PCT WORLD INTELLECTUAL PROPERTY International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER TH WO 9605688A2

(51) International Patent Classification 6 : **H04M 11/02**

A2

(11) International Publication Number: **WO 96/05688**

(43) International Publication Date: 22 February 1996 (22.02.96)

(21) International Application Number: PCT/GB95/01879

(22) International Filing Date: 9 August 1995 (09.08.95)

(30) Priority Data:
9418482.7 10 August 1994 (10.08.94) GB

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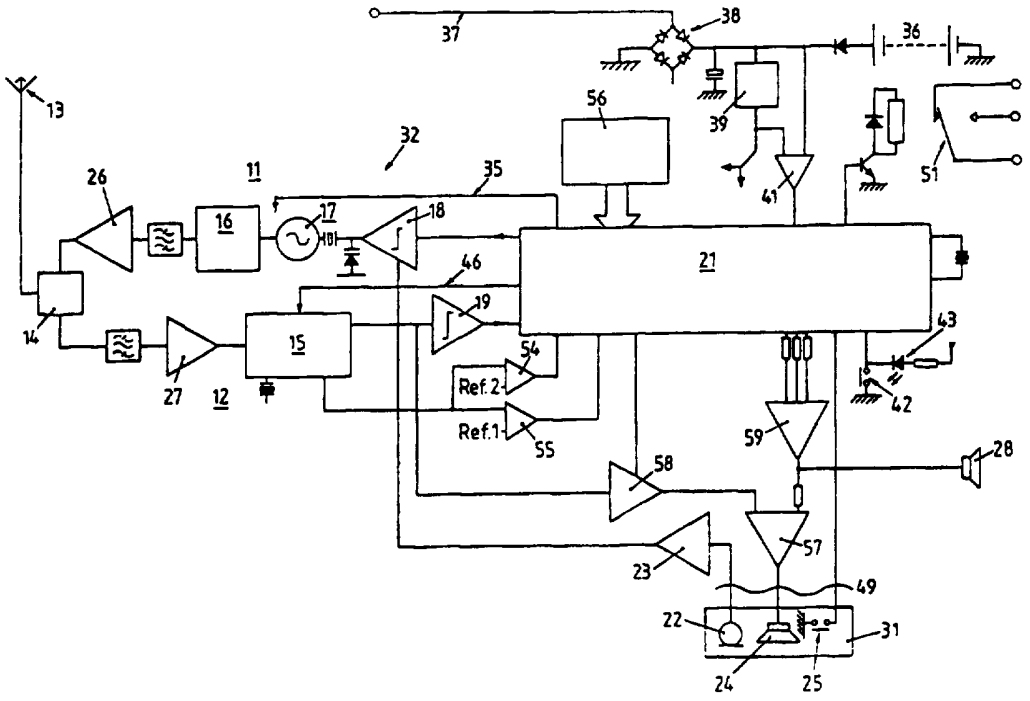
(81) Designated States: AM, AT, AU, BB, BG, BR, BY, CA, CH, CN, CZ, DE, DK, EE, ES, FI, GB, GE, HU, JP, KE, KG, KP, KR, KZ, LK, LR, LT, LU, LV, MD, MG, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SI, SK, TJ, TT, UA, US, UZ, VN, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG), ARIPO patent (KE, MW, SD, SZ, UG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: INTEGRATED VOICE AND DATA COMMUNICATION FOR INTERCOM AND ALARM



(57) Abstract

An integrated radio intercom and alarm or alert for use as a door sentry incorporates a programmable dual mode, dual frequency FM transceiver (11, 12), enabling both speech communication between a mobile remote handset (33) and a base station (32), which in turn relays signals from a door switch unit (31) and also alarm or alert condition warning data communication with a remote alarm transducer (34), to generate an alarm or alert siren warning tone in the handset and base station.

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Integrated Voice and Data Communication for Intercom and Alarm

This invention relates to remote voice and data communication - that is intercommunication between remote stations - and is particularly, but not exclusively concerned with the integration of voice and data in an intercom and alarm system - and especially with their programmable stand alone or integrated operation.

The term programmable embraces any means of predetermining operational modes, with a facility for changing some or all of such modes - for example, using microprocessor control.

One use for such an intercom and alarm is a (door) 'sentry', or entry/access monitoring device - which enables a caller/visitor to premises to communicate, by voice contact, remotely across a doorway or other premises entry threshold with a 'receptionist' or access controller or guardian.

Similarly, alarm functions may monitor or passively 'patrol' critical elements of property boundaries.

Hard-wired intercoms, and indeed alarms, are well known, and - even though known with microprocessor control - are typically low cost, low technology devices, but can be cumbersome to install and inflexible in location of the various elements and attendant interconnecting wiring.

Similarly, hard-wired alarms can require either troublesome concealment or exposed, and thus visually intrusive wiring, vulnerable to unauthorised tampering, for example bypassing or short-circuiting, in order to undermine or obviate the alarm functions.

In either case, power supplies can be self-contained, battery-operated and/or utilise a mains supply.

There have also been various proposals for remote door intercoms using radio technology, but these have suffered from compromises in quality or functionality.

Thus, for example, so-called 'simplex', unidirectional, or one-way at a time, alternating hand-over, transmission modes have been adopted, but the sender and receiver modes must alternate manually, by deliberate synchronised user action and reaction, requiring a formal handover procedure or protocol - which is awkward and confusing even for the experienced user and may be unworkable for the untutored user.

Additionally, the clarity of transmission is degraded in low cost radio systems, making it difficult to comprehend speech or recognise even familiar voice characteristics.

In low grade systems, the transmission may be prone to interference from spurious signals in the environment and from general background noise or 'hiss'.

Severe practical difficulties arise in achieving low cost, high quality communication, since conventional techniques may impose a high internal component cost overhead.

Moreover, beyond generation of an audible or visible warning tone or light illumination, there has been no integration of voice intercom and more elaborate data functions, for example an alarm sensor and trigger.

The integration of voice and data has attendant interference problems.

Similarly, there have been proposals for radio alarms, that is sensors transmitting alarm indication signals to a central control unit, but these have generally been alarm-only devices, with no integration of alarm data and coherent speech signals, using common componentry.

Generally, transmission frequencies and power levels must meet prevailing regulatory constraints, precluding certain frequency and power levels which might otherwise ease the design problem to achieve desired performance levels, such as operational range.

Regulatory authority (eg telecom or DTI) approval must be sought and secured for a definitive circuit design, a sample of which must be submitted for testing before release for general public use. It is desirable to avoid using frequencies which would require each and every set to be individually licensed, but the more liberal 'public domain' frequencies may be more densely used and so pose interference problems.

Some aspects of the invention offer the facility of an intercom and/or alarm facility encompassing not only the immediate location or property under monitoring or surveillance, but a remote location, for example of a neighbouring or closely adjacent property. Encoding and frequency banding enable the identification of a property or location being monitored.

Thus, as a temporary measure, an authorised neighbour could be provided with a station or terminal enabling them to answer calls in the absence of any occupants in the property being monitored.

This serves as a deterrent to opportunistic crime arising from casual callers with criminal intent checking upon the occupancy of a property with a view to assessing its security and vulnerability to unauthorised forced entry.

Other aspects of the invention offer the facility of multiple intercommunicating stations in a network.

A similar facility can be extended to alarm functions, so that the outlying sheds and garages of multiple properties could be monitored by a central unit, with encoding to distinguish between and identify the source of any alarm signal.

According to one aspect of the invention, there is provided a single channel radio communication device for a sentry intercom and alarm, with automated periodic switching between transmit and receiver modes at each of a plurality of otherwise independent remote stations, monitoring the ambient conditions for alert or wake up

signals prefacing a coherent transmission stream of voice and or data.

According to another aspect of the invention, there is provided single channel or simplex communication device for a two-way sentry voice or speech intercom and alarm, imitating or simulating full duplex operation by a switched simplex mode, utilising a carrier wave which is switched digitally at a higher frequency to alternate multiple remote stations between transmit and receive modes, so that the users are unaware of any significant time delay or interruption in operation.

According to a further aspect of the invention there is provided a programmable door sentry intercom and alarm comprising a door switch unit, a control unit, and alarm unit and a relatively mobile station, the control unit and mobile unit being provided with a transmitter and a receiver, and the alarm unit being provided with a transmitter and a sensor, programmed to operate in a predetermined mode.

There now follows a description of some particular embodiments of the invention, by way of example only, with reference to the accompanying diagrammatic and schematic drawings, in which:

Figure 1 shows a block schematic layout of an interconnected control unit and door switch unit for an integrated door sentry intercom, doorbell and alarm;

Figure 2 shows a more detailed circuit of the control and door units of Figure 1;

Figure 3 shows additional detailed circuitry for the control unit of Figures 1 and 2;

Figure 4 shows a block schematic layout of a mobile handset for intercommunication with the control unit of Figures 1, 2 and 3;

Figure 5 shows a more detailed circuit of the control unit of Figure 4;

Figure 6 shows additional detailed circuitry of the handset of Figures 4 and 5;

Figure 7 shows a block schematic of an alarm or alert unit for communicating with the control unit of Figures 1, 2 and 3; and

Figure 8 shows a more detailed circuit of the alarm unit of Figure 7.

It should be appreciated that the circuitry disclosed, both in block schematic and in more detailed individual component form, is merely demonstrative of possible working arrangements or design approaches, in support of the broader aspects of the invention and does not itself limit the scope of the invention.

Referring to the drawings, and in particular Figure 1, which depicts the overall layout of major functional elements in an interconnected doorbell push switch unit and control unit. More particularly, a high performance (ie bandwidth, signal-to-noise ratio, sensitivity and power output) FM (frequency modulated) transceiver is controlled by a programmable microprocessor to achieve a desired operational regime or protocol.

A door switch unit 31 is a relatively passive switching and sound relay unit, for

switching the control unit into a fully operational mode and initiating the sending of wake-up alert calls and subsequent voice transmissions from a miniature microphone 22 in the door switch unit 31 itself to a remote handset transceiver, described later. The door switch unit 31 also relays received voice communication from the handset 33 through an in-built miniature loudspeaker 24.

As such, the door switch unit 31, is typically mounted at an outside entrance to premises, in the manner of a conventional door bell switch - and which it may therefore replace - and activates both an audible, electronically-generated or synthesised chime tone within the appended control unit and a warning alert tone in a remote handset.

The physical construction of the casing for the door switch unit 31 may either be hermetically sealed against the ingress of moisture, or may allow a through current of ambient air, with ample drainage provision to disallow moisture accumulation.

Monitoring and controlling the door switch unit is a control unit 32 - which is a relatively active unit and incorporates a transmitter stage 11 and a receiver stage 12 intercoupled to a microprocessor, and are operational a distinct frequency bands, specifically based upon transmission on 173 MHz and reception on 49 MHz.

These frequencies are pre-set and crystal-controlled in the oscillatory circuitry for stability.

One object of the adoption of such different frequencies is to reduce the risk of interference between the transmission and reception channels and to simplify the requirements of attendant circuitry and componentry.

Such interference can arise internally by intercoupling of physically adjacent circuitry, or externally via the aerial arrays, and elaborate physical and electrical screening

Another object is to meet regulatory constraints upon the frequencies legitimately available and the maximum power outputs allowable for such devices and the conflicting competitive demands upon those frequencies by other users.

However, internally, frequency division or multiplication is deployed, to allow internal operation at lesser frequencies and subsequent matching to the aerial frequencies. However, internally, the microprocessor itself is clocked at another frequency (eg 2 MHz).

The overall design objective is to achieve a relatively low-cost, high quality FM radio communication performance.

The transmitter and receiver stages 11 and 12 are intercoupled through a diplexer or splitter 14 to a common antenna 13, for example in the form of a trailing wire, which may be incorporated in an external umbilical interconnecting cable 39 to the door switch 31, described in more detail later.

The antenna 13 may take the form of a trailing lead, of length matched to suit the

(transmission/reception) frequencies employed - and thus typically of some 400 mm (17 inches) overall length, for efficient handling of the lower 49 MHz frequency, and which may be deployed from the control unit once mounted on, say, a wall. Such an aerial lead may also be incorporated into an umbilical cable between the control unit and the door switch.

If desired, a separate stub aerial may be employed for the higher 173 MHz frequency, and contained within the casing of the control unit.

It should be appreciated that, the more substantial the aerial, the lesser the power output burden upon the transmitter and the sensitivity burden upon the receiver circuitry.

Alternatively, separate 'matched' antenna can be used for the transmitter and receiver stages, with lengths optimised for the frequencies, or high-gain internally wrapped antenna configurations may substituted to minimise intrusive lengths.

The antenna efficiency makes a material contribution to the range of the device for a given circuit output power level and input sensitivity.

The difference in power levels between the transmission output and reception input is many orders of magnitude and thus interference or cross-talk between the stages must be eliminated as far as possible.

In conjunction with tuned filters or chokes, the diplexer 14 isolates the transmitter stage 11 from the receiver stage 12, and in particular prevents the relatively high power outputs of the transmitter stage 11 from being fed to and overloading the sensitive high gain receiver stage 12, whilst allowing the low level reception signals to be passed from the antenna 13.

Operational amplifiers 26 in the transmitter stage 11 and 27 in the receiver stage 12 respectively feed the transmission signal to the antenna 13 and the received signal from the antenna 13 to the receiver stage.

Attendant tuned filter or choke circuits separate and isolate the transmission and reception signals.

The receiver 12 can be activated periodically in a so-called 'sniff' mode to remain alert to an alarm condition data signal transmitted from a remote alarm transducer unit 34, as described later in relation to Figures 4 and 5. This preserves battery life, whilst enabling the system to remain alert in a more quiescent mode.

The control unit 32 can also be activated from a push/press contact switch 25 in the switch unit 31, which imitates and substitutes for a conventional bell push, and this alerts a microprocessor 21 to enable the transmitter 11 through a control path 35.

An alarm set switch 42 is also provided on the control unit 32 to trigger the microprocessor 21 to put the receiver into alarm-sensitive 'sniff' mode. An optional neon warning light 43 may be provided in the alarm switch circuit to indicate that alarm

mode is set.

The receiver 12 incorporates an FM decoder stage for separating the voice signal from the carrier and this voice signal is relayed by the microprocessor 21 both to a miniaturised weather-resistant loudspeaker 24 in the door switch unit 31 and a larger, higher output, internal loudspeaker 28 in the control unit 32 itself.

Once activated, the control unit 32 remains operational for a predetermined time period, to await speech transmission from a caller through a sensitive miniaturised microphone in the door switch unit 31 or repeat activation of the push button 25, or from a mobile handset 33, described later in relation to Figures 4 and 5.

Provision is made within the control unit 32 for a self-contained battery power supply, through a sealed dry cell array 36 and optionally also through a backup external mains supply through a rectifier 38 and regulator 39. A plug and socket connector (not shown) may be used for this purpose, along with an integrated proprietary mains transformer plug unit.

Should the battery voltage level become low, due to battery discharge, a voltage sensing/detector circuit 41 is triggered, to activate some form of warning indication, such as the generation of an intermittent warning tone through the loudspeaker 28.

Microprocessor 21 controls the initiation of transmission through a gate 18, enabling the door unit microphone 22 to provide modulation through an amplifier stage 23 through a frequency multiplier 17 at an operational frequency which is increased threefold through a tripler stage 16 to achieve the transmission base carrier frequency of 173 MHz.

Provision is made through an encoder 56 for codifying the transceiver operation, for example by prefacing each transmission with a seven digit code signal, to inhibit interference from a similar unit within range in an operational environment, for example when systems are installed in neighbouring premises.

Such encoding and frequency banding mean the transmissions from one system will not activate another system - or more particularly, even if alerted initially, the receivers can discriminate between transmissions, and not pass encoded or wrongly coded transmissions for demodulation and relay through the associated audio loudspeakers.

The audio output of the receiver 15 is applied through a gate 19 to the microprocessor 21 and through a gate 56 to a gate 57 and thence to the loudspeaker 24 in the door switch unit 31.

The receiver 15 may be enabled/disabled through a mute signal path 55 or a 'carrier detect' or reset signal path 54. It may thus be arranged that the receiver 15 is automatically disabled upon reception of a 'cancellation' or end code transmission from the remote mobile handset 33, or upon cessation of transmission activity for a predetermined time period.

Similarly, a 'mute' button may be provided upon the remote handset 33, which when

pressed, generates a mute code disconnecting, by closing the gate 56, the audio output from the receiver 15 to the door unit loudspeaker 24.

