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Vanyi

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[54] HEAT CONTROL FOR HEATED TOOL

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[22] Filed: May 24, 1972

[21] Appl. No.: 256,494

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[52] U.S. Cl..... 228/53, 219/229, 228/51

[51] Int. Cl..... B23k 3/04

[58] Field of Search 228/51, 53, 54, 55,
228/59; 219/229, 230, 258, 434, 439, 462

[56]

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ABSTRACT

A heat flow control system for a heated tool whereby the work engaging tip of the tool is maintained at a low temperature during standby periods to retard tip corrosion but can be almost instantaneously raised to a high working temperature when needed.

8 Claims, 23 Drawing Figures

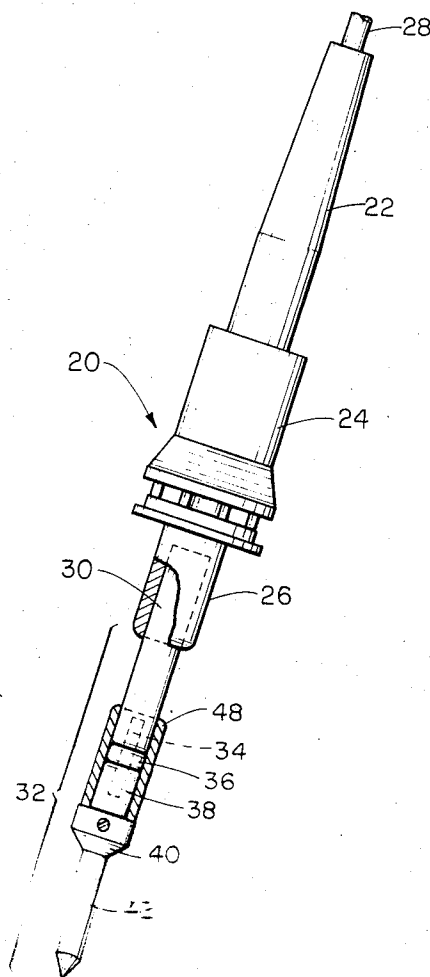


Fig. 1.

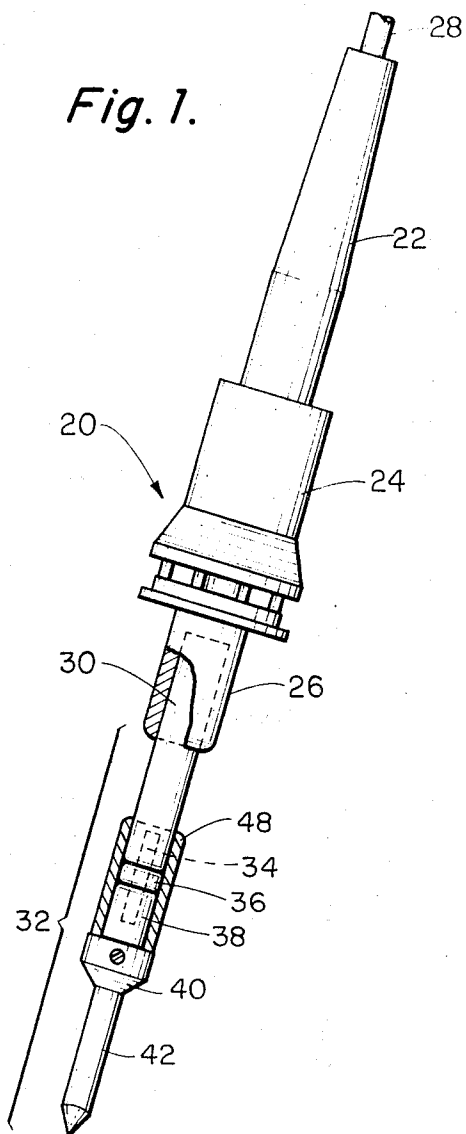


Fig. 3.

