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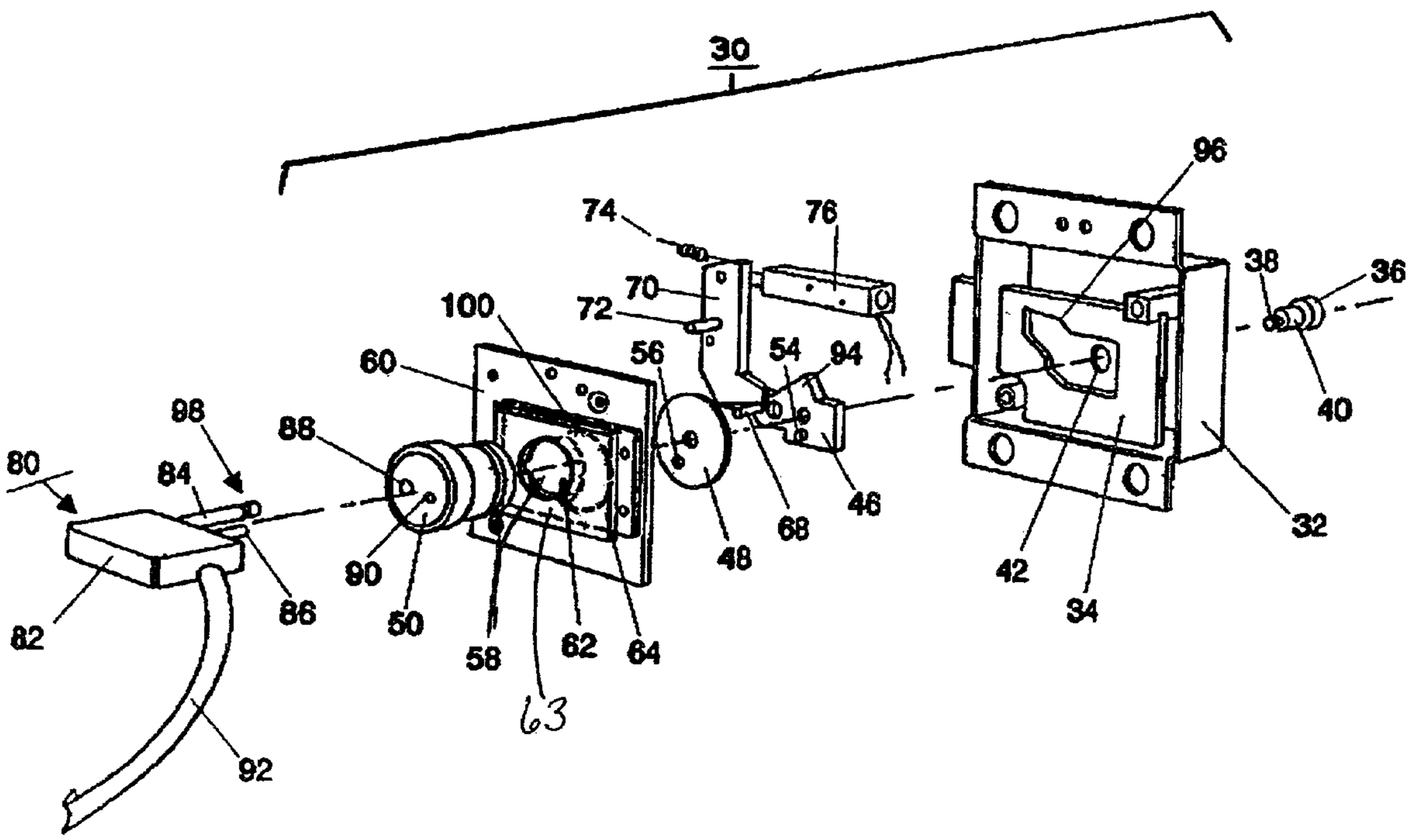

(57) Abrégé/Abstract:
In a preferred embodiment, an intelligent lock system which includes a wrench insertable in a lock mechanism, the wrench transmitting a signal to the lock mechanism from a microprocessor indicating the presence of the wrench and receiving from the lock mechanism an identifying signal, the lock mechanism transmitting the identifying signal to the microprocessor through the wrench, the microprocessor subsequently transmitting to the lock mechanism a password through the wrench, and, the lock mechanism receiving the password and unlocking the lock mechanism in response thereto.

INTELLIGENT LOCK SYSTEM
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ABSTRACT OF THE DISCLOSURE

In a preferred embodiment, an intelligent lock system which includes a wrench insertable in a lock mechanism, the wrench transmitting a signal to the lock mechanism from a microprocessor indicating the presence of the wrench and receiving from the lock mechanism an identifying signal, the lock mechanism transmitting the identifying signal to the microprocessor through the wrench, the microprocessor subsequently transmitting to the lock mechanism a password through the wrench, and, the lock mechanism receiving the password and unlocking the lock mechanism in response thereto.

BACKGROUND OF THE INVENTION

1. Field of the Invention.

The present invention relates to locking systems generally and, more particularly, to a novel intelligent lock system which is particularly useful for locks on coin operated telephones.

2. Background Art.

While the present invention is described with reference to locks on coin operated telephones, for illustrative purposes, it will be understood that it may be applied as well in any application in which it is desirable to be able to unlock a number of locks with a single unlocking mechanism.

The coin boxes in coin operated telephones must be removed periodically to remove the coins. Conventionally, this is done by giving a coin collector a large shackle of keys which holds a unique key for each telephone which is to be opened to remove the coin boxes therein on a particular

day. As prior steps, the telephone boxes to be accessed must be identified, the appropriate keys pulled, and a route form prepared. The coin collector goes to each telephone, selects the proper key, uses the key to operate a lock release mechanism, uses another key to open the coin box access door on the telephone, removes the coin box, checks the coin box number against the one printed on the route form, and inserts an empty coin box. The empty receptacle number is recorded on the route sheet and the receptacle stub along with the time, date, and collector number. This system is cumbersome and time consuming, since the coin collector must take time to select the correct key for each telephone and make proper notations to assure that a coin box is identified to a particular telephone. The latter step introduces opportunity for error.

It has been proposed to employ an "intelligent key" for use in unlocking coin operated telephones. The key would be programmed, by a main computer, to unlock, say, 100 telephones on a given day. The coin collector would use a bar code reading wand attached to the intelligent key to read a bar code attached to an outside surface of the telephone to obtain the identification of the telephone. The smart key would look up the identification in its programmable memory to verify that the telephone is one that can be unlocked on that day. The intelligent key is then

inserted in the lock and the lock mechanism released by means of data transfer between the two. Bar codes on the full and empty coin boxes are scanned and this data is inputted to a memory in the intelligent key. While this system is an improvement over the conventional method of accessing coin boxes, it has the substantial disadvantage of having to read external indicia for verification of the telephone. Such external indicia are subject to damage or removal which represents a substantial maintenance cost and which requires manual input of the information to the key.

Accordingly, it is a principal object of the present invention to provide a system for unlocking a coin operated telephone which does not rely on reading external indicia to identify the telephone.

It is a further object of the invention to provide such a system in which the lock mechanism itself identifies the telephone.

It is another object of the invention to provide such a system which permits a single programmable unlocking mechanism to selectively unlock a large number of locks.

It is an additional object of the invention to provide such a system that is conveniently and easily employed.

Other objects of the present invention, as well as particular features, elements, and advantages thereof, will be elucidated in, or be apparent from, the following description and the accompanying drawing figures.

SUMMARY OF THE INVENTION

The present invention achieves the above objects, among others, by providing, in a preferred embodiment, an intelligent lock system which includes a wrench insertable in a lock mechanism, the wrench transmitting a signal to the lock mechanism from a microprocessor indicating the presence of the wrench and receiving from the lock mechanism an identifying signal, the lock mechanism transmitting the identifying signal to the microprocessor through the wrench, the microprocessor subsequently transmitting to the lock mechanism a password through the wrench, and, the lock mechanism receiving the password and unlocking the lock mechanism in response thereto.

BRIEF DESCRIPTION OF THE DRAWING

Understanding of the present invention and the various aspects thereof will be facilitated by reference to the accompanying drawing figures, submitted for purposes of illustration only and not intended to define the scope of the invention, in which:

Figure 1 is a perspective view of a conventional coin operate telephone.

Figure 2 is an exploded perspective view of one embodiment of the present invention.

Figure 3 is an exploded perspective view of another embodiment of the present invention.

Figures 4A and 4B illustrate details of the embodiment of Figure 3.

Figure 5 is a block/schematic diagram of the embodiment of Figure 2.

Figure 6 is a timing/logic diagram illustrating the operation of the present invention.

Figure 7 is a perspective view of the hardware components of the embodiment of Figure 2.

Figure 8 is a front elevational view, partially cut away, of an alternative lock mechanism embodiment according to the present invention.

Figure 9 is a cross-sectional view taken along line "9-9" of Figure 8.

Figure 10 is a front elevational view of the embodiment of Figure 8.

Figure 11 is a side elevational view of a wrench for use with the lock mechanism of Figures 8-10.

Figure 12 is a top plan view, partially in cross-section, of the wrench of Figure 11.

Figure 13 is a schematic diagram illustrating the electrical/electronic circuitry of the lock mechanism of Figures 8-10.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference should now be made to the Drawing, in which similar or identical elements are given consistent identifying numerals throughout the various figures thereof, and in which reference numerals in parentheses direct the reader to the figure(s) in which the element(s) being describe are best seen, although the element(s) may be seen in other figure(s) also.

Figure 1 illustrates a conventional coin operated telephone, generally indicated by the reference numeral 10. Since telephone 10 is conventional, only those elements thereof with which the present invention is concerned will be described. It will be understood that the base of telephone 10 includes a coin box (not shown) into which fall coins inserted into the telephone to permit operation thereof. Telephone 10 includes a lock mechanism, generally indicated by the reference numeral 12, which has a tumbler slot 14 into which a wrench (not shown) can be inserted to permit a slide bolt 16 to be withdrawn into the housing 18 of the mechanism. Once slide bolt 16 is so withdrawn, an internal mechanism (not shown) permits access door 24 to be opened by insertion of a key (not shown) into key slot 26. This operation gives access to the coin box as is more fully described above.

