

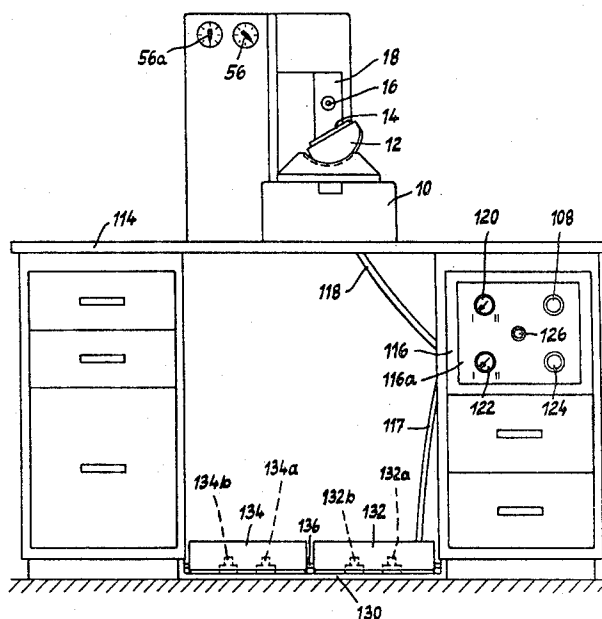
[72] Inventor **Martin Stachl**
Munich, Germany
 [21] Appl. No. **824,564**
 [22] Filed **May 14, 1969**
 [45] Patented **Sept. 7, 1971**
 [73] Assignee **Carl Zeiss-Stiftung**
Brenz, Wuerttemberg, Germany
 [32] Priority **May 17, 1968**
 [33] **Germany**
 [31] **P 17 72 455.9**

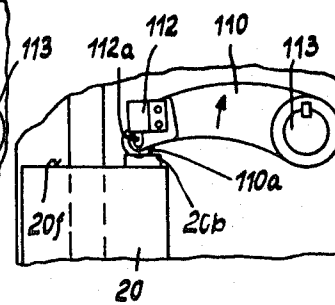
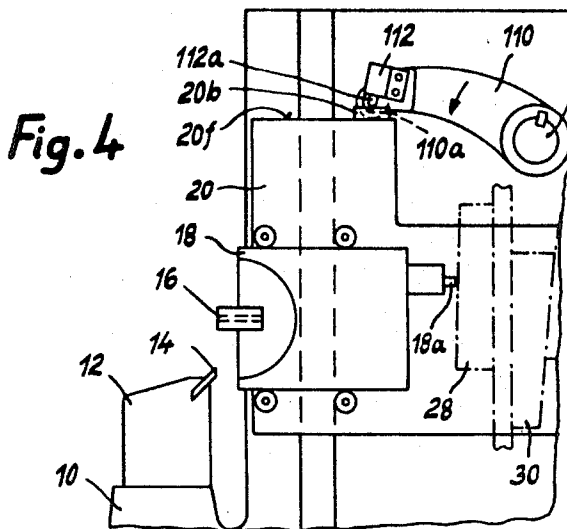
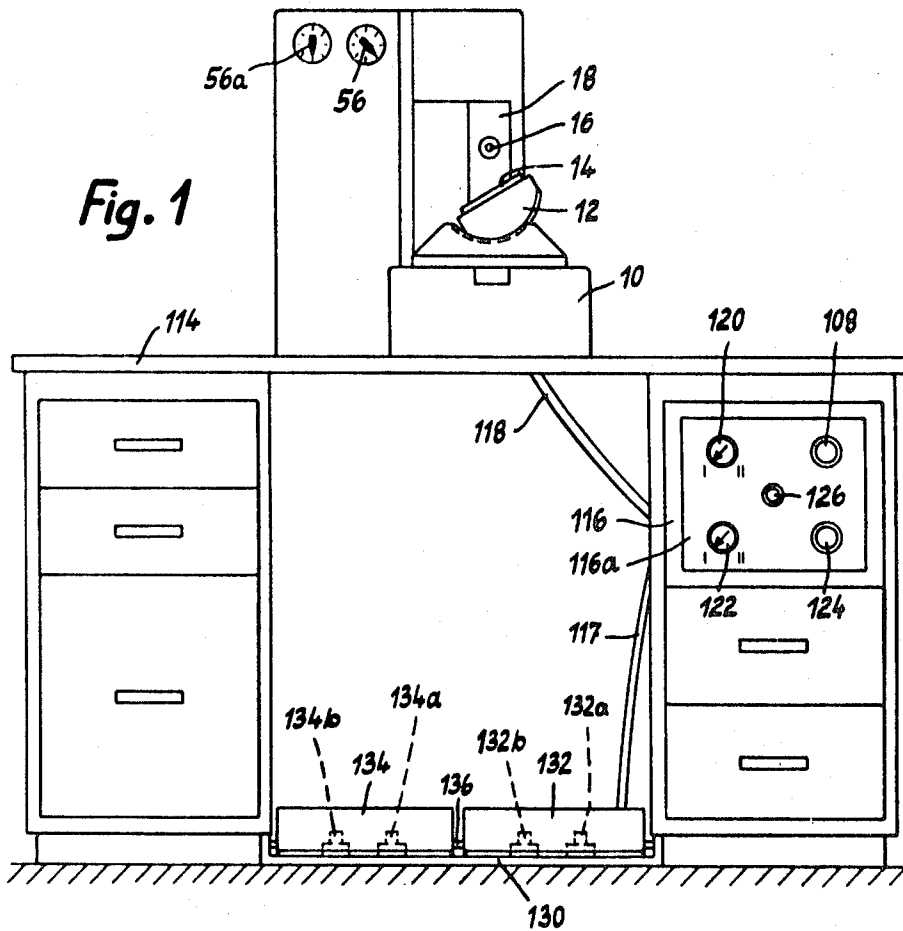
[56] **References Cited**
UNITED STATES PATENTS
 2,927,505 3/1960 Haanstra 83/915.5 X
FOREIGN PATENTS
 148,549 7/1961 U.S.S.R. 83/915.5
Primary Examiner—William S. Lawson
Attorney—Larson, Taylor & Hinds