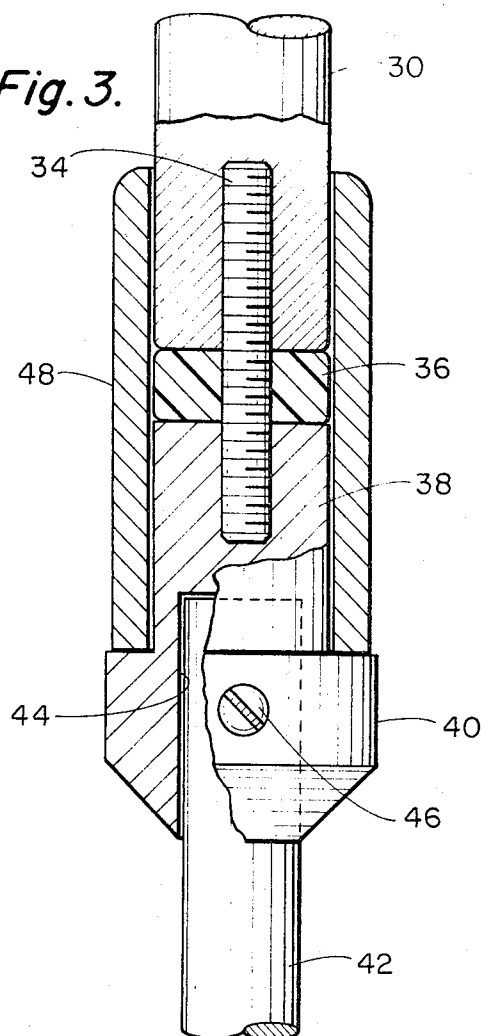
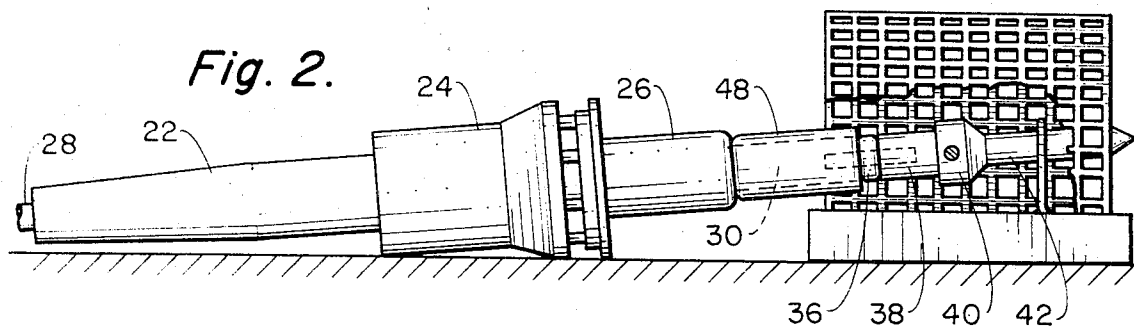
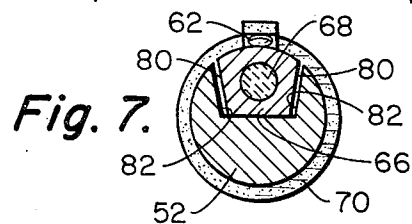
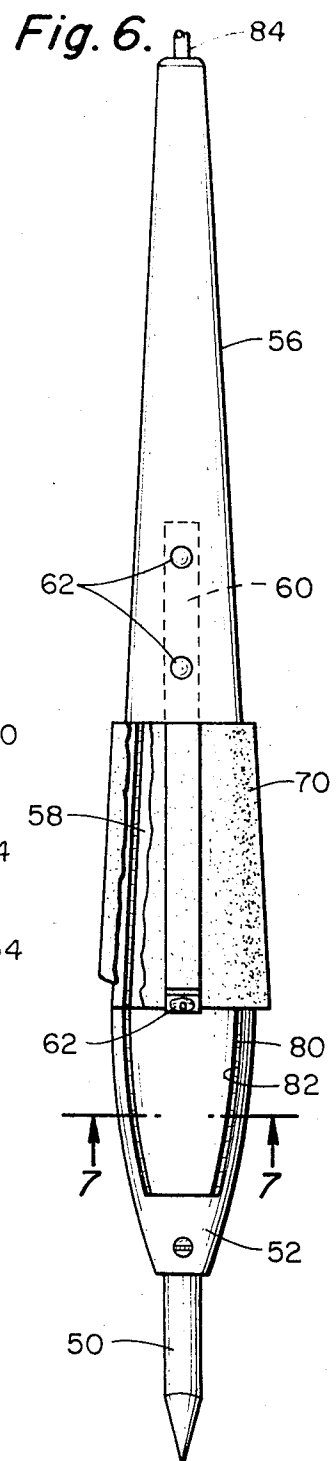
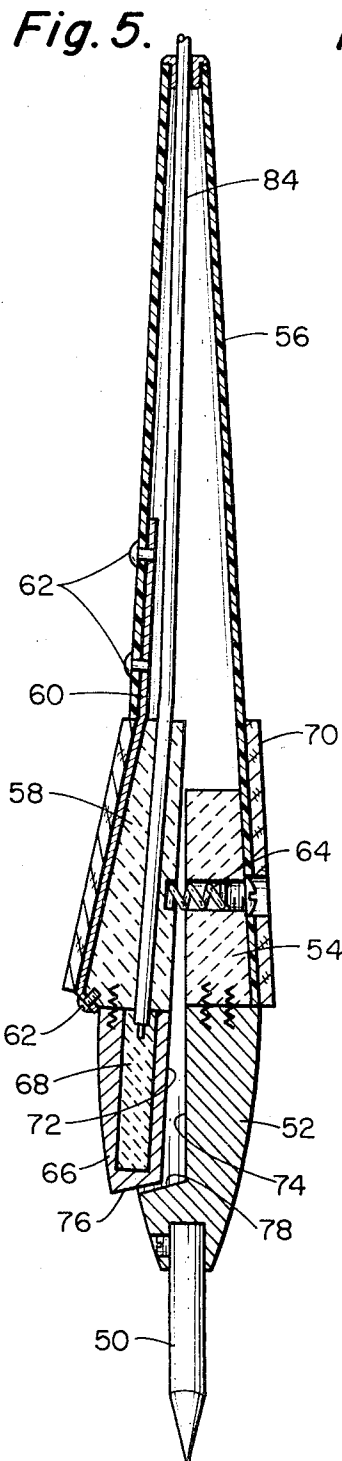
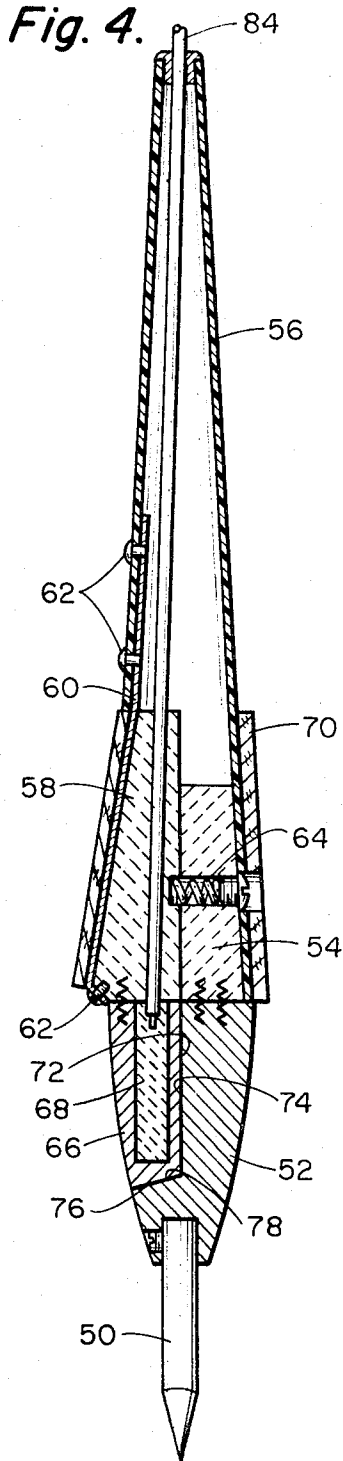


Fig. 2.





