United States Patent

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[54] **DEPTH-CONTROLLED DRILL PRESSES**
12 Claims, 4 Drawing Figs.

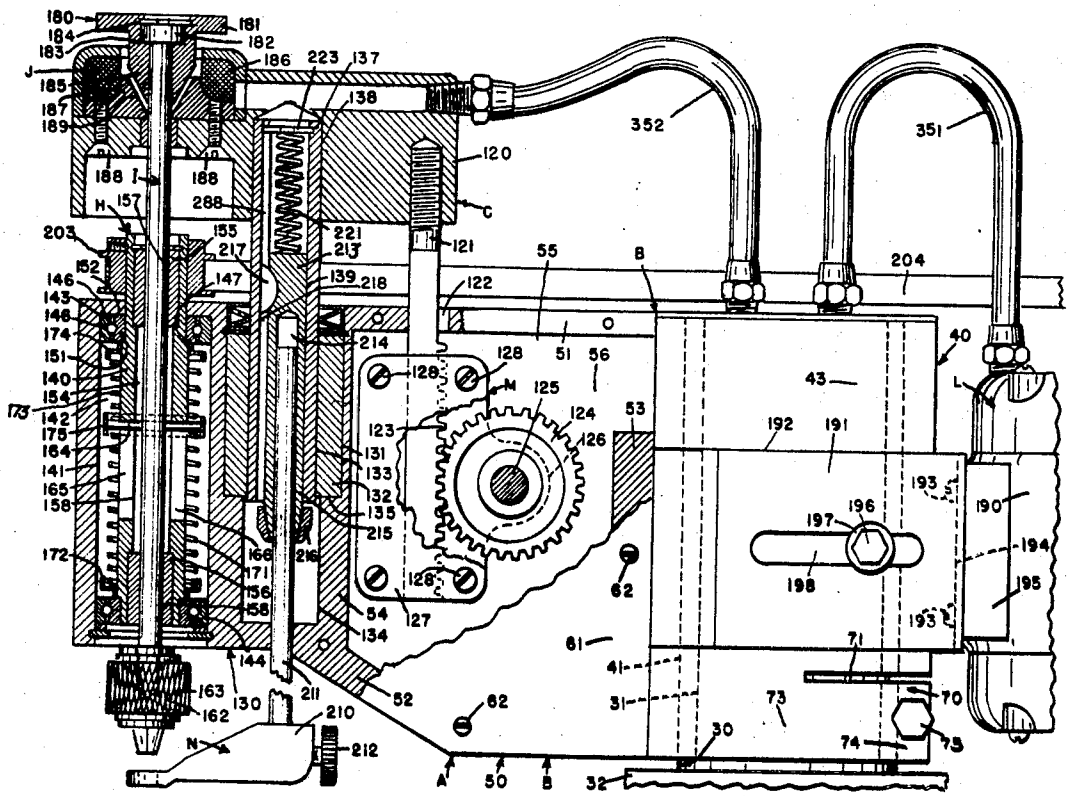
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[51] **Int. Cl.** **B23c 1/06,**
B23b 47/20
[50] **Field of Search** 90/11, 11.1, 14; 77/55, 32.1, 32.9; 318/39

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ABSTRACT: A depth-controlled drill press having a supporting means including a head slidably mounted in the body of said supporting means and manually movable toward and from a work rest carried by the body, a quill rotatably mounted in said body and held from axial movement, a motor rotating said quill, a tool supporting spindle received within said quill guided for axial movement and restrained from rotation relative to the quill. The upper end of the spindle is held attached to said head by an electromagnet and pushed away from the work by a spring when the electromagnet is deenergized by circuitry actuated upon the tool engaging a metallic member in the work.