An equivalent functioning the handset 33, described later, provides the user of the handset 33 with some temporary, controllable privacy, so that all sounds at the handset 33 are not automatically relayed to a caller at the door.

The handset 33 may also be provided with an 'accept' button, which – after receiving an alert signal indicating that a caller at the door has pressed the door switch 25 – must be depressed in order to accept that call and initiate two-way radio communication between the remote handset and the caller at the door.

Aside from a remote radio alarm trigger, described later, provision may be made for one or more 'proximity' alarm or alert trigger switch 51 to be hard-wired to the microprocessor 21.

The microprocessor 21 may be programmed to generate differentiated (for example, by frequency and volume level) and variable (eg by frequency sweeping) alarm and chime tones, which are output to an internal loudspeaker 28 in the control unit 32, and also relayed to the remote external loudspeaker 24 in the door switch unit 31.

The loudspeaker 24 is conveniently a miniaturised variant, with a synthetic plastics moisture-resistant cone.

When the transmitter stage 11 is activated through a transmission enable signal path 35, audio signals from the door unit microphone 22 are relayed through a amplifier/gate 23 to a modulator stage 18 – which applies them to a carrier frequency generated by a crystal-controlled oscillatory circuit 17, set at some 57 MHz (or 57.66' MHz), and thereafter passed to a frequency multiplier or tripler stage 16 to achieve the approximate 173 MHz transmission frequency.

Figure 2 depicts the circuitry of the control unit 32 and door switch unit 31 of Figure 1 in more detail and the same reference numerals are used for corresponding parts.

Referring to Figure 4, the remote mobile handset 33 also incorporates a programmable microprocessor controlled transceiver of similar layout to that described in relation to the control and door units of Figure 1.

Figures 5 and 6 show in more detail the circuitry of the handset shown in Figure 4 and again similar reference numerals are used for corresponding parts.

Thus a microprocessor 121 controls a transceiver, comprising a transmitter stage 111 and a receiver stage 112 connected through a diplexer 114 to a common antenna 113.

Conveniently, the antenna 113 in the mobile handset 33 may take the form of a multi-stage telescopic mast, to which the receiver circuitry 112 is tuned for sufficient sensitivity in its partially retracted condition to allow reception of a 'wake-up' signal from the control unit.

In order to communicate with the control unit 32, a transmission frequency of 49 MHz and a reception frequency of 173 MHz are employed in the handset 33. In this way, the handset transmissions can be handled by the control unit receiver, independently of the recognition of the control unit transmissions by the handset receiver.

Identification coding for the handset 33 is entered through an encoder 156 to the microprocessor 121, to correspond with the encoding of the control unit 32 and the alarm unit 33.

A self-contained internal dry cell (re-chargeable) battery 136 is incorporated feeding the microprocessor 121 through a battery low detection stage 141.

Provision is made for battery (re-)charging using a mains supply 137 through a full wave rectifier 138 to a charging controller 147, with an operations indicator light 149, and a regulator converter 139 to feed the microprocessor 121 through the voltage detection gate 141 and also to replenish the battery 136.

A battery low indicator neon or LED 143 provides the handset user with an indication that re-charging is required.

The handset 33 incorporates an internal microphone 122 signals from which are fed through an amplifier 123 to modulate the transmitter 111.

A loudspeaker 128 is also incorporated in the handset 33 to relay audio speech or alarm signals from the receiver 112 through amplifiers and gates 156 and 157.

A call accept push-button switch 181 instructs the microprocessor 121 to pass received speech signals from the receiver 112 to the loudspeaker 128.

A call clear or cancel push-button switch 182 instructs the microprocessor 121 to disable the transmitter 111 through an enable/disable control signal line 135.

A panic mode is contrived by pressing both accept and clear buttons 181 and 182 simultaneously, to generate an alarm condition, which is relayed to the control unit 32 through the transmitter 111 and produces alarm siren tones in both the control unit loudspeaker 28 and the handset loudspeaker 128.

A mute push-button switch 183 is provide to enable the user temporarily to suspend transmission from the handset, by disconnecting the microphone 122 from the transmitter 111. Such a mute function button may be combined with, say, the call accept button, which then deals with onset of communication and its interruption.

As with the control unit micro 21, the handset micro 121 may be pre-programmed to generate harmonious door chimes or discordant alarm siren tones, according to the conditions co-operatively monitored by the control unit 32, handset 33 and alarm unit 34.

Control gates 114 and 115 monitor the presence of a carrier transmission with prefacing encoding and supervise the transfer of receiver audio output to the internal

loudspeaker 128.

Control gate 118 relays transmission coding instructions from the micro 121 to the transmitter 111.

Control gate 119 relays demodulated audio signals from an FM receiver tuner stage 115 in the receiver 112 to the micro 121.

Figure 7 shows the general circuitry layout of an alarm unit incorporating a programmable microprocessor controlled transmitter stage triggered by a remote sensor, such as a simple magnetic contact switch, with a permanent magnet 280 and associated keeper for bridging contacts 281 - although admitting of a variety of disparate and more sophisticated sensors.

A microprocessor 221, clocked at 2 MHz, controls the generation of a codified alarm signal from a transmitter stage 211 comprising a crystal-controlled oscillator 217 feeding a frequency multiplier or tripler 216 to an operational amplifier 226, to feed a 49 MHz signal to an antenna 213 through an umbilical cable 279 and (closed) switch contacts 281.

An encoder 256 is used to input a predetermined code into the microprocessor 221, which in turn produces a prefacing coded transmission modulation applied to a gate 218.

This coding corresponds to that used for the control unit described in Figures 1 and 2 and is again adopted to obviate interference with any other alarm, control or handset units in the vicinity.

The alarm unit 34 has a self-contained (eg nominal 9 volt, dry-cell) battery 236 connected to the microprocessor-controlled transmitter only stage 211 through a switch logic circuit 276, so that transmission is only initiated when the alarm sensing or trigger contacts 281 are open-circuited.

A magnetic keeper 280, for example mounted upon a movable element such as a door or window, controls the open or closed condition of a contact closure element across the contacts 281, which is mounted upon a relatively static adjacent frame element.

The trigger contact condition thus generates a set or reset signal to the microprocessor 221 in order to respectively arm or re-arm the transmitter 211.

A set or test button (not shown) may be provided to set or prime the alarm ready for operation or to check operability and a companion warning indicator light, such a low consumption light-emitting diode or neon 243 to indicate operating condition or serviceability of the alarm unit 233.

Once the alarm transmission is triggered, the alarm condition may be preserved for a predetermined time, either by timing the duration of the transmission or setting the control unit receiving the alarm transmission to latch into warning tone or siren generation mode for a preset time.

Simply closing the trigger contacts 280 after they have been open-circuited will not cancel the alarm condition, which continues either until timed-out or reset by a deliberate control action.

If desired, some form of anti-tamper circuitry may be incorporated to inhibit bridging or otherwise by-passing of the trigger switch circuitry.

Only a proportion (eg 5 volts) of the battery voltage is used to drive the microprocessor controlled circuitry through a regulator 239 - promoting operational stability and longevity of batter life. This is particularly valuable for a device in a remote location which is called upon to operated only occasionally, but with a high degree of reliability.

Battery condition is monitored through a battery 'low' (voltage) condition detector 241, in turn monitored by the microprocessor 221 to generate an appropriate (audio/visual) warning indication.

The trigger contacts 281 are connected to the switch logic circuit 276 through an umbilical cable 279, which can also serve as or incorporate the transmission (49 MHz) transmission antenna 213, which is de-coupled or insolated from the switch logic circuit through isolator coils 278.

Figure 8 shows in more detail the circuitry of the alarm unit shown in Figure 7 and, for ease of understanding, the same reference numerals are used for corresponding parts.

Operational Mode

The co-operative operation of the door unit 31, control unit 32, handset unit 33 and alarm unit 34 is generally as follows:

Door Unit and Control Unit

Having been set or primed, all units are initially quiescent in dormant or sleep mode.

This conserves power consumption, battery drain and ultimately overall component life.

If the alarm set switch 42 on the control unit 32 has not been set on, the system is programmed for speech communication only - and a warning indication 43 may be provided on the control unit to this effect.

In this speech-only mode, the control unit 32 responds only to the door unit 31, not the alarm unit 34.

Dealing with the speech communication all transceivers - ie in the control unit 32 and handset 33 are off - except that for speech sensing the receiver 112 in the handset 33 is periodically activated to check for any transmissions from the control unit 32.

Similarly, for alarm sensing purposes, the receiver 12 in the control unit 32 is periodically activated.

The system is woken by a caller pressing the door (bell) push button switch 25, which triggers a sound chime through both loudspeakers 28, 24 in the control unit 32 and door unit 31 and activates the transmitter section 11 in the control unit 32 to send a wake-up signal to the receiver 112 in the handset 33, with a warning tone generated in the handset 33 to alert a handset user to the presence of the caller at the door, or whatever threshold is being monitored.

After transmitting the wake-up or alert burst, the control unit transmitter 11 is powered-down or de-activated and the companion receiver 12 is powered up, ready to receive an 'acceptance' reply signal from the transmitter 111 in the handset 33.

If no such acceptance signal is received for a preset time, eg 30 seconds, the control unit receiver 12 is automatically powered down.

The handset user must actively and deliberately accept a call, by pressing an accept button 181 on the handset, which allows full two-way speech conversation between the door unit 31 and the handset 33 through the intermediary of the control unit 32. Similarly, positive call cancelling through button 182, can be empowered to preface any repeat of the call cycle.

If such conversation should cease for a predetermined period, or indeed to limit call length (and so preserve battery life) the circuitry can be programmed to time out automatically and revert the transceivers to quiescent mode, until the cycle is repeated by a caller pressing the switch 25 on the door unit 31.

A door unit switch 31 activation closely after the first is accepted and repeats the call sequence, but repeated door unit switch activation is disregarded for a pre-set time, to obviate repeated sounding of the door chime by persistent unwanted callers.

If a call accept signal is initiated from the handset transmitter 111, both transceivers in the handset 33 and control unit 32 are rendered fully operational for a pre-set time, eg 60 seconds, or until the over-ride call cancel button 182 is pressed on the handset 33, whereupon the system re-enters quiescent mode.

During this active phase, all speakers and microphones are enabled, although at any stage the handset 33 may be set to mute mode, by pressing and holding the mute button 183 on the handset, to temporarily allow privacy and stop the relaying of unwanted sounds from the handset 33 to the door unit 31. The mute and accept functions may be integrated on a single button 181.

If the alarm is set, the control unit 32 will continue to respond to activation of the door unit 31, but additionally the receiver 12 will periodically wake-up to check for an RF carrier transmission from an alarm unit 34. Should this be received, its code is checked against a pre-set code in the control unit 32, and if matched will allow the generation of an alarm (siren) tone through all the loudspeakers of the door unit 31, control unit 32 and handset 33, for a pre-set time, eg 60 seconds.

Handset

As with the control unit 32, the handset transceiver 111, 112 is normally dormant to conserve power consumption, and the handset speakers and microphones are muted, but the receiver 112 is powered up periodically to check for any RF carrier transmission from the control unit 32.

The alarm unit 34 and handset 33 thus do not communicate directly, but rather through the intermediary of the control unit 32.

If a carrier is detected, it is checked for coding, and if its coding matches the pre-set code in the handset microprocessor 121 a door warning chime is sounded in the handset 33. The unit then waits a pre-set time, say 30 seconds, for the handset call accept button 181 to be pressed - failing which the unit returns to sleep mode. Upon a call accept action, the handset transmitter 111 is powered up to enable handset transmission.

Initially the transmit identification code is transmitted, during which time the handset receiver 112 can be powered down, and after which full handset transceive mode prevails, with handset microphone 122 and loudspeaker 128 enabled by suppressing their respective mute functions.

Full handset transceive mode is maintained for a pre-set time, eg 60 seconds, until a call cancel/clear button 182 is pressed, or until the call accept button 181 is pressed again, to function as a call end. This in turn triggers the transmission of the unit identification code. When this is sensed by the control unit receiver 12, it is interpreted as a call end or cancellation command and the control unit transceiver 11, 12 is disabled. Similarly, the handset transceiver 111, 112 re-enters sleep mode.

For relaying alarm functions, the handset 33 will generate an alarm (siren) tone through its internal loudspeaker 128 upon detection of an alarm code transmission, relayed from the control unit 32, in turn instigated by the alarm unit 34 and attendant trigger. Alarm tones may also be relayed to the door switch speaker 24.

Alarm Unit

In sleep mode both the microprocessor 221 and transmitter 211 are powered down - and line voltages A1 and A2 are low. Similarly, any LED indicator would be off and line voltage A3 low. The alarm unit microprocessor remains in sleep mode, even if Vcc, MCLRbar and RTCC voltage levels are still high.

In order to reset, power is momentarily switched to the microprocessor 221 and to MCLRbarr and RTCC.

The microprocessor 221 holds the supply voltage line A0 high and checks for a battery low condition on B7 and sets a battery flag accordingly.

The microprocessor is then readied for transmit mode - in which line voltage A0 remains high, and provided the battery flag is OK, any warning indicator LED is held on by a high line voltage A3, until sleep mode is initiated.

The transmitter 211 is powered up, with line voltage A1 high and an identification code is transmitted repeatedly at intervals through line A2, then sleep mode is resumed.

For ease of reference, there follows a general component list:

transmitter stage	11
receiver stage	12
common antenna	13
diplexer or splitter	14
receiver	15
tripler stage	16
frequency multiplier	17
gate	18
modulator stage	18
microprocessor	21
microphone	22
amplifier/gate	23
miniature loudspeaker	24
push/press switch	25
operational amplifier (transmitter)	26
operational amplifier (receiver)	27
internal loudspeaker	28
door switch unit	31
control unit	32
handset	33
alarm unit	34
battery	36
umbilical cable	37
rectifier	38
regulator	39
voltage sensing/detector circuit	41
alarm set switch	42
warning light	43
'proximity' alarm trigger switch	51
'carrier detect' or reset signal path	54
mute signal path	55
encoder	56
gate	57
gate	58
transmitter stage	111
receiver stage	112
common antenna	113
diplexer	114
control gate	115

control gate	118
control gate	119
microprocessor	121
internal microphone	122
amplifier	123
loudspeaker	128
enable/disable control signal line	135
battery	136
mains supply	137
full wave rectifier	138
regulator converter	139
battery low detection stage	141
battery low indicator neon or LED	143
charging controller	147
operations indicator light	149
encoder	156
gate	157
gate	158
call accept switch	181
clear or cancel switch	182
mute switch	183
transmitter stage	211
antenna	213
frequency multiplier or tripler	216
crystal-controlled oscillator	217
gate	218
microprocessor	221
operational amplifier	226
battery	236
regulator	239
light-emitting diode or neon	243
encoder	256
switch logic circuit	276
isolator coils	278
umbilical cable	279
permanent magnet	280
contact bridging keeper	281

Claims

1. A programmable speech and data transceiver comprising a microprocessor controlled transmitter (11) and receiver (12) capable of discrimination between speech and alarm or alert data from one or more remote locations to enable predetermined response action.

2. A programmable door sentry intercom and alarm comprising a door switch unit (31), a control unit (32), an alarm or alert unit (34) and a relatively mobile station (33), the control unit and mobile unit being provided with a transmitter (11, 111) and a receiver (12, 112), and the alarm unit being provided with a transmitter and a sensor, programmed to operate in a predetermined mode.

3. A programmable integrated speech intercom and alarm or alert device, for communication between remote stations and monitoring for alarm or alert conditions at a remote sensing location, both speech and alarm signals being relayed to a common base station to a mobile handset.

4. A radio intercom network, in which a plurality of mobile handsets can intercommunicate directly or via a common base station, using programmable encoded and frequency banded transceiver modes.

5. A voice intercom comprising
a transmitter section (11)
and a receiver section (12)
intercoupled to a microprocessor (21),
operative to activate the receiver periodically,
in a voice monitoring mode,
in order to remain alert
to occasional voice activation,
and upon detecting a voice signal
to trigger the transmitter,
to relay the detected voice signal,
by activating a transmission to the receiver,
the receiver also been switched periodically
in a monitoring mode,
to check for a transmitter signal,
and to be rendered operational
for a predetermined period
upon detection of a transmitter signal,
and to be de-activated automatically
upon absence of a transmitter signal
for a predetermined time period.