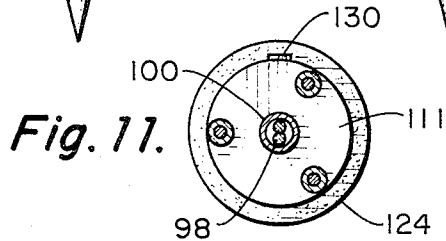
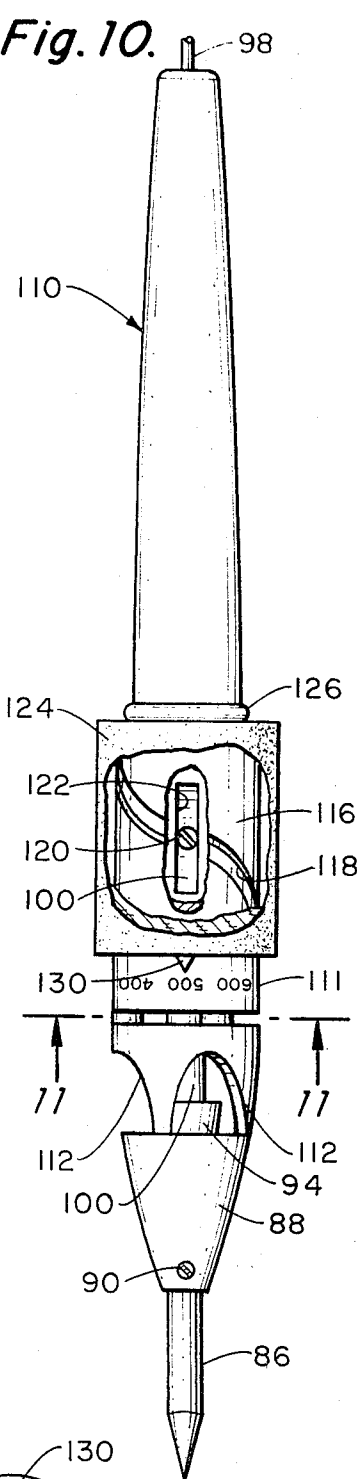
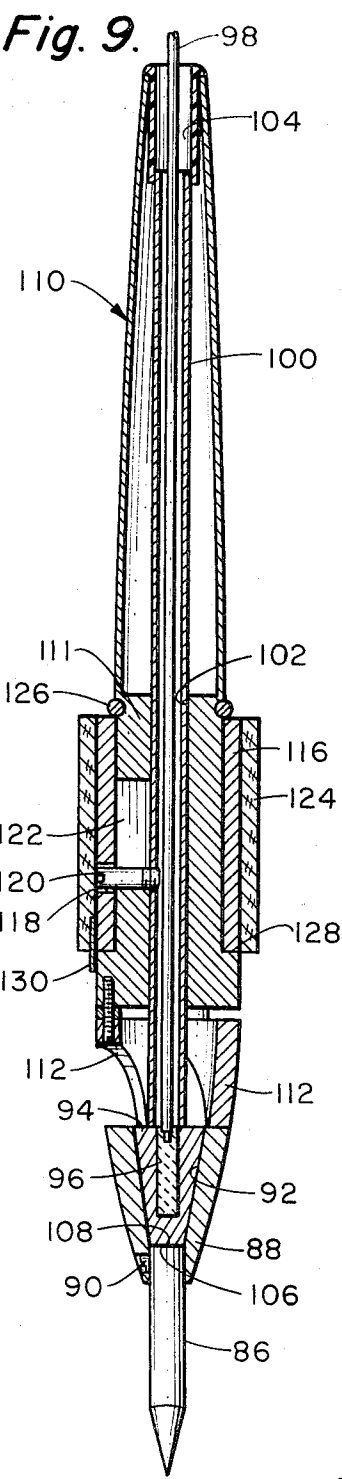
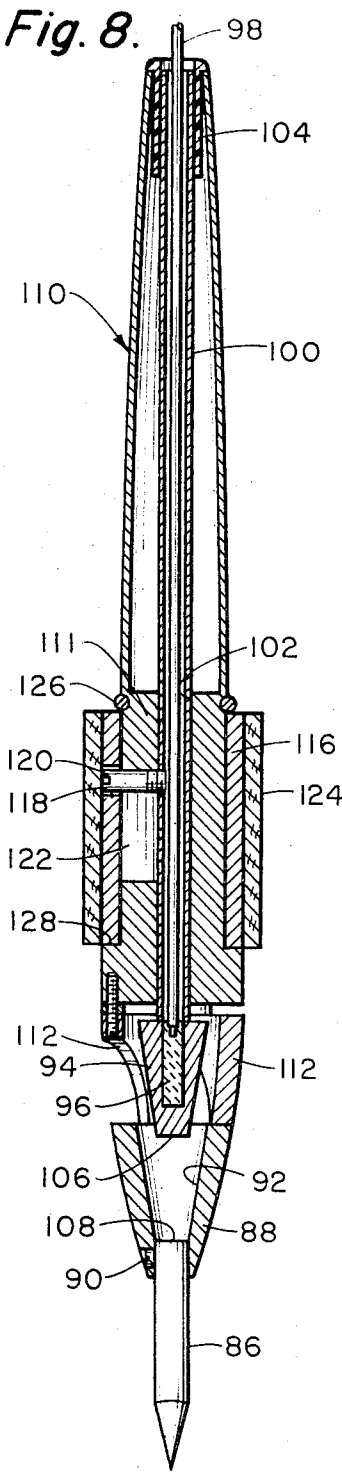


Fig. 12.

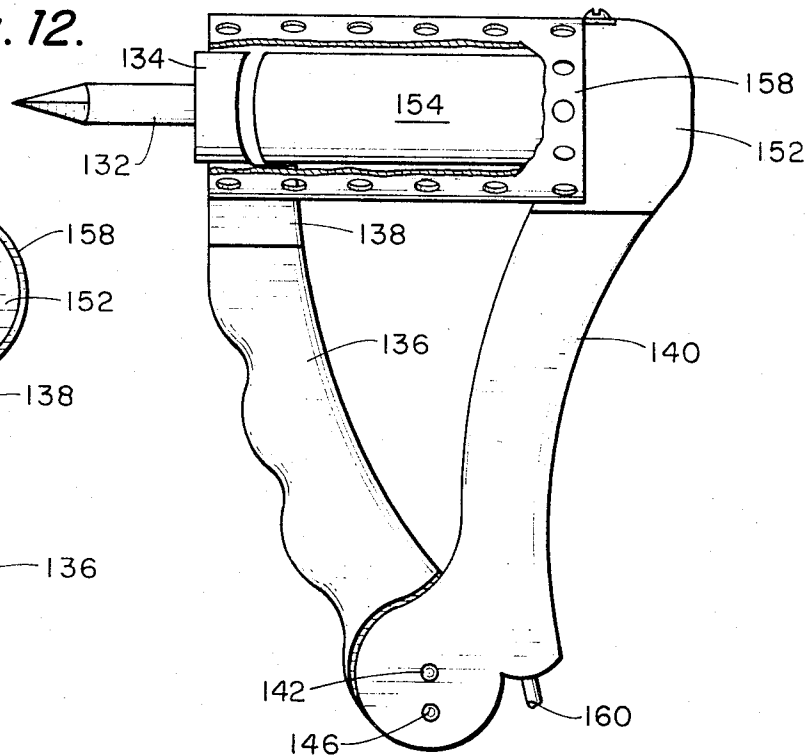


Fig. 13.

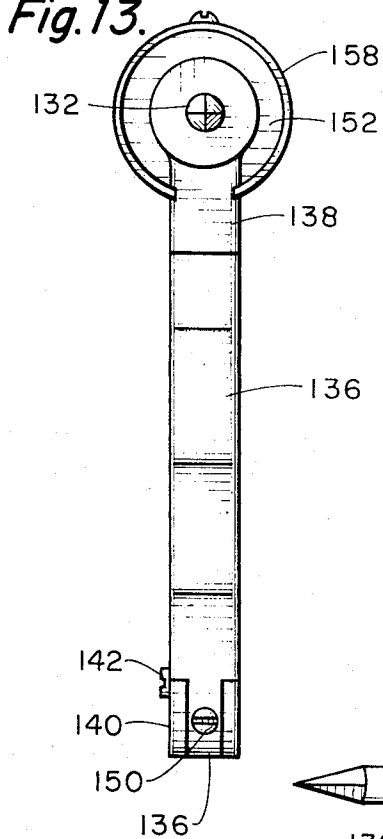


Fig. 14.

