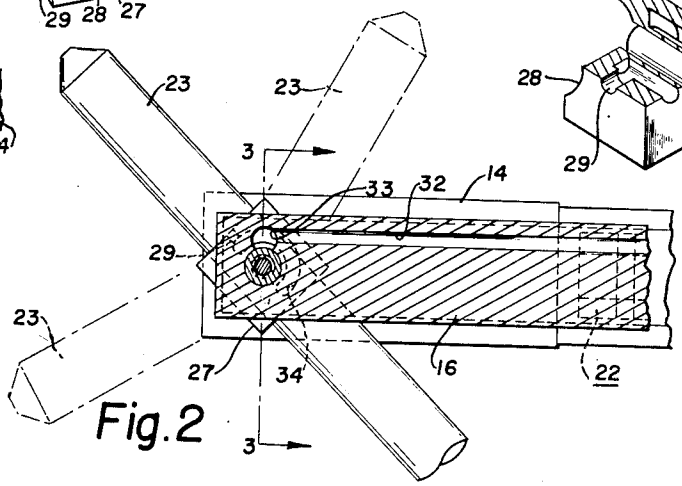


Fig.2

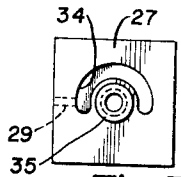


Fig.5

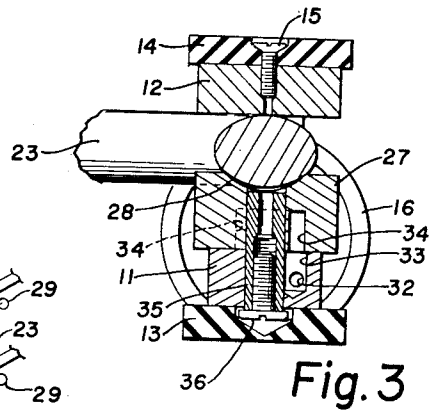


Fig.3

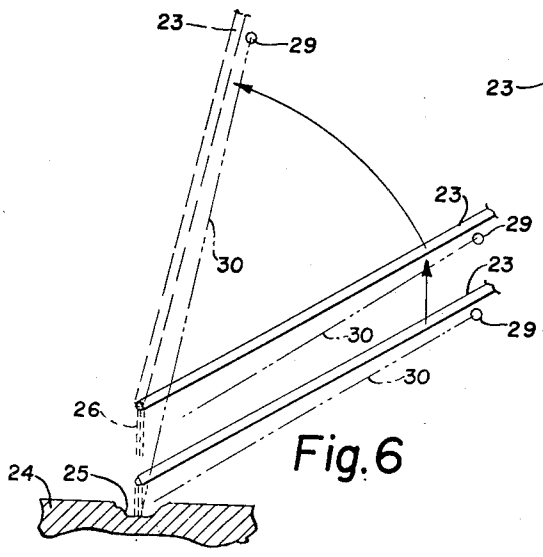


Fig.6

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ELECTRODE HOLDER

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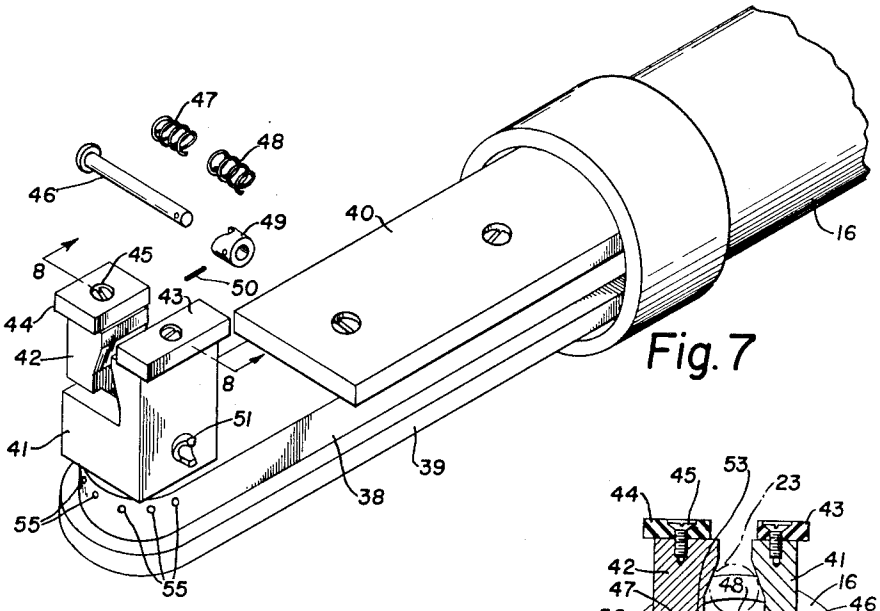