[54] **MICROTOME WITH ELECTRICAL DRIVE**
4 Claims, 6 Drawing Figs.

[52] U.S. Cl. **83/412,**
83/915.5
 [51] Int. Cl. **G01n 1/06**
 [50] Field of Search **83/490,**
915.5, 412

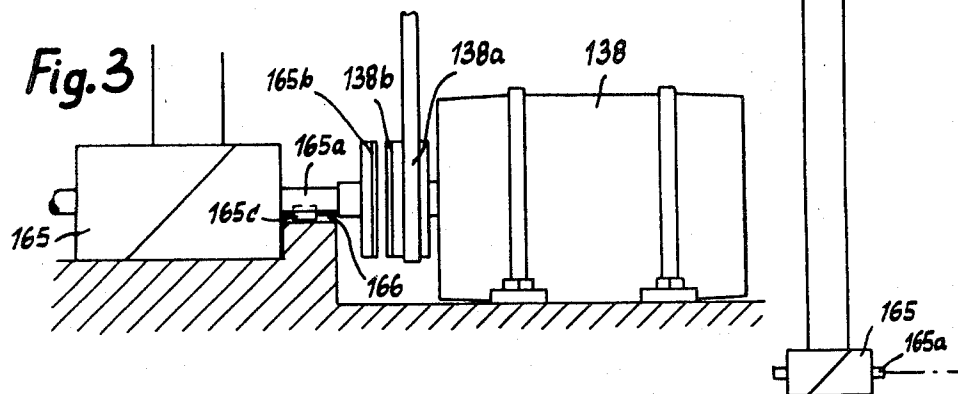
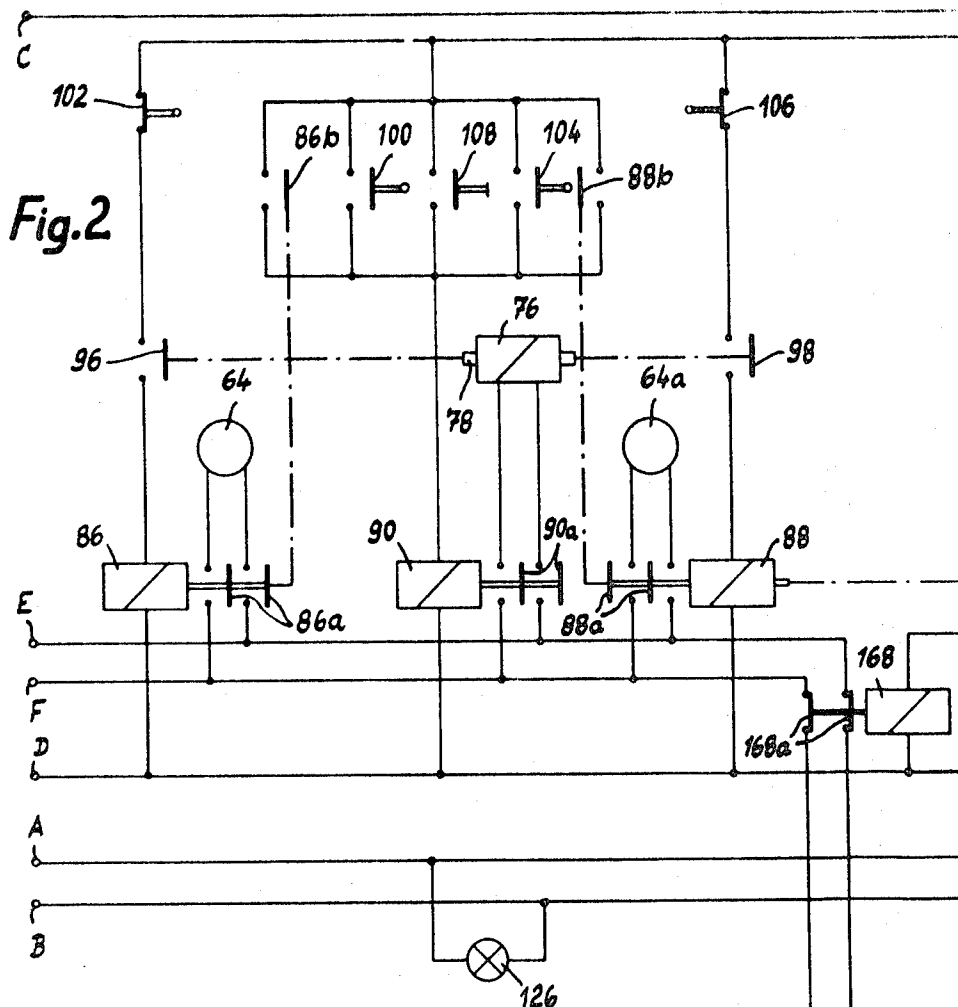
ABSTRACT: A microtome arrangement comprising a microtome knife, a preparation holder, and an electric motor for producing relative movement of the holder with respect to the knife to effect cutting of a preparation held in the holder includes a foot-operated switch which controls energization and deenergization of the motor so as to free the hands of the operator. A safety switch provides for deenergization of the motor when a motor-driven drive lever for the preparation holder becomes disengaged from the preparation holder and thus prevents damage to the microtome upon jamming or the like. An electromagnetically controlled brake is automatically operated upon deenergization of the motor.