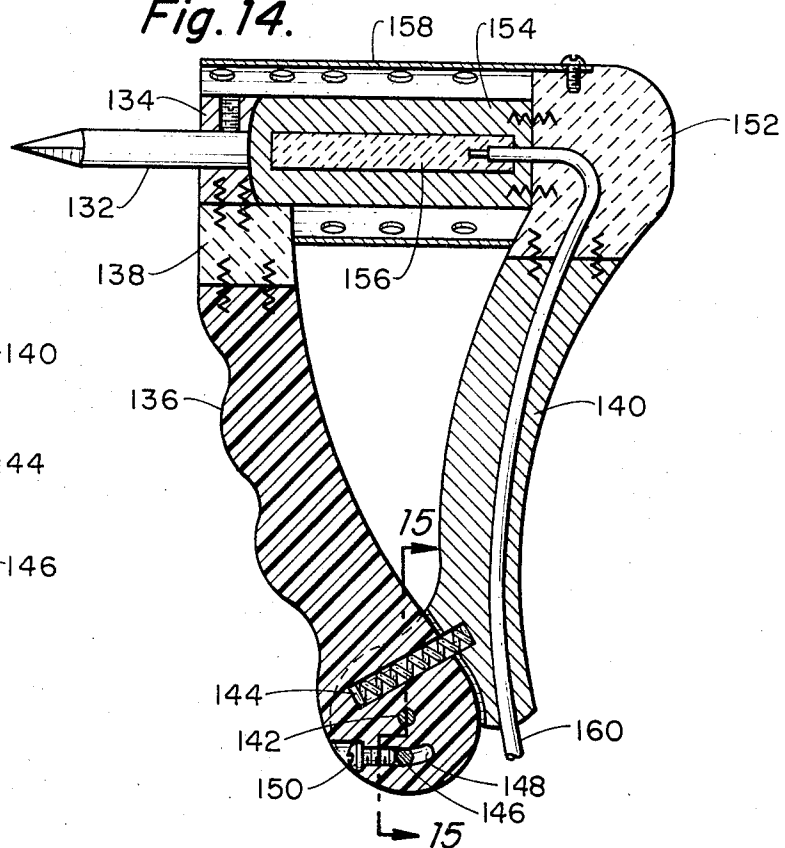


Fig. 15.

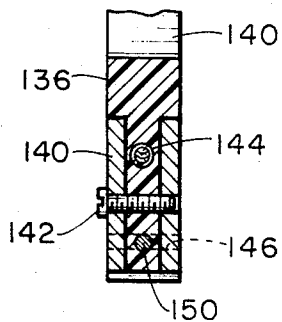


Fig. 16.

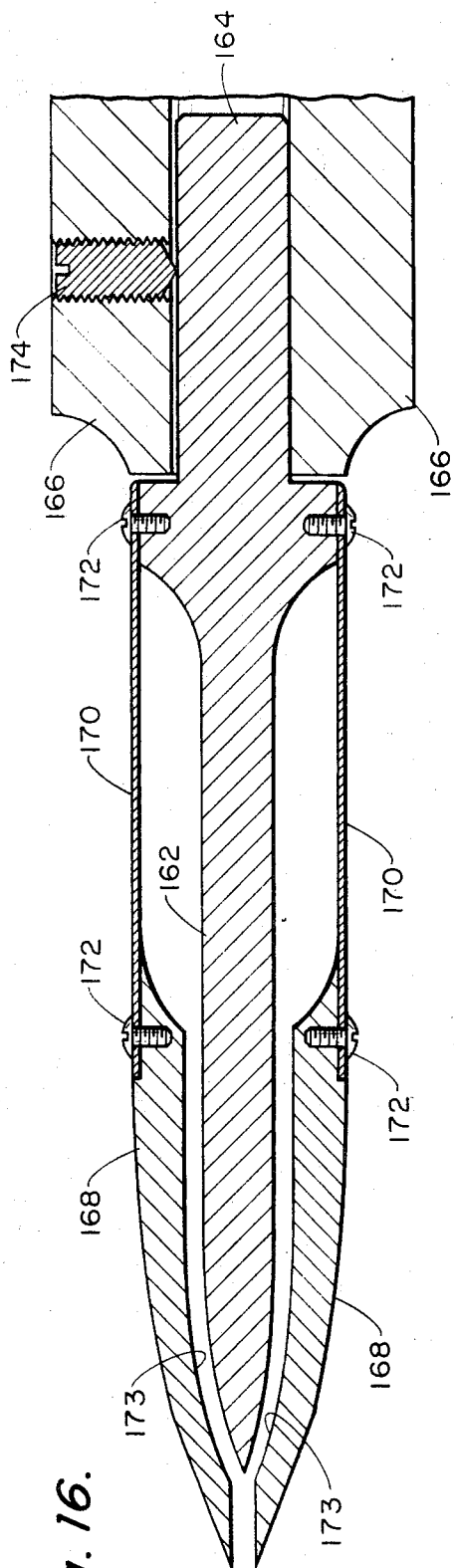


Fig. 17

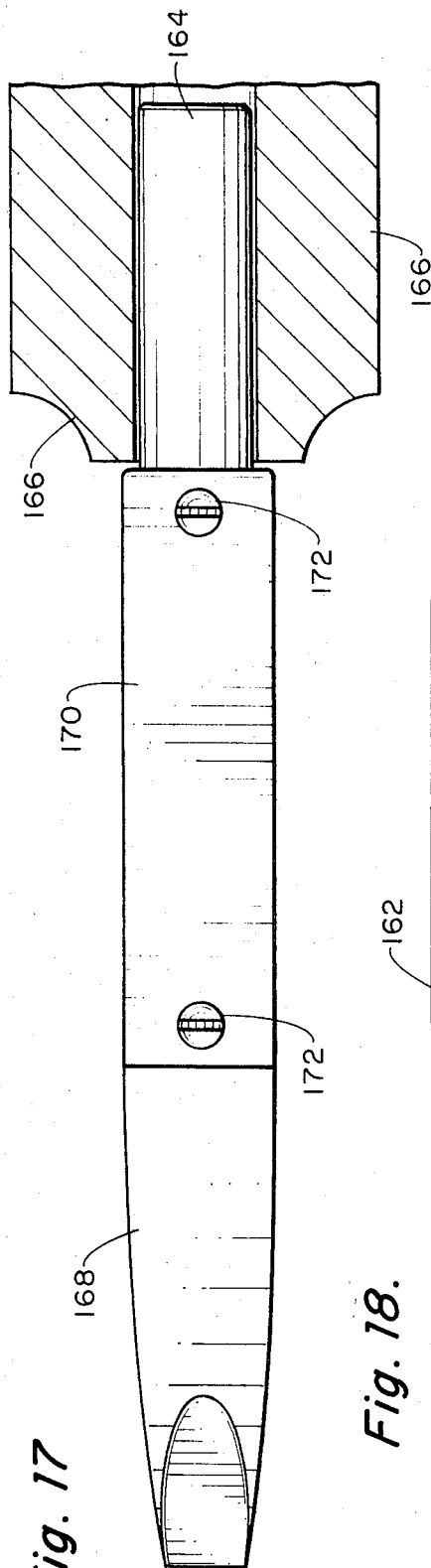
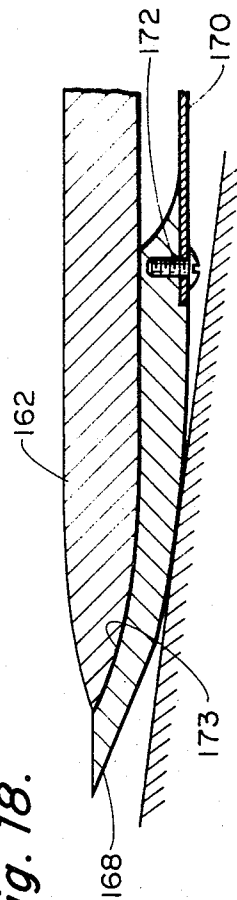


Fig. 18.