Fig. 7

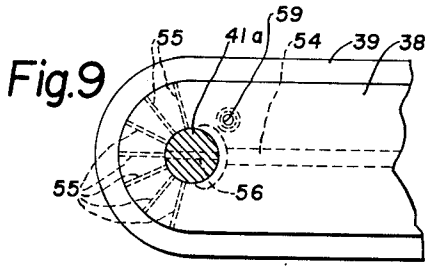


Fig. 9

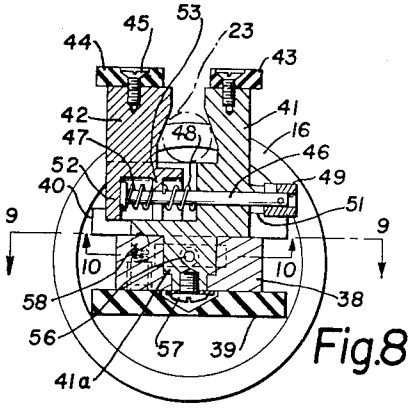


Fig. 8

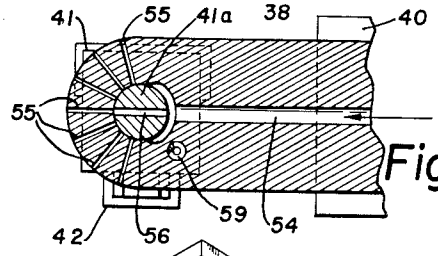


Fig. 10

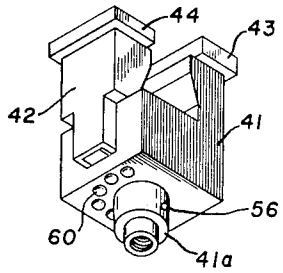


Fig. 11

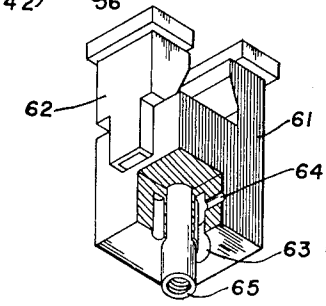


Fig. 12

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2,784,293

ELECTRODE HOLDER

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Application April 22, 1954, Serial No. 424,894

8 Claims. (Cl. 219—70)

My invention relates to electrical apparatus for melting metal through the use of an electric arc. My invention is of the general type of devices illustrated in my United States Patents No. 2,526,624 and No. 2,527,490.

An object of my invention is the provision of a device of this class in which a stream of gas is discharged along an axis which is retained in a definite relationship to the axis of an electrode utilized in the apparatus.

Another object is the provision of electric arc apparatus in which the direction of the stream of gas discharge by the apparatus is varied in accordance with the changed angular positions of the electrode carried by the apparatus.

Another object is to provide in apparatus of this type a valve mechanism which permits a stream of gas to be discharged throughout a range of positions in which the electrode may be disposed and which cuts off or terminates the discharge of gas at another position of the electrode.

Another object is the provision of an electrode-holding device which includes a gas discharge means arranged to provide for discharge of gas along the electrode when in certain positions and to cut off or terminate the discharge of gas when the electrode is located in other positions.

Another obejct is the provision of a combined electrode holder and gas-discharge mechanism which automatically directs the stream of gas in accordance with the angular disposition of the electrode and which automatically turns off the discharge of gas upon the electrode being disposed in another position.

Another object is the provision of an improved mechanism for holding an electrode in a device of this class.