Figure 2 illustrates one embodiment of a lock mechanism according to the present invention, generally indicated by the reference numeral 30. Lock mechanism 30 includes a housing 32 in which is disposed for sliding back and forth movement a slide bolt 34. A support pin 36 having a threaded distal portion 38 and an intermediate unthreaded portion 40 is inserted through an opening 42 defined in the rear wall of housing 32, with the unthreaded portion engaging the wall of the opening. Disposed on unthreaded portion 40 are a cam 46 and a printed circuit board 48. The threaded end of support pin 36 engages a barrel 50 so that, unless otherwise impeded, the support pin and the barrel will rotate together. A shear pin 54 fixed to cam 46 extends through an opening 56 defined in printed circuit board 48 and into barrel 50 so that those elements will rotate with the barrel and support pin 36.

Barrel 50 extends through an opening 62 defined in a anti-removal retainer 64 which is fixedly attached to the face of side panel 60 of a telephone (not shown) and through an opening 58 defined in the side panel. A cover plate is fixedly attached over anti-removal retainer 64 so, that with the elements of lock mechanism assembled as described above, those elements cannot be extracted from the telephone without disassembly of the telephone.

The rotatable elements of lock mechanism 30 are prevented from rotation in the direction indicated by the arrow shown on Figure 2 by means of a latch pin 68 fixedly attached to cam 46 which latch pin engages the bottom of a latch bar 70 rotatably attached to side panel 60 by means of a shaft 72. Latch bar 70 is held in the position shown by means of a return spring 74 attached to side panel 60. Also attached to side panel 60 is a solenoid 76 operatively connected to the upper end of latch bar 70 to withdraw the latch bar from engagement with latch pin 68 and permit the rotatable elements of lock mechanism 30 to rotate.

The means by which lock mechanism 30 is unlocked includes a wrench, generally indicated by the reference numeral 80. Wrench 80 includes a housing 82 with a data probe 84 and a pin 86 extending therefrom. Data probe 84 and pin 86 are insertable into lock mechanism 30 through channels 88 and 90, respectively, defined in barrel 50. Data probe 84 extends through barrel 50 and contacts printed circuit board 48, while pin 86 terminates in the barrel. Probe 84 is of the spring loaded type. Wrench 80 is connected to a computer (described below) by means of a cable 92.

In operation, wrench 80 is inserted in lock mechanism 30 so that probe 84 contacts printed circuit board 48. When appropriate signals have been exchanged over cable 92, solenoid 76 is activated causing the disengagement of latch bar 70 from latch pin 68 and the wrench can then be rotated clockwise as indicated by the arrow. Such rotational movement causes sliding engagement of a cam surface 94 with a shoulder 96 formed on slide bolt 34 causing the slide bolt to withdraw its distal end into housing 32, thus releasing an internal mechanism (not shown) in the telephone as described above with reference to a conventional telephone lock mechanism. Data probe 84 includes an annular channel 98 which engages the edge of a cut-out 100 in opening 62 to prevent removal of wrench 80 when lock mechanism 30 is in its unlocked state.

Figure 3 illustrates another embodiment of a lock mechanism, generally indicated by the reference numeral 30'. Elements of lock mechanism identical, or nearly so, to those of lock mechanism 30 of Figure 2 are given primed reference numerals. Lock mechanism 30' includes a support pin journalled for rotating motion in opening 42' and having a smooth shaft portion 110 on which is mounted cam 46'. Lock mechanism 30' further includes a barrel 112 fixedly attached to side panel 60' and having an axial channel 114 defined centrally therethrough. An anti-rotation retainer

116 having a slotted opening 118 defined therethrough and aligned with channel 114 is fixedly attached to side panel 60'. Cam 46' has holes 124 and 126 defined therethrough for fasteners (not shown) which pass through holes 128 and 130 defined through printed circuit board 48' and into a rotation ring 134 to fasten those three elements together so that they are rotatable as a unit. Rotation ring 134 has a channel 136 defined therethrough axially aligned with channel 114 and opening 118. Extending radially into channel 136 is a shear pin 138.

Unlocking of lock mechanism 30' effects the same result as the unlocking of lock mechanism 30 (Figure 2); however, lock mechanism 30' employs a different wrench, generally indicated by the reference numeral 444. Wrench 444 includes a housing 446 and a probe, generally indicated by the reference numeral 448. With reference also now to Figures 4A and 4B, probe 448 includes a shaft portion 450 and a distal tip portion 452, between which is an annular channel 454. Distal tip portion 452 includes two flats 454 and 456 spaced apart by 180 degrees on opposite sides of the tip portion and two channels 458 and 460 spaced apart by 180 degrees on opposite sides of the tip portion intermediate the flats. A spring loaded probe tip 464 extends from tip portion 452.

The elements of lock mechanism 30' are configured so that distal tip portion 452 may pass through channel 114. Flats 454 and 456 permit passage of tip portion 452 through slotted opening 118 in one orientation, but not if wrench 444 is rotated from that orientation. Tip portion 452 may be inserted in channel 136 and, when the orientation of the tip portion to rotation ring 134 is as shown on Figure 3, shear pin 138 will be captured in one of channels 458 and 460. When wrench 444 is so inserted in lock mechanism 30', probe tip 464 will contact printed circuit board 48'.

With wrench 444 so inserted in lock mechanism 30' and the appropriate signals having been exchanged over cable 92', solenoid 76' will be activated, withdrawing latch bar from engagement with latch pin 68' and cam 46' may be rotated clockwise as indicated by the arrow, by virtue of the engagement of shear pin 138 with one of channels 458 and 460 (Figures 4A and 4B).

Lock mechanisms 30 and 30' cannot be unlocked by brute force with a tool fabricated for that purpose, since shear pins 54 and 138, respectively, will be severed by rotation of the tool, absent activation of solenoids 76 and 76' which breaks mechanical communication between a tool inserted in the lock mechanisms and cams 46 and 46'. Shear pins 54 and 138 are selected of such diameter and material that they can

be forcibly severed much more easily than latch pins 68 and 68', respectively. Were the situation reversed, the latch pins would be severed, the cams would be rotatable, and the respective lock mechanisms 30 and 30' could be unlocked by brute force.

Reference now to Figures 5 and 6 together will aid in understanding the operation of the present invention.

While the reference numerals on Figure 5 are given for the embodiment shown on Figure 2, it will be understood that the schematic applies as well to the embodiment on Figure 3. On Figure 5, a computer 150 includes a microprocessor 152 which receives operating power from a voltage regulator 144 which is connected to internal battery 148 when computer 150 is configured as a portable unit. The power source, here, battery 148, is also connected to a communication line 154 in cable 92 through a resistor 156. Microprocessor 152 provides outputs to a maximum power switching transistor 160 and to a data transmitting switching transistor 162. Microprocessor 152 has SENSE and RECEIVE DATA inputs.

Communication line 154 is connected through probe 84 to a microcontroller 170 in lock mechanism 30, the microcontroller receiving operating power from a voltage regulator 172 which is connected to the communication line 154 through an isolation diode 174. A capacitor 176

connected between voltage regulator 172 and diode 174 is connected to ground. Microcontroller 170 provides outputs to a data transmitting switching transistor 180 and to a power switching transistor 184 connected between solenoid 76 and ground. Microcontroller 170 has a RECEIVE DATA input connection to communication line 154.

Figure 6 is a timing/logic diagram for the circuitry shown on Figure 5. A complete unlock/lock sequence is divided into seven segments, A-G. Segment A is wrench insertion, going from an out position to an in position. During that time, communication line 154 (Figure 5) and resistor 156 are at full battery voltage V1. At the point that probe tip 164 (Figure 4B) makes contact with printed circuit board 48, the voltage on communication line 154 drops to a value determined by a voltage divider network comprising resistors 156 and 178, here, voltage V3. A comparator (not shown) at SENSE input to microprocessor 152 receives voltage V3 and, since V3 is between voltage limits V2 and V4, the output of the comparator goes positive providing a presence sense signal in the microprocessor. The presence sense signal stays at that condition until removal of the wrench. The comparator window is provided so that, if there is a short circuit on insertion of the wrench, the sequence will be not be started.

Once the presence sense signal is established, microprocessor 152 starts charging, segment C, by turning on transistor 160 which shorts resistor 156 and charges capacitor 176 through diode 174. Voltage regulator 172 starts to provide operating power for microcontroller 170. Capacitor 176 maintains a charge on voltage regulator 172 during the communication cycle and diode 174 isolates the voltage on capacitor 176 from being discharged. At the end of segment C, transistor 160 is turned off.

Segment D is the communication segment in which transistors 162 and 180 are alternately turned on depending on whether microprocessor 152 or microcontroller 170, respectively is transmitting during bidirectional communications. Turning on either transistor 162 or 180 pulls down resistor 156 which becomes a pull up resistor. Microprocessor 152 first sends microcontroller 170 an interrogation signal. Microcontroller 170 answers with the serial number of lock mechanism 30. If the serial number corresponds with one stored in microprocessor 152, that is, it identifies a lock that is to be unlocked at this time, microprocessor 152 transmits a password to microcontroller 170 and then turns on transistor 160 to provide power for solenoid 76. When microcontroller 170 verifies the password, it turns on transistor 184, activating solenoid 76

and releasing latch bar 70 from cam 46. Cam 46 can then be rotated, forcing slide bolt 34 (Figure 2) into housing 32.

Rotation of wrench 80 during segment E leads to unlock segment F during which transistor 184 is turned off. During this segment, the presence sense signal is still positive and microcontroller 170 continues to output an unlocked signal to microprocessor 152. Wrench 80 cannot be removed from lock mechanism 30 unless the wrench is rotated back to the zero position.

In the final, unlock, segment G, wrench 80 is rotated and removed, while communication line 154 is again pulled up to battery voltage, V1, and the presence sense signal drops to zero.

A number of methods may be used to provide the password to microcontroller 170 from microprocessor 152. For further security, microcontroller 170 may be provided with a real time clock so that a time encryption method may be used advantageously. Such a method is described in copending US Patent Application Serial Number 07/520,763, filed May 9, 1990, by James S. Bianco et al, titled "Method and Means to Limit Access to Computer Systems," now US Patent Number 5,067,155, issued November 19, 1991, the disclosure of which is incorporated by reference hereinto. In the method described therein, an accessing device encrypts identification information with real time so that

the resulting password can be used only for a limited, predetermined period of time.

Figure 7 illustrates a hardware embodiment of the present invention, including wrench 80 attached to computer 150 by cable 92 to form a compact, easily carried unit. Computer 150 has attached thereto a bar code reading wand 190 which may be used to scan bar codes on coin boxes and for other input functions. Computer 150 further includes a data display 192 and a keyboard 194 for manual input of data. Also included in computer 150 is an LED 198 which provides a visual indication when solenoid 76 (Figure 5) has been energized and wrench 80 can be rotated to unlock lock mechanism 30.