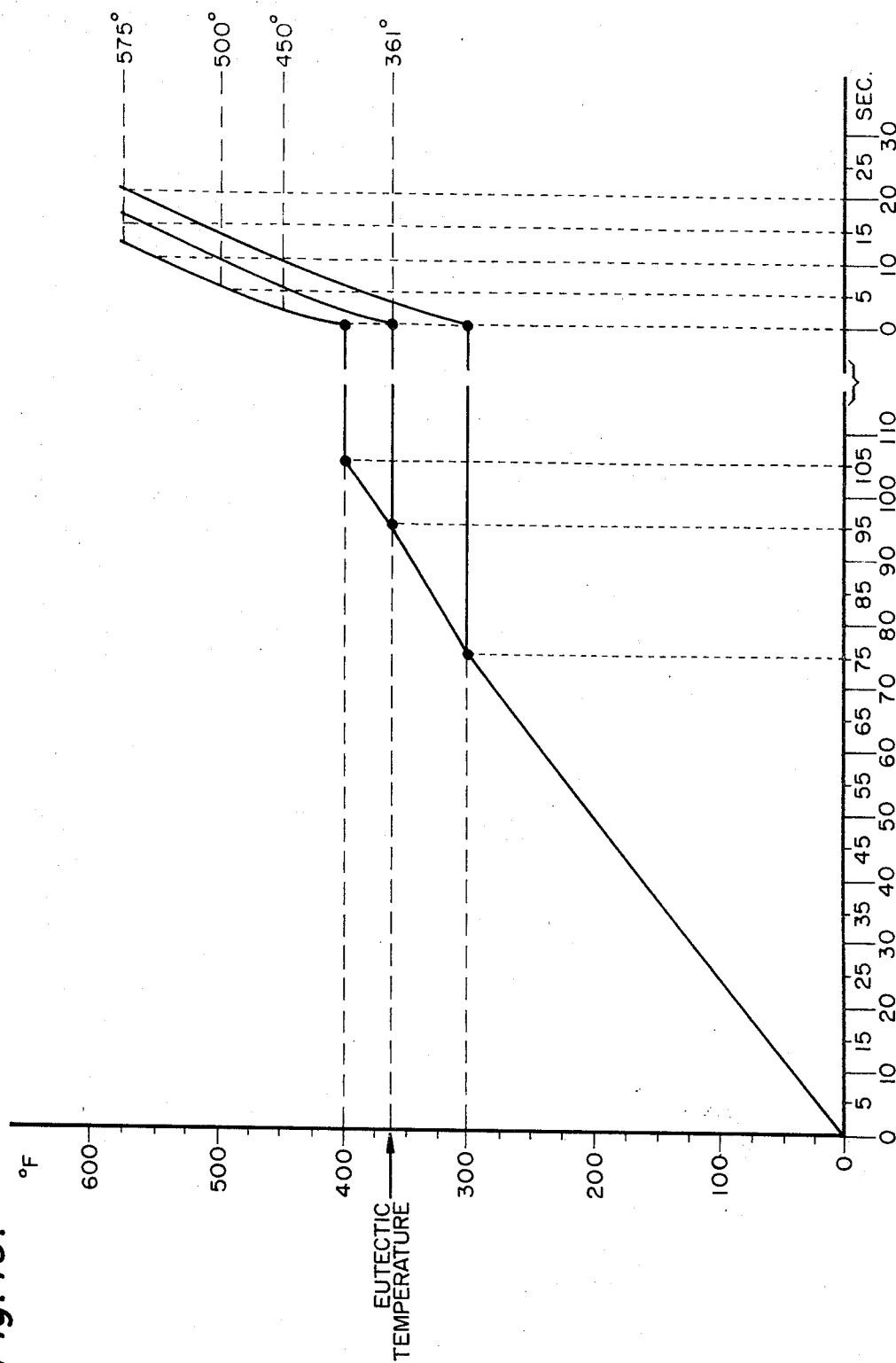


Fig. 19.

Fig. 20.

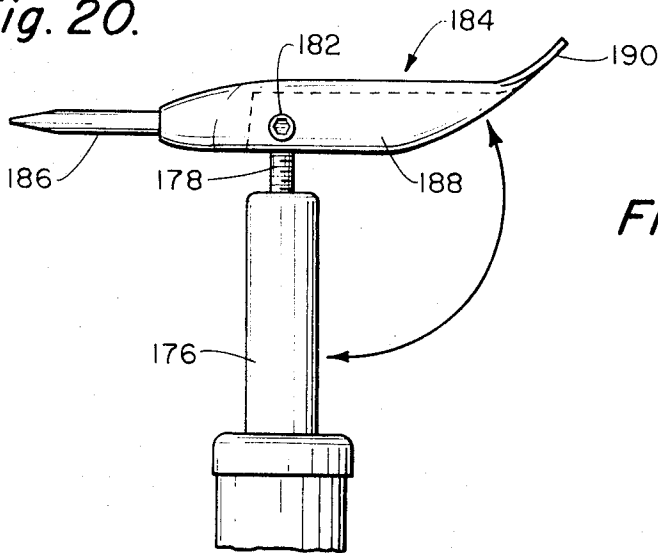


Fig. 21.

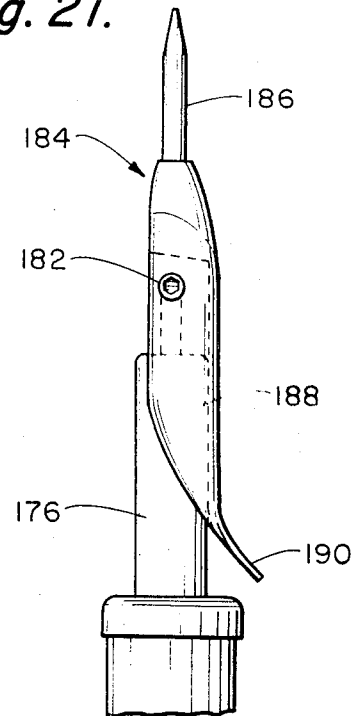


Fig. 22.

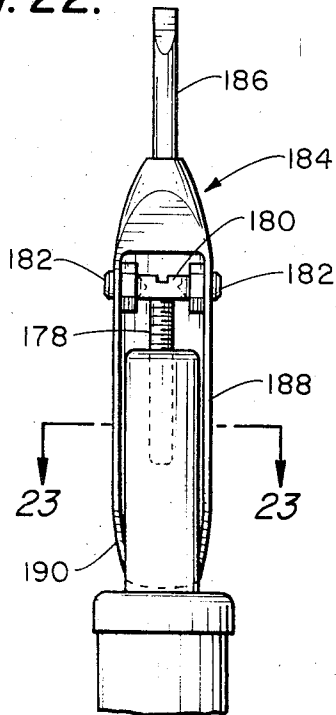
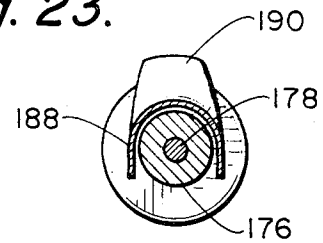


Fig. 23.



HEAT CONTROL FOR HEATED TOOL

STATEMENT OF GOVERNMENT INTEREST

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to tools intended for the application of heat to a work surface. An example of such a tool is a soldering iron having a heated tip portion which may be employed to apply or remove solder. Of course, other types of tools are contemplated including heated knives, surgical tools, wood burning and plastic working tools, etc.