INVENTOR
MARTIN STACHL

Parson and Taylor
ATTORNEYS



INVENTOR
MARTIN STACHL

Larson and Taylor
ATTORNEYS

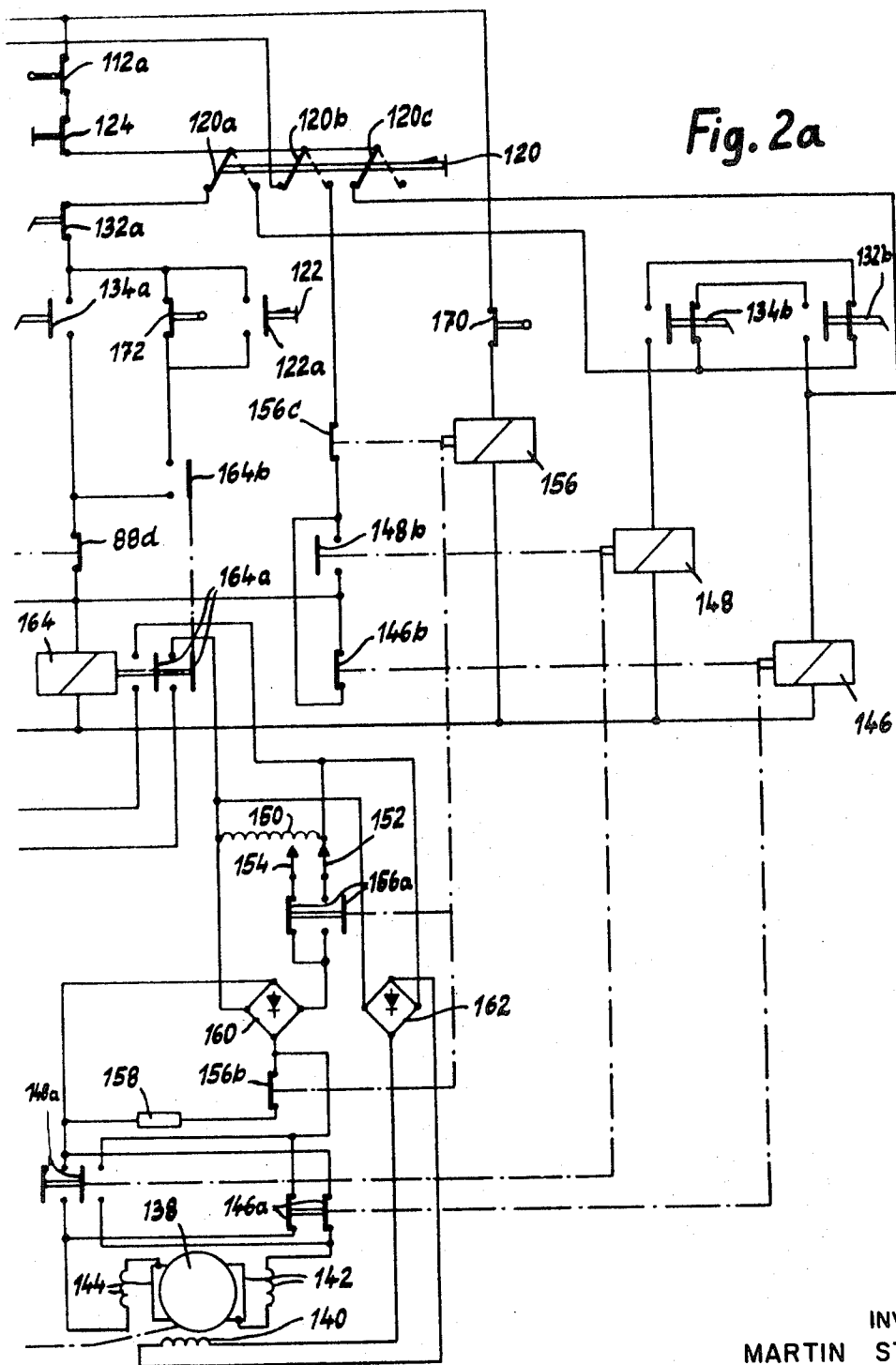


Fig. 2a

INVENTOR
MARTIN STACHL

Larsoy and Dayles
ATTORNEYS

MICROTOME WITH ELECTRICAL DRIVE

FIELD OF THE INVENTION

The present invention relates to a microtome of the type wherein an electrical drive causes movement of a preparation holder with respect to the microtome knife to effect cutting.

BACKGROUND OF THE INVENTION

Microtomes of the type described above are generally operated by a single operator who must control the energization and deenergization of the electrical drive as well as control and supervise the actual cutting operation. The various operating handles and knobs which are involved in the operation of a microtome frequently cannot be attended to simultaneously and delays in performing various functions during the microtome operation can often produce undesirable results and a general impairment of the quality of the work carried out.

SUMMARY OF THE INVENTION

In accordance with the present invention a microtome arrangement is provided which overcomes the various shortcomings of known arrangements such as discussed hereinabove. A microtome arrangement according to the present invention includes a switching system which provides more versatile handling of the microtome as well as improvement in the general operation thereof.

In accordance with an important feature of the present invention at least one foot-operated switch is provided for controlling the electric drive. Switch control may be effected through a pivotable footboard and in a presently preferred embodiment of the invention first and second footboards arranged in side-by-side relationship are utilized. These footboards each control a set of first and second switches, actuation of at least one switch in the set being controlled by a manually operated selector switch provided on a suitable control panel. This arrangement frees the hands of the operator during the operation of the microtome in that only the setting of the selector switch need be attended to manually. In accordance with a further feature of the invention the footboards and the associated switches form a single portable unit which is conductively connected to the electrical drive through a coupling cable. This arrangement permits positioning of the switching unit away from the microtome itself to provide for remote operation of the microtome.

In accordance with a further feature of the present invention a safety device is provided which prevents damage to the preparation holder and the mechanical drive therefor because of jamming or the like such as occurs under so-called "hard cutting" operation. Considering the operation of a microtome of the type described it is noted that where the preparation holder is obstructed during its return movement the movement of the mechanical drive therefor will be unobstructed and thus damage to the holder or to the mechanical drive may result. In accordance with the present invention an electrical switch is provided which opens in response to disengagement of the mechanical drive from the preparation holder. Openings of this switch causing deenergization of the electrical drive. In a specific embodiment, the mechanical drive for the preparation holder includes a pivotable lever which carries a portion of a pressure-actuated switch, the switch being closed through engagement of the pivotable lever with the preparation holder and being opened upon disengagement. The pressure-actuated portion of the switch is preferable mounted on the drive lever and held in the closed position thereof by a projection on the preparation holder.