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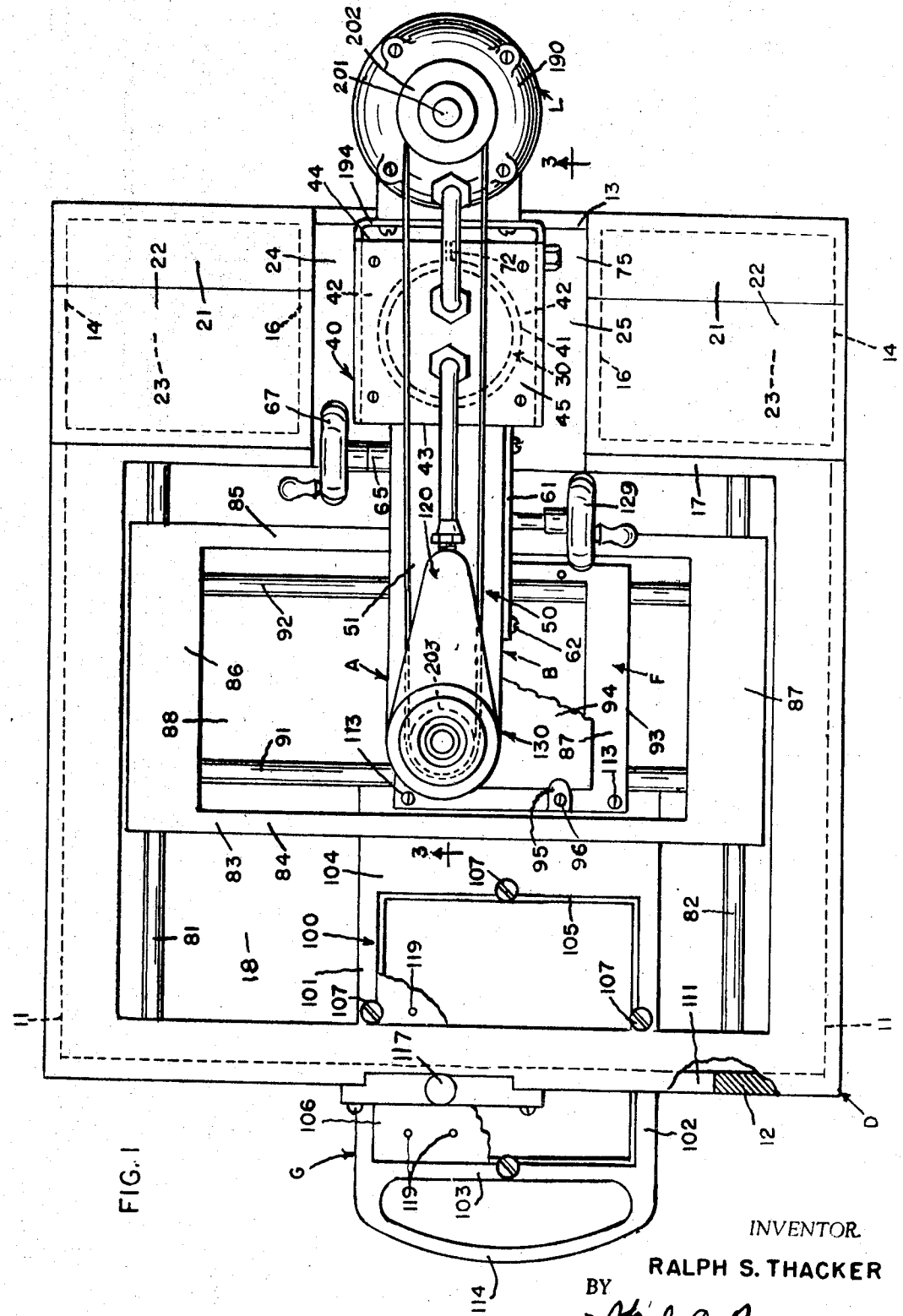
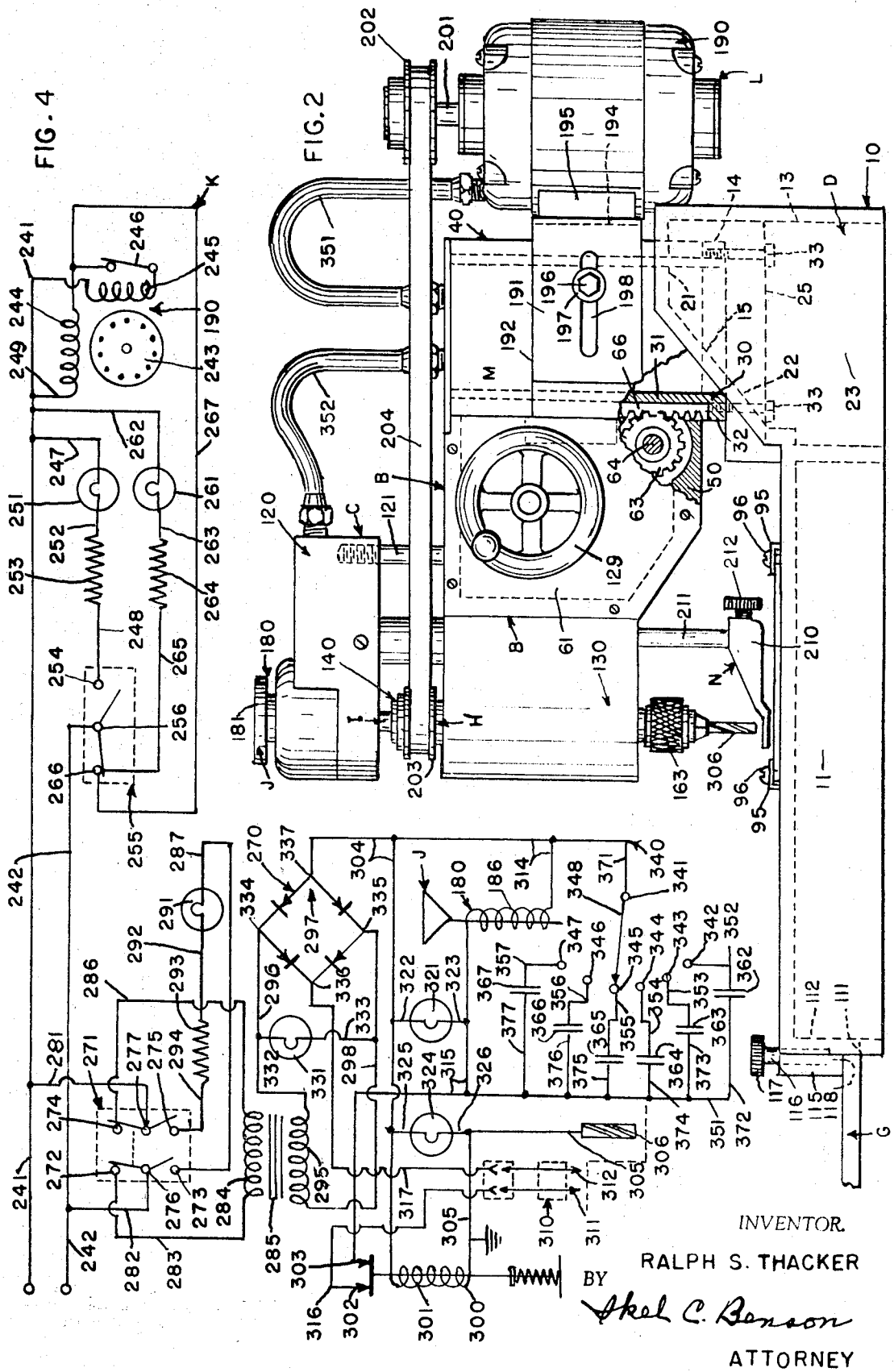