2. Discussion of the Prior Art

It is characteristic of metals used for soldering tips or other heated tool members that heat which is high enough to effect melting of solder or accomplishing other work operations greatly accelerates corrosion of the heated portion of the tool, shortens its useful life, and soon destroys its surface. Attempts have been made to provide a heat control system whereby such tools can normally be maintained at a relatively low "standby" or "idle" temperature but, when needed for use, may be raised to a high "working" temperature at which they will be effective to perform their work function such as soldering, cutting, molding, pressing, gauging, etc. Such devices ordinarily involve the use of two electric heating coils, one coil (small) to provide standby heat and a second coil (large) to supplement the first when needed to achieve the desired higher working temperature. Such prior devices, however, are slow in operation since considerable time is required to raise the temperature of the second coil and to transmit increased heat to the work contacting portion of the tool where it is needed. Furthermore, such prior art devices are more expensive and complex since they require additional electric heating elements and controls and therefore are more prone to failure.

SUMMARY OF THE INVENTION

A heat control system for a heated tool having a work engaging portion wherein heat from a heat source is transferred to the work engaging portion through a heat path having variable heat flow characteristics. By this means, the work engaging portion of the tool may be maintained at a selected standby temperature between periods of use but may almost instantaneously be raised to a desired working temperature through the expedient of increasing the rate of heat flow from the heat source to the tip.

STATEMENT OF THE OBJECTS OF THE INVENTION

It is an object of the present invention to provide a system to control the heat applied to the work engaging portion of a heated tool.

Another object is to make such system adjustable so that the amount of heat applied to the work engaging portion of the tool may be varied in accordance with need.

Still another object is to provide a reliable system having a minimum number of parts which system is effective to change the temperature of the work engaging

portion of tool from a selected temperature to a desired different temperature.

A further object of the invention is to permit varying the selected different temperature to a different temperature level as desired.

A further object is to provide a heat flow control system for a heated tool wherein the rate of heat flow to the work engaging portion of the tool is varied by pressure exerted when such portion is brought into contact with the work.

It is a further object to provide a tool and a heat control system which is simple in operation, may be constructed of readily available material, and is effective to maintain a desired low temperature for long periods of time but can quickly elevate such temperature upon demand.

Still another object is to provide a tool having a heat flow control system which is actuated to change the rate of heat flow automatically when the tool is bodily moved and reoriented to a new position.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view partially in section of a stylus-like electrically heated soldering tool showing one embodiment of the invention in the high heat flow condition.

FIG. 2 is a side elevational view with a portion broken away, showing the device of FIG. 1 at rest in a protective soldering iron holder with the heat flow path in the low temperature position.

FIG. 3 is an enlarged detailed view of the heat flow controlling portion of the device illustrated in FIG. 1.

FIG. 4 is a longitudinal sectional view through a second embodiment of the invention wherein the tool temperature may manually be shifted from a "standby" to a "working" temperature.

FIG. 5 is a changed position view of the device of FIG. 4 showing the parts in a standby temperature conducting position.

FIG. 6 is a face view looking from the left of the device of FIGS. 4 and 5.

FIG. 7 is a transverse sectional view taken along a line substantially corresponding to line 7—7 of FIG. 6.

FIG. 8 is a longitudinal sectional view through a third embodiment of the invention which construction permits control of heat flow by rotation of a rotatable sleeve, shown in the low temperature position.

FIG. 9 is a change position view showing the device of FIG. 8 in the high temperature position.

FIG. 10 is an elevational view with a portion broken away of the embodiment illustrated in FIGS. 8 and 9 with the rotatable sleeve shown in an intermediate temperature position.

FIG. 11 is a transverse sectional view taken along a line substantially corresponding to line 11—11 of FIG. 10.

FIG. 12 is a side elevational view with a portion broken away of a fourth embodiment of the present invention incorporating a pistol grip type of heat control and showing the parts in the low temperature position.

FIG. 13 is a front view of the device of FIG. 11 drawn to a reduced scale.

FIG. 14 is a vertical sectional view through the device of FIG. 12 with the parts in the maximum heat flow position.

FIG. 15 is a detailed sectional view taken along a line substantially corresponding to line 15—15 of FIG. 12.

FIG. 16 is a side elevational view partially in section of still another embodiment wherein the heat source and the work contacting portions of the tool are brought into contact by pressure of the tool against the work.

FIG. 17 is a top plan view of the tool shown in FIG. 16.

FIG. 18 is a change position view of a portion of the tool shown in FIGS. 16 and 17 with a work contacting portion in contact with the heat source.

FIG. 19 is a graph plotting work contacting tip temperatures against time and depicting the operating characteristics of the device of FIGS. 1 to 3.

FIG. 20 is a side elevational view of a heated tool employing a pivoted heat member.

FIG. 21 is a change position view of the tool of FIG. 20 with the head in the maximum heat flow position.

FIG. 22 is a view similar to FIG. 21 but rotated 90°.

FIG. 23 is a transverse sectional view taken along a line substantially corresponding to line 23—23 of FIG. 22.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings in detail and particularly to the embodiment illustrated in FIGS. 1—3, there is shown a relatively thin pencil type soldering implement 20 having an elongate handle portion 22 and provided with a finger accommodating collar 24. Both handle 22 and collar 24 may be made of heat insulating material such as cork.

An electrically heated heat conductive extension 26 is located below collar 24 and contains a conventional electric heating element which receives current through an electrically conductive cord 28. The lower end of extension 26 has an axial opening joining a socket receptacle adapted to receive and hold the upper portion 30 of a removable tip assembly designated overall by the reference character 32.

As best shown in FIG. 3 the lower end of extension 30 has a small threaded axial bore which receives a threaded heat conductive stem 34. This stem conducts heat at a selected standby temperature level from extension 30, through a central opening in a heat barrier such as heat insulating bushing 36 to a tip supporting socket member 38. It will be clear that the rate of heat flow and hence the standby temperature of a tool work engaging surface may be adjusted by varying the heat conductive or insulating characteristics of stem 34 or bushing 36, respectively.

As best shown in FIG. 3, socket member 38 may have a radially extending flange 40 and a soldering tip 42 may be kept in socket 44 by means of retainer screw 46 or the like.

In order to raise tip 42 suddenly to its operating temperature control means must be provided to deliver a large quantity of heat to the tip 42 upon demand. In the embodiment of FIGS. 1—3, this is accomplished through the medium of a longitudinally shiftable sleeve member 48 which is normally in the upper heat absorbing or heat soak position shown in FIG. 2 where it sur-

rounds and absorbs heat from the electrically heated upper portion 30 of the tip assembly.

When required for use, the tool is picked up from its reclining position shown in FIG. 2 and the handle 22 is elevated to the position shown in FIG. 1. This causes the heated sleeve 48 to drop by gravity to its lowermost position with its lower end abutting the upper surface of radial flange 40 as shown in FIG. 1. When in such position, the sleeve not only promptly subjects the lower half 38 of the tip assembly to an immediate flow of high heat, but it also establishes and maintains a heat conductive bridge across heat insulating bushing 36. Over this bridge, heat flows continuously thereafter from the upper half 30 to the lower half 38.

Considering now the embodiment of FIGS. 4—7. As there shown a tool portion to be heated such as a soldering tip 50 may be received in the socket of a tip holder 52 constructed of heat conductive material and mounted on the lower end of block 54 of insulating material supported by a tool handle 56.