Another object is the provision of an improved arrangement for discharging the gas stream through a selected one of a plurality of orifices as determined by the position of an electrode carried by the device.

Another object is the provision of improved means for clamping an electrode to an electric arc device or torch and at the same time for the improved control of the gas discharge utilized with the device.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a perspective view of the preferred form of my device, utilizing an electrode for the melting of metal;

Figure 2 is an enlarged sectional view taken through the line 2—2 of Figure 1;

Figure 3 is a cross-sectional view taken through the line 3—3 of Figure 2;

Figure 4 is an enlarged view of the electrode-engaging member utilizing my device and being in partial cross-section;

Figure 5 is an end view of the electrode-engaging device shown in Figure 4;

Figure 6 is a diagrammatic view illustrating the use of my device and showing how the device is initially positioned close to a metal workpiece to start the arc, then raised upwardly to extend the arc, and then swung around

to direct the gas stream into the pool of molten metal formed by the heat of the electric arc;

Figure 7 is a perspective view of a modified form of my device with the cross-pin and springs of the clamp removed in an exploded arrangement for purposes of illustration;

Figure 8 is an enlarged sectional view taken through the line 8—8 of Figure 7 but showing the cross-pin and springs mounted in their proper position rather than separated as in Figure 7;

Figure 9 is a sectional view of my device taken through the line 9—9 of Figure 8;

Figure 10 is a sectional view taken through the line 10—10 of Figure 8;

Figure 11 is a perspective view of the electrode-engaging member utilized in the modified form of my device illustrated in Figures 7 and 8; and

Figure 12 is a perspective view of another modified form of an engaging member.

As is known in the art, defects and foreign substances in ferrous castings may be removed by electrically melting the metal at the area of the defect or foreign body with an electric arc and by discharging a stream of gas upon the pool of molten metal to oxidize and blow away the molten metal. The gas utilized may be oxygen or air containing oxygen. In some other uses of my device, an inert gas may be utilized to smother the area of the molten metal. I use the term gas in its broadest sense so as to include air as well as pure gases. It is desired that the stream of gas be so controlled that the axis of the stream may be directed toward the pool of molten metal across the electric arc. Preferably, the orifice or discharge opening for the gas is directed in a definite relationship to the axis of the electrode so that the operator by shifting the axis of the electrode may also shift the axis of the gas stream. The length of the electrode extending from the device may also be determined relative to the location of the orifice so as to provide the angularity desired, and particularly the relationship of the gas stream relative to the electric arc.

My device permits the electrode to be swung in an arc through several positions while continuing the stream of gas through this range of positions and also permits the electrode to be swung to an inactive position, which movement automatically cuts off or terminates the discharge of gas from the discharge orifice or opening.

In the preferred form of my device, there is an arm or elongated member 11 of electrical-conducting material. A clamp bar 12 is arranged in spaced relationship therefrom at the operating end of the device. There is an insulating strip 13 secured to the elongated member 11 and an insulating strip 14 secured to the clamp bar 12 by means of the screws 15. The strips 13 and 14 are of a suitable material which is both electrical insulating and heat insulating in character. At the rear end of the device, there is a handle 16 of suitable non-conducting material which may be grasped and held by the operator using the device.

An electric cable 17 enters the rear of the device and is in electrical connection with the arm or member 11 so as to carry electric current to the forward end of the device. A hose 18 is adapted to be connected to a source of suitable gas and connects to a valve member 19. The valve member 19 is connected to a gas conduit 20 which extends forwardly through the device and communicates with a longitudinal gas conduit 32 formed within and extending longitudinally of the arm or elongated member 11.

The clamp bar 12 is hingedly carried by the arm 11 by means of a hinge assembly 22 in such manner that the clamp bar 12 may rock or swing thereon relative to the arm 11. A spring assembly 21 is interposed between the member 11 and the member 12 in such manner as to resiliently urge outwardly the rear end of the clamp

bar 12. An electrode engaging member 27 is pivotally carried by the member 11 at its forward end. This engaging member 27 has a concave surface 28 facing the clamp bar 12 in such manner as to complementarily receive the side of a carbon electrode 23. This carbon electrode 23 is resiliently clamped between the flat inner face of the bar 12 and the concave surface 28 of the engaging member 27.