FIG. 1

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FIG. 4

FIG. 2



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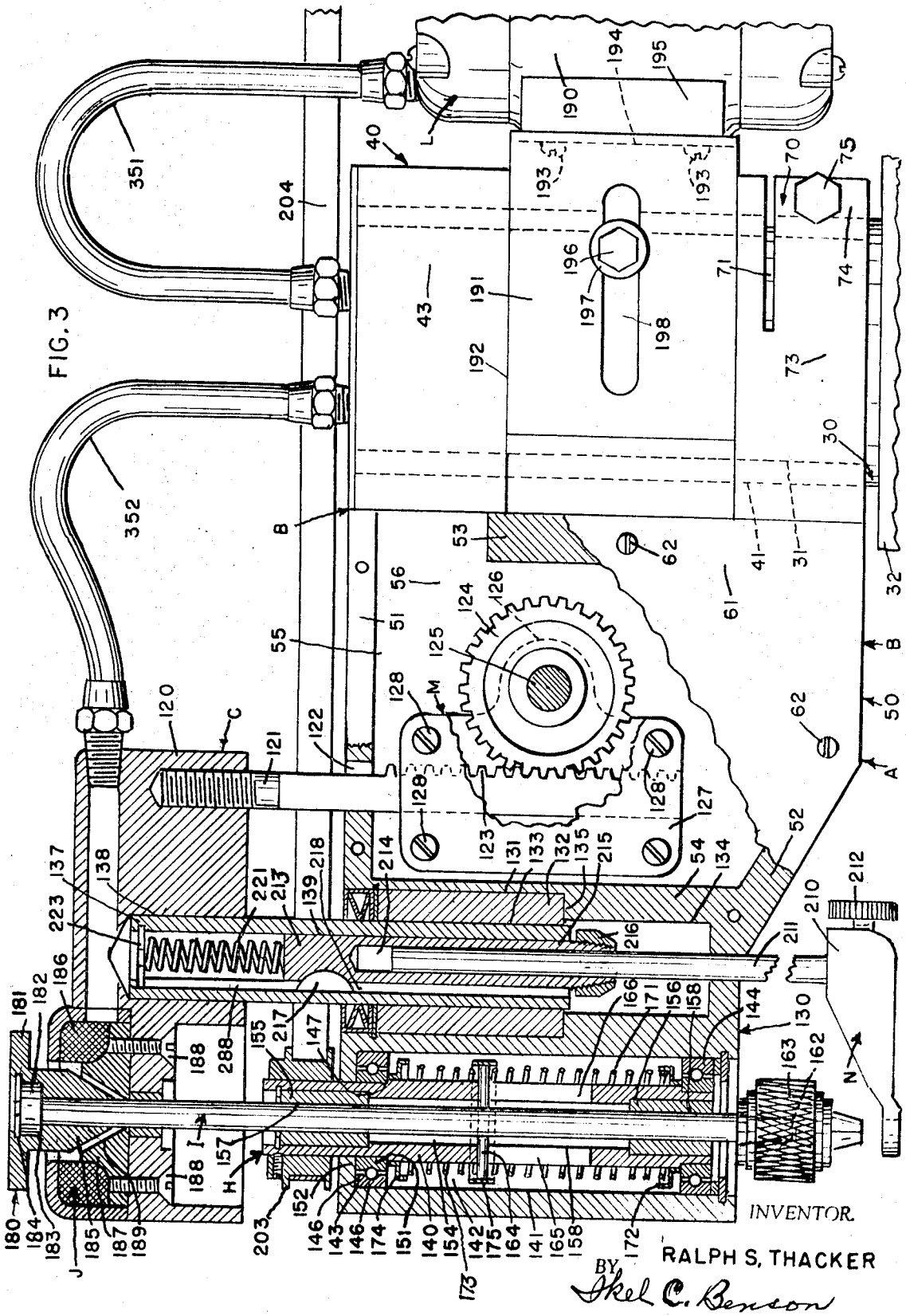