In accordance with yet a further feature of the present invention, movement of the preparation holder after the microtome has been switched out of operation is precluded by a brake arrangement which is energized when the electrical drive for the microtome is deenergized. The brake arrange-

ment preferably includes an electromagnetic operator which is automatically energized when the electrical drive is deenergized.

Other features and advantages of the present invention will be set forth in or apparent from the detailed description of the preferred embodiment found hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front view of a presently preferred embodiment of the invention showing the overall system including the microtome operating table;

FIG. 2 and 2a together are a schematic circuit diagram of the electrical system for the microtome;

FIG. 3 illustrates a detail of a portion of the system of FIG. 2, 2a shown schematically in FIG. 2, 2a; and

FIGS. 4 and 5 illustrate details of the microtome shown in FIG. 1 in different operating positions.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring particularly to FIGS. 1 and 4, a microtome arrangement is shown which includes a baseplate 10, a holder 12 for a microtome knife 14, a holder 18 for receiving a preparation 16, and a main slide 20. The microtome shown in FIGS. 1 and 4 is of a construction more fully described in U.S. Pat. No. 3,293,972 and thus specific details of the construction of the microtome will be omitted and only the elements thereof which are essential to an understanding of the present invention will be described. The microtome further includes an auxiliary slide which has been omitted from the drawings for purposes of clarity of illustration and which carries first and second wedges 28 and 30 shown in phantom in FIG. 4. The microtome is mounted on a working table 114 in the form of a writing desk and first and second knobs 56 and 56a are located on a panel mounted on table 114 adjacent the microtome. Positioning of wedge 28, which provides fine adjustment, is controlled through adjusting knob 56 whereas positioning of wedge 30, which provides coarse adjustment, is controlled through adjusting knob 56a. The wedges 28 and 30 are adjusted in steps to determine the horizontal movement of the preparation holder 18, the amount of advance produced by the two wedges being added together to produce a resultant movement which is transmitted through a pin 18a to the preparation holder 18. This movement, as stated, will produce a corresponding movement of the preparation 16 horizontally to the left as shown in FIG. 4 and thus will position the preparation 16 relative to the cutting knife 14 so that cutting of the preparation 16 may be effected. Reference is made to U.S. Pat. No. 3,293,972, referred to above, for a further description of the wedges and the drive arrangement therefor.