The forward end of the electrode 23 shown in working position in Figure 1 may be held spaced from a metal workpiece 24 so that an electric arc 26 extending between the electrode 23 and the workpiece 24 melts and forms a crater 25 of molten metal in the workpiece 24. The workpiece 24 is connected in electrical circuit with the electric current flowing to the electrode 23 from the electric cable 17.

A pivoted connection between the engaging member 27 and the member 11 is provided by an internally threaded pin 35 brazed or otherwise connected to the member 27 so as to extend therefrom. A threaded screw bolt 36 engaged in the pin 35 holds the engaging member 27 to the member 11 in such manner as to permit the engaging member to pivot relative thereto and thus to permit the electrode 23 to swing in an arc through various angular positions relative to the device.

A discharge orifice or outlet 29 is positioned in the member 27 in such a manner that the axis of the gas stream coming from the orifice 29 extends along and at a small angle to the axis of the electrode, this axis being in the order of an included angle of approximately two to four degrees. This provides that the stream of gas may be directed so as to intercept the electric arc and upon proper positioning of the device to direct the gas stream into the crater 25 of molten metal.

The angular disposition of the parts relative to the electrode, the gas stream, the electric arc, and the surface of the metal workpiece is illustrated in a diagrammatic manner in Figure 6. In this view, the axis of the gas stream is indicated by the reference character 30. The varying positions of the electrode in use are shown in Figure 6 in that the electrode 23 is first held in close proximity to the workpiece so as to initiate the electric arc, then raised upwardly to lengthen the electric arc, and then swung around at another angle so as to direct the axis of the gas stream downwardly into the crater 25 of molten metal to oxidize the metal and to blow it away from the operator.

Gas reaches the orifice 29 of the member 27 so as to be discharged therefrom at various angular positions of the electrode relative to the member 11 by means of an arcuate slot or port 34 on the face or surface of member 27 abutting and in sliding engagement with the inner face of the member 11. This arcuate slot or port 34 is in communication with the orifice 29 so that gas entering the slot or port 34 is discharged through the orifice 29. A round port 33 extending laterally of the member 11 communicates with the longitudinal gas conduit 32, extending to the member 11 from the conduit 20 entering the device from the valve 19. The arrangement of the round port 33 and the arcuate port 34 is such that they register and are in direct communication with each other through a range of positions of the member 27 as the member 27 is pivoted by the swinging of the electrode 23. There is, however, a position of the member 27 in which the round port 33 does not communicate with the arcuate port 34 and in which the round port 33 is closed or cut off by the flat inner surface of the member 27. Preferably, the cut off or closed position of the ports 33 and 34 is arranged at the location where the engaging member 27 is turned when the electrode 23 is swung so that its working end or point is pointed downwardly and rearwardly toward the operator. Thus, when the electrode 23 is in the position shown in Figure 1, the ports 33 and 34 are in communication and gas is discharged through the orifice 29. Also because of the

lengthened or arcuate form of the port 34, the discharge of gas will continue through a considerable range of angular positions of the electrode 23. However, when the electrode 23 is swung to a position substantially at right angles to the position shown in Figure 1 so that the point from which the arc is derived is pointed toward rather than away from the operator, then communication between the ports 33 and 34 is terminated and the flow of gas ceases. The arrangement of the engaging member 27 with the structure shown and the member 11 with the structure shown is such that a constant delivery of gas is maintained through the desired operating range of the electrode so that the gas is automatically turned off and the discharge is terminated upon moving the electrode to another position. In this way, the engaging member 27 operates both as a valve, a gas discharge means, and an electrode-engaging member.

A modified form of my device is illustrated in Figures 7 to 11 inclusive. Here the electrode 23 is clamped to the device by another structural arrangement. An arm or elongated member 38 in this modified form of device has a suitable insulating strip 39 secured thereto so as to give both electrical and heat protection. An electrode-engaging member 41 is pivotally carried by the member 38 by having an extending or neck portion 41–*a* extending through an opening in the member 38 near the forward end thereof. A screw 57 holds the neck portion 41–*a* in position so as to hold the member 41 on the member 38 and at the same time to permit its rotation relative to the member 38.