Handle 56 also supports a companion block 58 of insulating material located adjacent block 54 but spaced therefrom and held in movable relationship with respect thereto by a hinge strip of thin material 60 preferably of metal or other resilient substance. Rivets 62 secure strip 60 to handle 56. If desired, strip 60 may merely be flexible and a separate spring 64 may be provided to normally urge the blocks apart. Block 58 supports an extension 66 made of a material having high heat conducting characteristics such as copper and embedded therein is an electric heating element 68.

In FIG. 5, heat conductive extension 66 and the heat conductive tip holder 52 are shown somewhat separated so that only a low temperature standby radiated heat flow path is maintained from the heated block 66 to the tip holder 52. Separation of the blocks may be assured by the resilience of strip 60 or by compression spring 64, or both. To protect the operator's hand, an exterior layer of heat insulating material 70 such as cork may surround the medial portion of the tool.

In use, the handle of the tool is grasped by the operator so that one or more fingers are superimposed over blocks 54 and 58 but are protected by the heat insulating layer 70. When this portion is squeezed, heated extension 66 is brought into intimate contact with the heat conductive tip holder 52 as shown in FIGS. 4, 6 and 7. This contact includes opposed faces 72 and 74 and opposed end faces 76 and 78 and assures intimate positioning of side faces 80 and 82 shown in FIG. 7. Faces 80 and 82 may be slightly tapered if desired to permit them to be brought into positive contact when moved into juxtaposition. This action immediately floods tip holder 52 with a large quantity of heat from many sides to almost immediately raise the tip held thereby to the desired operating temperature. This condition persists as long as the parts are held together in their maximum heat position since heating element 68 is always supplied with electricity through electric cord 84. By the foregoing, a control means is provided which may easily be adjusted to vary the rate of flow from the heat source to the work circulating portion of the tool.

In the embodiment shown in FIGS. 8 to 11, an implement with a different heat flow control arrangement is illustrated. In this embodiment work contacting tool 86 is supported in the lower end of a cuplike tool holder 88, being retained in place by suitable means such as a set screw 90.

Tool holder 88 has an axially aligned, tapered, upwardly opening cavity 92 into which may be received a similarly tapered heat sink body 94. That body contains a heating element 96 receiving electric current through an electric cord 98 and the heat sink body is mounted on the lower end of a long tubular stem 100 through which cord 98 passes.

Stem 100 is supported in bearing surfaces 102 and 104 so that it may be shifted axially for a limited distance. Such axial movement positions the heat sink 94 relative to the cavity 92 in the cuplike tool holder 88 which action effectively regulates the quantity of heat transferred from the heat sink 94 to the work contacting tool 86. As shown, the cavity 92 may, if desired, be so deep as to communicate with the receptacle or socket which receives the upper end of the work contacting tool 86 and therefore the lower end 106 of sink 94 may then directly contact the upper end 108 of tool tip 86 for maximum heat transfer.

As shown the operating parts may be supported by a handle structure 110 which may have a hollow tapered upper portion supporting bearing surface 104 and may have an enlarged lower portion or base 111 to accommodate the heat sink positioning means described below. As shown the handle structure supports tool holder 88 by means of a heat barrier 112 which may have a number of cut away arch portions to help prevent return heat flow from the tool holder 88 to the handle structure 110.

Heat sink 94 may be positioned any desired distance from tool holder 88 through an adjustable control member acting to move stem 100 axially. In this embodiment the control includes a rotatable temperature control sleeve 116 which has a helical cam slot 118 therein. A cam follower pin 120 secured at its inner end to sleeve 100 as by threads and extending perpendicularly therefrom is free to move longitudinally through a straight slot 122 in the base portion of handle 110. The outer end of this pin rides in helical slot 118 and sleeve 116 has a covering sleeve 124 movable therewith which latter may be of cork or other heat insulating material. An O-ring or similar device 126 may be added at one side of sleeve 116 and together with shoulder 128 on the base prevents longitudinal shifting of the temperature control sleeve.

In order to indicate the degree of heat control sleeve rotation and hence measure the spacing of the heat sink 94 from the tool holder 88, a pointer 130 may extend from one side of the rotatable temperature control sleeves 116 and 124. Suitable temperature indicating indicia located adjacent the sweep of the pointer provides an indication of the temperature of the work contacting tool tip for various rotational positions of sleeve adjustment.

In operation the temperature adjusting sleeve is initially adjusted to a desired standby temperature. Thereafter, when it is desired to raise the temperature of the work contacting tool to a high heat such temperature control sleeve is merely rotated until pointer 130 indicates the desired higher tool working temperature. By such movement, the helical cam slot 118 shifts cam follower pin 120 to move stem 100 downwardly and the heat sink 94 then approaches the tool holder 88 causing an almost instantaneous increase in the temperature of the work contacting tool tip 86.

In the embodiment of FIGS. 12 to 15 there is shown still another embodiment of this invention. As there il-

lustrated, a work contacting tool or tip 132 is supported in a holder 134 which is mounted near the upper end of a pistol grip holder including a pivoted, finger actuated, arm 136. Heat flow to such arm may be limited by the interposition of a heat insulating block 138 therebetween.

As shown in FIG. 14, the lower end of arm 136 is pivotally attached to the lower end of a cooperating curved upwardly directed handle 140. This attachment includes a pivot pin 142, a resilient spring 144 which continually urges arm and the pistol grip handle apart, and a stop pin 146 movable in slot 148 and controlled by an associated pin travel limiting screw 150.

Mounted on the upper end of piston grip handle 140 is a shaped block 152 of insulating material to which is secured a large, forwardly directed heat sink 154 within which is buried an electric heating element 156. A shield 158 prevents accidental contact with the hot portions of the tool and an electric cord 160 provides current to heating element 156.

It will be apparent that the work contacting tool may be maintained at a standby temperature when the tool holder 134 and the heat sink 154 are separated a selected distance, as determined by the setting of screw 150. When a high working temperature is desired the pistol grip is compressed, moving tool holder 134 into contact with heat sink 154 (FIG. 14) and substantially instantaneously inducing high heat flow to the work contacting tool 132. Release of the pistol grip enables such tool to return to its normal standby temperature.

In FIGS. 16, 17 and 18, another embodiment is illustrated wherein an elongated heat source 162 is supported by a stem portion 164 in heated socket 166 centrally disposed in juxtaposition with one or more work contacting tools or tips 168. These may be retained in place by resilient mounting strips 170 connected at each end by screws 172. The stem 164 may be retained in place by a set screw 174.

In use the work contacting tips 168 will be heated to a standby heat by virtue of their proximity to the heat source 162. This condition will continue until one of the tips 168 is brought into contact with a workpiece whereupon, due to the flexibility of its support strip 170, the inside surface 172 of tip 168 is brought into contact with the outer surface of heat source 162 and an immediate high heat path between the two is established. This brings the temperature of part 168 immediately to a much higher heat than its standby temperature and enables the desired work operation to be performed.

FIG. 19 depicts characteristic work contacting tip temperatures obtained by a tool embodying a heat control utilizing the principle of the present invention. In the graph there shown, temperature is plotted against time. It will be noted that in this graph, customary warm-up times of 75 to 105 seconds are shown as being required to raise a work contacting tip to idling temperature. That idling temperature may be below or above the 360° F conventional "eutectic" temperature of tin/lead alloys of which solder is ordinarily composed.