Main slide 20, which carries preparation holder 18, is moved vertically downward to effect cutting of preparation 16 through an arrangement including a lever 110 affixed to a drive shaft 113 driven from an electric motor 138 (see FIG. 2, 2a and FIG. 3). Lever 110 rotates about shaft 113 in the counterclockwise direction so that an end portion 110a thereof engages and bears against an upper surface 20f of main slide 20 and thus causes movement of slide 20 downwardly (not the biasing action provided by a return spring arrangement (not shown). These return springs will cause upward movement of the main slide when lever 110 is rotated in the clockwise direction so that slide 20 will be returned to the initial position thereof. A safety switch 112 is mounted on the end of lever 110 and includes a push button 112a which engages a projection 20b on main slide 20 when end portion 110a of lever 110 contacts the upper surface 20f of slide 20, switch 112 thus being closed under these conditions. Further details of the operation of switch 112 will be set forth hereinbelow.

A switch box 116 mounted in microtome table 114 as shown provides a control center for the microtome operation and is connected to the microtome through a multilead cable 118. The front panel 116a of unit 116 includes a series of switches 120, 122, 108, 124 as well as a light 126. Switch 120

is a two position switch which in position I provides for normal operation of the microtome and in position II provides for a tapping operation described hereinbelow. Switch 122 is also a two-position switch and in position I provides single operation of the microtome and in position number II provides continuous operation. Switch 108 is a press switch which provides for return of the wedges 28 and 30 to the initial positions thereof. Switch 124 is a stop switch for arresting movement of the microtome. Signal light 26 is utilized to indicate that the microtome arrangement is ready for operation. It is noted that a number of further controls could be mounted on the switchboard face provided by panel 116a such as an indicator for providing a count of the number of cuts made by the microtome, a rotary speed regulator, various key switches for connecting to the power mains, and a switch for providing additional illumination of the microtome.

Left-hand and right-hand footboards 132 and 134 are mounted in the space between the supporting portions of table 114, provided for the legs of an operator, for easy access. Footboards 132 and 134 are mounted on a common supporting rod 136 suspended in a U-shaped base support 130. Footboards 132 and 134 are pivotable about rod 136 and are held in a position spaced from the floor, such as shown in FIG. 1, by suitable compression springs (not shown). Footboards 132 and 134 each control a set of switches, footboard 132 controlling an upwardly acting switch 132a and a double-pole switch 132b and footboard 134 controlling a downwardly acting switch 134a and a double-pole switch 134b. Switches 132a, 132b, 134a and 134b are connected to control unit 116 through a cable 117. Mounting support 130 and associated footboards 132 and 134 are preferably formed as a single unitary structure and can, as shown in FIG. 1, be mounted under operating table 114 as described hereinabove or in any other suitable operating locality. This unitary construction of the footboard arrangement and associated switches provides for remote control from any point.

FIGS. 2 and 2a taken together form a schematic circuit diagram of the wiring arrangement for the electrical equipment associated with the microtome. The electrical portion of the system consists of three basic circuits, namely, a main driving circuit having an input at terminals A and B, a first control circuit having an input at terminals C and D and a second control circuit having an input at terminals E and F. For purposes of convenience these circuits will be referred to by their input terminals so that the main driving circuit will be referred to as main driving circuit "A, B." The input at terminals A and B of driving circuit A, B may for example be a 220 volt AC input whereas the input to circuit E, circuit C, D may, for example, be a 24 volt AC input and the input for control circuit E, F may, for example, be a 24 volt DC input. It will be appreciated that various transformers and rectifiers (not shown) are preferably included in the electrical system to enable the various operating voltages described above to be taken from a common source such as from the power mains.