A clamping member 42 is carried by the engaging member 41 in such manner as to hold an electrode 23 therebetween in a recess provided by opposed inner surfaces, as shown in Figure 8. An insulating strip 43 is secured to the outer or top surface of the member 41 and an insulating strip 44 is secured to the outer or top surface of the member 42 by screws 45.

Means are provided to resiliently urge the member 42 toward the member 41 and to yieldingly clamp an electrode therebetween and at the same time to provide variation in the resilient yielding force holding the members together. A bolt 46 connects the members 42 and 41 together, as shown in the drawing. A first spring 47 being under compression urges the head of the bolt 46 to the left in Figure 8 and a spring 48 also under compression, abutting a shoulder 53 of member 42 and an inner surface of member 41, urges members 41 and 42 apart. The springs 47 and 48 are mounted upon and concentric with the bolt 46. The head of the bolt 46 abuts against an end wall 52 of the member 42. There is formed on the outside of the member 41, around the opening in which the bolt 46 is positioned, a camming abutment or surface 51. A camming head 49 is secured to the outer end of the bolt 46 by a cross-pin 50. The relationship of the camming head 49 and the camming abutment 51 is such that upon turning of the bolt 46, through seizing and rotating the head 47, the bolt 46 is cammingly moved outwardly and held in one position.

Upon grasping the head 49 to rotate the bolt 46 through a 180-degree turn, the opposed camming surfaces permit the bolt 46 to move inwardly or to the left in Figure 8 and to thus vary the resilient hold of the spring 47 upon the electrode 23. The balance of the compressive forces between the springs 47 and 48 is such that there is always a slight pull inward or to the left in Figure 8 to hold the camming surfaces together, but also at the same time to maintain a resilient grasp upon the electrode 23 positioned between the members 41 and 42. The arrangement thus provides for a continued resilient and yielding grasp on an electrode and at the same time an adjustment to vary the resilient yielding grasp to facilitate the insertion and removal of electrodes and the changing of the position of electrodes by the members 41 and 42.

There is a longitudinal gas conduit 54 through the elongated member 38. This conduit 54 is in communi-

cation with a source of gas connected to the device at the rear of the device, such as shown in the preferred form of Figure 1. At the forward end of the member **38** there are seven small orifices or discharge outlets **55** radiating outwardly at the arcuate end of member **38**. These discharge orifices **55** are adapted to communicate with the longitudinal conduit **54**. There is an opening **56** extending through the neck portion **41**–*a*. This neck portion **41**–*a* thus is a valve control member for controlling the flow of gas from conduit **54** to a selected one of the orifices or discharge outlets **55**.

In the arrangement shown in Figures 9 and 10, the member **41** and its neck portion **41**–*a* are pivoted so that the intermediate orifice **55** in direct line with the conduit **54** communicates through opening **56** with the conduit **54**. All the other orifices **55** are cut off from the conduit **54** by the body of the neck portion **41**–*a* of member **41**. By pivoting the assembled members **41** and **42** so as to rotate the neck portion **41**–*a* in the opening of member **38**, any selected one of the orifices **55** may be placed in communication with the gas conduit **54**. By the arrangement shown, gas may be discharged in a desired direction relative to the angular disposition of an electrode held by the members **41** and **42**. Also by pivoting the members **41** and **42** relative to the member **38**, the discharge of gas may be terminated through having the opening **56** of the neck portion **41**–*a* turned so as not to communicate with any of the orifices **55**.

To facilitate the positive positioning of opening **56** with one of the several orifices **55**, or in a definite position not in registration with any of the orifices, there is provided a spring-biased detent ball **58** which may fit into any one of a plurality of recesses **60** formed in the opposed surfaces of member **41**. If there are eight positions, including seven discharge positions and one closed position, then there would be preferably eight sockets or recesses in which the ball **58** may be selectively positioned.