6. A switched simplex transceiver, using a single channel of frequency, but capable of simulating full duplex or two-way communication, and comprising a microprocessor-controlled transmitter and receiver, capable of switching alternately between transmit and receive modes rapidly in succession at a rate such as to give users the impression of a duplex or two channel transceiver capability.

7. A switched simplex transceiver, as claimed in Claim 6, wherein the switching between transmit and receive modes is at least partly triggered by monitoring the transmission activity in the immediately preceding period – ie to determine if a user at one station has completed a transmission before enabling a user at the receiving end to initiate transmission on the same channel.

8. A switched simplex transceiver, as claimed in Claim 6 or Claim 7, wherein the switching rate between transmit and receive modes is higher than the transmission carrier frequency employed.

9. A voice intercom substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

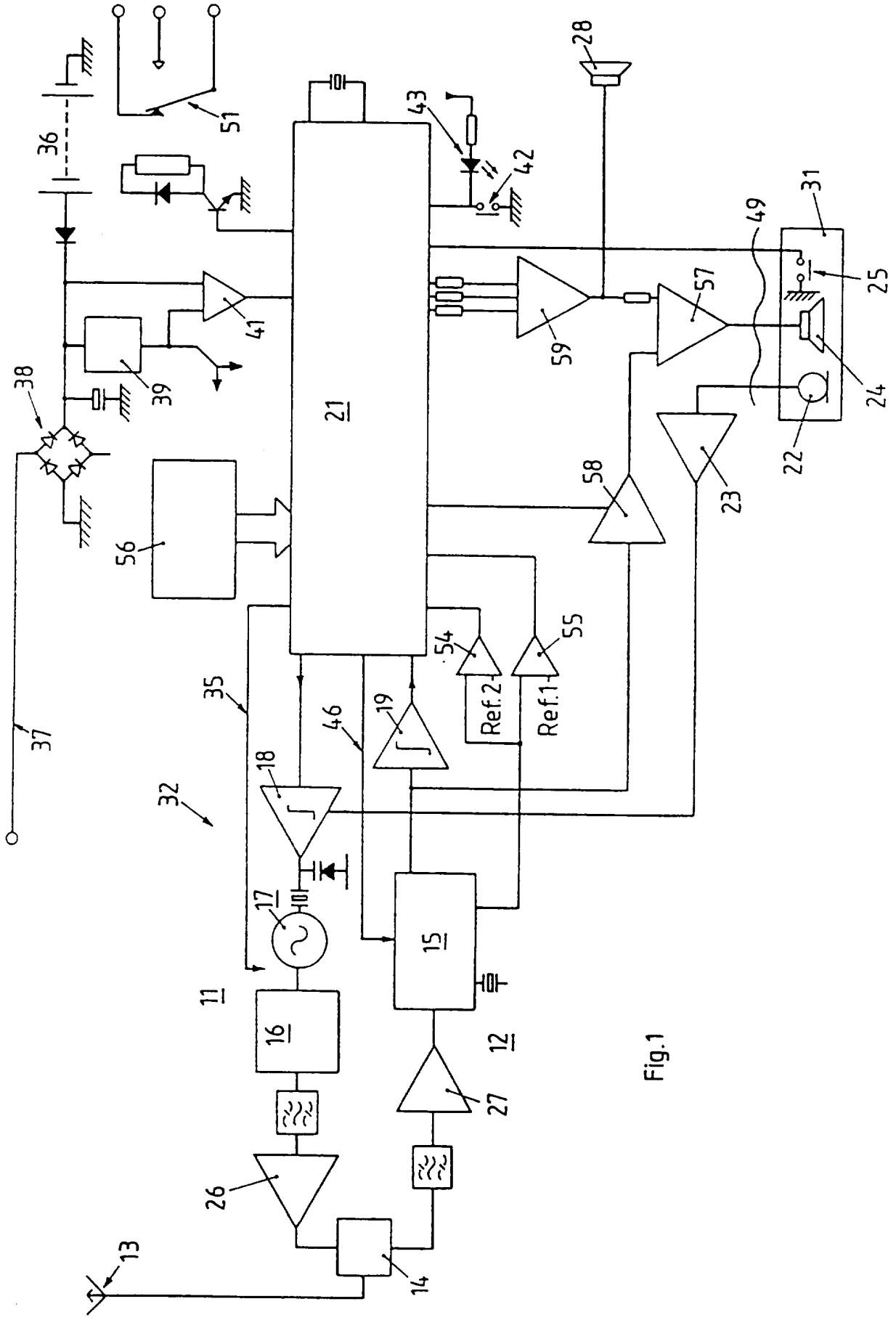
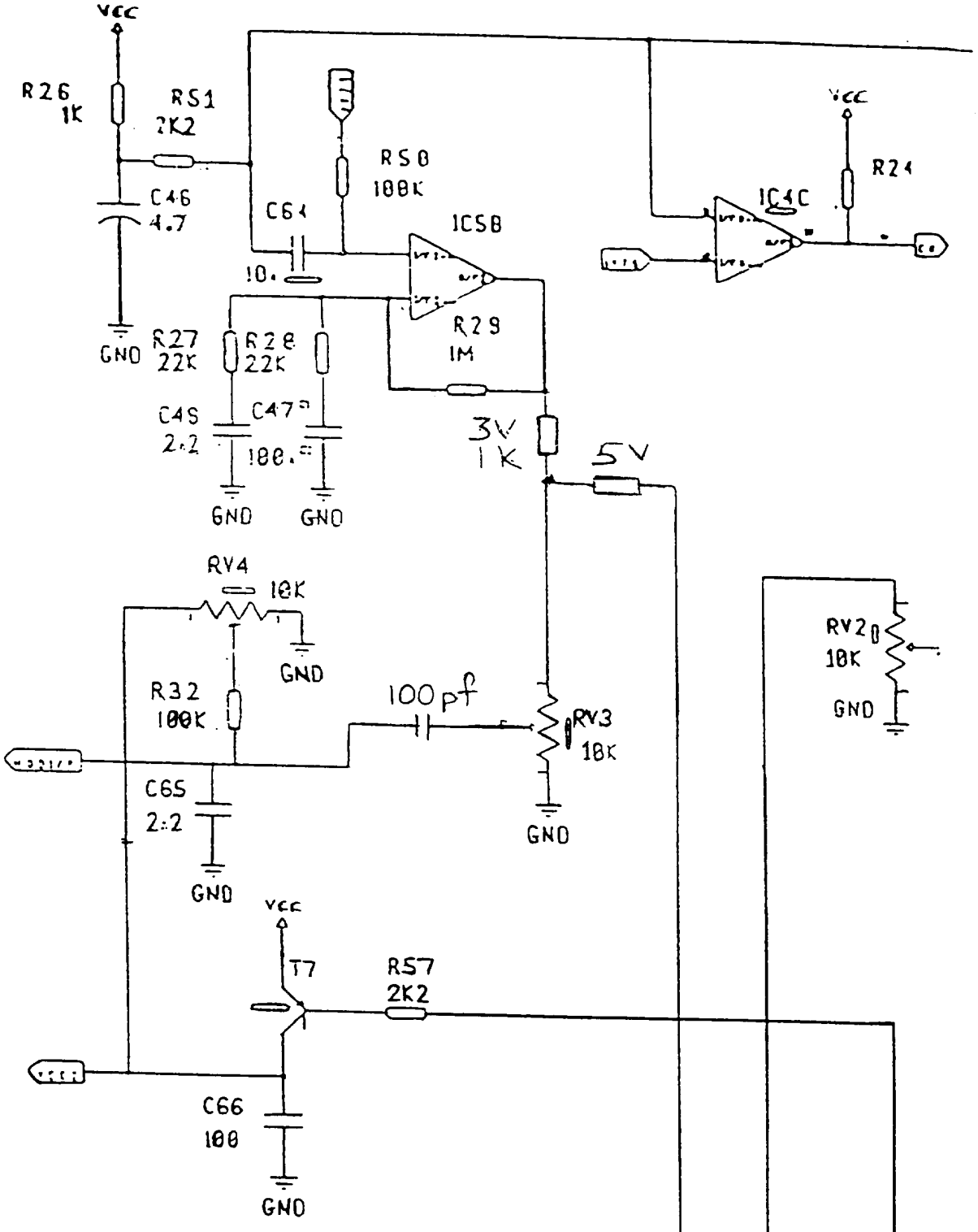

28
43
51
36
42
31
49
41
57
25
59
39
38
21
24
22
58
23
56
54
55
Ref.2
Ref.1
35
46
19
37
18
32
17
15
11
16
12
27
26
13
14

Fig.1


VCC
R26 1K
RS1 2K2
C46 4.7
GND
RS8 100K
C64 10.
IC5B
R27 22K
R28 22K
R29 1M
C48 2.2
C47 100.
GND
GND
3V 1K
5V
VCC
R24
IC4C
RV4 10K
GND
R32 100K
100pf
RV3 10K
GND
RV2 10K
GND
C65 2.2
GND
VCC
T7
RS7 2K2
C66 100
GND

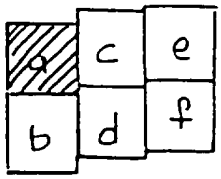

a
c
e
b
d
f

Fig 2a

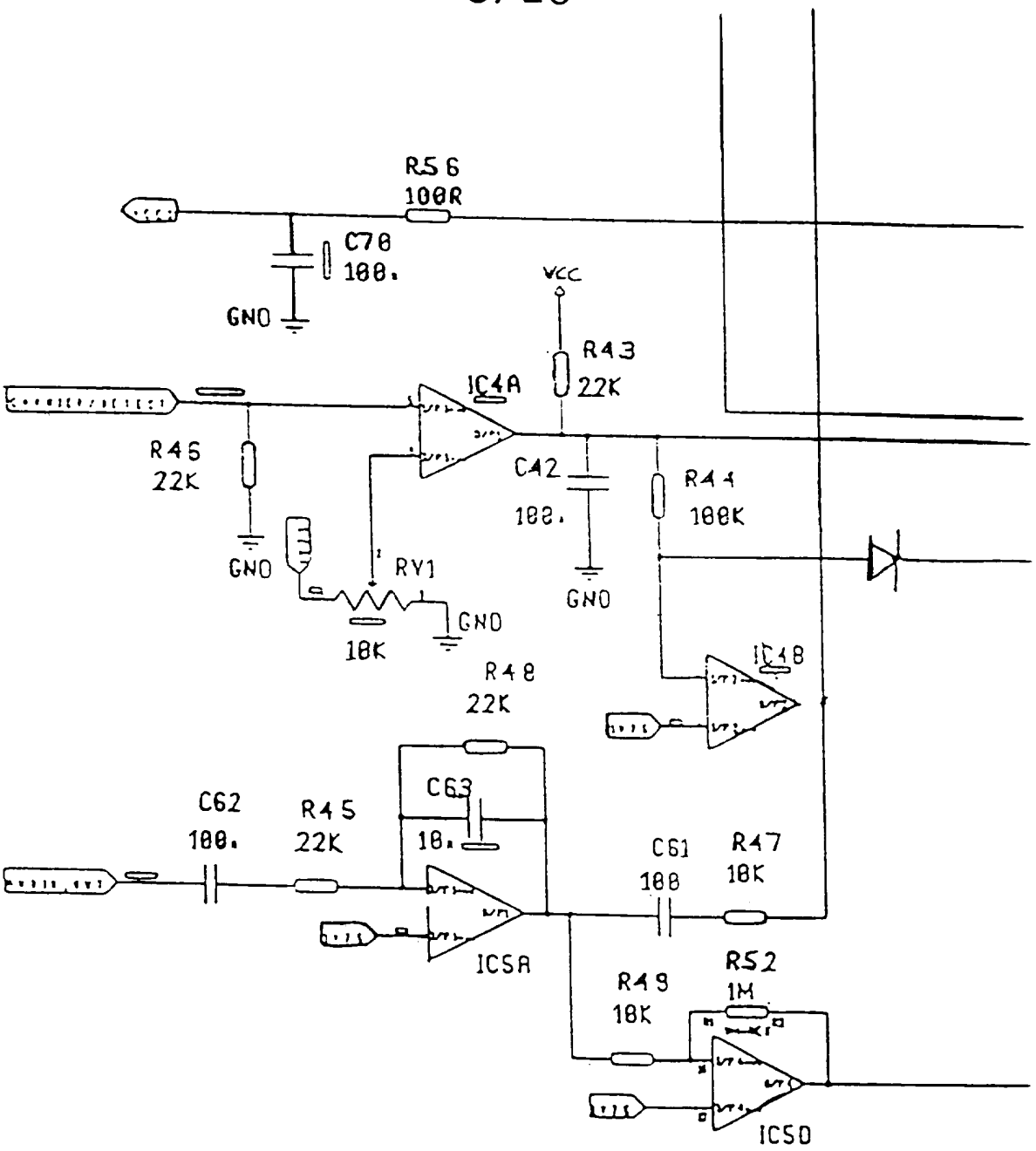
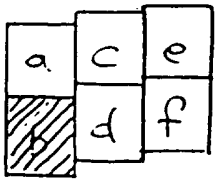

R56
100R
C78
100.
GND
VCC
R43
22K
IC4A
R46
22K
GND
C42
100.
R44
100K
RV1
GND
10K
GND
IC4B
R48
22K
C63
10.
C62
100.
R45
22K
C61
100
R47
10K
IC5A
R49
10K
R52
1M
IC5D