The electrical drive motor 138 for shaft 113 described hereinabove is connected to the main driving circuit A, B and includes a conventional field winding 140 and reversing poles 142 and 144. The reversing of electric motor 138 is effected through double-pole switches 146a and 148a operated by relays 146 and 148, respectively. A transformer 150 is connected in driving circuit A, B for regulating the rate of rotation of the driving motor 138. Transformer 150 provides for movement of the main slide 20 at 9 different speeds during a cutting cycle, such as at a relatively slow speed during the cutting operation and at a relatively more rapid speed during the return of the main slide 20 to the initial position thereof. Transformer 150 includes first and second adjustable taps 152 and 154 and depending on the position of switch 156a a higher or lower rate of rotation of the electric motor 138 will be produced in accordance with whether the control circuit for the motor 138 is completed through tap 152 or 154 by switch 156a. A built-in braking resistance 158 precludes the occurrence of an excessive residual voltage for a given working cur-

rent. A switch 156b connected between resistance 156a and a rectifier bridge 160 is controlled by relay 156 referred to above. Driving circuit A, B further includes the signalling lamp 126 referred to hereinabove, a further rectifier bridge 162 and a double switch 164a controlled by a relay 164 whose function will be described hereinbelow.

As shown in FIG. 3, motor 138 includes a belt pulley 138a having a brake lining 138b secured to the face thereof. A brake disc 165b is located opposite brake lining 138b on an armature 165a of an electromagnetic relay 165. A downwardly extending projection 165c on armature 165a engages in a fixed slot or groove 166 and thus prevents rotation of armature 165a. The electromagnetic device 165 is connected in control circuit E, F and is energized by a double-pole switch 168a controlled by a relay 168. Closing of switch 168a causes energization of the magnetic winding of the electromagnetic device 165 and consequently movement of armature 165a such that brake disc 165b is pressed against and engages the brake lining 138b of motor 138 to cause braking of the movement of the rotor of motor 138a. First control circuit C, D includes a series of further switch 146b, 148b, 156c and 164b which are respectively controlled through relays 146, 148, 156 and 164 and whose functions will be described hereinbelow. Circuit C, D further includes first and second switches 170 and 172 which, also as described in more detail hereinbelow, are operable responsive to the movement of driving shaft 113. The switch control knob 120 referred to above controls a series of two-position switches 120a, 120b and 120c.

Referring to the left-hand portion of the circuit diagram and more particularly to FIG. 2, a motor 64 is provided for driving wedge 28 and a motor 64a is provided for driving wedge 30. Motors 64 and 64a are connected together with an electromagnet 76 in control circuit E, F and function to return wedges 28 and 30 to the initial positions thereof. Connection of motors 64 and 64a and electromagnet 76 in circuit E, F is controlled through corresponding double-pole switches 86a, 88a and 90a. Switches 86a, 88a and 90a are controlled by respective electromagnetic relays 86, 88 and 90 which are located in control circuit C, D. Switches 86a and 88a are, respectively, mechanically coupled to further switches 86b and 88b as indicated. Control circuit C, D further includes first and second switches 96 and 98 which are coupled to the armature of electromagnet 76 and are controlled by the movement thereof. The function of these switches will be described hereinbelow.

A closure switch 100 and an opening switch 102 are positioned in the path of travel of wedge 28, this path being vertical as shown in FIG. 4. Closure switch 100 is actuated by the wedge 28 in the uppermost limit position of the wedge whereas the opening switch 102 is actuated by the wedge in the lowermost limit position thereof. An opening switch 104 and a closure switch 106 are similarly actuated during the movement of wedge 30 but with the difference that the closure switch 106 is operated by wedge 30 in the lowermost limit position of the wedge whereas the opening switch 104 is operated by the wedge 30 in the uppermost limit position thereof.

The functions of the various switches described hereinabove can best be appreciated from a consideration of the overall operation of the microtome arrangement and the various operational capabilities provided thereby. As shown in FIG. 1, selector knob 120 is set in position I corresponding to normal operation and selector knob 122 is set in position I corresponding to a single cutting cycle. To bring the microtome into operation the operator presses down on footboard 134 with his left foot so that switch 134a is closed and remains closed as long as footboard 134 is depressed. Closing of switch 134a causes energization of relays 164 and 168 and consequently closing of switches 164a and 164b and opening of switch 168a. Under these conditions, electromagnet 165 is deenergized so that the braking engagement between brake lining 138a and brake disc 165b is broken through disengagement of armature 165a (see FIG. 3). Consequently electric

motor 138 will begin to turn so that main slide 20 and hence preparation holder 18 is driven through drive shaft 113 and lever 110 in a vertically downward direction so that a disclike portion of preparation 16 is sliced off. The operational speed of preparation holder 18 during the cutting phase is regulated by tap 154 on transformer 150 to provide relatively slow movement of the preparation holder 18. When slide 20 has reached the lowermost limit position thereof the switch 170 referred to above is open by shaft 113. Switch 170 may comprise a conventional microswitch and may be positioned relative to shaft 113 so that a projection (not shown) on shaft 113 will cause deactuation thereof. With switch 170 open, relay 156 is deenergized and the switches 156a, 156b and 156c controlled thereby are opened. Deenergization of relay 156 also causes movement of double-pole switch 156 to a position wherein the motor control circuit is completed through tap 152 so that motor 138 is operated at a speed such as to accelerate the upward motion of the slide 20, transformer 150 providing full output voltage with tap 152 connected in the motor control circuit. At the end of the upward movement of slide 20, the switch 172 referred to above is temporarily opened responsive to the corresponding movement of drive shaft 113, so that relays 164 and 168 are deenergized and, consequently, switches 164a and 164b are open and switch 168a is closed. Closing of switch 168a causes energization of electromagnet 165 so that movement of armature 165a causes engagement of brake disc 165b with brake lining 138b and hence the immediate arrest of the motion of the rotor of motor 138. At this time, switch 170 is again closed to energize relay 156, and switches 156a, 156b and 156c operated thereby assume the initial position shown in FIGS. 2, 2a. Thus a single cutting cycle is completed and the system is returned to the initial position thereof ready to begin a new cycle.