In Figure 12, I show a modified form of engaging member. In this modified form, an engaging member **61** has a clamping member **62** which opposes it to resiliently clamp an electrode therebetween by an adjustable resilient mechanism, such as illustrated in connection with the device of Figures 7 to 11, inclusive. However, the member **61** has an orifice **64** which corresponds to the orifice **29** of the electrode-engaging member **27** in the preferred form of device shown in Figure 1. An arcuate or elongated slot **63** corresponds with the arcuate or elongated slot **34** of the preferred form of device shown in Figure 1 and the internally threaded pin **65** corresponds with the pin **35** of the preferred form of device shown in Figure 1. By using the modified engaging member shown in Figure 12, the gas discharge is not through a plurality of orifices, such as the orifices **55** in member **38**, but rather the gas discharge is through the one orifice **64** which discharges in a direction which varies in accordance with the pivoting of the member **61** on the elongated member **38** in much the same way that the direction of the orifice **29** is varied in the preferred form of the device shown in Figure 1. Similarly, the engaging member **61** incorporates the valving arrangement of the engaging member **27** shown in the preferred form of device in Figure 1.

By substituting the clamping device made up of parts **61** and **62** for the parts **41** and **42**, the discharge of gas is directed in the same way and the discharge of gas is valved in the same way as described in connection with the preferred form of the device shown in Figure 1.

The present disclosure includes the description contained in the appended claims, as well as that contained in the foregoing description.

Although this invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in details of construction and the combination and arrangement of parts may be resorted to

without departing from the spirit and scope of the invention as hereinafter claimed.

What is claimed is:

1. In electric arc apparatus, the combination of an electrode holder comprising an elongated member having a handle portion and an arm portion extending therefrom, an electrode engaging member pivotally carried by said arm portion at a location spaced from said handle portion, a clamp carried by said elongated member for holding an electrode in engagement with said engaging member, electric conducting means carried by said elongated member for conducting current to said electrode engaging member, conduit means carried by said elongated member and adapted to conduct gas forwardly along said arm portion, said arm portion and said engaging member having mating surfaces in sealing contact with each other and slidable relative to each other upon pivotal movement of the engaging member relative to the arm portion, said arm portion having an opening disposed in the respective mating surface of the arm portion and communicating with said conduit means, said engaging member having an orifice in a wall thereof for discharge of gas in a direction relative to an electrode held by said engaging member dependent upon the pivoted position of the engaging member relative to said arm portion, said engaging member having an arcuate slot disposed in the respective mating surface of the engaging member, said slot communicating with said orifice, the circle coinciding with said slot having a solid portion intermediate the ends of said slot at said respective mating surface of the engaging portion, said slot communicating with the said opening in the arm portion in some pivoted positions of the engaging member to provide for flow of gas from said conduit means to said orifice in said some pivoted positions, said solid portion closing said opening in the arm portion in other pivoted positions of the engaging member to prevent the flow of gas from said conduit means to said orifice in said other pivoted positions.

2. In electric arc apparatus utilizing an electric arc and a gas stream for removing metal from a metallic body, the combination of an elongated member, an electrode engaging member, pivot means pivotally carried by said elongated member for pivotally mounting said engaging member to permit pivotal movement of said engaging member relative to the elongated member, said engaging member having portions arranged to embrace an electrode to cause said engaging member to pivot with the electrode upon swinging the said electrode in an arc, orifice means arranged for directing a gas stream along an axis related to the axis of said electrode, said orifice means being carried by said engaging member, conduit means carried by said elongated member for conducting gas to said orifice means, and valve means operable by pivoted movement of said engaging member, said valve means being interposed between said conduit means and said orifice means for controlling the flow of gas therebetween, said valve means including mating surfaces slidably movable relative to each other and a first port and a second port in said surfaces, disposition of said ports in communication permitting flow of gas through said valve means and disposition of said ports out of communication blocking flow of gas through said valve means, one of said ports having such size relative to the other port as to be disposed in communication with the other said port throughout a first range of sliding movement between said mating surfaces and as to be disposed out of communication with the other said port throughout a second range of sliding movement between said mating surfaces, the said first range corresponding to an arc through which an electrode engaged by said engaging member may be swung on said pivot means for discharge of gas through said orifice means and said second range corresponding to a position to which said electrode may be swung for termination of said discharge of gas.