Fig 2b


a
c
e
d
f

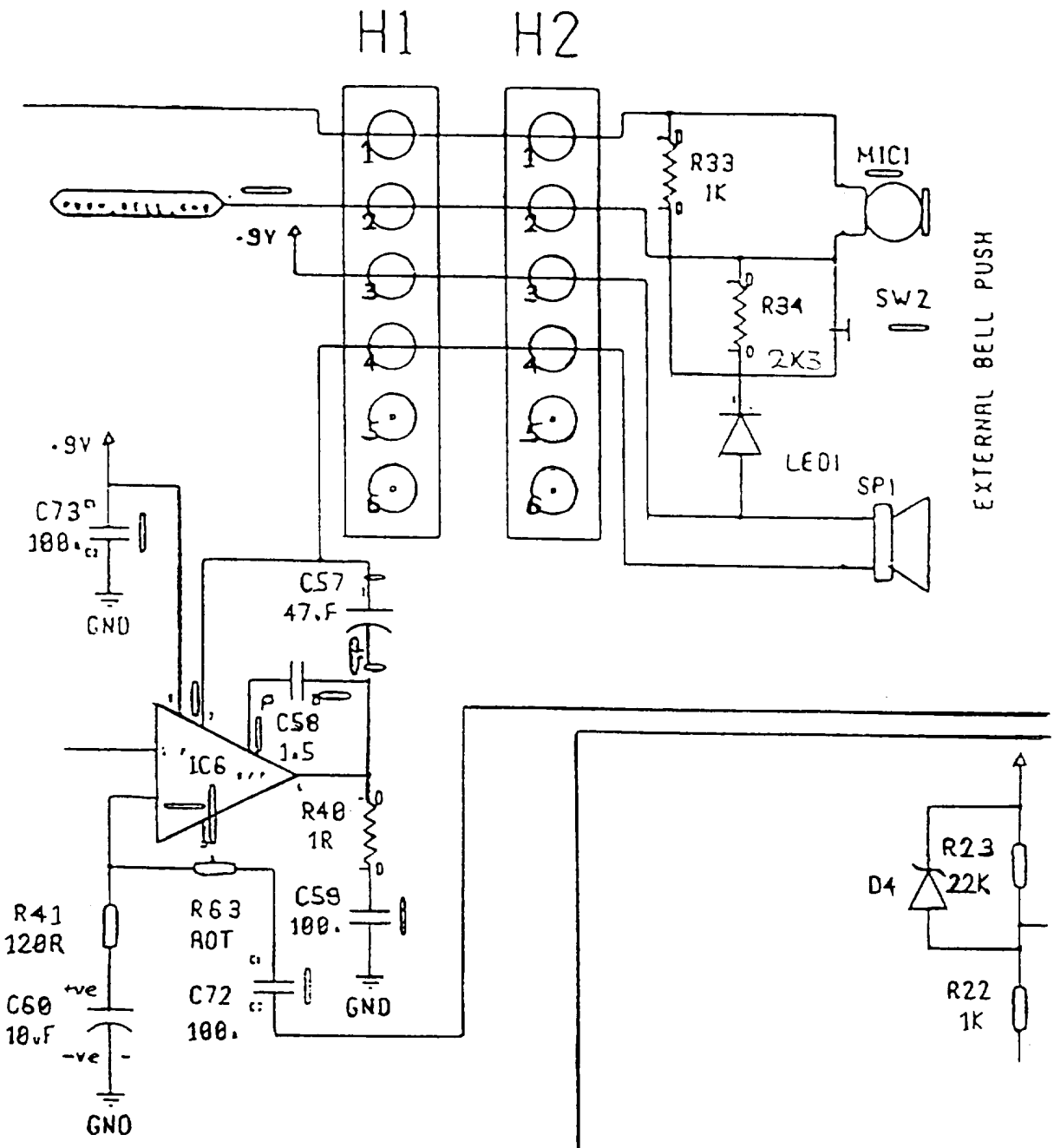
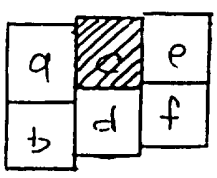
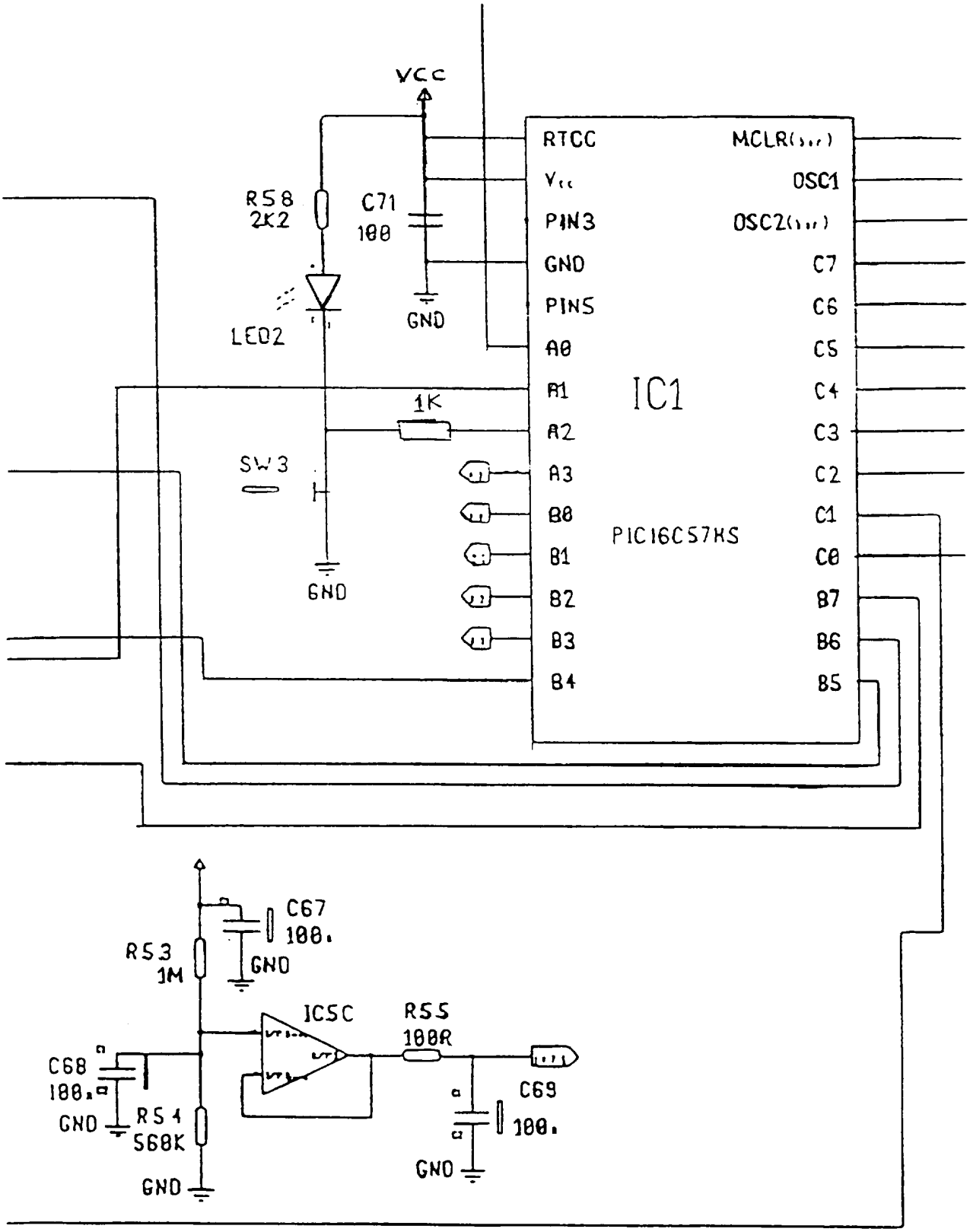

H1
H2
R33
1K
MIC1
-9V
R34
2K3
SW2
EXTERNAL BELL PUSH
LED1
SP1
.9V
C73
100.
GND
C57
47.F
C58
1.5
IC6
R40
1R
R41
120R
R63
AOT
C59
100.
C60
10.F
+ve
-ve
C72
100.
GND
GND
R23
22K
D4
R22
1K

Fig 2c


a
e
b
d
f


VCC
R58
2K2
C71
100
LED2
GND
SW3
GND
1K
RTCC
PIN3
GND
PIN5
A0
A1
A2
A3
B0
B1
B2
B3
B4
IC1
PIC16C57HS
MCLR
OSC1
OSC2
C7
C6
C5
C4
C3
C2
C1
C0
B7
B6
B5
C67
100.
R53
1M
GND
IC5C
R55
100R
C68
100.
GND
R54
560K
GND
C69
100.
GND

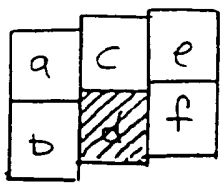

a
c
e
b
d
f

Fig 2d

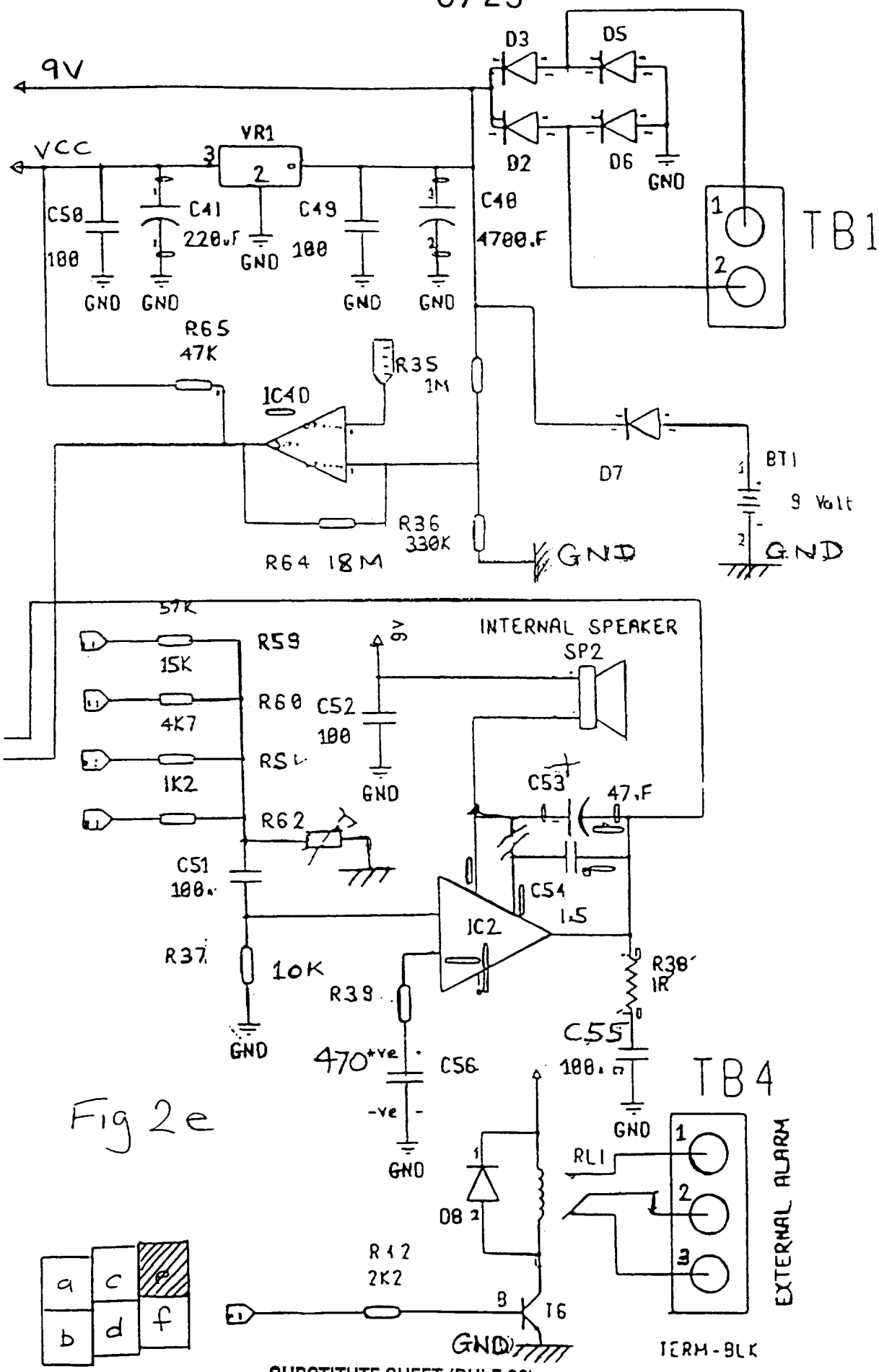

9V
VCC
VR1
D3
D5
D2
D6
GND
TB1
C50
100
C41
220uF
C49
100
C48
4700uF
R65
47K
R35
1M
IC40
D7
BT1
9 Volt
R36
330K
R64 18M
INTERNAL SPEAKER
SP2
R59
15K
R60
4K7
R61
1K2
R62
C52
100
C53
47uF
C51
100n
C54
1.5
IC2
R37
10K
R39
R38
1R
C55
100n
470 +ve
C56
-ve
TB4
RL1
D8
R42
2K2
T6
EXTERNAL ALARM
TERM-BLK
a
b
c
d
e
f

Fig 2e

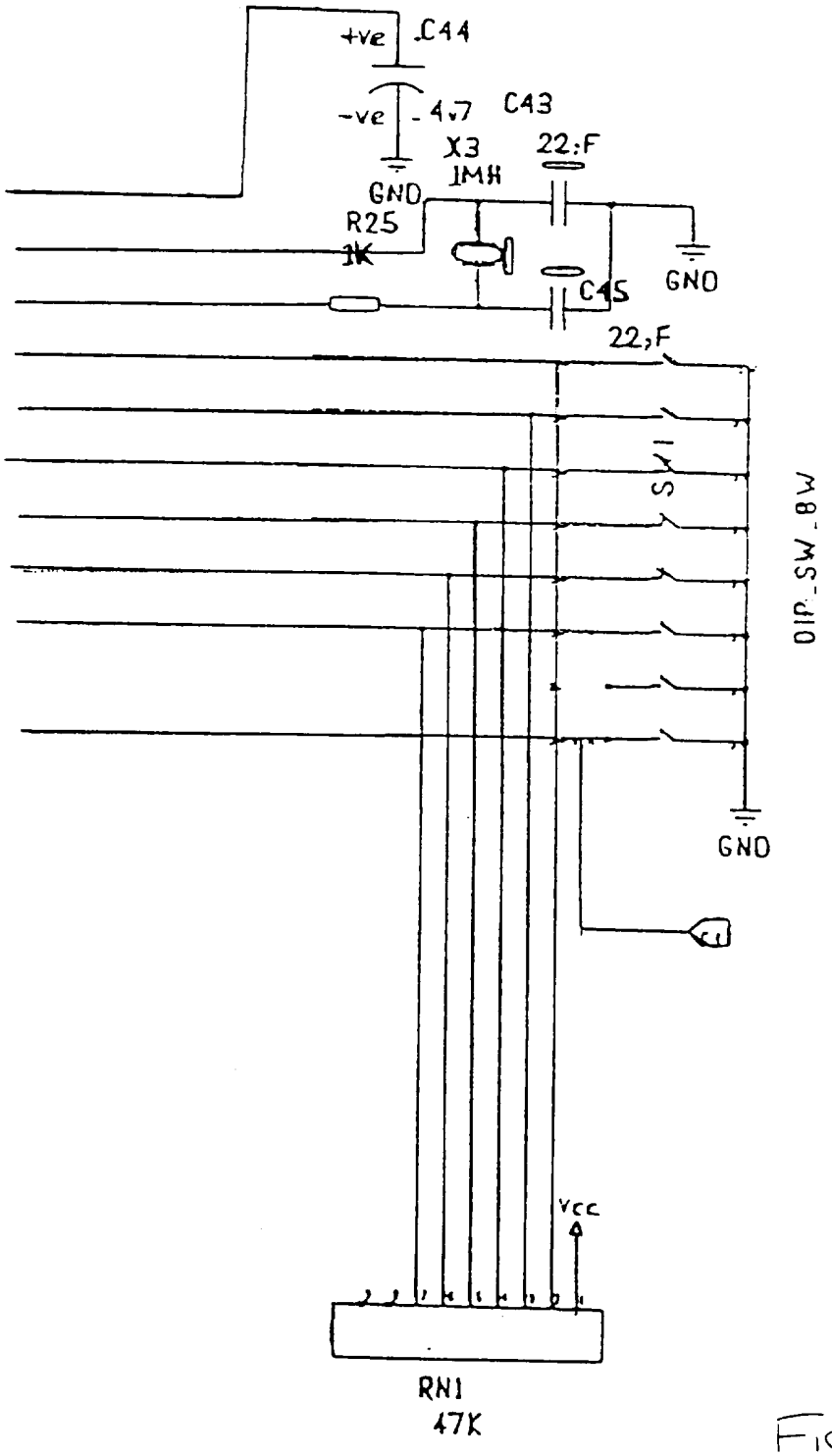
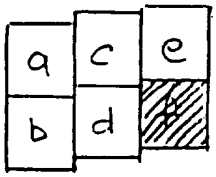

+ve
C44
-ve
4.7
C43
X3
1MH
22:F
GND
R25
1K
C45
GND
22:F
SW1
DIP_SW_8W
GND
Vcc
RN1
47K

Fig 2f


a
c
e
b
d

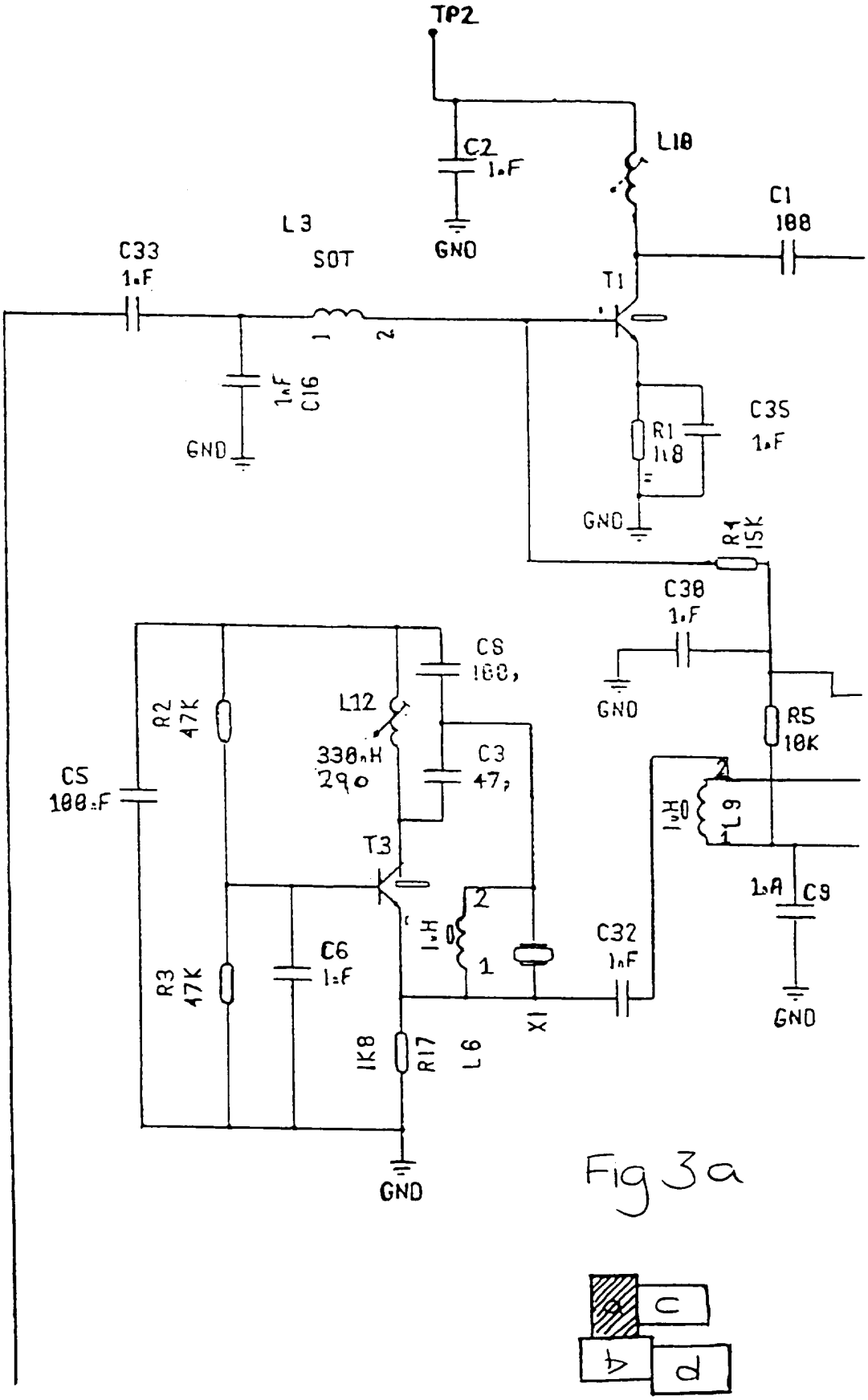

TP2
C2
1nF
GND
L18
C1
100
L3
SOT
C33
1nF
T1
1
2
1nF
C16
GND
R1
118
C35
1nF
GND
R4
15K
C38
1nF
GND
C8
100
L12
330nH
290
C3
47
R2
47K
C5
100nF
T3
R5
10K
L9
1nH
1nA
C9
GND
2
1
1nH
C32
1nF
C6
1nF
R3
47K
1K8
R17
L6
X1
GND