Considering the operation of the arrangement wherein a number of disclike portions of the preparation are to be cut successively, selector knob 122 is moved from position I, corresponding to single operation to position II, corresponding to continuous operation so that switch 122a controlled thereby is closed during the entire operation. Thus if the microtome is brought into operation in the manner described hereinabove through closing of switch 134a by depressing footboard 134 the operation will proceed as described except that switch 172, which is opened by shaft 113 at the end of each cutting cycle, is no longer effective to terminate the cycle in that switch 122a provides a shunt path for current which bypasses switch 172. For the continuous mode operation, movement of the slide 20 and thus of preparation holder 18 can be terminated in either of two ways, by depressing of right-hand footboard 132 to cause opening of upwardly acting switch 132a or by manually opening the stop switch 124 mounted on the front panel 116a of control unit 116.

It will be appreciated that the mounting of a new preparation 16 in the preparation holder 18 will require a new setting of knife 14 relative to the new preparation. Further, the preparation itself may be positioned in a skewed fashion relative to the plastic casing in which it is enclosed and thus it is customary to provide a number of rapid strokes at the beginning of the operating cycle to ensure that the slices of preparation produced are full cross sections. For this reason it is advantageous to switch from the normal operating cycle wherein one or a number of cutting movements are provided during the period of the cycle, to a so-called "tapping" operation. To effect a tapping operation the operator moves selector knob 120 from the position I corresponding to normal operation to position II corresponding to the desired tapping operation. Under these circumstances switches 120a, 120b and 120c assume the positions shown in dotted lines in FIGS. 2, 2a. With switches 120a, 120b and 120c in these positions, foot-operated switches 132a and 134a and switches 122a and 172 are rendered inoperative and double-pole switches 132b and 134b are connected such that these latter switches may be operated in series. Moreover, switch 120c in this position will cause deenergization of relay 146 and consequently opening of switches 146a and 146b.

Under these circumstances, when switch 132b is actuated by the depressing of right-hand footboard 132, relay 146 will cause closing of switches 146a and 146b and consequently energization of relays 164 and 168. With these latter relays energized motor 138 is also energized and will cause downward movement of slide 20 and associated preparation holder 18 so that a disc of the preparation 16 is cut off. After the cutting phase of operation, the operator releases footboard 132 so that switch 132b opens and thus motor 138 is deenergized. At this time, the left-hand footboard 134 is depressed and switch 134 is closed so that relay 148 is energized and switches 148a and 148b controlled thereby are closed. As a result, switch 164a controlled by relay 164 closes and switch 168a controlled by relay 168 opens. Under these circumstances motor 138 again begins to turn but at this time in the opposite direction so that slide 20 and associated preparation holder 18 will move vertically upward until the left-hand footboard 134 is released and movement of slide 20 is halted.

It will be appreciated that by normal "tapping" alternatively on the left-hand and right-hand footboards 132 and 134, respectively, the cutting stroke of slide 20 is shortened and a number of cuts can be carried out within a shorter period. Thus the situation wherein a full cross section of preparation 16 is produced by a cut is quickly reached since a shortened stroke controlled by the operator through footboards 132 and 134 is used. It will be understood that after this preliminary cutting procedure the system will be changed over to the normal cutting cycle through movement of selector knob 120 to position I corresponding to normal operation.

It is noted that during the return movement of the slide 20 and associated preparation holder 18, that is the upward movement of slide 20, provided by the return springs referred to hereinabove, it is possible, particularly where "hard" cutting is involved, that the slide 20 and associated preparation holder 18 may be hindered in the return movement thereof and will continue to be driven in the clockwise direction by shaft 113 so that the engagement between lever 110 and slide 20 will be broken. The safety switch 112 described hereinabove prevents damage of any kind resulting from such an eventuality, switch 112 being open upon the disengagement of lever 110 and slide 20 and thus interrupting the current flow to electric motor 138 (see FIG. 5).