It will be apparent that any other desired idling temperature could be selected either above or below such eutectic temperature. As examples, the graph shows illustrative idling temperatures of 300° F, 361° F and 400° F. In any event, when it is desired to raise the temperature of the work contacting tip above the selected idling temperature, the device of the present invention

allows this to be accomplished with a very rapid rise in the temperature of the work contacting portion of the tool. The rate of rise will of course vary with such factors as the mass of the heat source, which determines the amount of stored heat available; the mass of the work contacting portion which is to be heated; and the degree of heat transfer coupling which can be effected therebetween. It will appear that when these factors are optimum then the rate of heat rise in the work contacting portion will be maximum.

Of course, where a tool is employed for soldering purposes, any temperature above that at which the solder melts will enable soldering operations to be begun. However, the desirable degree of elevation of the tool temperature above eutectic varies with the heat absorbing characteristics of the work to which the tool tip is applied and therefore the rate of continuous heat flow that is necessary in order to perform a satisfactory soldering operation. It will be apparent that no single working tip temperature is optimum for all purposes, however, it is found that a work contacting portion temperature elevation of some 50° to 60° above the eutectic temperature is generally sufficient to enable soldering operations to commence.

FIGS. 20 - 23 depict an arrangement wherein a heat source 176 supports an adjustable threaded stem 178 which has a heat conductive end 180 with which two oppositely disposed pivot pins 182 pivotally engage to hingedly support a partially hollow heat conductive head 184 that mounts a work contacting tip 186. When the head 184 is in the crosswise position shown in FIG. 20, there will obviously be a minimum of heat flow thereto through threaded conductive stem 178. This provides the desired standby temperature which may be varied by threading the stem 178 inwardly or outwardly as desired to vary the degree of heat conductive coupling effected thereby.

In the crosswise position, the reduced rate of heat flow insures that the work contacting tip 186 is kept at a sufficiently low temperature to inhibit corrosion thereof.

In FIG. 21, the head 184 is shown pivoted 90° to a position aligned with the axis of the heat source 176. In such aligned position the tail portion 188 of head 184 encloses and nests around the elongate heat source 176 where it is in a position to absorb a maximum amount of heat therefrom. Thus a large amount of heat stored in the heat source 176 is rapidly conducted to the head 184 and therethrough to the work contacting tip 186.

As shown in FIG. 22, the head 184 may be in the shape of an open sided tube, the end 190 of which may be provided with upturned tip so as to be easily engaged by a tool to facilitate flipping the head from one position to another. It will be observed that with this arrangement, it will be apparent at a glance whether the tool is in the minimum or the maximum heat conductive position and hence the tip may easily be protected from unnecessary corrosion.

Obviously, many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. In a heated tool incorporating a tool life prolonging heat flow control system the combination comprising:

- a. a work contacting portion adapted to be heated;
- b. a heat source spaced from said work contacting portion;
- c. means for conducting heat from said source to said work contacting portion;
- d. control means including spring means for regulating the rate of heat flow between said heat source and said work contacting portion;
- e. the heat source and the work contacting portion being movable relative to each other to thereby vary the rate of heat exchange therebetween;
- f. said heat source and said work contacting portion being normally urged apart by the spring means which is adapted to be overcome manually upon tool manipulation by the operator;
- g. said control means being adjustable to cause a low rate of heat flow from the source to the work contacting portion when the tool is not in use;
- h. said control means also being adjustable to cause a high rate of heat flow to the work contacting portion during tool use;
- i. the work contacting portion of the tool not being subjected to high temperatures except when the tool is in use so that corrosion of the work contacting portion is minimized.

2. In a heated tool incorporating a tool life prolonging heat flow control system, the combination comprising:

- a. a work contacting portion adapted to be heated;
- b. a heat source spaced from said work contacting portion;
- c. means for conducting heat from said heat source to said work contacting portion;
- d. said means for conducting heat being in the form of a sleeve of heat conductive material;
- e. said sleeve being movable to an interassociating position establishing a high heat flow path from the heat source to the work contacting portion of the tool to raise the temperature of said work contacting portion;
- f. said sleeve being operable as control means for regulating the rate of heat flow between said heat source and said work contacting portion;
- g. said sleeve also being movable to a noninterassociating position which interrupts the high heat flow path, causing a low rate of heat flow from the source to the work contacting portion to lower the temperature of the work contacting portion when the tool is not in use; and also being adjustable to cause a high rate of heat flow to the work contacting portion during tool use;
- h. the work contacting portion of the tool not being subjected to high temperatures except when the tool is in use so that corrosion of the work contacting portion is minimized.

3. The device of claim 2 wherein said movable sleeve is rotatable and has a cam means thereon, and a cam follower associated with said cam, said cam follower being linked to said heat source, whereby rotation of said sleeve causes movement of the heat source relative to the work contacting portion.

4. In a heated tool incorporating a tool life prolonging heat flow control system, the combination comprising:

- a. a work contacting portion adapted to be heated;
- b. a heat source spaced from said work contacting portion;

- c. means for conducting heat from said source to said work contacting portion;
 - d. control means for regulating the rate of heat flow between said heat source and said work contacting portion;
 - e. said control means being adjustable to cause a low rate of heat flow from the source to the work contacting portion when the tool is not in use;
 - f. said control means also being adjustable to cause a high rate of heat flow to the work contacting portion during tool use;
 - g. said heat source constituting an extension of the end of the tool;
 - h. said work contacting portion lying alongside said heat source to receive a limited heat flow therefrom;
 - i. the work contacting portion being so supported as to be movable into contact with said heat source in order to increase the rate of heat flow;
 - j. the work contacting portion of the tool not being subjected to high temperatures except when the tool is in use so that corrosion of the work contacting portion is minimized.
5. In a heated tool incorporating a tool life prolonging heat flow control system, the combination comprising:
- a. a work contacting portion adapted to be heated;
 - b. a heat source spaced from said work contacting portion;
 - c. means for conducting heat from said source to said work contacting portion;
 - d. control means for regulating the rate of heat flow between said heat source and said work contacting portion;
 - e. said control means being adjustable to cause a low

- rate of heat flow from the source to the work contacting portion when the tool is not in use;
 - f. said control means also being adjustable to cause a high rate of heat flow to the work contacting portion during tool use;
 - g. said heat source being in the form of an elongate mass lying parallel to the axis of the tool;
 - h. said work contacting portion normally lying alongside the heat source for receiving heat therefrom;
 - i. said heat source and said work contacting portion being supported on the tool for relative movement to vary the space and therefore the heat flow therebetween;
 - j. the work contacting portion of the tool not being subjected to high temperatures except when the tool is in use so that corrosion of the work contacting portion is minimized.
6. The device of claim 5 wherein the tool includes a pistol grip handle and the heat source is mounted on one part of said pistol grip handle and the work contacting portion is mounted on another part of said pistol grip handle:
- said pistol grip handle being articulated for movement of said heat source and work contacting portion together when the handle is squeezed.
7. A device as in claim 5 wherein said work contacting portion is pivotally supported on said heat source such that said work contacting portion, when normally lying alongside said heat source, will absorb maximum heat therefrom at a high rate of heat flow and at said low rate of heat flow when pivoted from lying alongside the heat source.
8. A device as in claim 3 wherein said cam means is a helical slot in said movable sleeve.

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