FIG. 3

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DEPTH-CONTROLLED DRILL PRESSES

FIELD OF THE INVENTION

The invention relates to apparatus for removing insulation from an imbedded flat conductor without appreciably reducing the thickness of the conductor and providing a soldering area, the removal of the insulation being terminated by circuitry activated by contact of the tool with the conductor.

PRIOR ART

The prior art known to applicant shows an electric motor for driving the tool and circuitry operated by the tool contacting the conductor and stopping the motor.

SUMMARY OF THE INVENTION

Applicant greatly reduces the time cutting continues after contact is made by raising the tool from the work while the tool is rotating instead of stopping the motor and the tool.

In the drawings illustrating an embodiment of the invention:

FIG. 1 is a plan view of the structure shown.

FIG. 2 is an elevational view of part of the structure shown in FIG. 1.

FIG. 3 is a fragmentary sectional view taken on line 3–3 of FIG. 1 and drawn to a greater scale.

FIG. 4 is a wiring diagram of the invention.

The invention comprises supporting means A which includes a body B and a head C slidably mounted therein. The body B is mounted for vertical adjustment on a standard 30 mounted on a base D. A work rest F and template supporting means G also are mounted on the base D. Rotatably mounted in the body is quill means H and rotatable with said quill and slidable along the same is a spindle 1. Feed means M moves the cutter toward and from the work rest. Shifting means J includes electromagnetic means which connect the spindle I to the head C and a spring which shifts the spindle away from the work. Control means K controls the operation of the shifting means J and power means L powers the spindle I through the quill H.

BASE

The base D, best shown in FIGS. 1 and 2, has sidewalls 11 and end walls 12 and 13. The rear ends of these sidewalls have upwardly projecting extensions 14 formed with forwardly inclined edges 15. Walls 16 corresponding in configuration with the extension 14 are disposed inwardly of said extensions. The rear end wall 13 extends completely across the extensions 14 and walls 16 and is the full height of said walls and extensions and ties all of the parts together. Between the walls 16 and the extensions 14 are tops 21 and inclined walls 22. This construction provides two compartments 23 within said walls and extensions and an open space 24 between the walls 16. Across the walls 16 at the lower portion of the same is a shelf 25 which is integral with these walls and the rear end wall 13.

Resting on the shelf 25 is a tubular standard 30 which has a cylindrical upright 31 with a flange 32 issuing outwardly therefrom at the lowermost portion thereof. This flange rests upon the shelf 25 and is held in position thereon by means of capscrews 33 which extend through said shelf 25 and are screwed into the flange 32.

BODY

The supporting means A comprises the body B best shown in FIGS. 1 and 3. This body is cast and has a rear section 40, a front section 130 and an intermediate section 50.

The rear section 40 of body B is substantially square in cross section and has a vertical bore 41 in the same receiving the upright 31 and guiding said body for vertical sliding movement in an up and down direction. By means of this construction, the section 40 is formed with sidewalls 42, a front end wall 43 and a rear end wall 44. A cover 45 closes the open upper end of the bore 41.

The intermediate section 50 has a top wall 51, a bottom wall 52, a rear end wall 53, a front wall 54, and a sidewall 55 to form a chamber 56 within the same. This chamber 56 is closed by a cover 61 attached to the walls 51, 52, 53 and 54 by means of screws 62.

Means for raising and lowering the body B consists of a pinion 63 attached to a shaft 64 journaled in a bearing 65 issuing from the sidewall 55 of section 50. Upon the end of the shaft 64 projecting beyond the bearing 65 is a handwheel 67 which is secured thereto and by which the pinion 63 may be rotated. This pinion meshes with a rack 66 secured to the upright 31 of standard 30.