Fig 3a

a
c
b
d

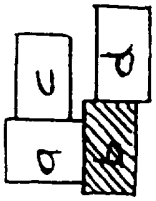

a
b
c
d

Fig 3b

R11 470 K
C22 1nF
GND
R12 33K
L4 18nH
L2 47nH
C12 5-20pF
C23 100nF
GND
L18
C36 100nH
C28 22nF
C26 1nF
GND
R18 12K
L17 120nH
C27 3,9
R14 10R
R15 10R
TS
C24 1nF
GND
L16 18nH
L15 150nH
C17 5-20pF
L14 180nH
GND
10cm
7.5cm
L5 350nH
C14 5-20pF
TO 49MH RX I/P
SOT
L11

Fig 3c

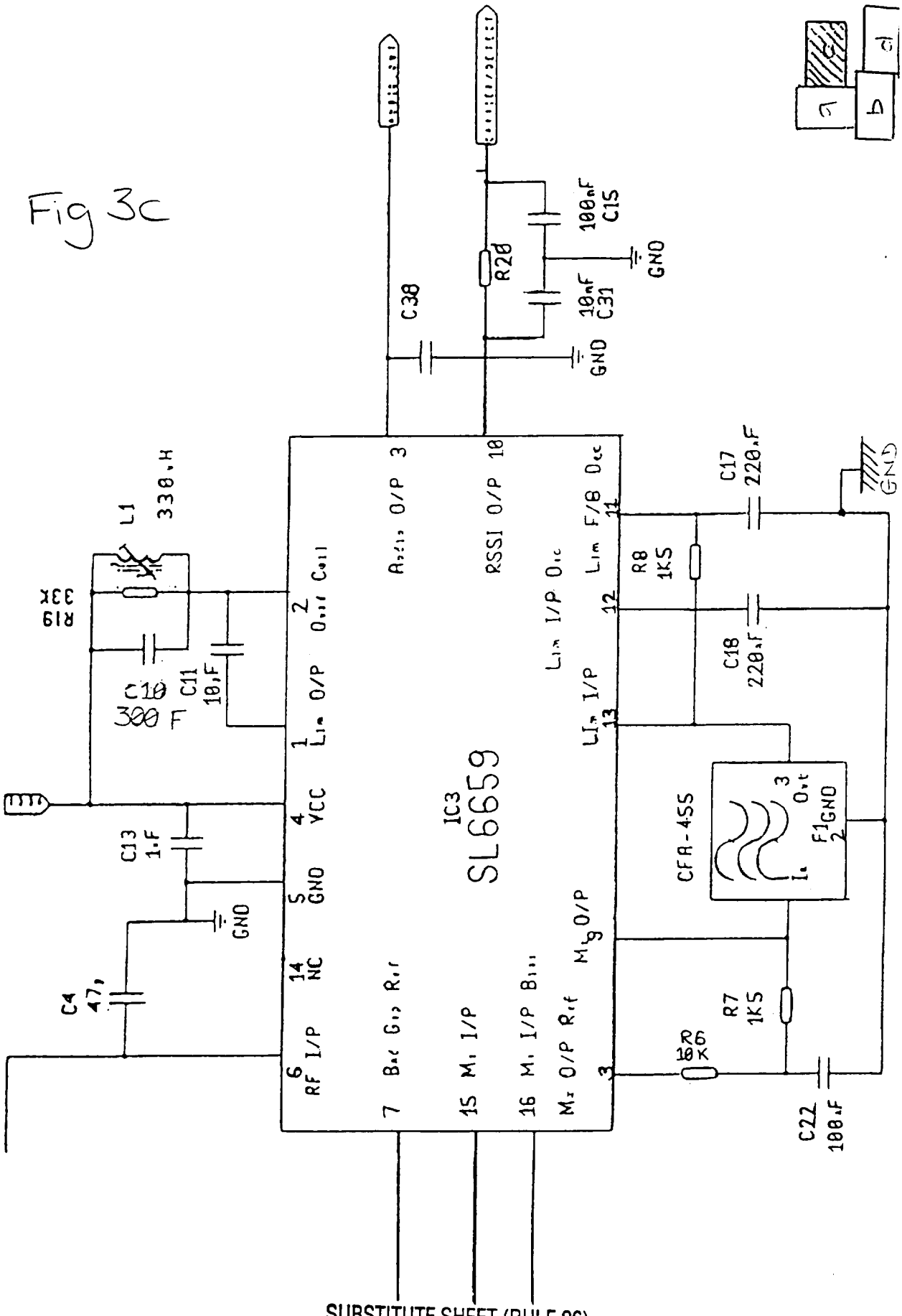
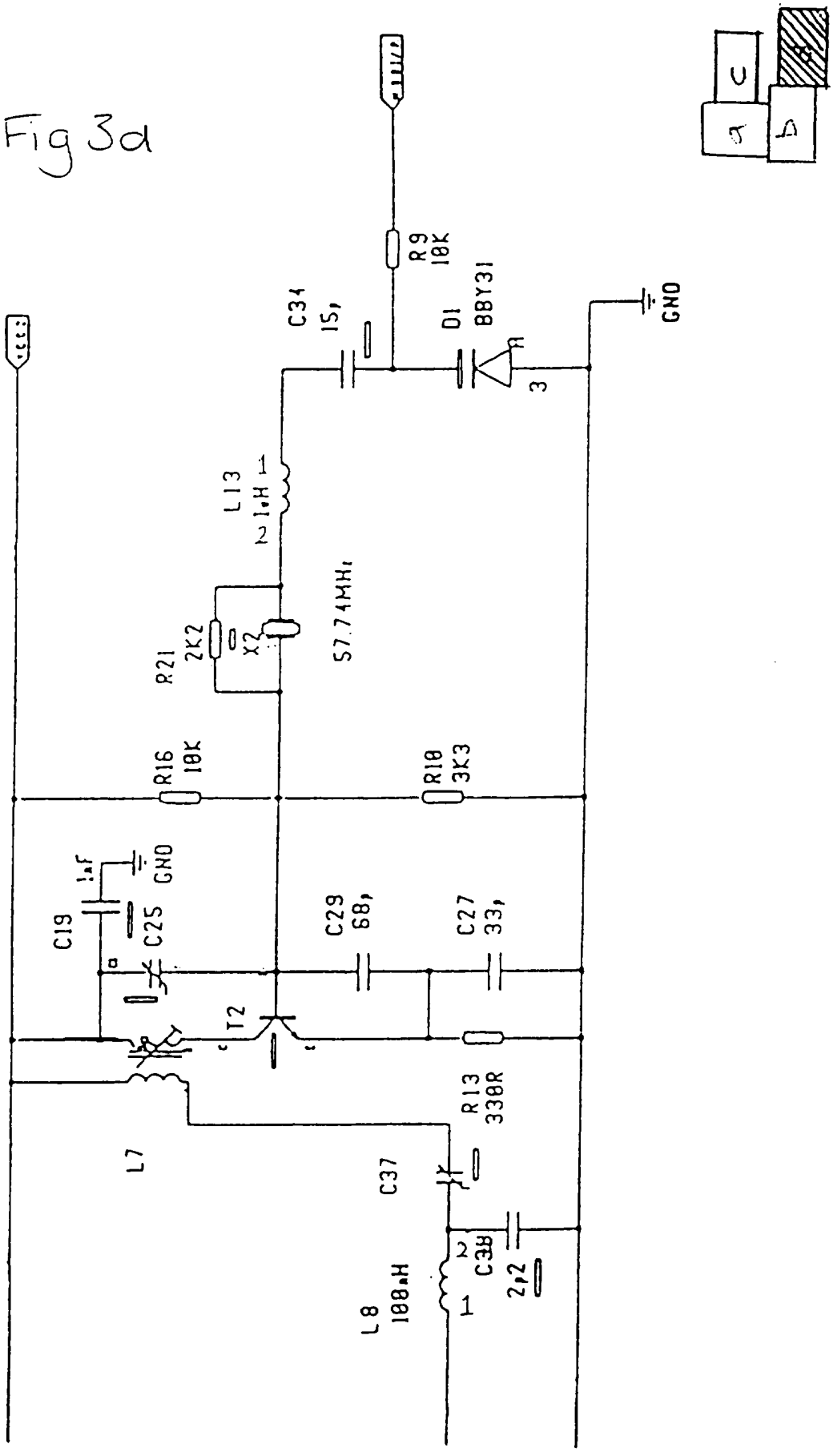

IC3
SL6659
C38
R20
C15 100nF
C31 10nF
GND
L1 330nH
R19 33K
C10 300 F
C11 10nF
C13 1nF
C4 47n
C17 220nF
R8 1KS
C18 220nF
CFA-455
R7 1KS
R6 10K
C22 100nF
1 Lim O/P
2 Osc Cell
3 Aud O/P
4 VCC
5 GND
6 RF I/P
7 Buf Osc Ref
10 RSSI O/P
11 Lim F/B Vcc
12 Lim I/P Vcc
13 Lim I/P
14 NC
15 Mix I/P
16 Mix I/P Buf
Mix O/P Ref
Mix O/P
GND

Fig 3a


R9 10K
C34 15,
D1 BBY31
GND
3
L13 1,1H
2
1
S7.74MHz
R21 2K2
X2
R16 10K
R18 3K3
C19 1nF
GND
C25
C29 68,
C27 33,
T2
R13 330R
L7
C37
C38
2,2
L8 100nH
2
1

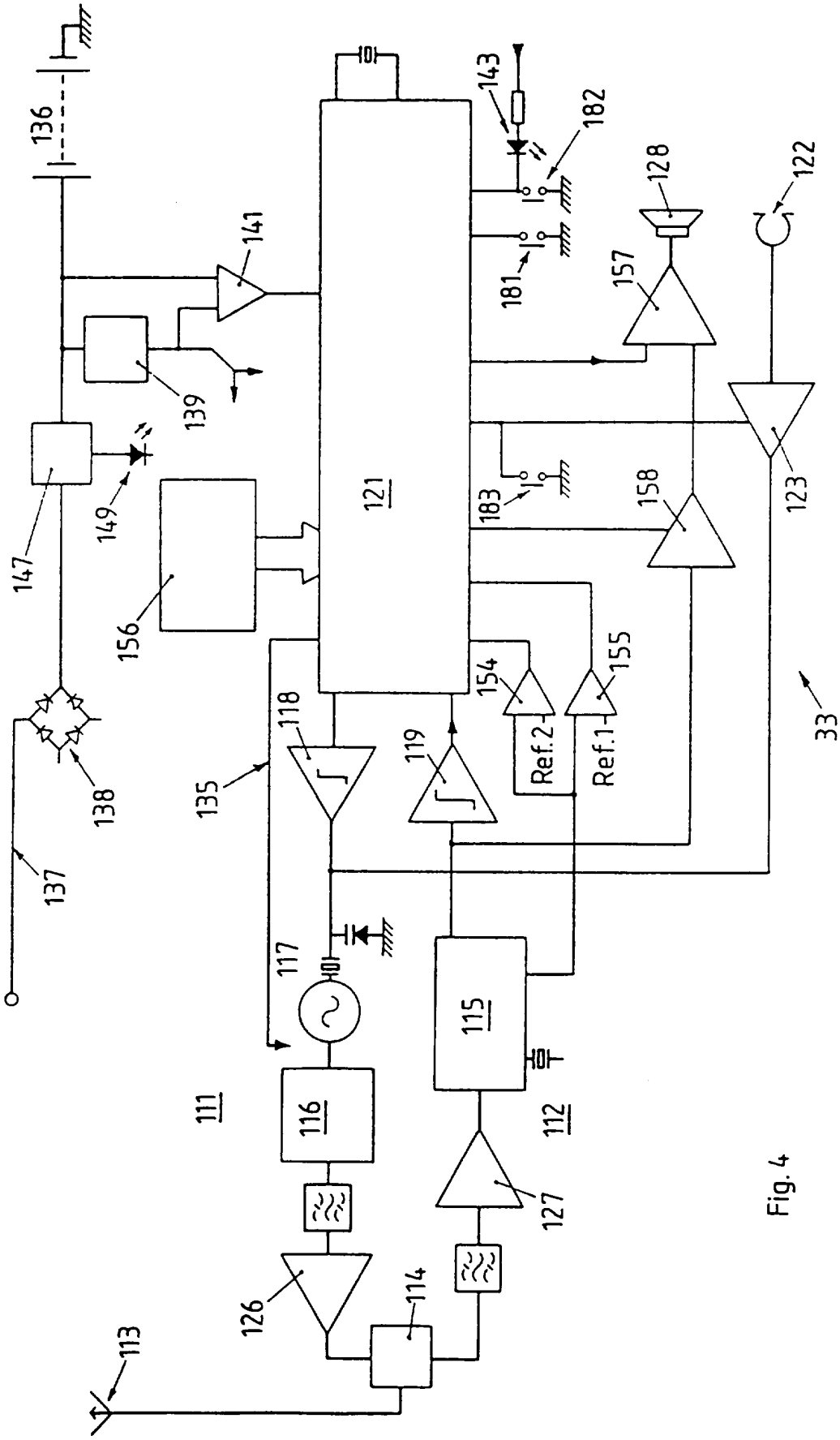
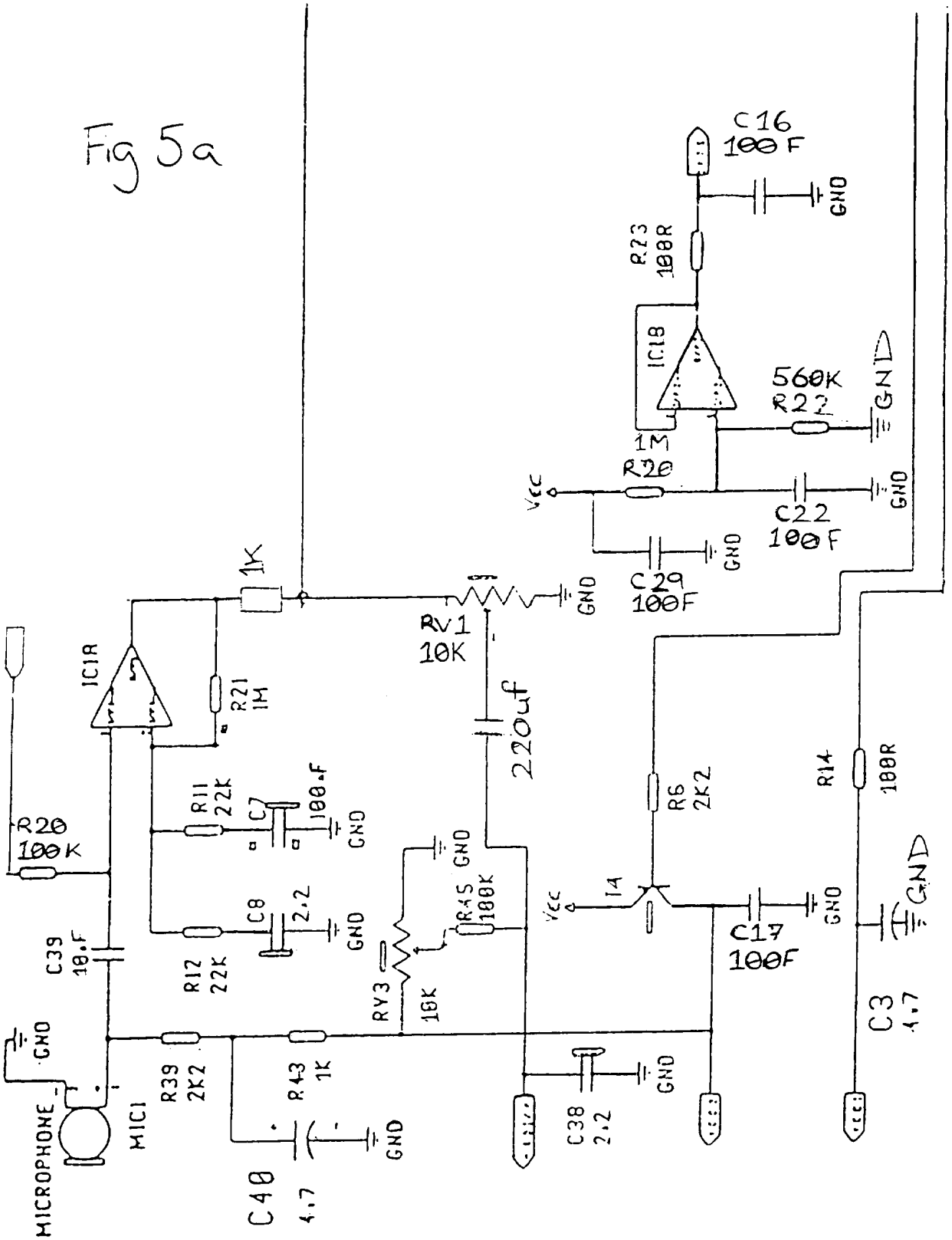