Prior to the beginning of collection rounds, data as to route, serial numbers of telephones to be accessed, and other information can be downloaded by a main computer to computer 150. At the same time, battery 148 in computer 150 can be replaced or recharged as necessary.

Figures 8-10 illustrate an alternative preferred embodiment of a lock mechanism, generally indicated by the reference numeral 300.

Referring primarily to Figures 8 and 9, lock mechanism 300 is characterized in that it is very simple, having only three moving parts: a slide bolt 302, a cam 304 fixedly mounted on a drive shaft 306 by means of a shear pin 308,

and a solenoid plunger 310 on the distal end of which is fixedly mounted a stop 312. Solenoid plunger 310 moves up and down within a solenoid body 314 (Figure 8).

The foregoing moving parts are disposed in a housing 320 having extending therefrom mounting flanges 322 and 324. An internal cavity 326 is defined internally of housing 320, which internal cavity is closed by means of a cover plate 328 attached to housing 320 by means of screws 330 and 332 (Figure 10). A printed circuit board 340 is disposed against the inner surface of cover plate 328. A cylindrical wrench retainer 350 (Figures 9 and 10) is fixedly attached to and extends orthogonally outwardly from cover plate 328 and drive shaft 306 is journalled in, and extends between, in the wrench retainer and the rear wall 352 (Figure 9) of housing 320. A spacer 254 is disposed parallely between slide bolt 302 and rear wall 352. Slide bolt 302 is disposed for back-and- forth horizontal motion within housing 320.

In use, lock mechanism 300 operates in a very similar manner to the way lock mechanisms 30 and 30' (preceding figures) operate, except for two very important features. The first feature is that slide bolt 302 has mounted thereon a wiper contact 360 which contacts printed circuit board 340 to permit sensing of the position of the slide bolt. This

is important for it allows sensing that bolt 302 is in the locked position notifying external electronics of that fact. The information can be duly noted in the transaction data that lock mechanism 300 was physically unlocked and then locked. This is required for audit purposes.

The second feature is that stop 312 engages a contact on printed circuit board 340 when lock mechanism 300 is in the locked position (Figures 8 and 9). Thus, it can easily be sensed that solenoid plunger 310 has returned to the locked position and is not stuck inside solenoid body 314, leaving slide bolt 302 in the locked position but without stop 312 in the locked position such that lock mechanism 300 could be unlocked without the necessary electronic clearance. If some one should tamper with stop 312 or plunger 310, that fact would be duly noted when the next time lock mechanism 300 were used and the data collected.

Another of the important features of lock mechanism 300 is that it is sealed at the point of exposure to the outside and, therefore, extremely protected against tampering. As is shown on Figure 9, drive shaft 306 seals against the inner wall of wrench retainer 350 and an electrical contact 362 is disposed concentrically within the wrench retainer external to housing 320.

Referring now to Figures 11 and 12, there is illustrated a wrench, generally indicated by the reference numeral 370, for use with lock mechanism 300 (Figures 8-10. Wrench 370 includes a generally cylindrical housing 372 having a two-conductor wire extending from the proximal end thereof and a drive pin holder 374 extending from the distal end thereof. Mounted in and extending axially from drive pin holder 374 are two drive pins 376 and 378 which are insertable in drive sockets 380 and 382 (Figures 9 and 10) defined in the end of drive shaft 306.

Drive pin holder 374 has two, opposed tabs 386 and 388 in which drive pins 376 and 378 are mounted, respectively, extending outwardly from the central portion of the drive pin holder so as to form a bar shape interrupted by the central portion of drive pin holder. A spring-loaded contact pin 392 is disposed axially centrally of wrench 370 and is connected to the positive of the two conductors of wire 374. The ground conductor of wire 374 is connected to at least one of drive pins 376 and 378.

So configured, drive pin holder 374 is insertable into wrench retainer 350 so that tabs 386 and 388 engage a wrench slot 390 (Figure 10) defined in the wrench retainer, drive pins 367 and 378 are inserted in drive sockets 380 and 382, and spring-loaded contact 392 engages contact 362.

Wrench slot 390 (Figure 10) serves as a clean-out slot and allows chewing gum and the like to be easily removed by a simple tool or pick. Spring-loaded contact 392 in wrench 370 is protected against static and damage for and forming housing 372 of plastic further reduces the possibility of static.

Lock mechanism 300 works in a simple fashion as follows: When wrench 370 is inserted into wrench retainer 350, drive pins 376 and 378 engage drive sockets 380 and 382 and, among other points of contact, this establishes a ground for the electronic circuit. Spring-loaded contact pin 392 in wrench 370 contacts the center contact in lock mechanism 300 and establishes a path for power and communications.

As before, with lock mechanisms 30 and 30', when power and communications are established between wrench 370 and lock mechanism 300, the decision is made whether access is permitted or denied. If access is denied, it will be impossible to rotate wrench 370 in either direction. (See Figure 8). Rotation counterclockwise is stopped by cam 304 striking slide bolt 302 at surface 400. Rotation clockwise causes cam 304 to strike slide bolt 302 at surface 402. Cam 304 then causes slide bolt 302 to slide to the right until the bolt hits stop 312. Further travel of slide bolt 302 is

prevented by the stop, for it is forced against the wall of housing 320. Continued pressure clockwise of drive shaft 306 by the wrench will cause shear pin 308 to sever, thus rendering the drive shaft useless and preventing forced entry.

If access is permitted, solenoid 314 will cause solenoid plunger 310 to retract and compress a return spring 318. Stop 312 will thereby be moved out of the way of slide bolt and clockwise rotation of drive shaft 306 will cause cam 304 to move slide bolt 302 to the right on Figure 8 into the retracted or open position. As soon as wiper contact 360 on slide bolt disconnects from a sense point on printed circuit board 340, the power to solenoid 314 is removed at that point, greatly reducing the power drain on the batteries energizing the solenoid. When drive shaft 306 is turned approximately 45 degrees clockwise, a flange 344 extending from the right side of slide bolt 302 will strike the right side of housing 320 (Figure 8). At this point, slide bolt 302 is completely retracted and lock mechanism 300 is open. It should be noted that when the power is removed form solenoid 314, spring 318 cannot return stop 312 to the locked position for it is held in the compressed position by bolt flange 344. When wrench 370 is turned counterclockwise approximately 35 degrees, stop 312 will slide off slide bolt flange 302 into the locked position,

thus striking the contact sense point on the printed circuit board 340.

Wrench 370 may only be removed from wrench retainer 350 when wrench tabs 386 and 388 are aligned with wrench slot 390 in the retainer ring. This prevents the accidental removal of wrench 370 when lock mechanism 370 is in the open position. Note that slide bolt 302 allows stop 312 to return to the locked position when drive shaft 302 is only returned 35 degrees counterclockwise. The remaining 10 degrees is to insure that the lock is closed before the wrench is removed.

Referring now to Figure 13 there is illustrated the electrical/electronic circuitry of lock mechanism 300. Since the basic operation thereof is the same as described with reference to lock mechanism 30 on Figure 5, the description of the basic operation will not be repeated here. The differences are that lock mechanism 300 provides an input from wiper contact 360 to microcontroller 170' and stop 312 also provides an input thereto. Wiper contact 360 moves between a position in contact with a sense point 420 on printed circuit board 340 (Figures 8 and 9) when lock mechanism 370 is in its closed position (wiper contact in solid lines) and a position out of contact with the sense point when the lock mechanism is in its open position (wiper

contact in broken lines). Stop 312 moves between a position in contact with a sense point 422 on printed circuit board (Figures 8 and 9), providing an input to microcontroller 170' when lock mechanism 300 is locked and a position not in contact with the sense point when the lock mechanism is unlocked.

It will thus be seen that the objects set forth above, among those elucidated in, or made apparent from, the preceding description, are efficiently attained and, since certain changes may be made in the above construction without departing from the scope of the invention, it is intended that all matter contained in the above description or shown on the accompanying drawing figures shall be interpreted as illustrative only and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

1. An intelligent lock system, comprising:

(a) a lock mechanism having a microcontroller to transmit an identifying signal; and

(b) a wrench insertable in the lock mechanism and having means to transmit a signal from a microprocessor to said lock mechanism indicating the presence of said wrench and to receive from said lock mechanism the identifying signal and to transmit said identifying signal to said microprocessor;

wherein said microprocessor has stored therein a plurality of identifying signals, each corresponding to different lock mechanisms, and has means for sampling the identifying signal received from said lock mechanism to confirm that it is one of the plurality of identifying signals and for subsequently transmitting a password via said wrench to said lock mechanism, and wherein said microcontroller has means for receiving said password and for activating said lock mechanism in response thereto to allow the lock mechanism to be unlocked by said wrench.

2. The intelligent lock system, as defined in Claim 1, wherein said lock mechanism includes:

(a) a housing;

(b) a slide bolt disposed in said housing and movable between locked and unlocked positions; and

(c) a rotatable barrel disposed in said housing, rotation of said barrel causing said slide bolt to move between said locked and unlocked positions;

wherein said wrench is insertable in said barrel such that rotation of said wrench will cause said barrel to rotate.

3. The intelligent lock system, as defined in Claim 2, wherein said lock mechanism further includes:

(a) a cam connected to said barrel, rotation of which cam moves said slide bolt between said locked and unlocked positions;

(b) latch means engagable with said cam to prevent rotation of said cam so as to prevent said slide bolt from moving from said locked position to said unlocked position; and

(c) release means operatively connected to said latch means to cause said latch means to disengage said cam to permit said cam to rotate and move said slide bolt from said locked position to said unlocked position, when said lock mechanism receives said password.

4. The intelligent lock system, as defined in Claim 3, wherein said cam is connected to said barrel by means of a shear pin which will break if attempt is made to rotate said barrel without said latch means being disengaged from said cam, thereby preventing said cam from being rotated.

5. The intelligent lock system, as defined in Claim 2, further comprising means to prevent said wrench from being removed from said barrel after said wrench has been inserted in said barrel and said barrel rotated to cause said slide bolt to move from said locked

position to said unlocked position.

6. The intelligent lock system, as defined in Claim 2, further including means to electrically sense when said slide bolt is in said unlocked position and to transmit that information to said microprocessor.

7. The intelligent lock system, as defined in Claim 3, further including means to electrically sense when said latch means is engaging said slide bolt and to transmit that information to said wrench.