3. An electrode holder for electric arc apparatus com-

prising an elongated member, said elongated member having a gas conduit carried thereby, said gas conduit having an outlet opening on a side of said elongated member, an electrode-engaging member pivotally carried by said elongated member at said outlet opening to cover the same, said electrode-engaging member having a gas-discharge orifice oriented to direct a stream of gas substantially longitudinally of an electrode carried by the holder, said electrode-engaging means having a port communicating with said orifice and facing said elongated member, said port extending over an arcuate range greater than the arcuate extent of said outlet opening to provide for continued communication between said outlet opening and said port through a range of pivotal movement of said engaging member in varied angular positioning of an electrode carried by the holder, said electrode-engaging member having a portion blocking said outlet opening upon pivotal movement of the electrode-engaging member to a position other than in said arcuate range to limit and throttle flow of gas from said outlet opening, and holding means for holding an electrode to said electrode-engaging member to pivot the same by swinging said electrode.

4. An electrode holder for electric arc apparatus comprising a first member, a second member pivotally carried by said first member for holding an electrode along a predetermined first axis, a third member carried by said holder for resiliently clamping said electrode to said second member, gas-discharge means carried by said second member for discharging a stream of gas along a second axis related to said first axis, conduit means carried by said first member for conducting gas to said second member, and valve means carried by said holder and operatively positioned to control the flow of gas between said conduit means and gas-discharge means, said valve means including opposed ports in said first member and second member arranged to remain in full communication through a substantial range of pivotal movement of said second member relative to said first member and to be out of communication at a position other than in said range, said arrangement providing for discharge of gas through said gas-discharge means at a plurality of angular positions of the electrode carried by the second member in said range and to terminate such discharge of gas at an angular position of said electrode other than in said range.

5. In an electrode holder utilizing a gas stream, the improvement of an electrode-engaging member having a gas-discharge orifice therein, a support member having an outlet therein to which gas is supplied, said outlet facing said electrode-engaging member, pivot means connecting said electrode-engaging member and support member to permit pivotal movement of the electrode-engaging member relative to the support member, said electrode-engaging member having a port communicating with said orifice and facing said support member, said port being arranged relative to said pivot means to communicate with said outlet at some pivotal positions of the electrode-engaging member but not at other pivotal positions, said electrode-engaging member blocking said outlet at said other pivotal positions.

6. In an electrode holder utilizing a gas stream, the improvement of an electrode engaging member, a support member, pivot means connecting the engaging member and support member, gas discharge means carried by the holder, and valve means for turning on and off the flow of gas to said gas discharge means, said valve means comprising port means and shut-off means arranged around the axis of said pivot means to move relative to each other upon pivotal movement of said engaging member relative to said support member.

7. An electrode holder in electrical apparatus comprising a first member having an outlet opening to which gas is supplied, a second member mounted to said first member, a third member carried by said second member and arranged to accommodate an electrode between said third member and said second member, resilient means biasing said second and third member relative to each other to yieldingly hold a said electrode, pivot means interconnecting said first member and second member, gas discharge means carried by the holder for directing a stream of gas for use in conjunction with use of said electrode, and valve means carried by the holder and arranged relative to the pivot means as to be operated by pivotal movement of the second member relative to the first member, said valve means including first means to provide communication between said outlet opening and said gas discharge means through a limited range of pivoted movement of said second member and second means to block communication between said outlet opening and said discharge means at a pivoted position of said second member other than in said range.

8. An electrode holder in electrical apparatus comprising a first member having an outlet opening to which gas is supplied, a second member mounted to said first member, a third member carried by said second member and arranged to accommodate an electrode between said third member and said second member, resilient means biasing said second and third member relative to each other to yieldingly hold a said electrode, pivot means interconnecting said first member and second member, said first member having a plurality of gas discharge orifices extending at a plurality of angles, respectively, therefrom, and a valve member extending from said second member concentric with said pivot means to control communication between said outlet opening and a selected one of said orifices and to terminate such communication, pivoting of said second and third members relative to said first member to determined pivoted positions operating said valve member to permit gas to flow through a selected one of said orifices and pivoting of said second and third members relative to said first member to other than said determined pivoted positions operating said valve member to cause said flow to terminate.

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