136
143
182
128
122
141
181
157
139
121
183
158
123
147
149
156
154
155
Ref.2
Ref.1
33
118
119
135
138
137
117
115
111
116
112
127
126
114
113

Fig. 4

Fig 5a


C16
100F
GND
R23
100R
IC1B
560K
R22
GND
13
R20
Vcc
C22
100F
GND
C29
100F
GND
1K
RV1
10K
IC1A
R21
1M
220uF
R11
22K
C7
100nF
GND
R20
100K
C8
2.2
GND
R45
100K
GND
C39
10nF
R12
22K
RV3
10K
R6
2K2
R14
100R
14
Vcc
C17
100F
GND
GND
C3
4.7
GND
R39
2K2
R43
1K
MICROPHONE
MIC1
C40
4.7
GND
C38
2.2
GND

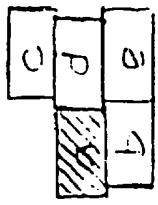
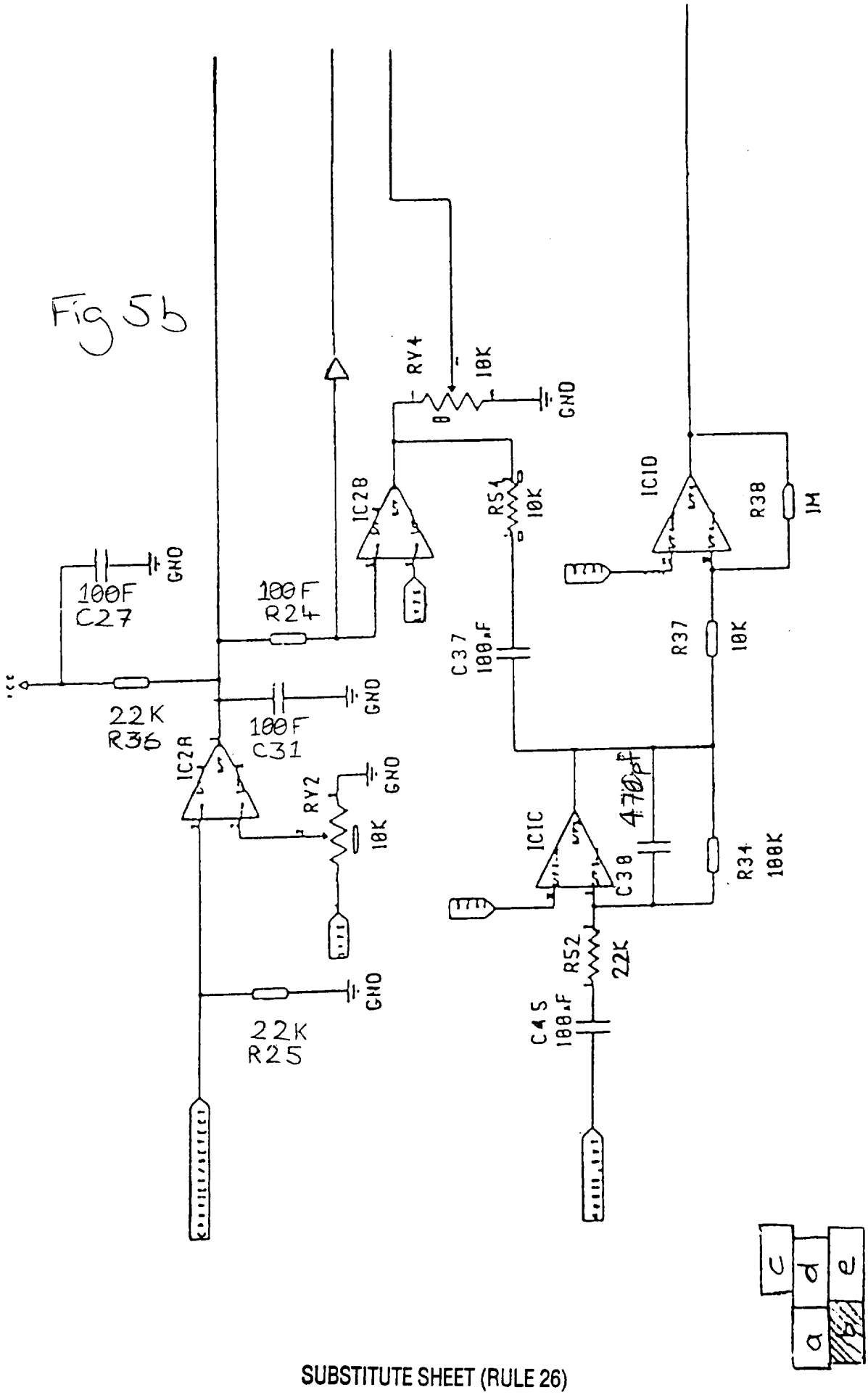

c
d
e
b

Fig 5


RV4
10K
GND
IC2B
RS4
10K
IC1D
R38
1M
100F
C27
GND
100F
R24
C37
100nF
R37
10K
22K
R36
100F
C31
GND
IC2A
RV2
GND
10K
IC1C
470pF
C38
R34
100K
RS2
22K
C45
100nF
22K
R25
GND

c
d
e
a
b

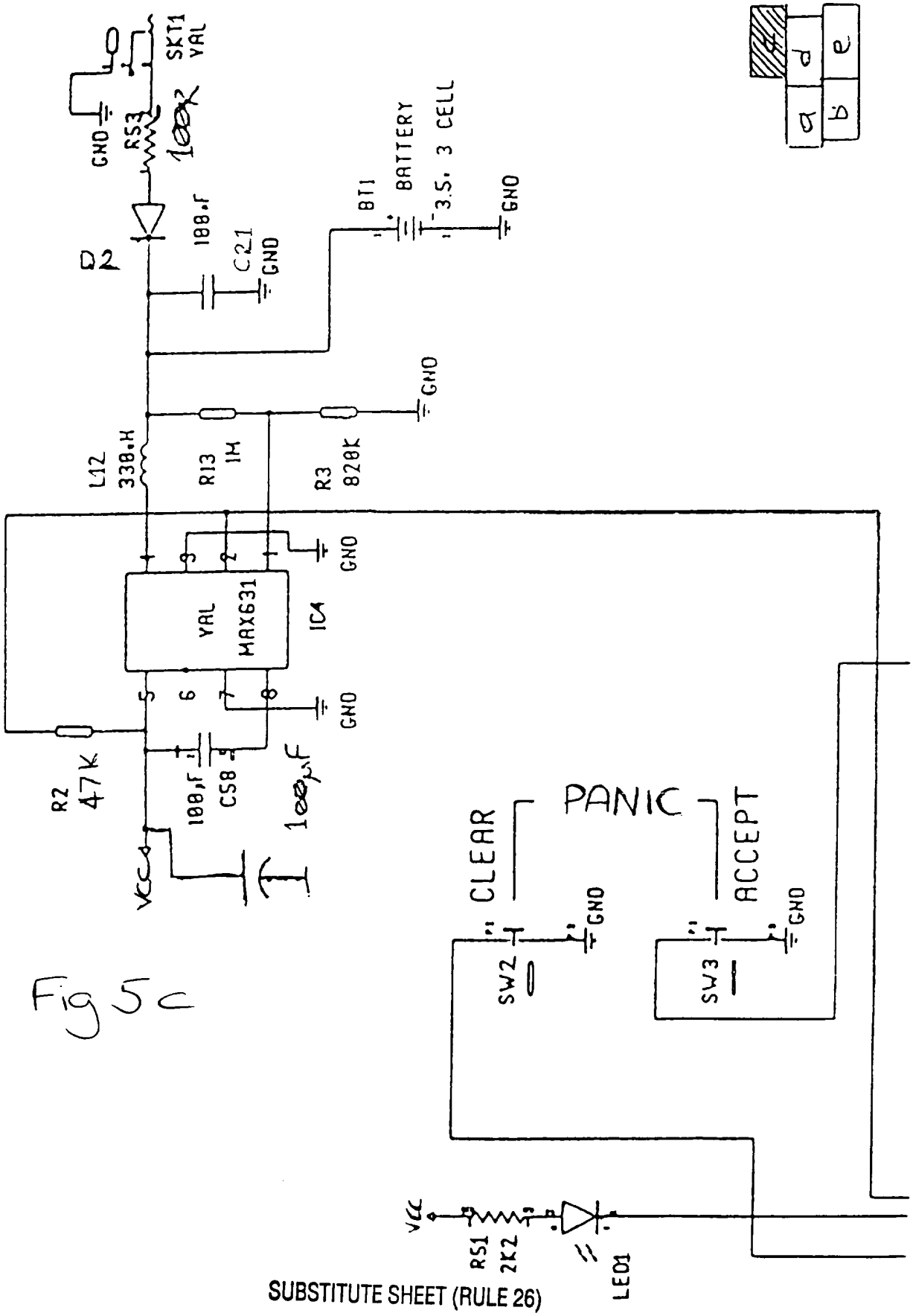

SKT1
VAL
GND
RS3
100R
D2
100nF
C21
GND
BT1
BATTERY
3.5, 3 CELL
GND
L12
330uH
R13
1M
R3
820K
GND
VAL
MAX631
IC4
GND
GND
R2
47K
100pF
CS8
100uF
Vcc
CLEAR
PANIC
ACCEPT
GND
GND
SW2
SW3
Vcc
RS1
2K2
LED1
a
b
d
e

Fig 5c

Fig 5a

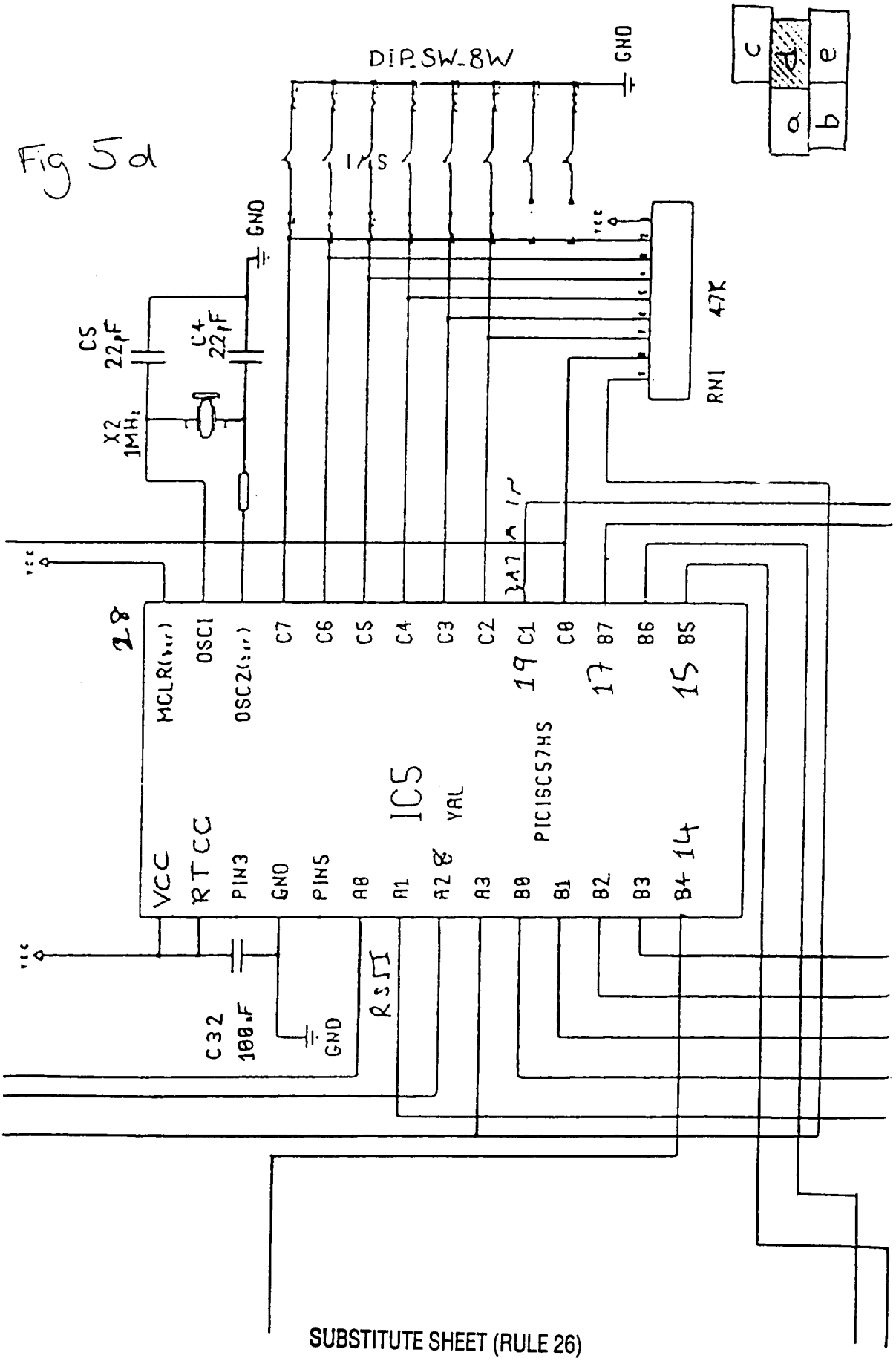
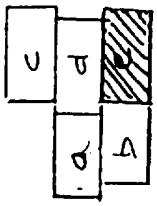

DIP SW-8W
GND
c
d
e
a
b
GND
C5
22pF
C4
22pF
X2
1MHz
RN1
47K
28
MCLR
OSC1
OSC2
C7
C6
C5
C4
C3
C2
C1
C0
B7
B6
B5
19
17
15
14
VCC
RTCC
PIN3
GND
PIN5
A0
A1
A2
A3
B0
B1
B2
B3
B4
ICS
YAL
PIC16C57HS
C32
100nF
GND
RST