8. The intelligent lock system, as defined in Claim 1, wherein electrical power to unlock said lock mechanism is transmitted by said wrench to said lock mechanism.

9. The intelligent lock system, as defined in Claim 8, wherein information exchange between said wrench and said lock mechanism and said electrical power are transmitted over a single common line.

10. The intelligent lock system, as defined in Claim 8, wherein said electrical power is disconnected immediately as soon as said lock mechanism is unlocked.

11. The intelligent lock system, as defined in Claim 2, wherein said lock mechanism further comprises:

(a) a planar cover disposed over the front of said housing;

(b) said rotatable barrel is cylindrical and extends partially through said cover in close fitting relationship, said rotatable barrel having an

external electrical contact on the major axis thereof;

(c) said rotatable barrel having at least one external drive socket defined in the external face of said rotatable barrel and spaced radially from said electrical contact;

(d) a cylindrical wrench retainer fixedly attached to said cover in which wrench retainer said rotatable barrel can rotate in close fitting relationship; and

(e) said wrench retainer having an opening defined therethrough through which opening said external electrical contact and said at least one drive socket are physically accessible;

and said wrench further comprises:

i) a housing;

ii) an electrical contact in the distal end of said housing and a drive pin holder extending from the distal end of said housing; and

iii) at least one drive pin extending from said drive pin holder;

wherein said drive pin holder and said electrical contact are disposed such that they may be inserted into said opening in said wrench retainer, with said electrical contacts in said wrench and said rotatable barrel in engagement, said at least one drive pin inserted into said at least one drive socket, and said drive pin holder being rotatable within said wrench retainer.

12. The intelligent lock system, as defined in Claim 11, wherein said drive pin holder cannot be removed from said wrench retainer after said drive pin holder is rotated within said wrench retainer.

13. The intelligent lock system, as defined in Claim 11, wherein said opening is a slot extending across said cover of said wrench retainer and down the sides thereof to permit the freeing of foreign material from the interior of said wrench retainer.

14. A method of unlocking an intelligent lock mechanism, comprising the steps of:

(a) indicating to said lock mechanism the presence of a wrench;

(b) transmitting from said lock mechanism through said wrench to a microprocessor an identifying signal;

(c) confirming that said identifying signal is one of a plurality of identifying signals stored within said microprocessor, wherein each of said plurality of identifying signals corresponds with a different lock mechanism;

(d) transmitting from said microprocessor to said lock mechanism a password; and

(e) said lock mechanism receiving said password and being activated in response thereto to allow the lock mechanism to be unlocked by the wrench.

15. The method, as defined in Claim 14, further comprising the steps of:

(a) scrambling said password as a function of current time;

(b) descrambling in said lock mechanism said scrambled password to determine if said password is valid for the then current date and time; and

(c) said lock mechanism being activated only if said password is valid for said then current date and time.

16. The method, as defined in Claim 14, further including electrically sensing when said lock mechanism is unlocked and transmitting that information to said microprocessor.

17. The method, as defined in Claim 14, further including said wrench transmitting to said lock mechanism electrical power to unlock said lock mechanism.

18. The method, as defined in Claim 17, wherein information exchange between said wrench and said lock mechanism and said electrical power are transmitted over a single common line.

19. The method, as defined in Claim 17, further including disconnecting said electrical power immediately as soon as said lock mechanism is unlocked.

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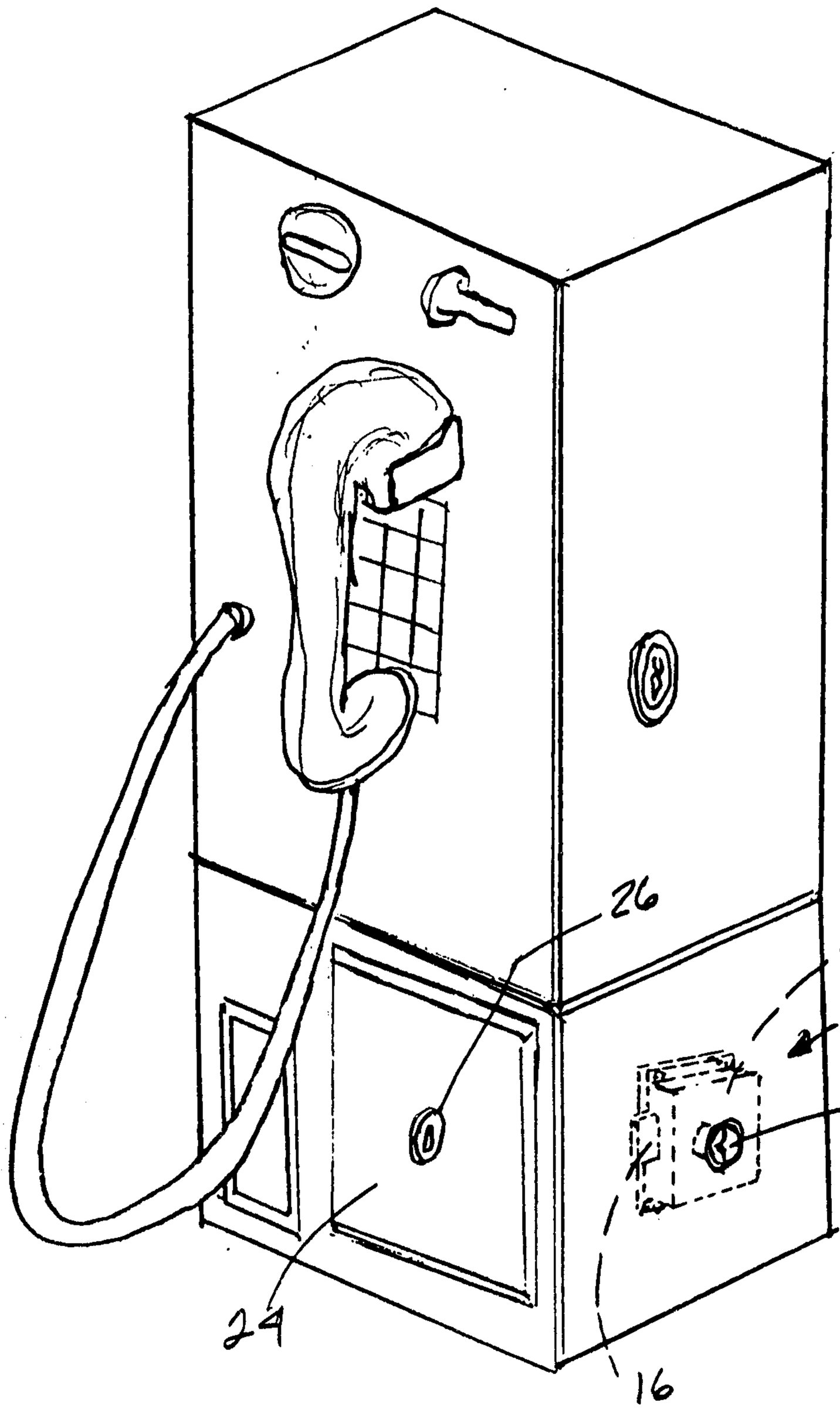


FIG 1
(PRIOR ART)