For holding the body B in position, clamping means 70 is provided which is shown in FIG. 3 and which is constructed by forming the lower end of the rear section with a transverse slit 71 extending wall toward the center of said upright. A vertical slit 72, FIG. 1, divides the portion of the lower part 73 formed by slit 71 into jaws 74. By means of a screw 75 passing through one of said jaws and screwed into the other, the jaws may be drawn together to clamp the section 40 and thus the entire body B to the upright 30 and thus to base D.

WORK REST

The space 18 between the front end wall 12 and a cross wall 17 intermediate the two end walls is open at the top. In this space is located the work rest F. This work rest is supported on two parallel longitudinal guide rods 81 and 82, which are spaced from the sidewalls 11 and are secured to the front end wall 12 and to the cross wall 17 of base D. Slidably mounted, for longitudinal movement along these rods, is a frame 83 which has lateral frame members 84 and 85 and longitudinal frame members 86 and 87. The space 88 between these frame members is open. The frame members 86 and 87 are bored longitudinally to receive the rods 81 and 82 which guide the frame for longitudinal movement relative to base D. In the space 88 are two transversely spaced parallel rods 91 and 92 which are spaced from the frame members 84 and 85 and which are attached to the frame members 86 and 87. Slidably mounted on these rods is a table 93 on which the work is mounted. A part of specimen 94 is shown which is held in position on said table by one or more clips 95 having screws 96 passing through them and screwed into said table.

TEMPLATE SUPPORTING MEANS

The template supporting means G consists of a frame 100 having longitudinal frame members 101 and 102, and transverse frame members 103 and 104. These frame members are rabbeted to form a groove 105 and which receives a standard template, a portion of one of which has been shown in FIG. 1 as inserted in the groove 105 and indicated by the reference numeral 106. This template lies flush or slightly below the top of the frame 100 and which is held in place by countersunk screws 107 which lie flush with or below the surface of the frame 100. The frame 100 is slidably mounted in a transverse slot 111, FIG. 1 and FIG. 2 in the wall 12 of bore D, and in which it can move both longitudinally and transversely of said base. The rear end 112 of said frame is attached to the table 93 by screws 113 and moves with said table in either or both directions. A handle 114 is attached to the outer end of frame 100 and by which both said frame and table can be simultaneously moved.

Above the frame 100 is a guide 115 and which guides for vertical sliding movement a pin 116 which has a head 117 by means of which the same may be manipulated. This pin has a reduced end 118 adapted to enter locating holes 119 in the template 106 to place the work 94 in proper position for cutting.

HEAD

The head C consists of a casting 120 which overlies the forward section 130 of the body B and also a portion of the intermediate section 50 of said body. In the section 130 is formed a

vertical bore 131 in which is received a guide 132 which has a cylindrical guideway 133. The bore 131 is reduced in diameter at its lower end as indicated at 134 in FIG. 3 to form a shoulder 135 therebetween. The tubular guide 132 is received in the bore 131 and rests on the shoulder 135. A tubular plunger 137 is pressed into a socket 138 in head 120 and held therein. The plunger 137 is received in the bore 133 in the guide 132 in Section B and guides the head C for movement toward and from the body B.

QUILL

Quill means H is best shown in FIG. 3 and comprises a quill 140 which is received in a bore 141 in the forward section 130 of body B. This bore 141 has a considerably greater diameter than the diameter of said quill so as to form a sizable annular space 142 therebetween. The quill 140 is journaled in two ball bearings 143 and 144 received in the bore 141. The outer race 146 of the bearing 143 butts up against a shoulder 147 in the body B while the inner race 151 butts up against a shoulder 152 on the quill 140. Bearing 144 is mounted in a similar manner to bearing 143. The quill 140 has a bore 154 extending throughout the length thereof which is enlarged at its ends to receive two guides 155 and 156. These guides have aligning bores 157 and 158.

SPINDLE

The spindle I is constructed of a solid rod which is received in the bores 157 and 158 of the guides 155 and 156 for sliding movement therein. The lower end of this spindle is tapered as indicated by the reference numeral 162 for the mounting of a drill chuck 163 thereon and in which any suitable cutter may be inserted. The spindle I is held from rotation relative to the quill 140 by means of a diametrically extending pin 164 which extends through and is slidable along two longitudinal diametrically disposed slots 165 and 166 in the quill 140. By means of this construction the spindle I may travel longitudinally relative to the quill 140 and rotates in unison with said quill.