Fig 5e



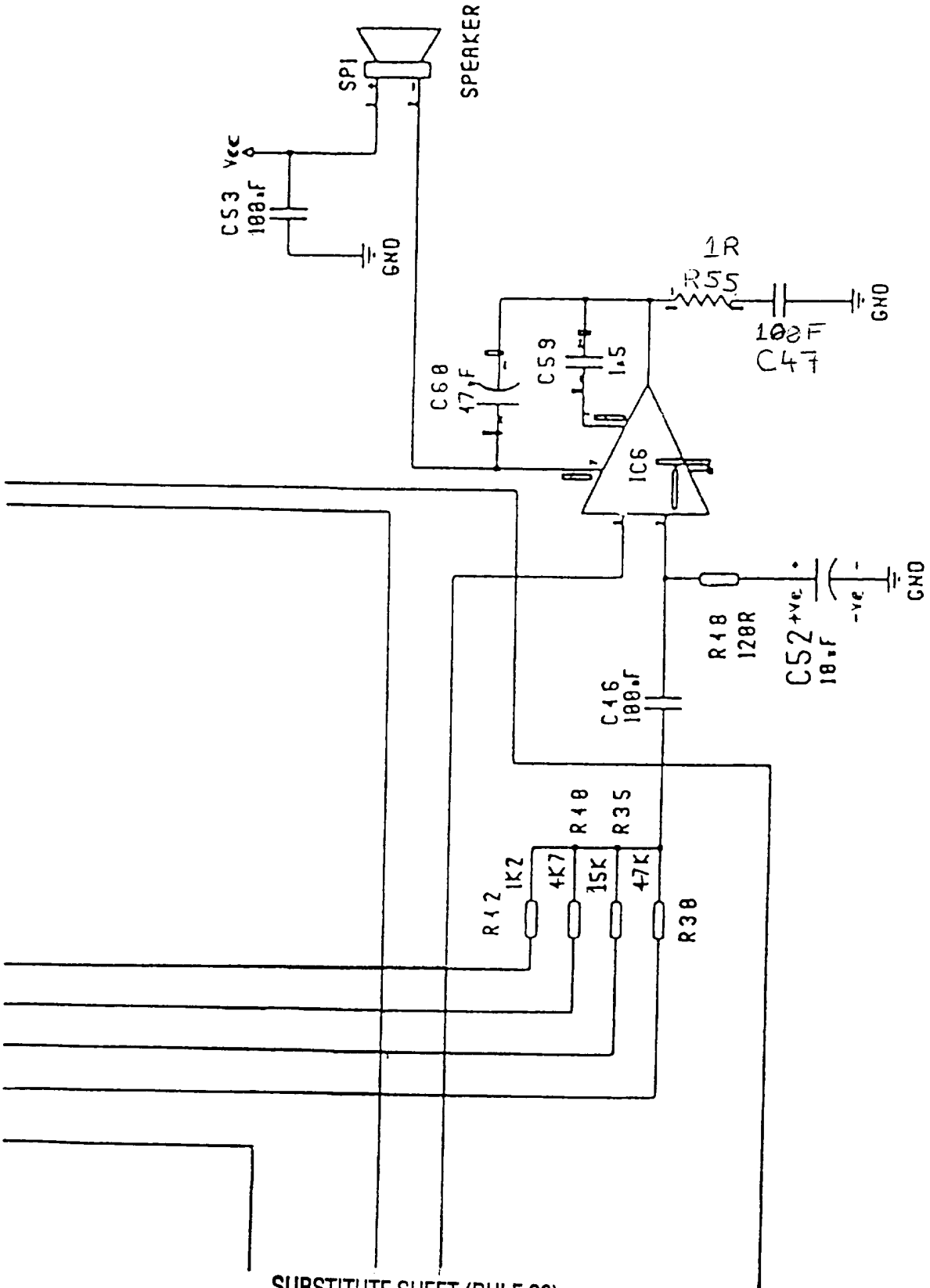
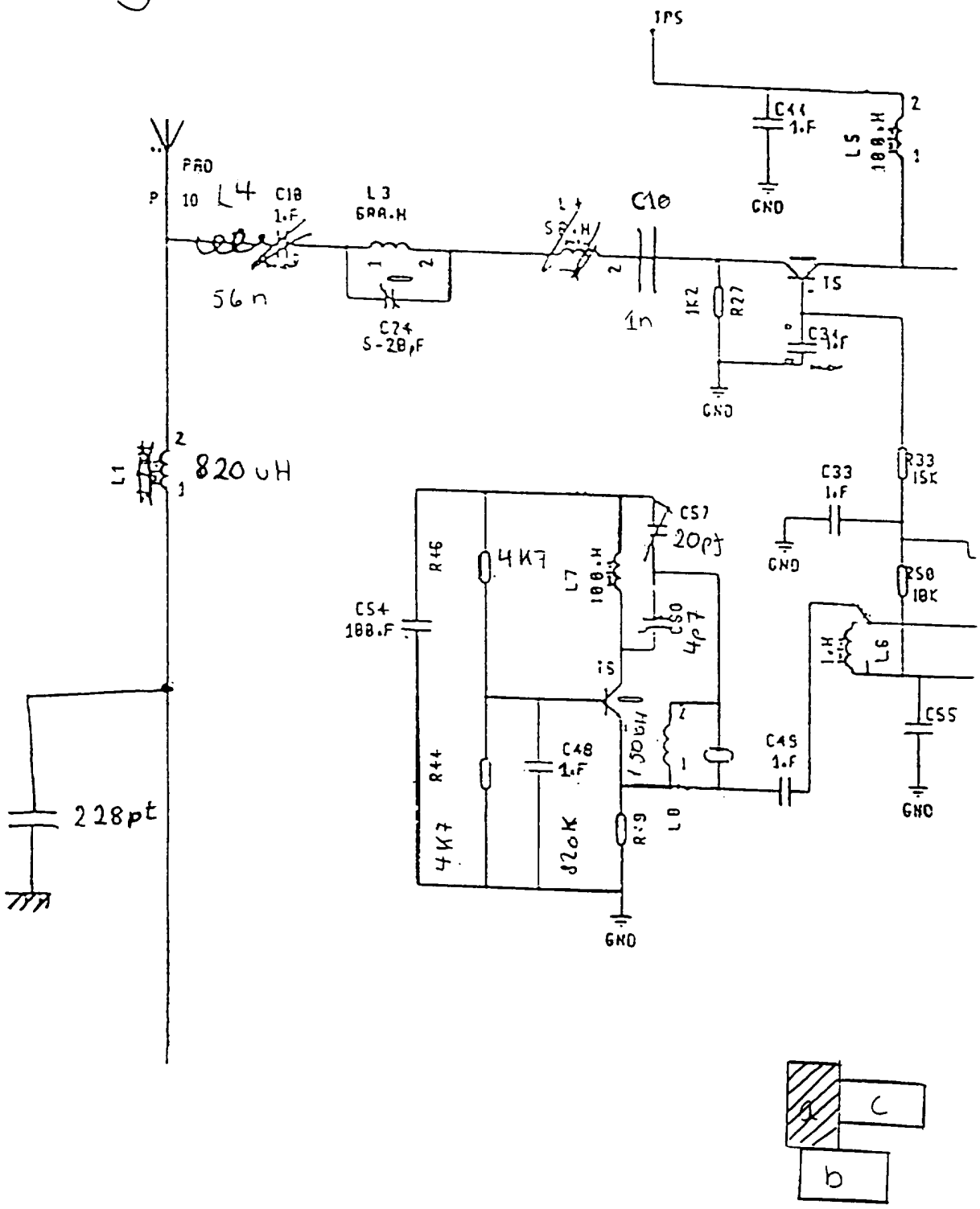

SP1
SPEAKER
C53 Vcc
100nF
GND
1R
R55
GND
100F
C47
C68
47nF
C59
1.5
IC6
C52 +ve
-ve
GND
R48
120R
C52
10nF
C46
100nF
R48
R35
R12
1K2
4K7
15K
47K
R38

Fig 6a


IPS
C11 1.F
L5 100.H
GND
PRO
P
10
L4
C18 1.F
56n
L3 680.H
C24 5-28pF
C10
1n
1K2
R27
TS
C31 1.F
GND
L1
820uH
R33 15K
C33 1.F
GND
R46
4K7
L7 100.H
CS7 20pf
C54 100.F
CS0 4p7
R50 10K
L6 1.H
TS
C48 1.F
R44
4K7
120K
R9
L8
C49 1.F
CS5
GND
228pt
GND
a
c
b

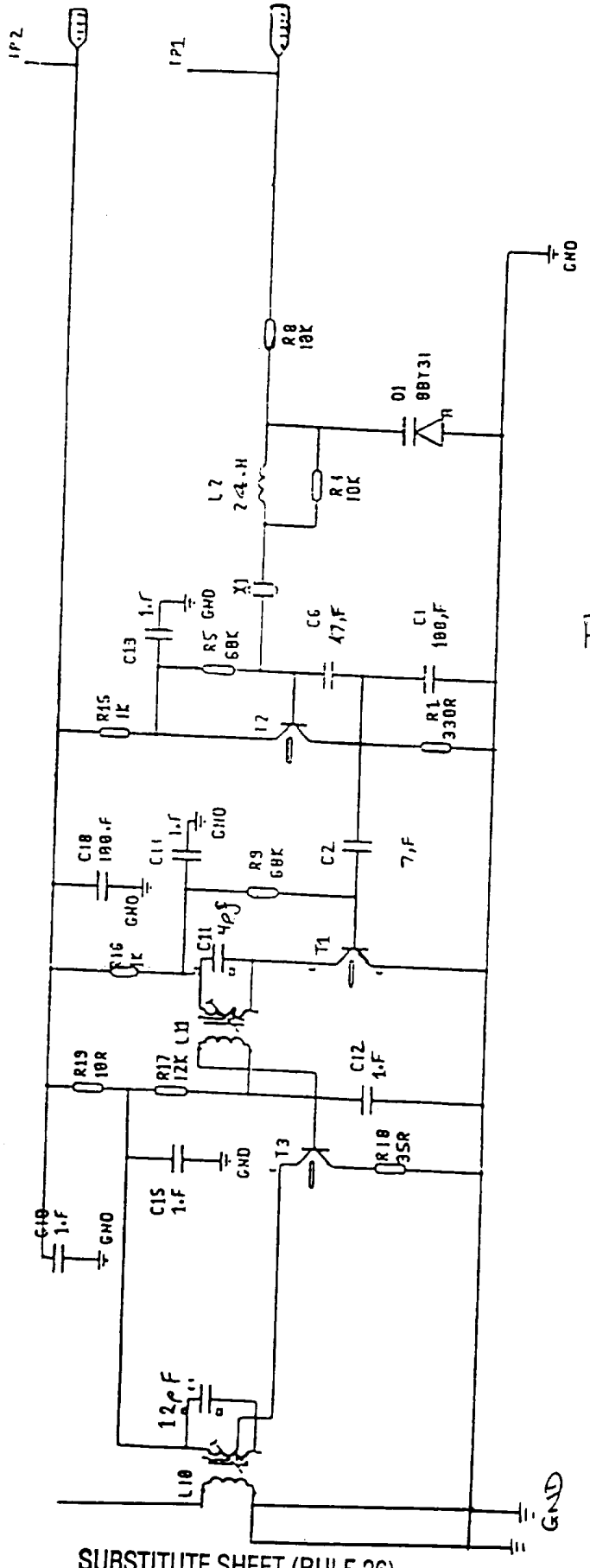
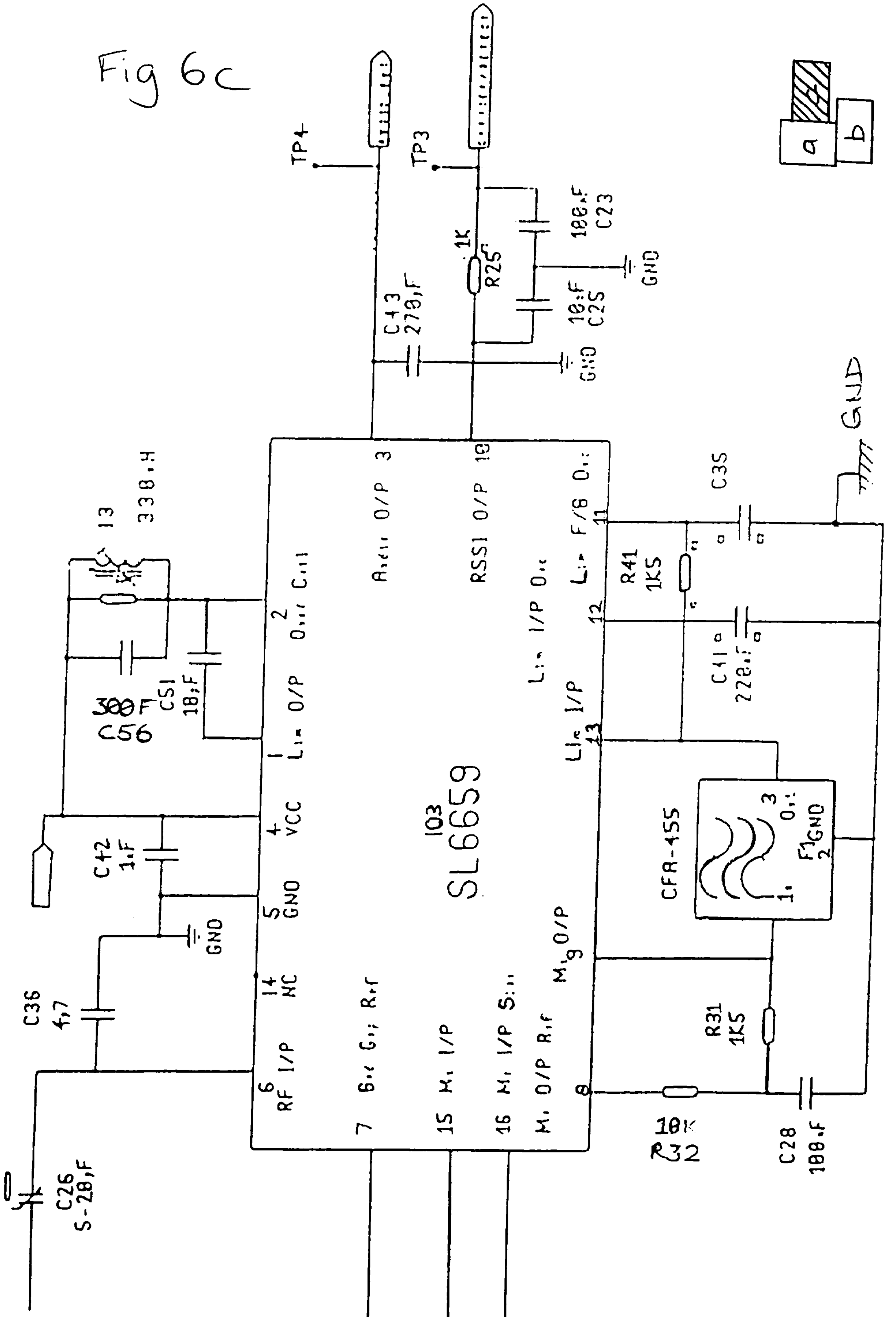

IP2
IP1
GND
R8 10K
D1 BBY31
L2 24.H
R1 10K
X1
C6 47,F
C1 100,F
C13 1.F
R5 68K
R15 1K
T2
R1 330R
C18 100.F
C11 1.F
C110
R9 68K
C2 7,F
C11 4pf
T1
R16 1K
L11
R19 10R
R17 12K
C12 1.F
T3
R18 35R
C15 1.F
C10 1.F
12pF
L10

Fig 6

Fig 6c


TP4
TP3
C43
R25
1K
C23
C25
GND
C35
R41
1K5
C41
SL6659
IO3
CFR-455
C42
C51
C56
C36
C26
R31
1K5
R32
10K
C28
RSSI O/P
VCC
RF I/P
a
b