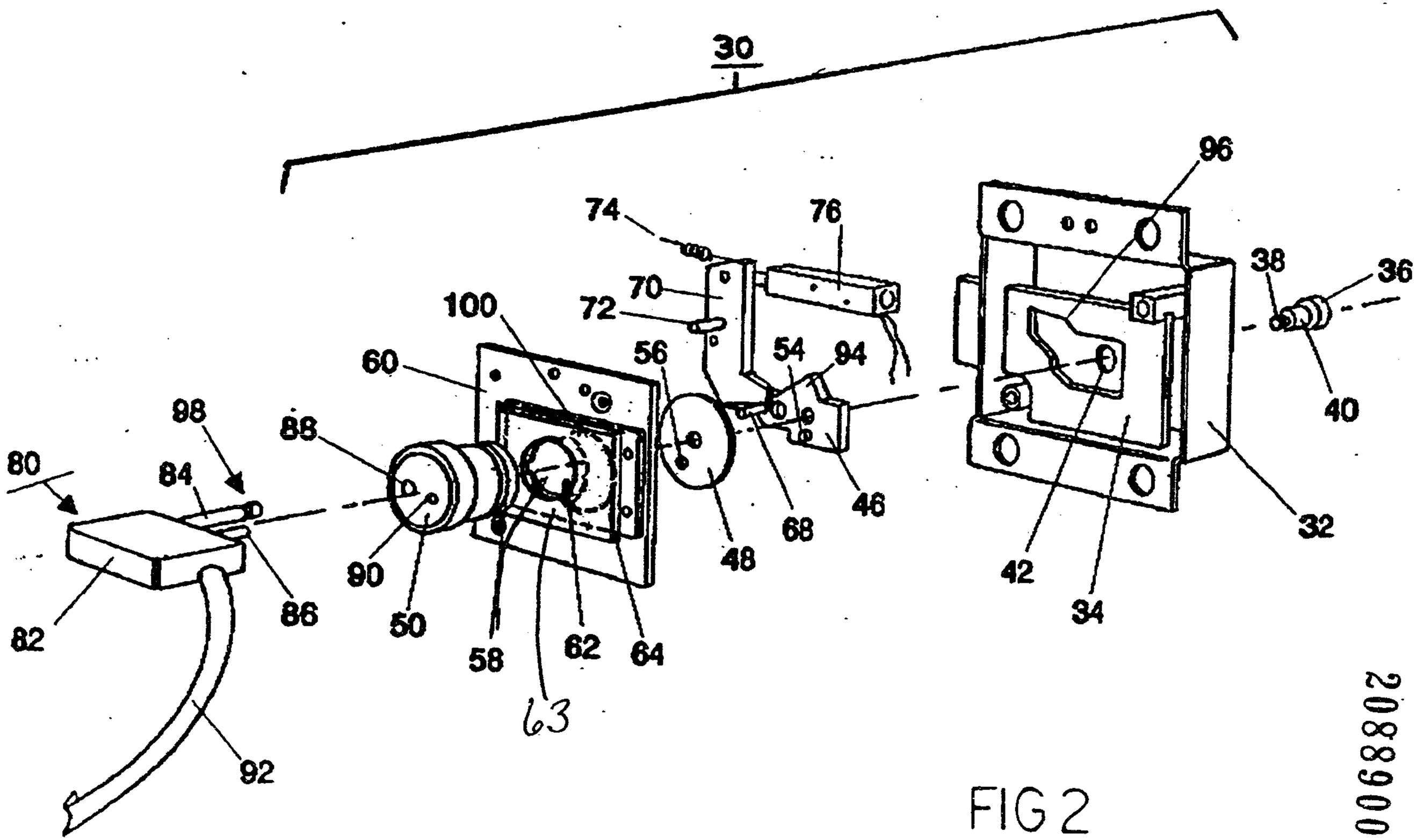


FIG 2

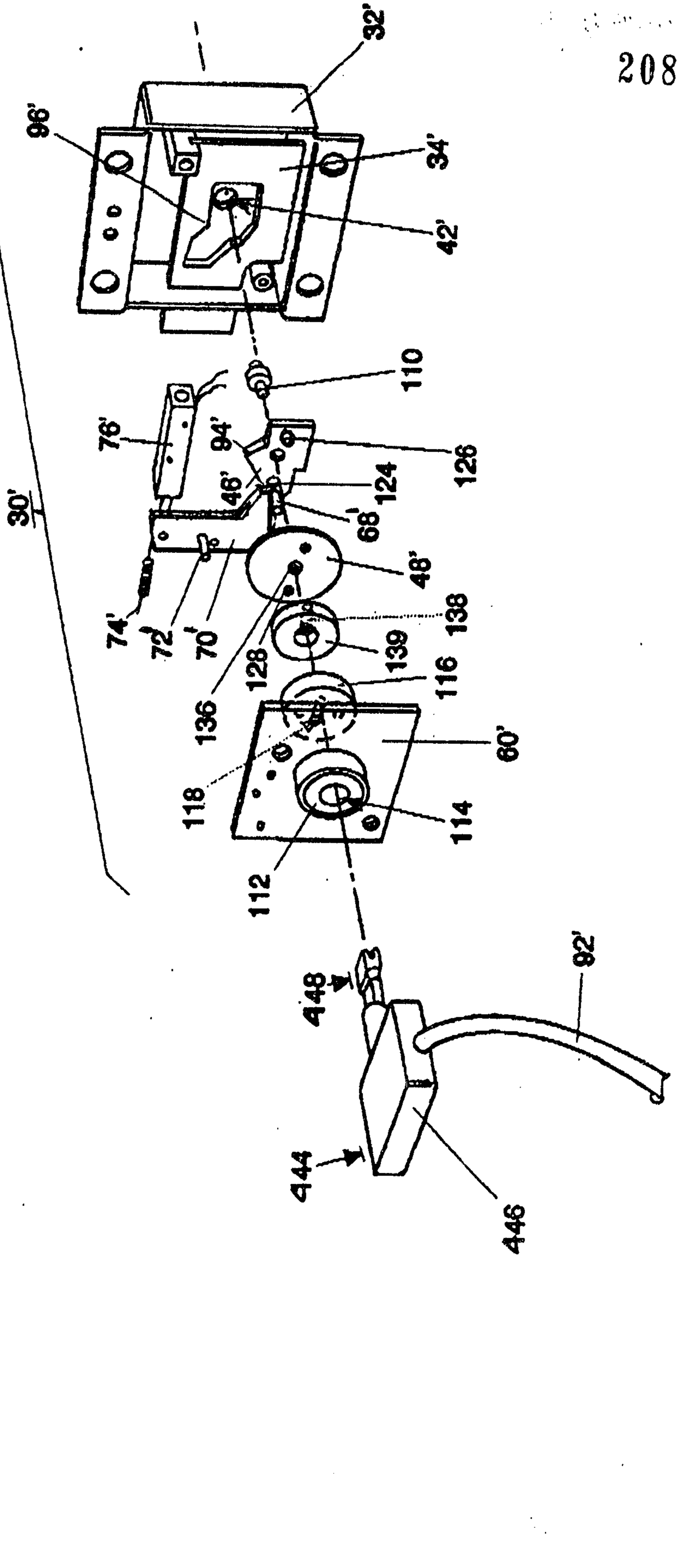

32'
96'
34'
42'
30'
110
76'
84'
126
48'
124
68'
48'
74'
72'
70'
138
139
128
116
136
60'
118
114
112
82'
44B
44A
46'

FIG 3

FIG. 4A

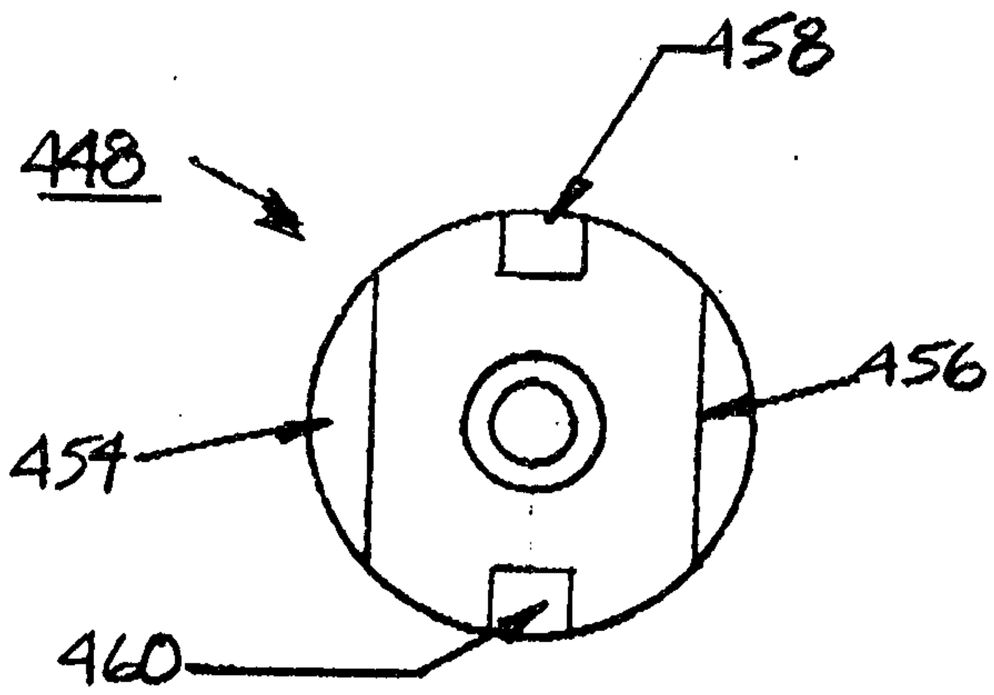
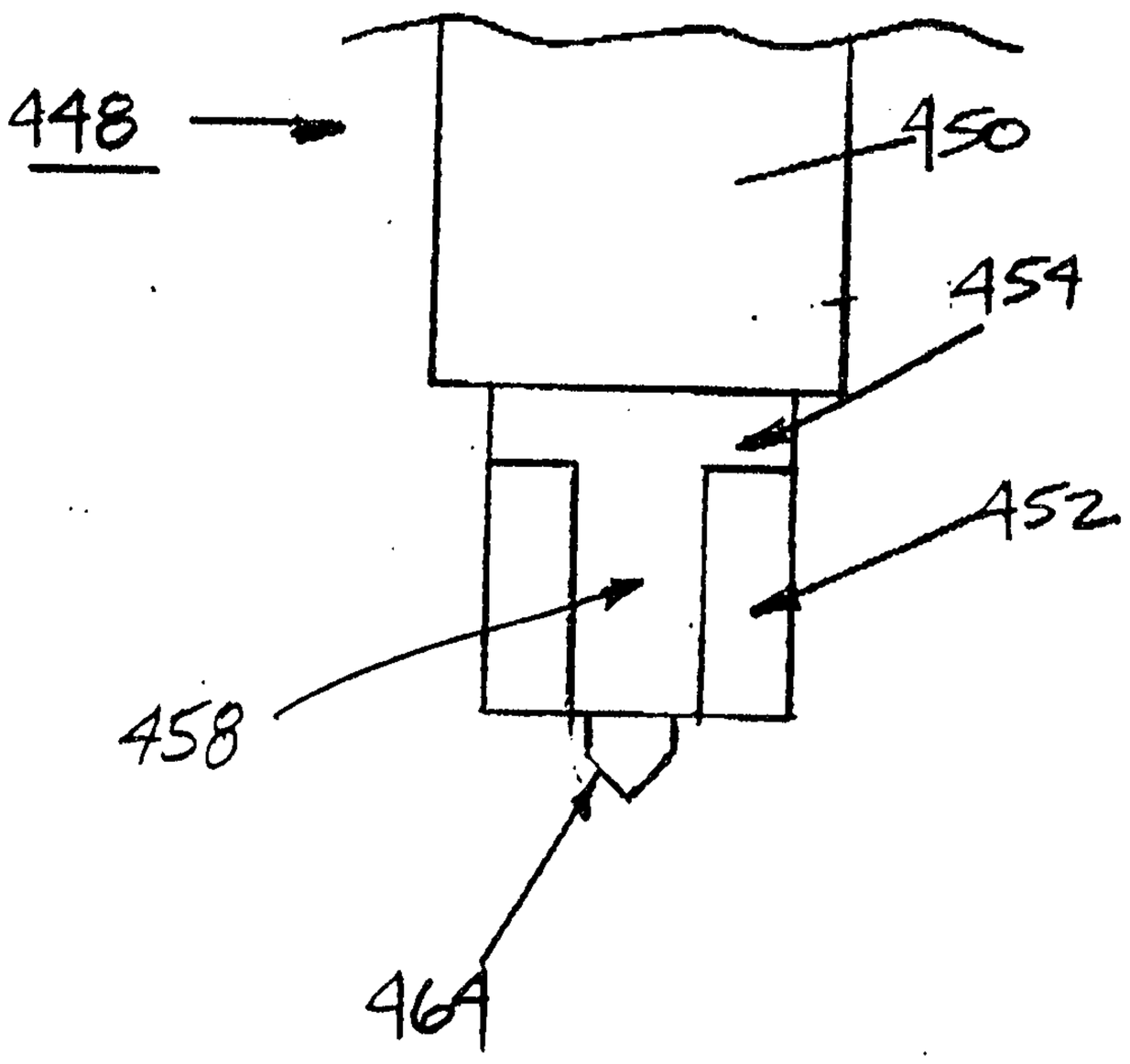