Encircling the lower end of the quill 140 is a main compression coil spring 171 which is seated at its lower end in a spring seat 172 resting on the inner race of the bearing 144. The pin 164 is of greater length than the diameter of the quill 140 and the upper end of the spring 171 is seated against the protruding ends of this pin. Above the pin 164 is buffer compression coil spring 173 encircling quill 140 and which is seated at its lower end against the pin 164 and at its upper end against a spring seat 174 which engages the inner race 151 of bearing 143. A sleeve 175 encircles the springs 171 and 173 as well as the pin 164 and holds these parts in operative positions. The spring 171 is stiffer than the spring 173 and urges the pin 164 against the portions of quill 140 at the upper ends of the slots 165 and 166.

SHIFTING MEANS

The shifting means J comprises electromagnetic means 180. Mounted on the upper end of spindle I is an electromagnet 181 which is freely rotatable thereon. A ball bearing 182 disposed on the end of spindle I and seated in a socket 183 in electromagnet 181 supports the spindle I for rotation relative to said electromagnet. An annular collar 184 carried by said electromagnet holds the bearing 182 in place in socket 183. The electromagnet 181 has a conical portion 185 at the lower end of the same and which is inverted. Encircling the conical portion 185 and spindle I is an electric coil 186 which has a core 187 secured to the casting 120 by means of screws 188. This core has a conical socket 189 adapted to receive the conical portion 185 of electromagnet 181.

FEED MEANS

The feed means M utilizes a rod 121 which is screwed into the head C and depends therefrom. This rod is parallel to the spindle I and also to the plunger 137 and is slidable through a hole 122 in the top wall 51 of intermediate section 50 of body B and into the chamber 56 therein. This rod has a rack 123 secured to it which meshes with a gear 124 in said chamber and which is secured to a shaft 125. This shaft is rotatably mounted in a bearing 126 formed on an attachment 127 secured to the sidewall 55 of intermediate section 50 of body B by screws 128. The shaft 125 extends outwardly through the cover 61 over chamber 56 and has attached to it a handwheel 129 by which the gear 124 may be rotated to raise or lower the spindle I and to feed the cutter carried thereby to the work.

POWER MEANS

The power means L includes an electric motor 190 which has attached to it two brackets 191 which are slidable in slots 192 on each of the sidewalls 43 of the rear section 40 of body B. Screws 193 passing through a flange 194 connecting said brackets together are screwed into the base 195 of motor 190 and hold the motor attached to the brackets. Capscrews 196 having washers 197 thereon pass through slot 198 in brackets 191 and are screwed into the walls 43 of the rear section 40 of body B, thus guiding the motor 190 for movement toward the quill 140.

The armature to shaft 201 of the motor 190 has mounted on it a pulley 202. Extending about this pulley and another pulley 203 on quill 140 is a belt 204 which rotates the quill 140 and the spindle I. The casting 120 has slots 205 in the lower portion of the same which receive the runs of the belt 204 when the head is lowered.

HOLDING MEANS

The holding means N is shown in detail in FIG. 3. Since the conductors to be cleaned of outer insulation are flat and generally thin, cutting must be closely controlled. To hold the work down tight against the table 93 the holding means N is used. This holding means comprises a foot 210 which is detachably secured to the end of a small rod 211 by means of a screw 212. In the bore 139 of plunger 137 is slidably mounted a slider 213 which is drilled at its lower end as indicated by the reference numeral 214 to receive the rod 211. The lower end 215 of the slider 213 is conical and is split longitudinally. A nut 216 similarly constructed is screwed on the end of said slider and when tightened holds the rod 211 in adjusted position in the drilled hole 214 of said slider. The slider 213 is held from rotational movement relative to the plunger 137 by means of a key 217 issuing from said slider and slidable along a keyway 288 formed in said plunger. The slider 213 is urged downwardly by means of a compression coil spring 221 disposed in the bore 139 of plunger 137 and seated at its lower end against the upper end of the slider 213 and seated at its upper end against a spring washer 223 attached to the upper end of plunger 137.

CONTROL MEANS

The control means K comprises circuits shown in diagrammatic form in FIG. 4. Power is derived from any 115 volt alternating-current source by line conductors 241 and 242. The motor 190 is operated by a motor circuit 240. Motor 190 may be a split-phase single-phase alternating-current motor having an armature 243, a running winding 244 and a starting winding 245. Conductor 241 is directly connected to one end of the winding 245 and by a conductor 249 to the winding 244. Connected to the line conductor 241 by a conductor 247 is a pilot lamp 251 which is connected by a conductor 252 to a resistor 253. This resistor by a conductor 248 is connected to one terminal 254 of a two-way switch 255. The movable arm 256 of this switch is connected to the line conductor 242. Another pilot lamp 261 is connected by a conductor 262 to line conductor 241 and by a conductor 263 to a resistor 264. This resistor is connected by a conductor 265 to the other terminal 266 of switch 255. A second conductor 267 is connected to the terminal 266 and directly to the running winding 244 and through centrifugal switch 246 to the starting winding