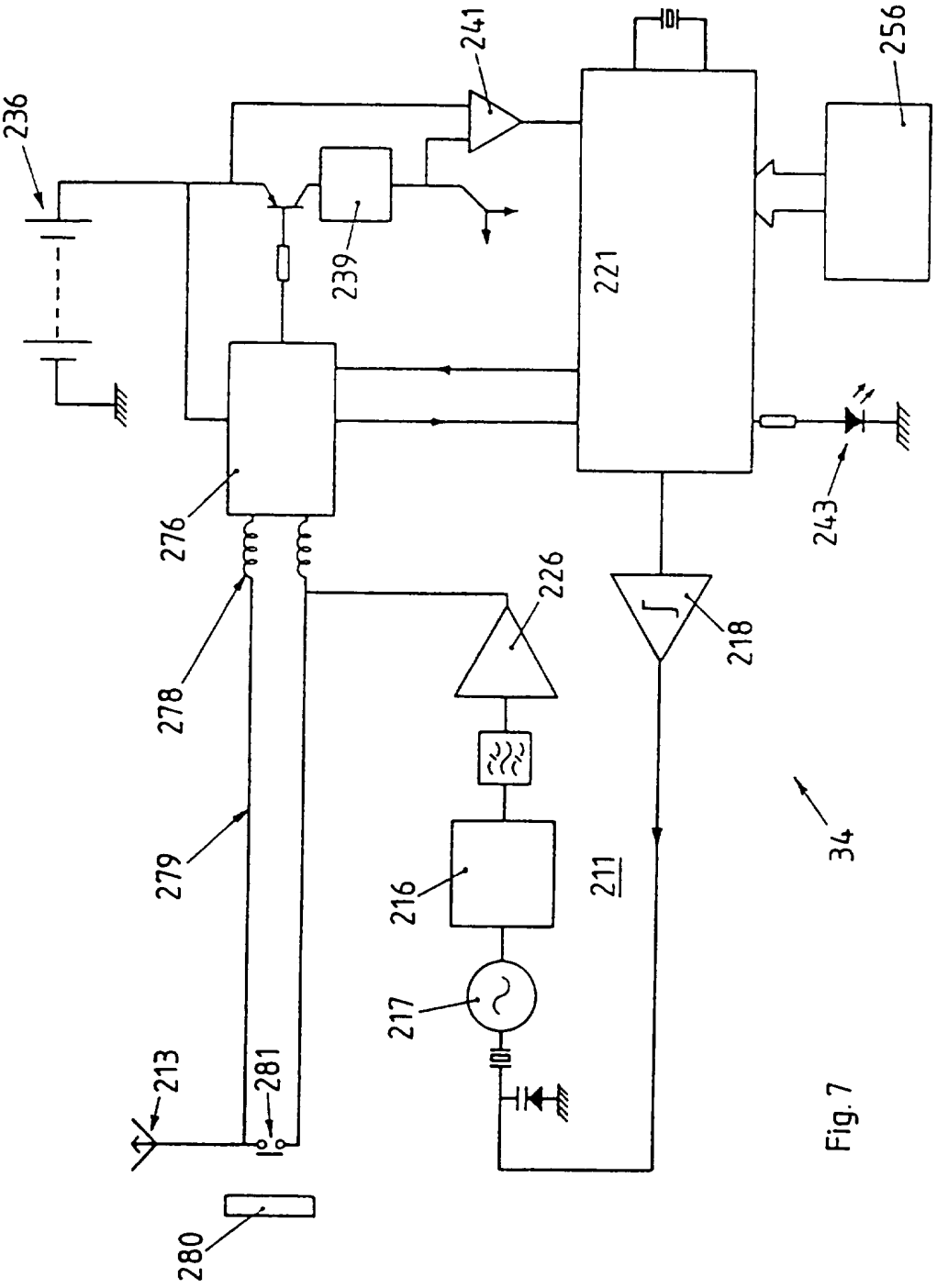

236
241
256
239
221
276
243
226
218
278
279
216
211
34
217
213
281
280

Fig. 7

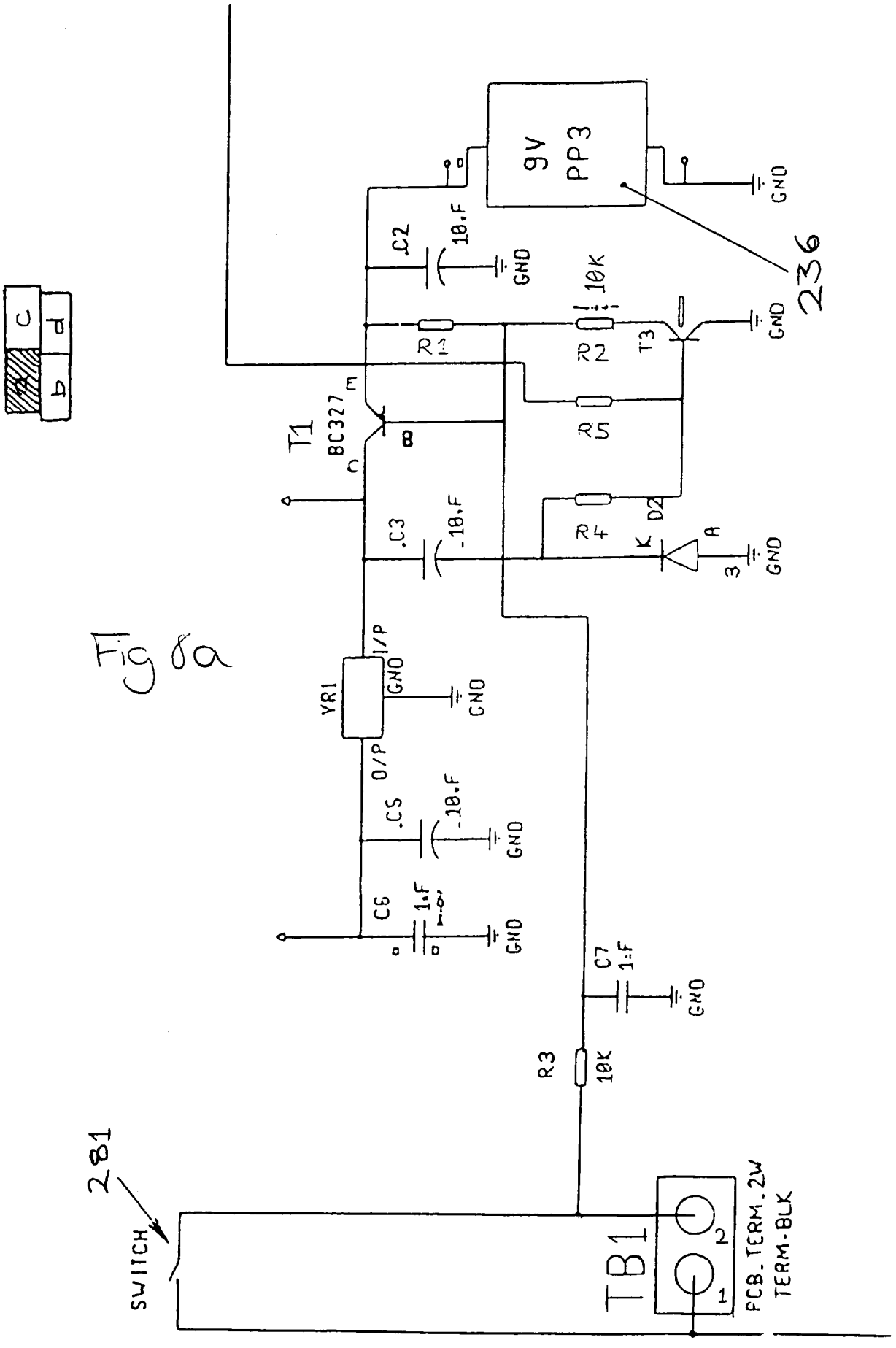

9V
PP3
GND
C2
10.F
10K
R1
R2
T3
236
T1
BC327
E
B
C
R5
R4
D2
K
A
3
.C3
.18.F
I/P
YR1
O/P
.C5
C6
1.F
C7
R3
10K
281
SWITCH
TB1
2
1
PCB.TERM.2W
TERM-BLK

Fig 8a

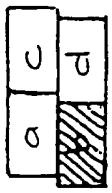

a
c
d

Fig 8

X2
C19
1.F
R18
68K
GND
C29
47,F
C27
100,F
R16
1K
T2
R12
330R
C22
100,F
C28
1.F
GND
13
3K
C28
7,F
GND
R11
1K
C23
T4
L2
R19
12K
C33
1.F
C24
1.F
GND
VCC
C26
1.F
GND
Vcc
T5
R15
35R
L7
C1
3M3
2
1
1.7vH
L11
R7
GND

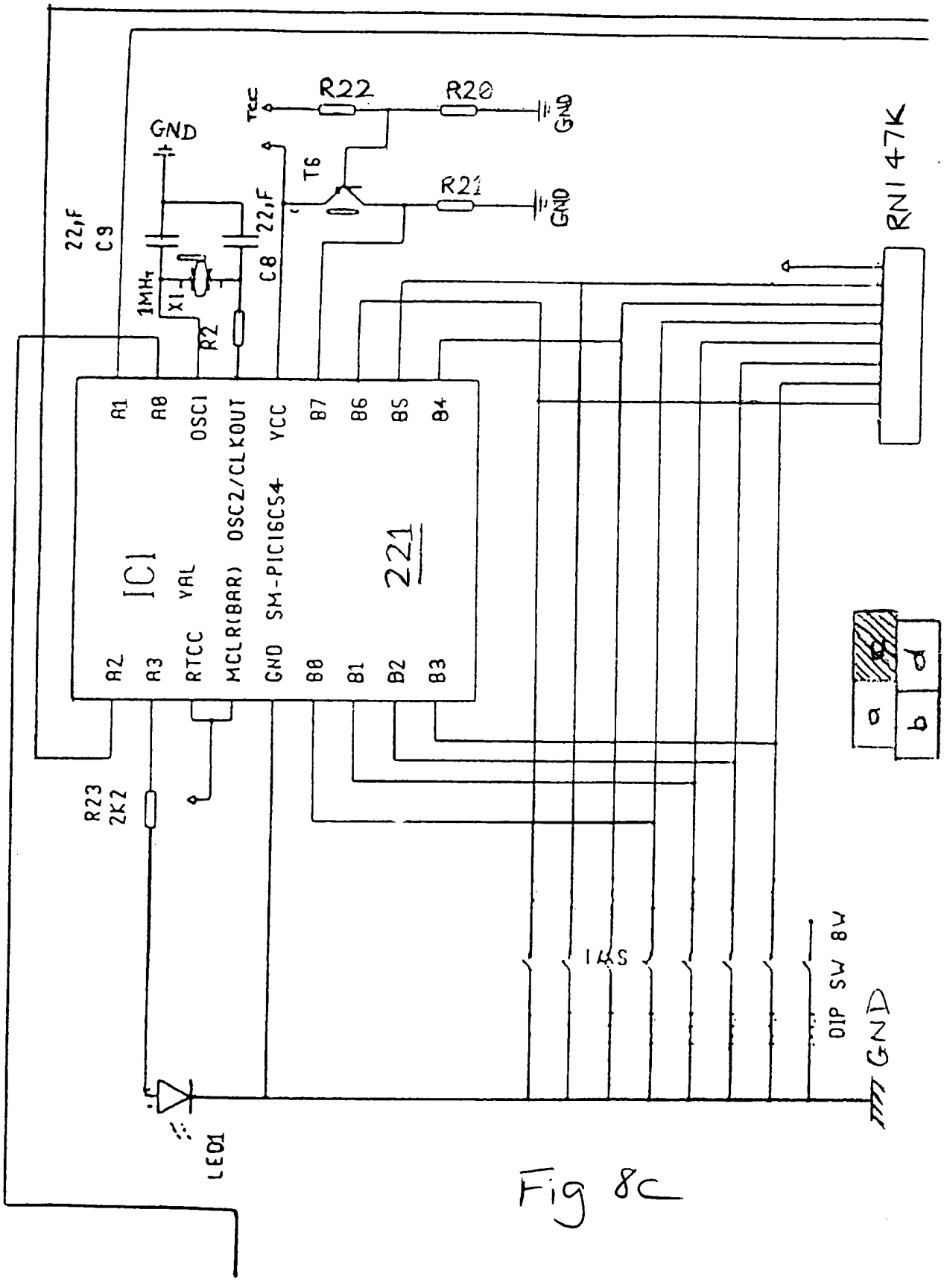
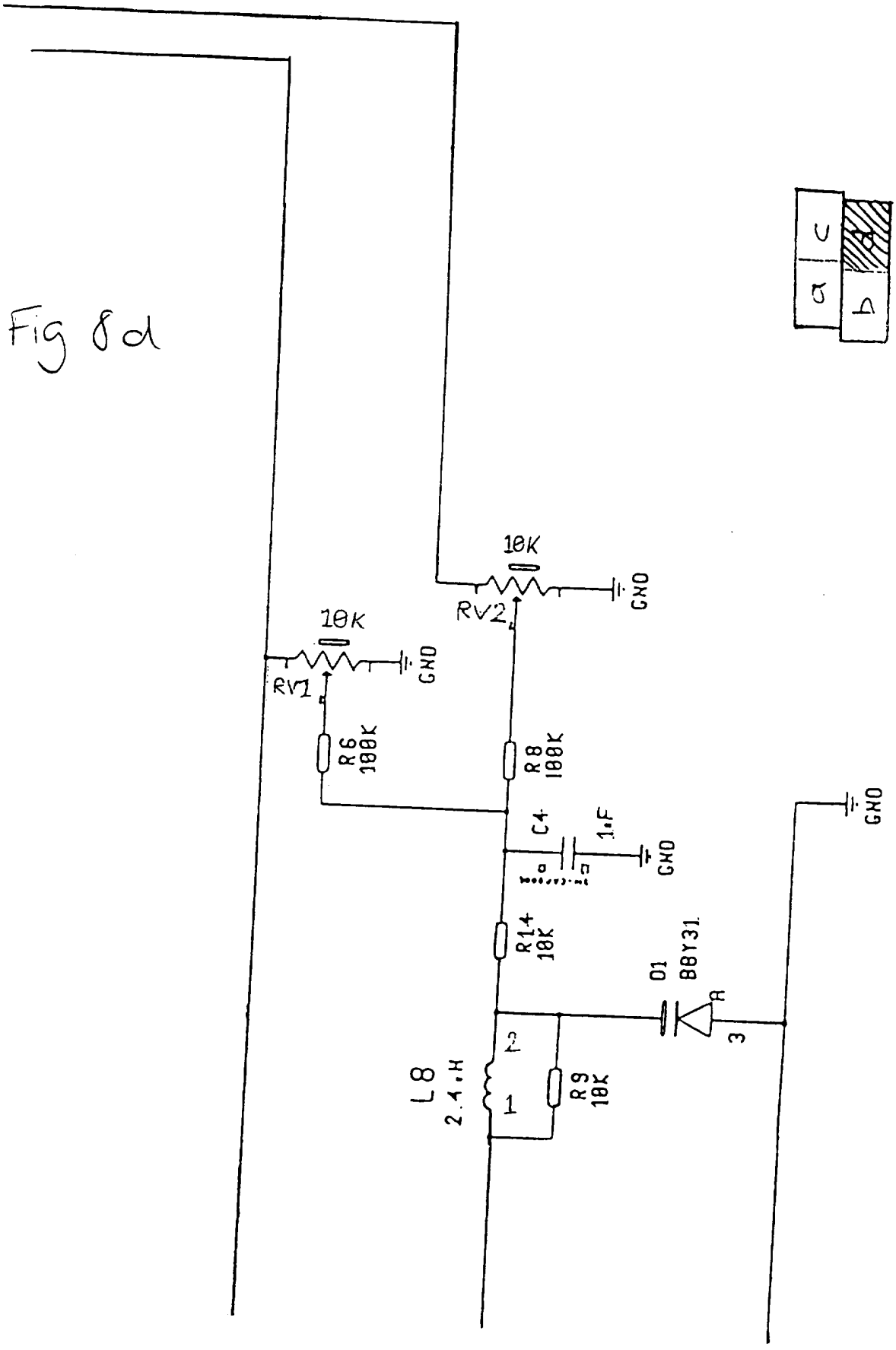

R22
R20
GND
R21
T6
22,F
C9
C8
1MHz
X1
R2
RN147K
IC1
SM-PIC16CS4
221
A1
A0
OSC1
VCC
B7
B6
B5
B4
A2
A3
RTCC
MCLR(BAR)
OSC2/CLKOUT
GND
B0
B1
B2
B3
YAL
R23
2K2
LED1
DIP SW 8W
GND

Fig 8c

Fig 8d


10K
RV2
GND
10K
RV1
GND
R6
100K
R8
100K
C4
1uF
GND
R14
10K
D1
BBY31
A
3
2
1
L8
2.4uH
R9
10K
GND
C
B
A
D