FIG. 4B



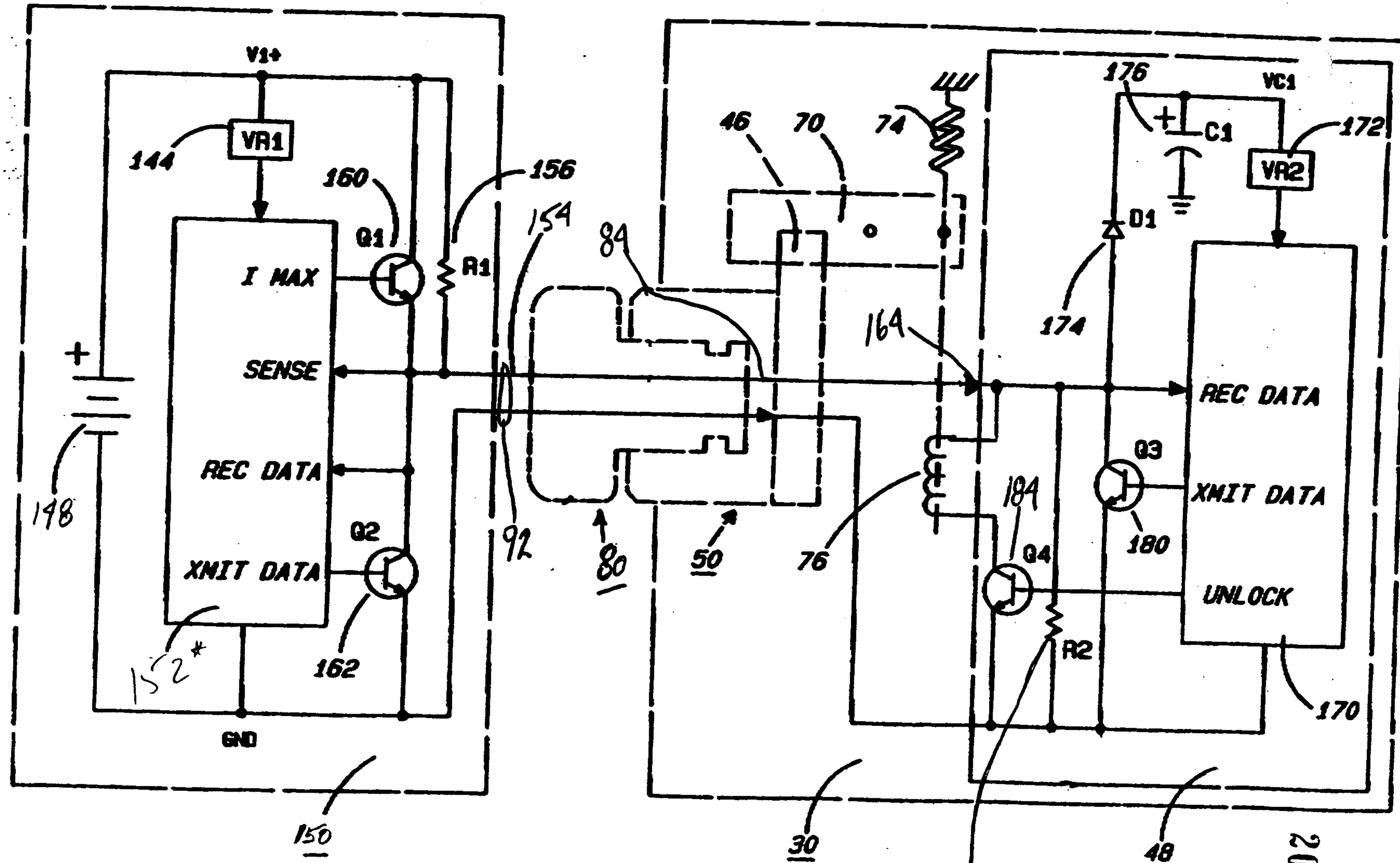
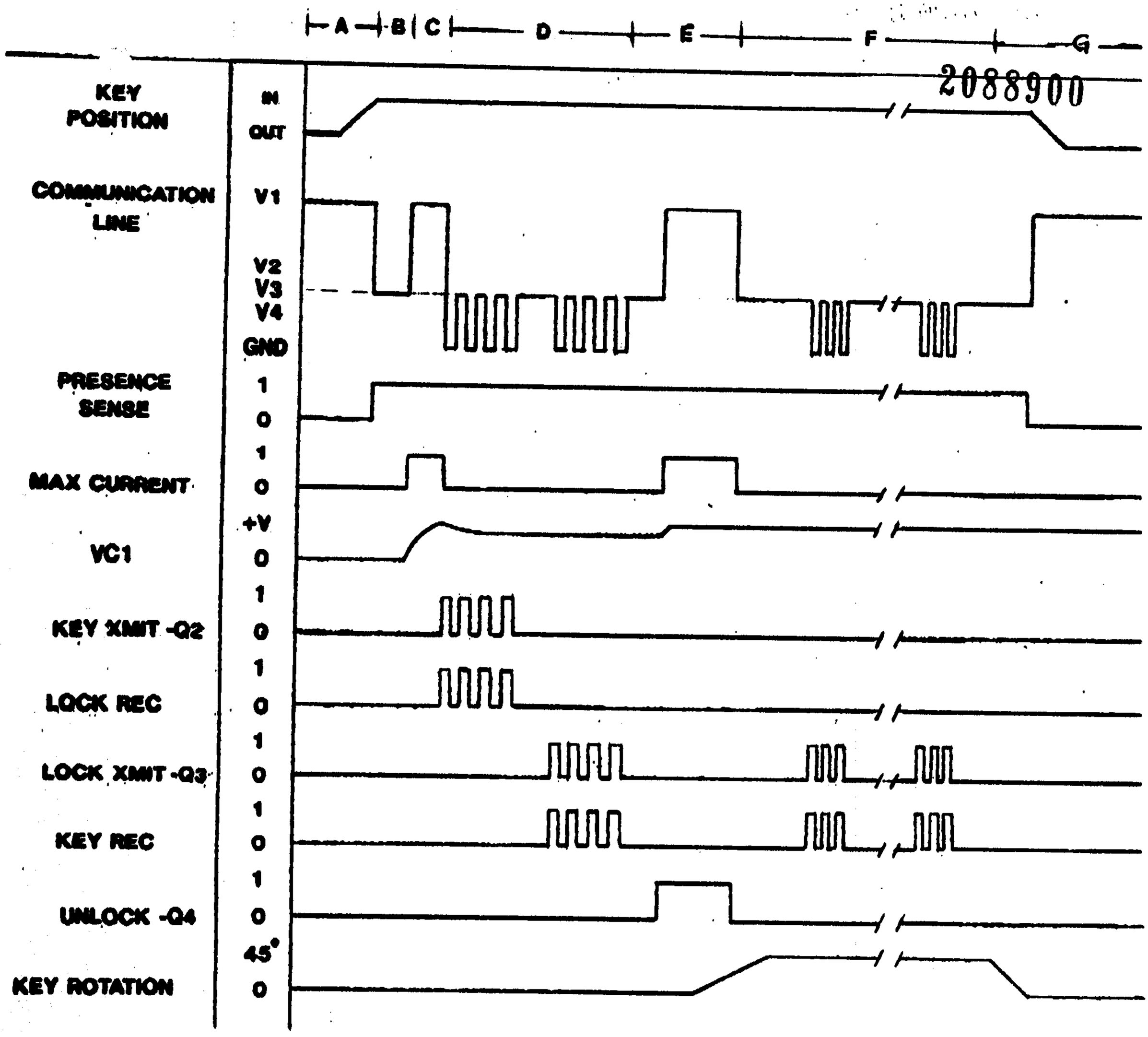


FIG 5



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A: KEY INSERTION
B: PRESENCE SENSE
C: CHARGE
D: BIDIRECTIONAL COMMUNICATION
E: UNLOCK
F: UNLOCK MONITOR
G: LOCKED
H: KEY REMOVED

FIG6

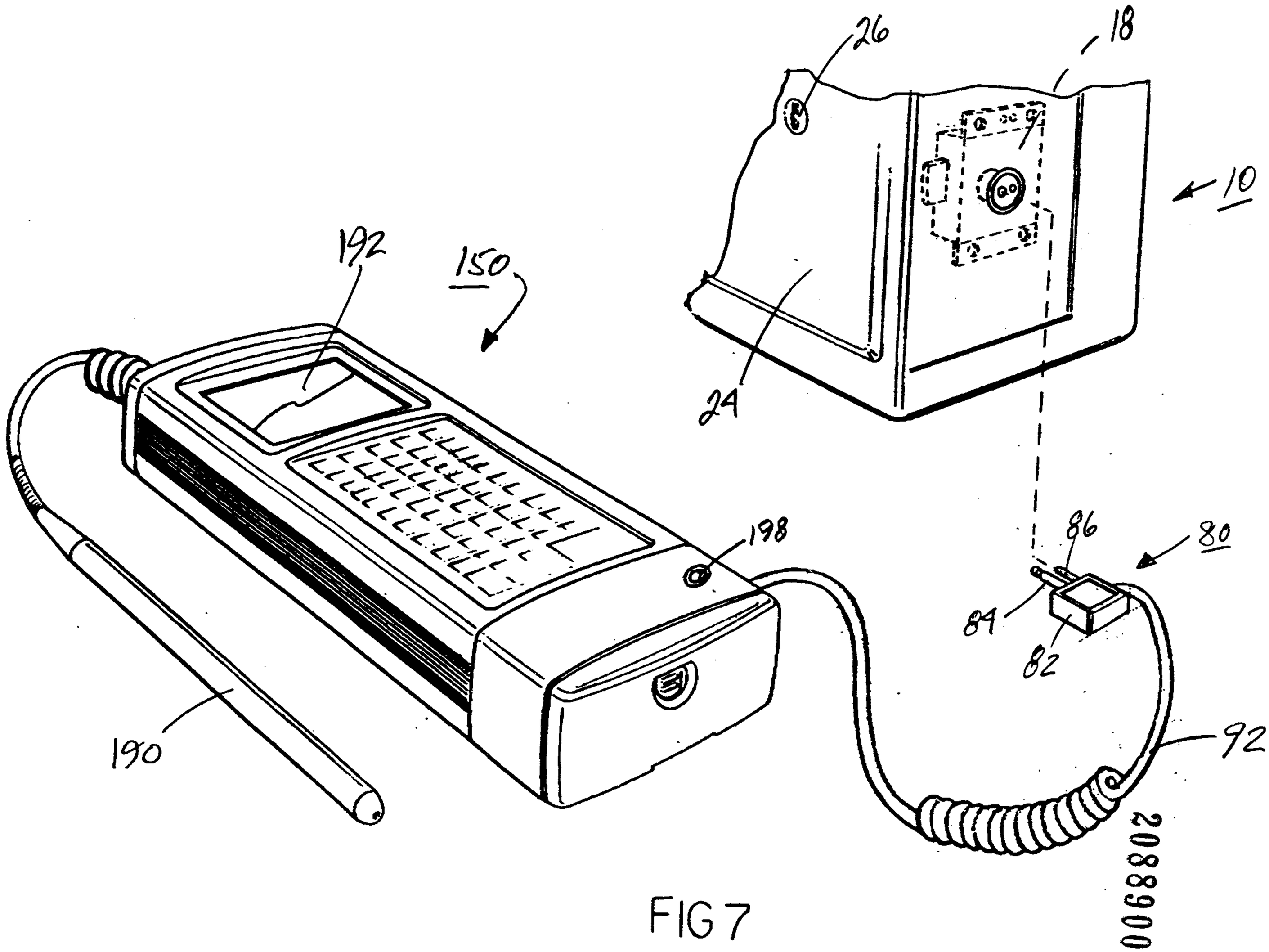


FIG 7

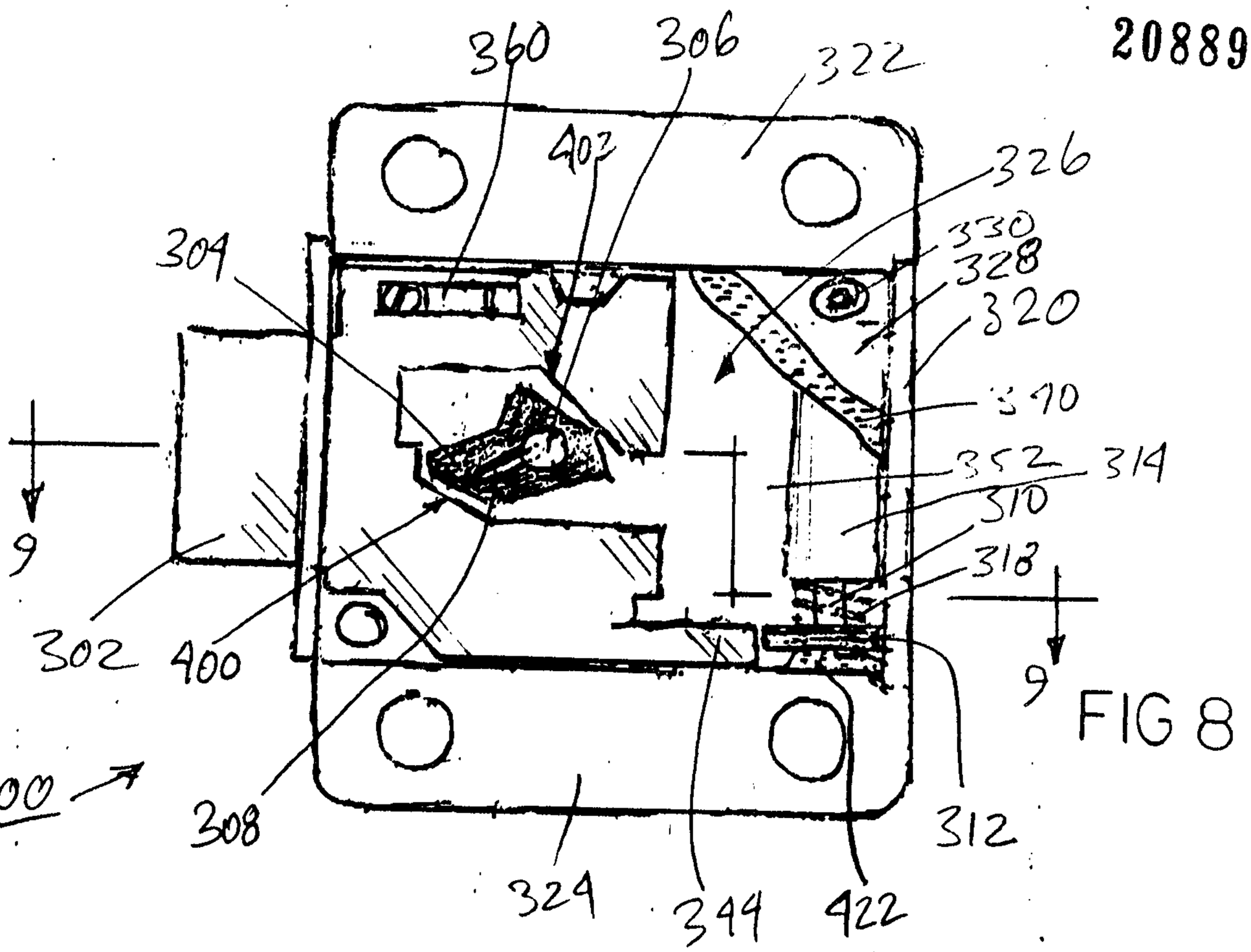

360
306
322
402
326
330
328
320
304
310
352
314
318
9
9
302
400
308
324
344
422
312
300

FIG 8

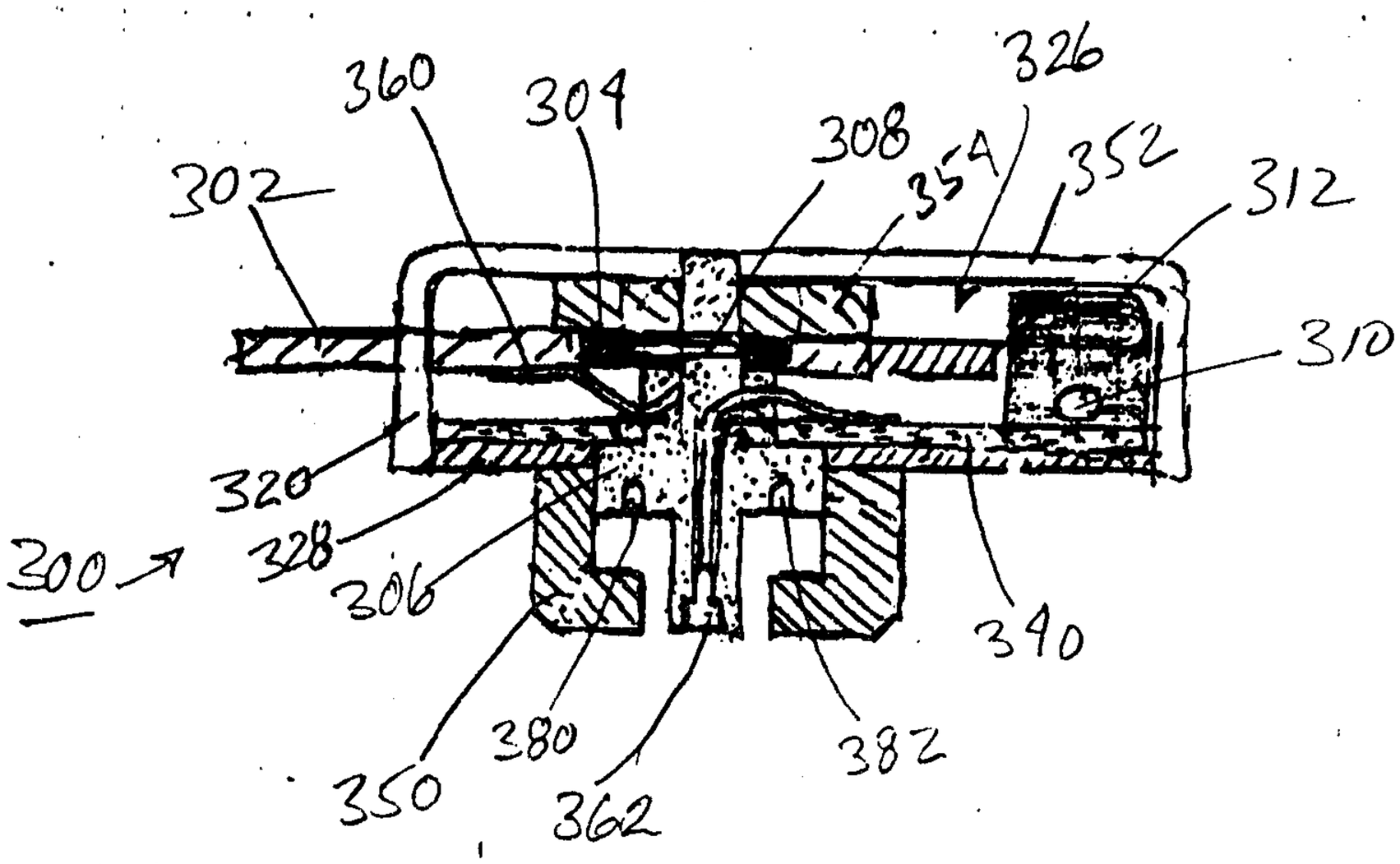

360
304
326
308
354
352
302
312
310
320
328
306
340
300
350
380
362
382

FIG 9

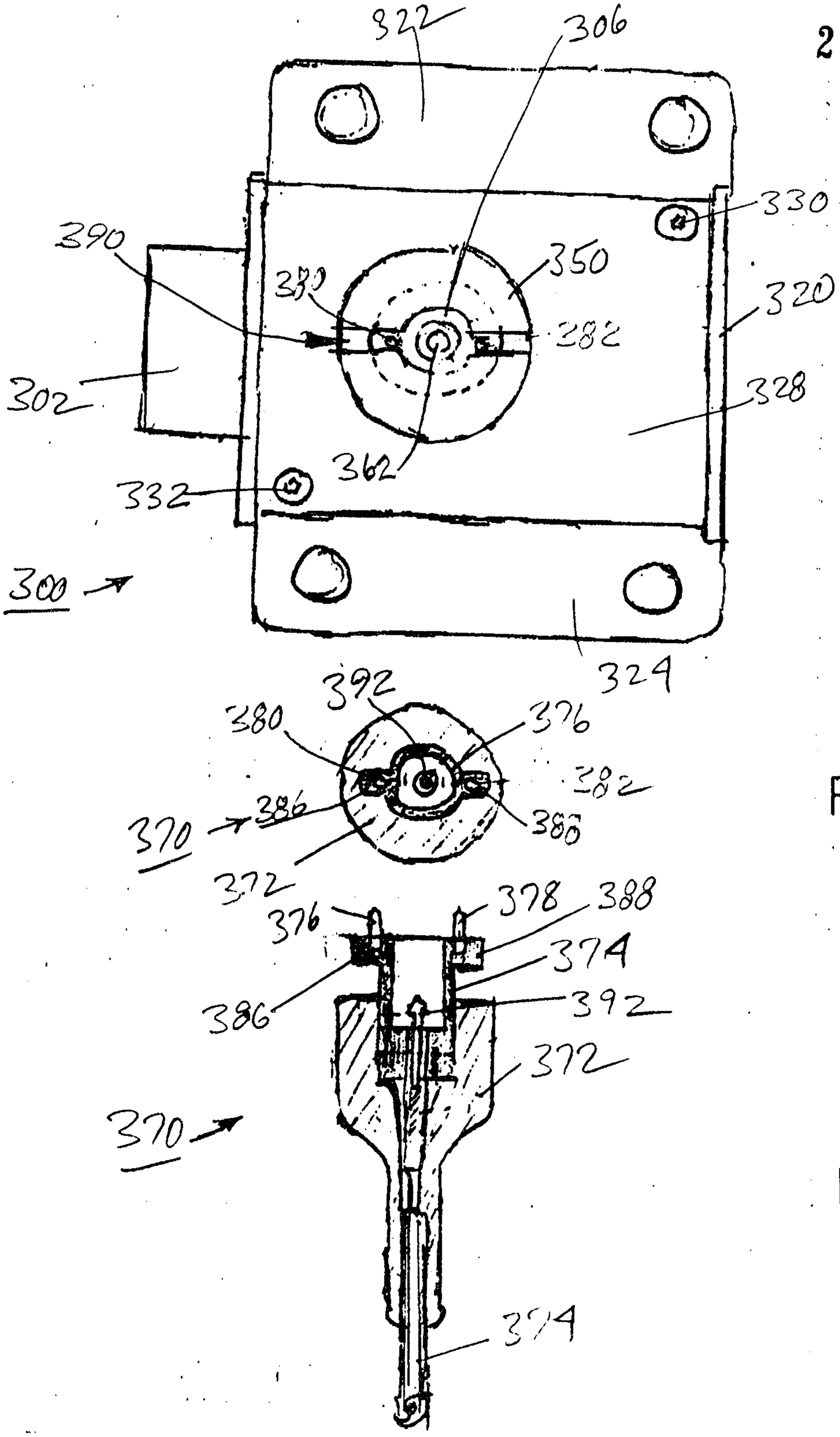


FIG 10

FIG 11

FIG 12

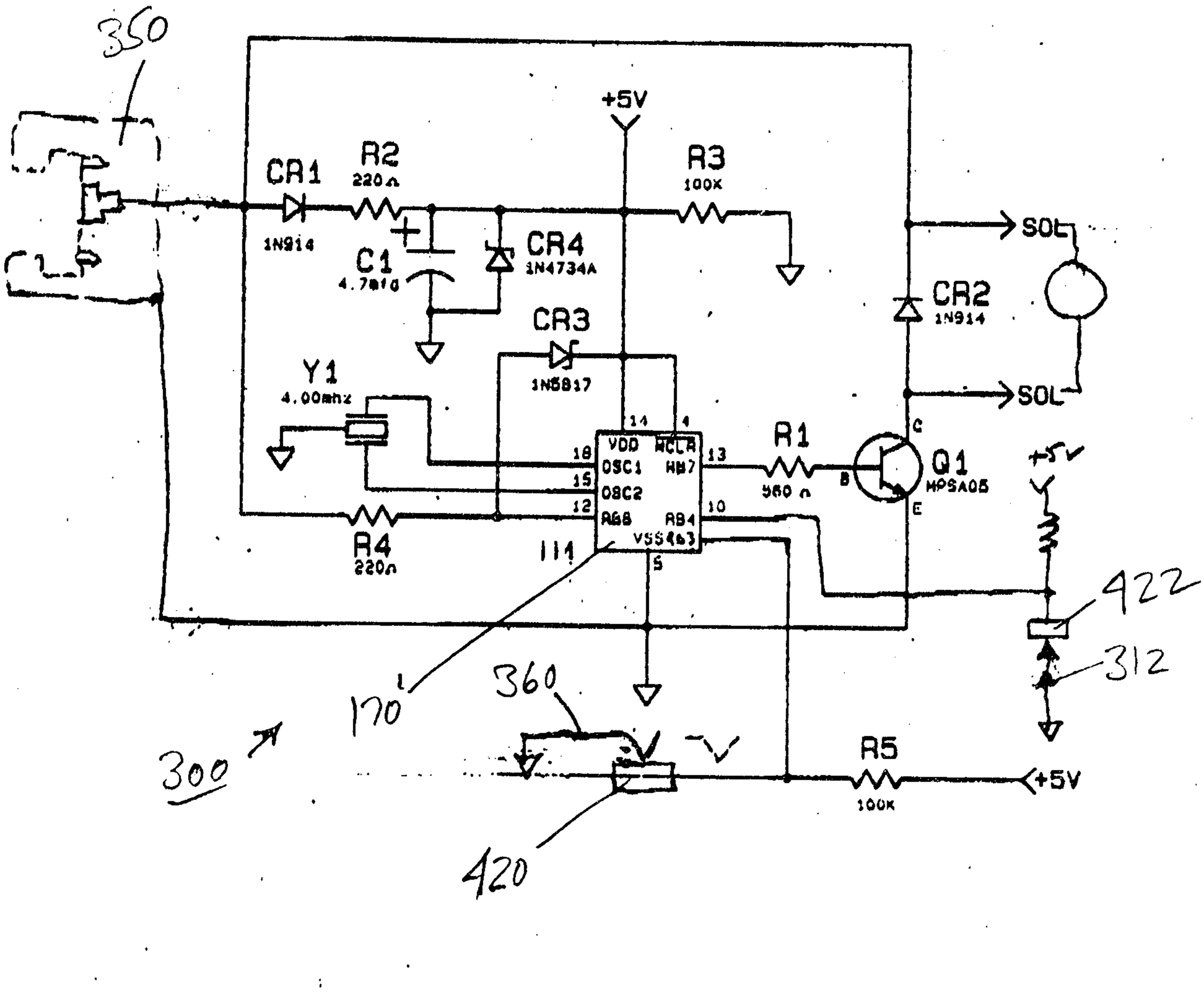
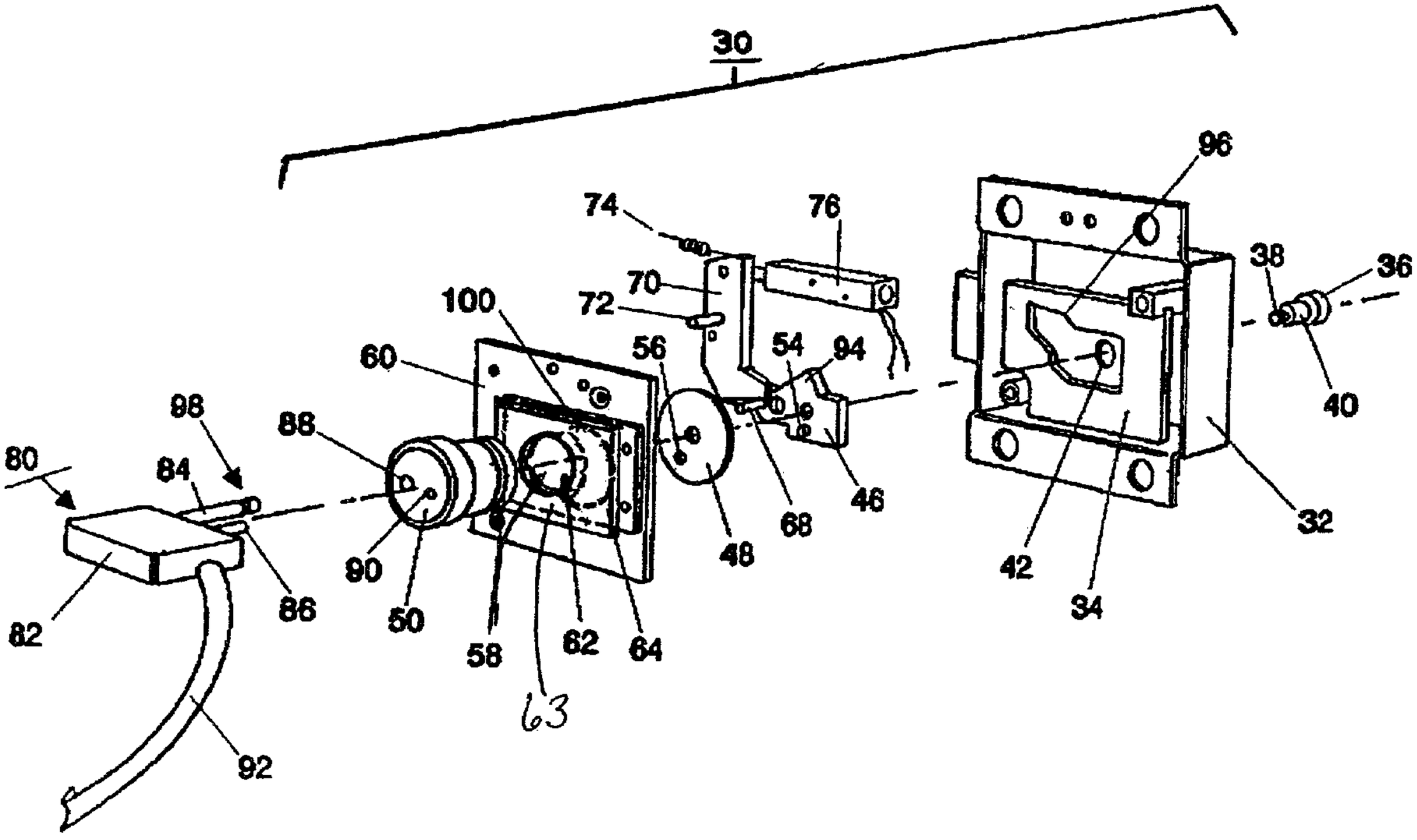

350
CR1
1N914
R2
220Ω
C1
4.7μf
CR4
1N4734A
+5V
R3
100K
CR3
1N5817
Y1
4.00mhz
SOL
CR2
1N914
SOL
14
4
VDD
MCLR
18
OSC1
RB7
13
15
OSC2
12
RA6
RB4
10
VSS
R1
560Ω
Q1
MPSA05
C
B
E
+5V
R4
220Ω
111
5
422
312
170
360
300
420
R5
100K
+5V

FIG 13


30
74
76
96
70
72
100
60
56
54
94
38
36
40
98
88
80
84
86
90
50
58
62
64
48
68
46
42
34
32
82
92
63