245. Lamp 251 indicates when the motor is off and lamp 261 indicates when power has been applied to the motor.

The control means K further includes a direct-current low voltage power supply 270. This power supply includes a double-pole double-throw switch 271 having terminals 272, 273, 274 and 275 and arms 276 and 277. The arm 277 is connected by a conductor 281 to the line conductor 241. The arm 276 is connected by a conductor 282 to the line conductor 242. Terminal 272 is connected by a conductor 283 to one end of the primary 284 of a transformer 285. Terminal 274 is connected by a conductor 286 with the other end of the primary 284 of transformer 285. Terminal 273 is connected by a conductor 287 with a lamp 291. This lamp is in turn connected by a conductor 292 to a resistor 293, which in turn is connected by a conductor 294 to the terminal 275 of switch 271. Illumination of lamp 291 indicates that the transformer is not energized. One end of the secondary 295 of the transformer 285 is connected by a conductor 296 to one input terminal 334 of a rectifier 297 and the other end of said secondary of transformer 285 is connected by means of a conductor 298 to the other input terminal 335 of the rectifier 297.

The control means K further includes a normally closed relay 300 having a coil 301 and two contacts 302 and 303. In addition, the control means includes a conductor 310 which has two terminals 311 and 312. Any type of connector such as is now well known in the art may be used. The terminals 311 and 312 may be prongs such as are used with electrical instruments or clips for temporarily making contact with the metal of the work. If sharpened, the prongs readily puncture the insulation and make contact with the metal of the work and may be held in position manually. If many spots are to be cleaned, clamps, screws, or clips may be used in the customary manner to hold the terminal attached to the work with the terminals 311 and 312 in contact with the metal of the work. Connected to the negative output terminal 337 of the rectifier 270 is a conductor 304 which is connected to one end of the coil 301 of relay 300. The plus output terminal 336 of the rectifier 297 is connected by a conductor 317 to the terminal 312 of conductor 310. The other end of coil 301 is connected by a conductor 305 to a cutter 306 mounted in the chuck 163. This conductor is grounded to the body B and Base D. The solenoid coil 186 is connected at one end by a conductor 314 to the conductor 304 and thus to the negative output terminal 337 of the rectifier 297; a conductor 315 connects the other end of the coil 186 with the contact 303 of relay 300. The other contact 302 of said relay is connected by a conductor 316 with the other terminal 311 of said conductor. A pilot light 321 is connected across conductors 304 and 315 by conductors 322 and 323 and thus across the coil 186 of electromagnetic means 180. Another pilot light 324 is connected by means of conductors 325 and 326 to conductors 304 and 305 and thus across coil 301 of relay 300. Still another pilot light 331 is connected by means of conductors 332 and 333 to conductors 296 and 298 and thus across the output of rectifier 297.

In cutting insulation from flat conductors, it becomes desirable to remove a slight amount of the metal at the surface thereof to facilitate soldering thereon. In order to accomplish this result the operation of the shifting means is delayed a short period of time. This is accomplished by time-delay means 340, utilizing capacitors and switches. This means utilizes a rotary switch 341 having six contacts 342, 343, 344, 345, 346 and 347 and a switch arm 348 rotatable to contact any of said contacts. These contacts are connected by conductors 352, 353, 354, 355, 356 and 357 to capacitors 362, 363, 364, 365, 366 and 376 which, in turn, are connected by conductors 372, 373, 374, 375, 376, 377 to a common conductor 351. Conductor 351 is connected to conductor 315. A conductor 371 connects the switch arm 348 to conductor 314. The capacitors 342, 343, 344, 345, 346 and 347 are of different values so that different timing can be procured as desired. Flexible conduits 351 and 352 conduct the conductors to the motor 190 and coil 186.

The operation of the invention is as follows: With no power applied, the drill 306 is inserted into the chuck 163 and the body B raised on standard 30 by means of handwheel 67 until the drill is a considerable distance above the work. The head C is then lowered to its lowermost position by handwheel 129 and in which said head rests upon the upper surface of body B. The entire body B is next lowered on standard 30 by rotating handwheel 67 until the end of the drill is just above the insulation on the work and said body locked in position by clamping means 70. So disposed, the drill can not enter the work. Head C is now raised by means of handwheel 129 a distance greater than maximum movement of the electromagnet 181 relative to core 187 by means of the handwheel 129. When switch 271 is in the opposite position from that shown in FIG. 4, the pilot light 291 is lighted indicating that electric power is available. When switch 255 is moved to the position shown in FIG. 4, light 261 is lighted and motor 190 energized. When in the opposite position, light 251 is lighted and the motor shut off. When the drill press is in use, the motor 190 runs continuously. When switch 271 is in the position shown in FIG. 4, the transformer 285 is energized and direct current is available at a lower voltage than the line voltage and at the output terminals 336 and 337 of the rectifier 297. Pilot light 331 is then lighted showing that direct current is available. The connector 310 is next applied to the work with the terminals 311 and 312 making contact with the metal of the work, the insulation of which is to be removed. With the power on a completed circuit may now be traced. The current flows from the plus terminal 336 of rectifier 297 through conductor 317 the point 312 of connector 310, the conductor being cleaned, point 311, metal of the work 316 contact 302 of relay 300, through the contact 303, conductor 315, coil 186 of electromagnetic means 180 and conductor 314 and 304 to the negative terminal 337 of rectifier 270. The electromagnet 181 is now attracted to the core 187 and the spindle I still rotating is drawn in a downward direction, its motion terminating when the electromagnet strikes the core 187. Cutting may now proceed by rotating the handwheel 129. When the cutter 306 first makes contact with the metal of the work being cleaned, another circuit is completed which may be traced as follows: Commencing at the positive terminal 336 of rectifier 297, current flows through conductor 317, the terminal 312 of connector 310, the work being cleaned, the cutter 306, conductor 305, coil 301 of relay 300 and conductor 304 to the negative terminal 337 of rectifier 297. This coil 301 of relay 300 now deenergizes the coil 186 of the electromagnetic means 180 and spring 171 acting on pin 164 raises the spindle I and disengages the cutter from the work with a delay caused by the time-delay circuit 340. Upon the cutter leaving the work, the circuit through the coil 301 is broken and the contacts 302 and 303 are closed, resetting the device for the next operation.

The advantages of the invention are manifest. The spindle can be so quickly raised that the cutter will only cut less than one-thousandths of an inch of the work being cleaned. The drill press is highly adjustable for all types of cleaning, thus preparing the surface of the work for soldering.

I claim:

1. A depth-controlled drill press comprising:
   a. supporting means
   b. a quill mounted in said supporting means,
   c. a work rest carried by said supporting means,
   d. a spindle carried by said quill and guided for rotational and axial movement toward and from said work rest,
   e. an end cutter carried by said spindle,
   f. feed means for feeding the spindle and cutter toward the work rest,
   g. shifting means for moving said spindle and the cutter away from the work rest independently of the feed means while the spindle is rotating,
   h. control means for actuating said shifting means when the cutter has made contact with the metal of the work
   i. and power means for continuously rotating said spindle.

2. A depth-controlled drill press for use in removing the outer layer of insulation from a flat conductor mounted on an insulating board according to claim 1 in which

a. the shifting means including

b. electromagnetic means having a normally closed electromagnet circuit holding said spindle with the cutter in operating position for advancement by the feed means toward the work

c. a control circuit including normally open trigger circuit having means adapted upon energization to deenergize said electromagnet circuit,

3. A depth-controlled drill press according to claim 1 in which:

a. the shifting means includes

b. an electromagnet and

c. a magnetic member cooperating with said electromagnet to control the movement of the spindle independently of the feed means.

4. A depth-controlled drill press according to claim 3 in which:

a. the electromagnet is mounted on the supporting means, and

b. the magnetic member is mounted on the spindle.

5. A depth-controlled drill press according to claim 4 in which:

a. the electromagnet has an inverted conical socket and,

b. the magnetic member is conical and is adapted to be attracted by the core of the electromagnet.

6. A depth-controlled drill press according to claim 4 in which:

a. the supporting means has a head and

b. a body with

c. guide means for guiding said head for movement toward and from the work rest.

7. A depth-controlled drill press according to claim 6 in which:

a. the electromagnet has a core which is mounted on the head and has an upwardly facing conical socket and

b. the magnetic member is mounted on the spindle above the core of the electromagnet and has an inverted conical surface engageable with the socket in the cone.

8. A depth-controlled drill press according to claim 7 in which:

a. a spring is mounted between the body of the housing and the spindle and moves the spindle and cutter away from the work rest when the electromagnet is deenergized.

9. A depth-controlled drill press accordingly to claim 8 in which:

a. a normally closed electromagnetic circuit actuates the electromagnet and

b. a normally open inversion circuit having the metal of the work and cutter in circuit and upon energization by the cutter engaging said metal, deenergizing the electromagnetic circuit.

10. A depth-controlled drill press according to claim 9 in which:

a. a relay is employed actuated by the inversion circuit and

b. deenergizing the electromagnetic circuit.

11. A depth-controlled drill press according to claim 10 in which:

a. a two-terminal connector is employed adapted to be connected in series with the controlled terminals of the relay and

b. energized by the same source of electricity as the inversion circuit is energized by,

c. a pilot lamp is connected across the input to the relay and

d. another pilot lamp is connected across the coil of said electromagnet

12. A depth-controlled drill press according to claim 9 in which:

a. time-controlled delay means delays the opening of the electromagnetic circuit.