Turning now to a consideration of the control operation for the movement of wedges 28 and 30, it will be assumed that the coarse wedge 30 has reached the lowermost limit position thereof first whereas the fine wedge 28 is located at a predetermined distance from the limit position thereof. It is noted that in order that a new cycle of movement of the wedges be initiated both of the wedges 28 and 30 must first be returned to the initial positions thereof. Wedge 30, in the lowermost position thereof, will cause closing of switch 104 for a brief period to thus cause energization of relay 90 and consequent closing of switch 90a. As a result electromagnet 76 is energized and wedges 29 and 30, through movement of armature 78, are respectively coupled to the drive shafts of the restoring motors 64 and 64a through a suitable mechanical coupling (not shown). Moreover, movement of armature 78 also causes closing of switches 96 and 98 and consequent energization of relays 86 and 88 and closing of switches 86a and 88a. Under these circumstances bridging switches 86b and 88b, which are coupled to switches 86a and 88a, are closed and switch 88d, operated by relay 88, is opened so that drive motor 138 is rendered inoperative during the restoring movements of wedges 28 and 30. At this time, restoring motors 64 and 64a begin to turn, motor 64 turning in the counterclockwise direction and motor 64a in the clockwise direction. As a consequence wedge 28 moves downwardly and wedge 30 moves upwardly and switch 104 which provided the starting signal for the restoration of the wedges 28 and 30 is released from contact with wedge 30 shortly after the beginning of the return movement of wedge 30 and thus switch 104 opens. Despite the opening of switch 104, current flow to relays 90, 86 and 88 is maintained in that current paths are provided

through switches 86d and 88d which remain closed. After a predetermined time, wedge 28 will reach the initial position thereof and will cause opening of switch 102 and the interruption of current flow to relay 86. Deenergization of relay 86 will cause opening of switch 86a and coupled switch 86b and consequently deenergization of restoring motor 64. At this time the restoring movement of wedge 28 is terminated. At the termination of the restoring movement of wedge 28, wedge 30 has not yet reached the uppermost limit position thereof and thus motor 64a will continue to turn until this limit position is reached. In the limit position thereof wedge 30 will cause opening of switch 106 so that restoring motor 64a is deenergized because of the opening of switch 88a by deenergization of relay 88. Opening of switch 88a also causes armature 78 to drop out and switches 96 and 98 to open. Deenergization of relay 88 will also cause switch 88d to close and thus the electrical circuit for controlling restoration of the wedges 28 and 30 to the initial position thereof is completely deenergized and returns to initial operating conditions.

Switches 102 and 106 which were opened by wedges 28 and 30 respectively are immediately reclosed at the initiation of a new cutting operation. Thus it will be appreciated that a closure switch, switch 100 and switch 104, and a cutout or opening switch, switch 102 and switch 106, are respectively associated with each wedge so that the restoring operation is begun or arrested by one or the other of the wedges depending upon the positions of the wedges. The wedge restoration operation may also be indicated by closing press switch 108 mounted on switchboard panel 116a, switch 108 causing energization of relay 900 and consequent closing of switch 90a irrespective of the positioning of wedges 28 and 30 and thus initiates the restoring operation in the manner described hereinabove.

It should be understood that although the invention has been described in relation to a particular exemplary embodiment, those skilled in the art will recognize that the exemplary embodiment shown and described may be modified without

departing from the scope and spirit of the invention. Thus it will be understood that the invention is not to be limited by the exemplary embodiment shown and described.

I claim:

1. A microtome arrangement comprising a movable preparation holder, a microtome knife, electrical drive means for causing movement of said preparation holder relative to said knife to effect cutting of a preparation held in said preparation holder, first and second sets of first and second switches for controlling said electrical drive means, first and second footboards for controlling the operation of said first and second sets of switches, and a selector switch for controlling the actuation of at least one of the first and second switches of the respective sets of switches.

2. A microtome arrangement as claimed in claim 1 wherein said first switch of said first set comprises a cut-in switch, said second switch of said first set comprises an upwardly acting switch, said first switch of said second set comprises a cut out switch and said second switch of said second set comprises a downwardly acting switch.

3. A microtome as claimed in claim 1 further comprising means for providing operation of said microtome in a single-cut mode, means for providing operation of said microtome in a continuous-operation mode, a selector switch for switching the operation of said microtome between said single-cut mode and said continuous-operation mode, means for providing operation of said microtome in a normal, full-stroke mode and means for providing operation of said microtome in a tapping or partial-stroke mode, and a second selector switch for switching the operation of said microtome between said full-stroke mode and said partial-stroke mode.

4. A microtome as claimed in claim 1 further comprising means for housing said first and second footboards and said first and second sets of switches in a single portable unit and a coupling cable for connecting said unit to said electrical drive means.

40

45

50

55

60

65

70

75

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,603,189 Dated September 7, 1971

Inventor(s) Martin Stachl

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover page, that portion reading:

"Assignor to Carl Zeiss-Stiftung, Brenz, Wuerttemberg,
Germany"

should read:

--Assignor to Carl Zeiss-Stiftung, Heidenheim, Brenz,
Wuerttemberg, Germany--

Signed and sealed this 8th day of August 1972.

(SEAL)

Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents