JACKS, PLUGS, LAMP JACKS AND KEYS

CONTENTS

This pamphlet is mainly concerned with the equipment common to all branches of telecommunication engineering; where the equipment has detailed applications, these will be mentioned.

JACKS AND PLUGS

A jack is any piece of equipment used for terminating the permanent wiring of a circuit. It may consist of two or more springs arranged so that the insertion of a suitably designed 'plug' establishes a number of electrical connexions.

Jacks are often described by the number of separate terminations they may accommodate. For example, a 'five-point' jack enables five separate terminations to be made on the jack.

A plug is designed to engage the springs of a jack and may be used to terminate another portion of the permanent wiring, either directly, or by means of a flexible cord.

The plug is often described by the number of electrical connexions made with the jack springs, for example, a 'three-way' plug enables three electrical connexions to be made.

SWITCHBOARD JACKS AND PLUGS

To main types of jack are used in telecommunications, these being known as 'branching' and 'series'. A simple branching jack consists of connexion springs only; whereas a series jack has two sets of springs which are internally connected together, the connexion being broken when a plug is inserted. Another name for the series jack is a 'break' jack.

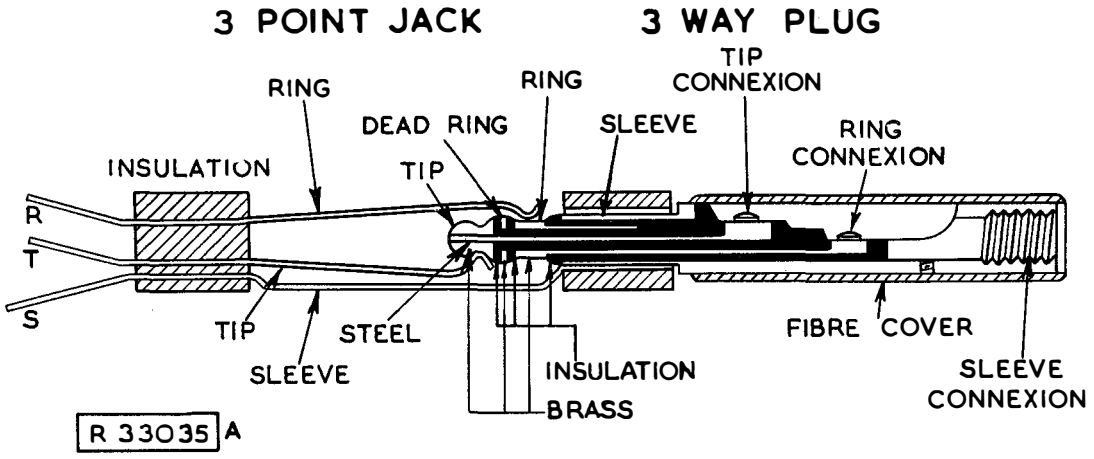

Fig. 1

Fig. 1 shows a section of a 3-way switchboard plug inserted into a 3-point branching jack.

One type of 'series' or 'break' jack is shown in Fig. 2. Fig. 3 shows another type of 'series' or break jack with a plug inserted; these jacks consist of four springs, the outer springs making connexion with the inner ones. The insertion of the plug connects the two sections of the plug to the outer springs and disconnects them from the inner springs.

A third connexion is made by the bush of the jack which bears against the sleeve of the plug when the plug is inserted in the jack.

The springs are of nickel-silver insulated from each other by shaped pieces of ebonite or synthetic resin-bonded paper (S.R.B.P.)

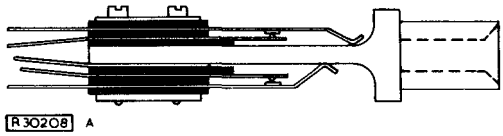

Fig. 2

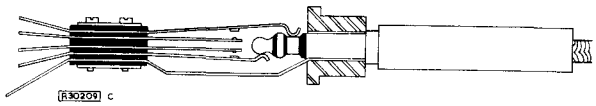

Fig. 3

The jack shown in Figs. 4 and 5 is fitted with an additional changeover spring-set. The long connexion spring has an ebonite pip which passes through a hole in the lower spring of the changeover set and rests upon the central spring. The insertion of a plug causes the connexion springs to break contact with the inner springs, and the movement of the long connexion spring causes the central spring to break contact with the lower and to make contact with the upper spring of the change-over spring-set.

This action is also available on branching jacks.

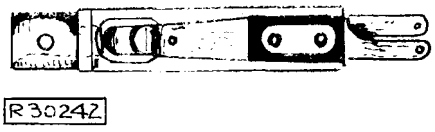

Fig. 4

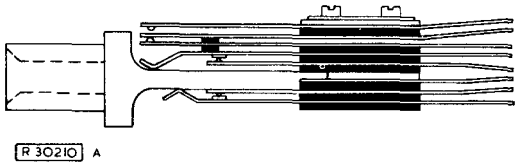

Fig. 5

One type of 3-point branching jack used in C.B. switchboards consists of two springs and a socket arranged as indicated in Fig. 6. The connexion arrangements are similar to those shown in Fig. 1.

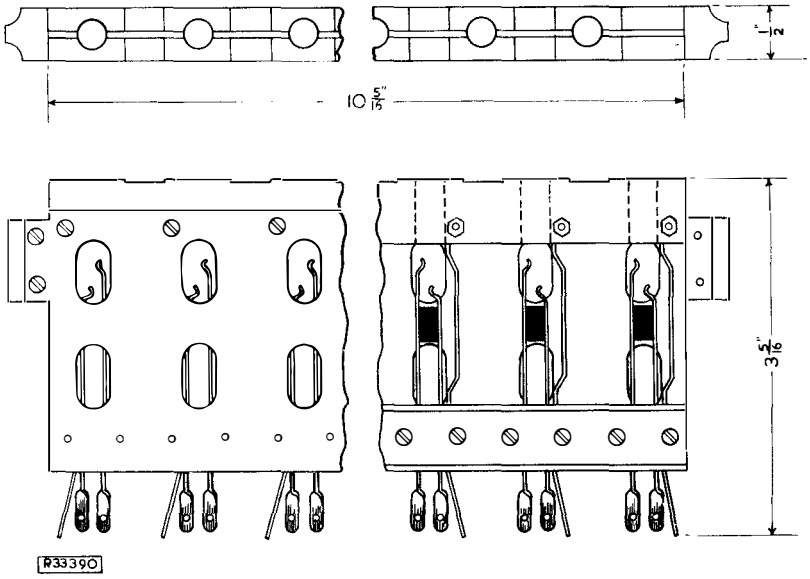

Fig. 6

These type of jacks are usually provided in strips comprising up to twenty jacks. The physical size of the jacks is kept as small as practicable to enable a large number to be accommodated in the multiple of a large telephone switchboard. The space requirements on some switchboards are not so severe, hence larger and more robust plugs and jacks may be used.

Jacks of various gauges have been manufactured in the past, an index letter being used to indicate the gauge of the jack or plug. The 'B' gauge with a sleeve diameter of 0.252 in. is the most common size and is standard for all new equipment. The 'C' gauge (0.208 in.) is the smallest size and has been used in CB1 exchanges to provide a large multiple capacity which will still be within the reach of a telephone operator.

The provision of jacks in strip form allows the method of fixing in the exchange multiple to be such that individual strips of jacks may be removed from the multiple

for maintenance purposes. Each strip of jacks has a projecting lug at each end as shown in Fig. 6. These lugs enable the strip to be rigidly held in position by jack-fasteners, each fastener consists of a cheese-headed screw and a thick brass washer from which a sector has been removed. The fastener may be disengaged by slackening the screw and rotating the washer until the cut-out portion is opposite the projecting lug on the jack.

The plug for making connexion to switchboard jacks is shown in Fig. 1. By means of this plug and a flexible connecting cord the terminations at the jack may be extended.

The metal parts of the plug are mainly made of brass, but a steel insert is provided down the centre of the plug to give additional strength. The insulating parts are of bakelite or a plastic of the urea group.

For C.B. exchange working it is important that during the insertion of the plug into the jack the tip and ring springs of the jack shall not be short-circuited. For this reason a "dead-ring" is provided between the tip and ring portions of the plug. This takes the form of an insulated brass collar when bakelite is used as the insulating material, but in plugs with the special plastic insulation the dead-ring is wholly plastic. The main body of the plug is covered with a fibre insulating cover to prevent shocks to operators, because, without this cover, the sleeve of the plug would be exposed and handled. The plug cover is coloured to indicate the function of the cord circuit to which it is connected.

The inside of the near end of the plug has a screw thread so that, when the plug is screwed on to the connecting cord binding, the latter takes all the strain.

The three cord conductors each consist of twenty-six strands of tinsel thread and are insulated by two close lappings of silk or rayon, covered with soft cotton braiding. The conductor braidings are coloured white, blue and red. The tip and ring conductors (white and blue respectively) are terminated by tags which grip the conductor strands and are secured to the respective parts of the plug by small screws. The sleeve connexion (red) is not terminated by a tag, but the bared conductor is folded back over the bound outer braiding of the cord, so that a tight connexion is made to the sleeve as the cord is screwed into the body of the plug.

OPERATOR'S INSTRUMENT PLUG AND JACK

Fig. 7 shows a plug and jack of the type which is used to connect the telephone operator's headset to the instrument circuit of a switchboard.

The plug is of more substantial construction than the switchboard plug previously described, since the space required by the associated jack is not of vital importance.

The jack consists of four nickel-silver springs, each fixed by two screws to the ebonite case. The case may be either as shown in Figure 7, or consist of an ebonite moulding comprising two jacks. When two jacks are provided they are connected in parallel in order that two plugs may be connected to the circuit.

The combination of the plug and jack allows the extension of four conductors.

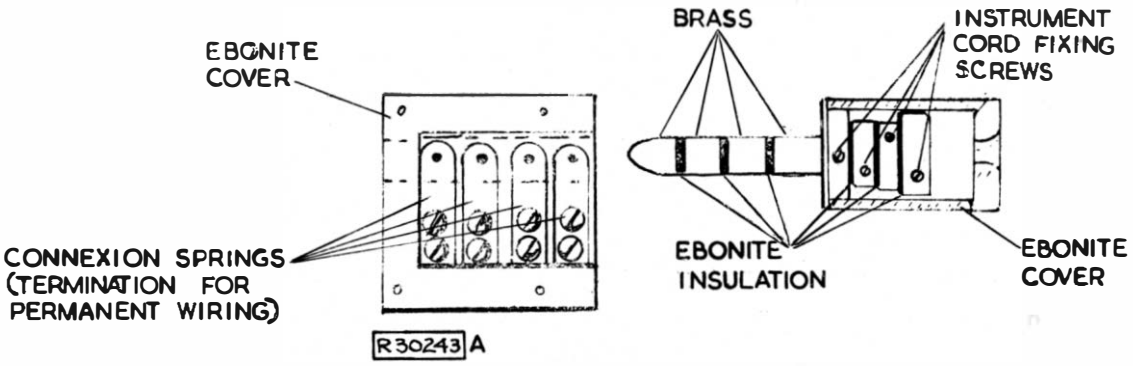

Fig. 7

Occasionally this type of plug and jack arrangement is provided at subscriber's premises to enable the telephone instrument to be transferred from room to room. The jack used for this purpose is fitted with auxiliary contacts which operate when a plug is inserted. The jack may extend either four, or six conductors depending upon the type of installation in which it is used. Fig. 8 shows a five-point jack with its four-way plug.

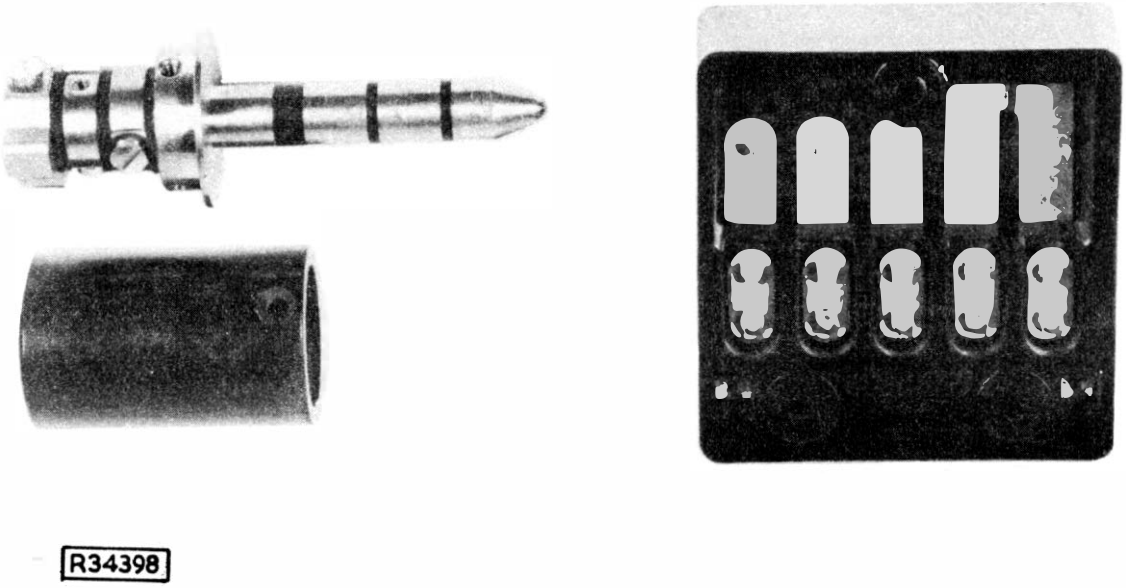

Fig. 8

The six-way plug and its associated jack is similar in construction to the four-way plug.

APPARATUS JACKS

Fig. 9 shows the type of test jack fitted to the B.P.O. standard 2000-type selector. The jack consists of moulded bakelite, built up in banks of 6 test points. The jack springs are pressed pieces of metal and have a tag formed in the pressing process. The pressings are lightly tensioned to provide a good electrical contact when the plug is inserted. Provision is also made for the insertion of a lamp; (lamp jacks will be described more fully later in this pamphlet).

The jack is used to provide access to the circuit of the selector for routining and to extend the maintenance engineer's telephone to the circuit.

Connexion to the jack is made with a plug of the type shown in Fig. 10.

The numbering of the jack springs of an 8 and 14 point jack is shown in Fig. 9.

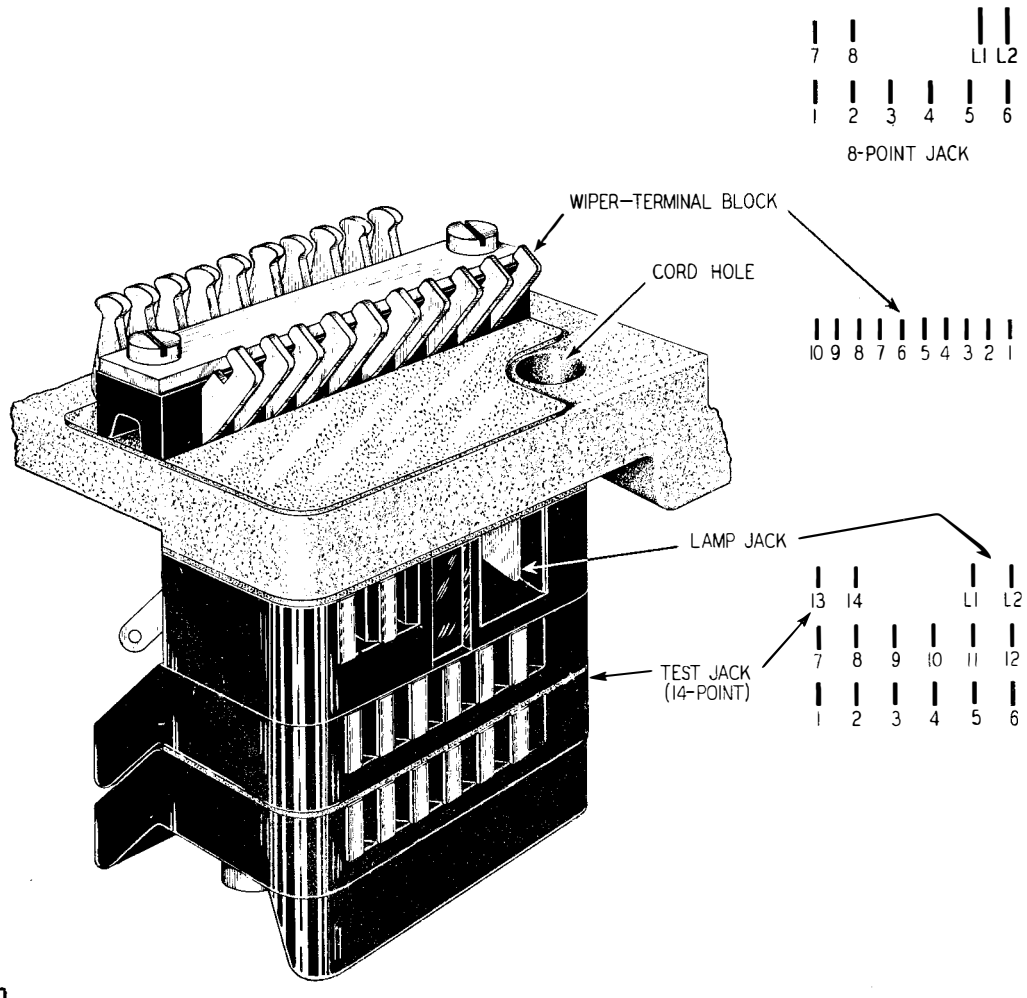

Fig. 9

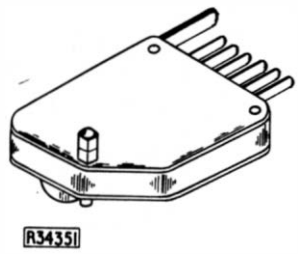

Fig. 10

The photograph in Fig. 11 shows a type of plug and jack arrangement in common use in telecommunication engineering.

Each connexion consists of a shaped piece of metal for the jack spring and a flat strip as the plug; two connexions are combined together with an insulator between them. The shaping of the jack springs allows the plugs to be easily inserted.

The photograph illustrates the connecting arrangements between a 2000-type selector and the selector frame, and provides for 32 single connexions.

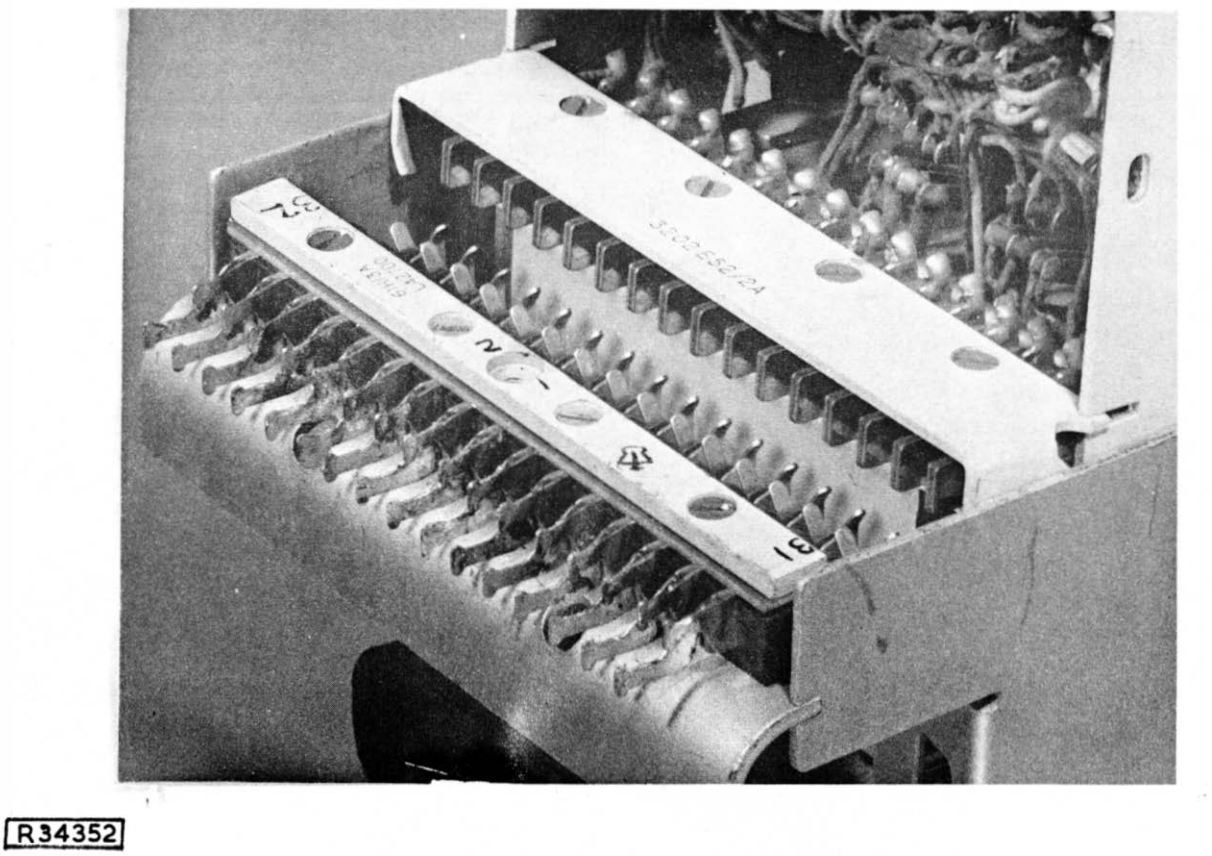

Fig. 11

Figs. 12 and 13 show an arrangement of plug and jack which is used to connect a telegraph-type relay to its control circuit. This differs from the arrangement of Fig. 11 in that the plug is connected to the permanent wiring and the jack is connected to the relay base.

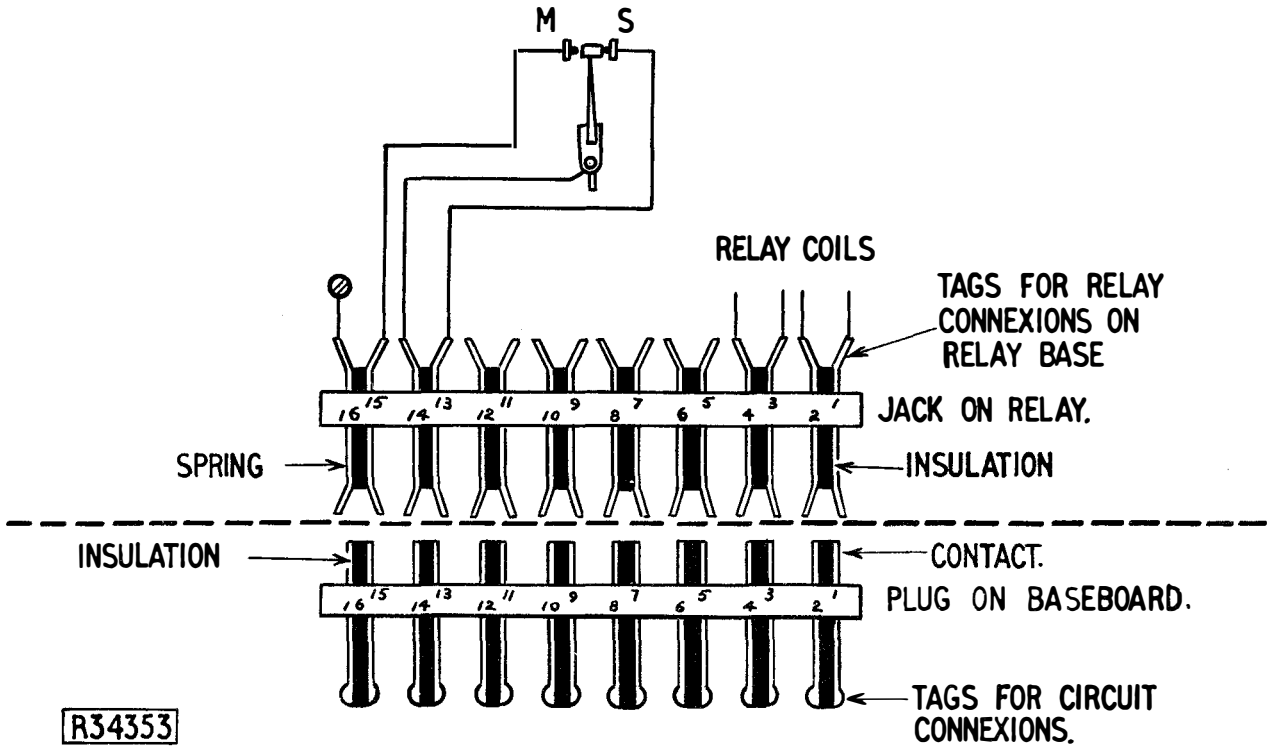
M
S
RELAY COILS
TAGS FOR RELAY CONNEXIONS ON RELAY BASE
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
JACK ON RELAY.
SPRING
INSULATION
INSULATION
CONTACT.
16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
PLUG ON BASEBOARD.
TAGS FOR CIRCUIT CONNEXIONS.
R34353

Fig. 12

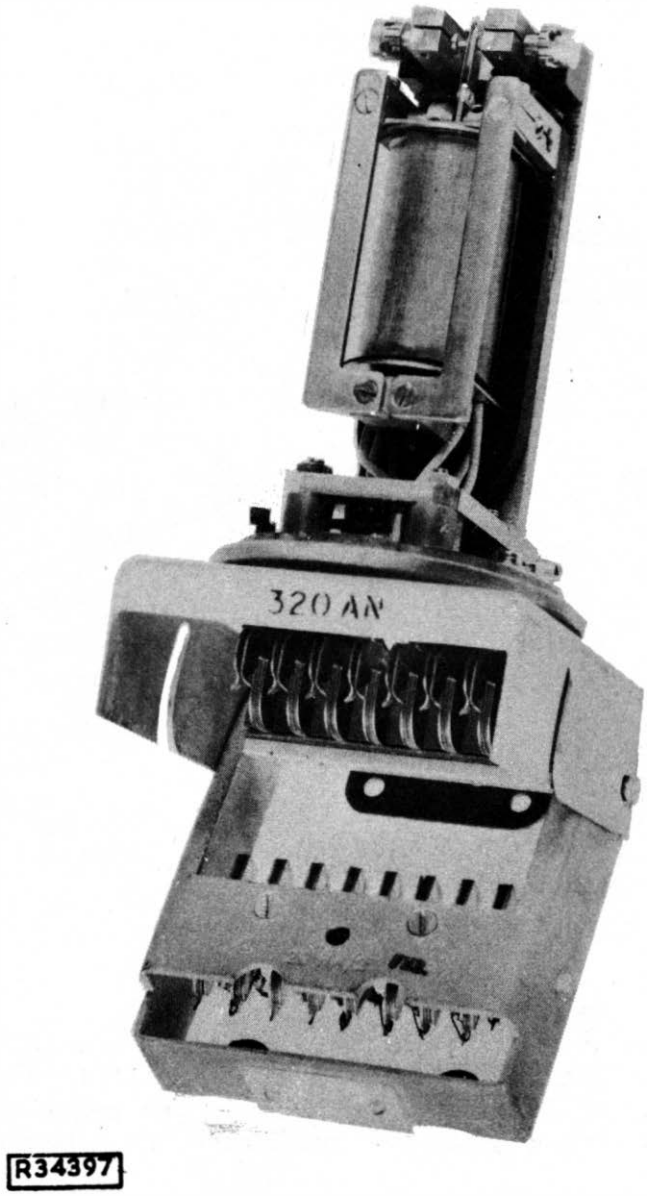

Fig. 13

LAMP JACKS

Small lamps are used to provide supervisory and calling signals in exchanges, and as the lamps may be required to be replaced because of failure a jacking arrangement is found suitable.

Fig. 14 shows a sketch of a lamp, lamp-cap, and lamp-jack of the type used as supervisory indicators. The frame is of pressed mild steel sheet. Two spring contacts form the jack springs and the contact plates of the lamp make electrical contact with the springs. The lamp is located and retained in position under the pressure of the insulated spring clip. The brass lamp cap may be provided with a coloured opal if required.

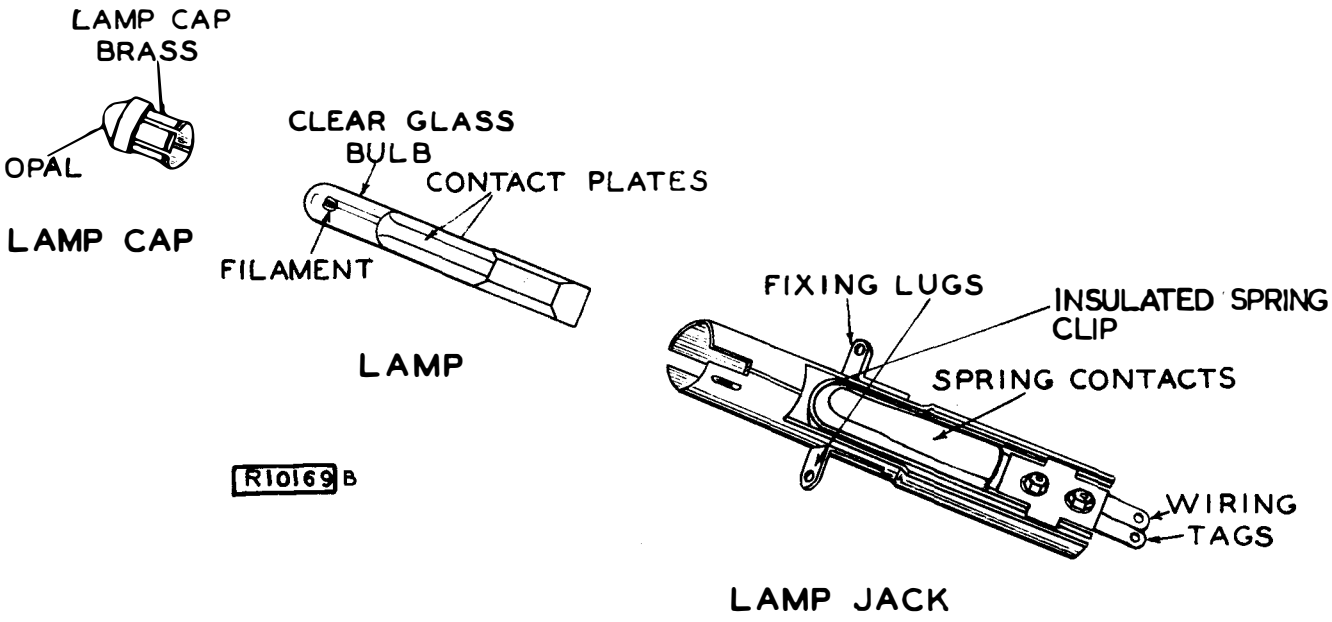

Fig. 14

The type of lamp jack used in the face equipment of a switchboard is made up into a similar form to the jack strip shown in Fig. 6. It is usual to associate a strip of jacks and a strip of lamp-jacks together in the incoming sections of a switchboard. The contact arrangements are similar to the supervisory lamp jack.

A strip of 20 calling lamps is shown in Fig. 15, but strips of 10 lamp jacks are also available.

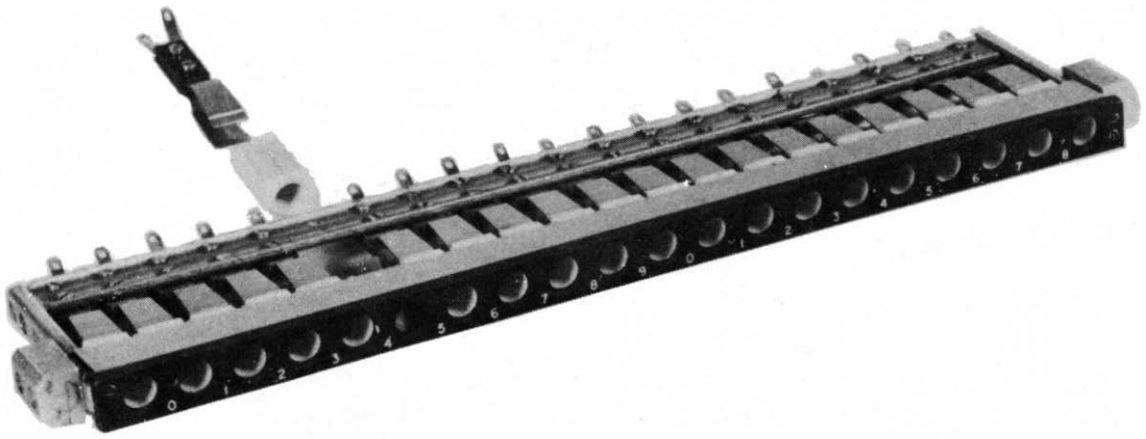

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Fig. 15

A variety of metals are used for the manufacture of jack springs, but the main properties required are non-rusting, good conductivity and sufficient flexibility to resist fatigue. Two materials which fulfil these requirements are nickel-silver and a bimetal strip consisting of phosphor-bronze and silver.

KEYS

In telecommunications a key is a hand-operated device for the connexion and disconnexion of circuit continuity. One of the earliest forms of key was the 'Morse' key, which may be used for the transmission of a message in code by electrical means between two telegraph offices. This type of key is used to connect a circuit between the sending and receiving station in such a manner that the current flows through the distant receiver according to the 'Morse Code'.

MORSE KEY

A typical Morse key is shown in Fig. 16, it consists of a brass lever, pivoted, and mounted horizontally. The lever is fitted with platinum-tipped contacts on either side of the pivot. The rear contact, which is adjustable, adjusts the travel of the lever. A restoring spring keeps the lever in such a position that its rear contact makes electrical connexion with the back stop contact under normal conditions. When pressure is applied to the knob attached to the lever, it rocks on its pivot and the front contact on the lever makes electrical contact with the front stop.

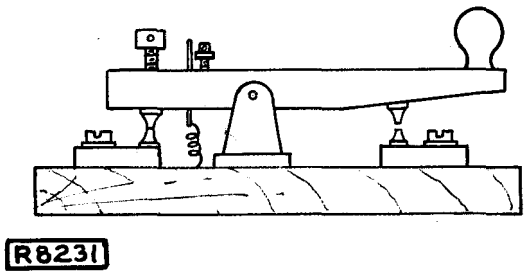

Fig. 16

The terminals of the key are, the lever, the front, and the back stop, thus the key can provide a change-over, a make, or a break action, according to the terminals used.

TELEPHONE-TYPE KEYS

In telecommunications it is necessary to connect or disconnect a number of circuits simultaneously, and obviously the simple type of morse key is unsuitable for this application. Two main types of key are in use by the British Post Office. These are:-

(i) Lever type

(ii) Plunger type.

Both types of key may be either locking, or non-locking. Locking keys remain operated when the operating condition is removed, non-locking keys restore. In all cases the contact members are flexed about a fixed point and not pivoted.

In general lever keys are used when frequent operation is required. They may also be used when a large number of spring combinations are necessary.

Plunger keys have a limited spring capacity, but occupy a very small space.

LEVER KEYS

A lever key may have three positions, one normal and two alternative operated positions. Fig. 17 shows a standard lever key.

The steel ball retains the cam in the normal centre position under the pressure of the blued-steel pressure spring, this arrangement also tends to eliminate overshoot when the key lever is returned to normal from the operated position.

The L-shaped brass frame carries the contact assembly and the axle for the cam. The cam of the key lever is of nickel-plated mild steel and has a circular recess cut on its periphery. The contact springs are made of nickel-silver and have contacts made of a gold and silver alloy.

The insulating pieces between the springs, the insulating bushes, and the rollers are made of ebonite or S.R.B.P.

In the non-locking position two insulated buffers are placed under the short limb of the frame to restrict the travel of the lever, thus preventing the key remaining permanently operated in this position.

When the key is required to have only one operated position a pin is inserted through a hole in the cam to restrict the movement of the lever.

Any combination of contact springs can be fitted on the key frame.

In the case of a break or change-over contact assembly, the main springs have an L-shaped projection which is hooked over the short spring as shown in Fig. 17. When the key lever is operated, the projection does not engage the short spring until the key lever has rotated through a few degrees; thus electrical contact is retained between the main spring and the break spring if the key lever is accidently disturbed.

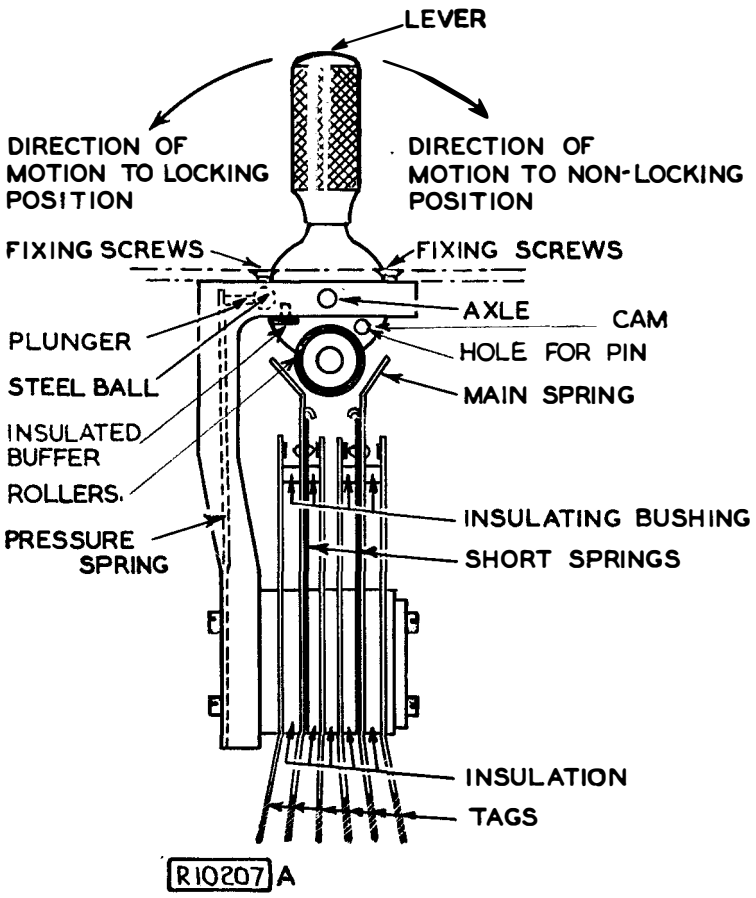

Fig. 17

Another lever-type key is shown in Figs. 18 and 19. This type of key allows the contact spring assembly to be operated for a predetermined duration of up to 7 secs. It is fitted with a dial-type governor mechanism which causes the return of the lever to be delayed under the control of the governor. A helical spring as used in the telephone dial, is contained within the cam. A gear wheel, operated from the cam, allows the lever to be moved in the operate direction without engaging the governor mechanism.

The spring-set is held in the operated position when the key lever is normal by an insulated steel pin attached to the cam. When the key lever is operated, the spring-set is released for the period the key lever is operated.

The spring-set provides a change-over spring combination and is built up from 600-type relay springs having twin contacts.

The overall dimensions of the key allow it to be interchangeable with any standard lever-type key.

One use of this type of key is for the provision of a fixed duration clearing signal on teleprinter switching systems and in this case the key is adjusted to restore in 5 seconds.

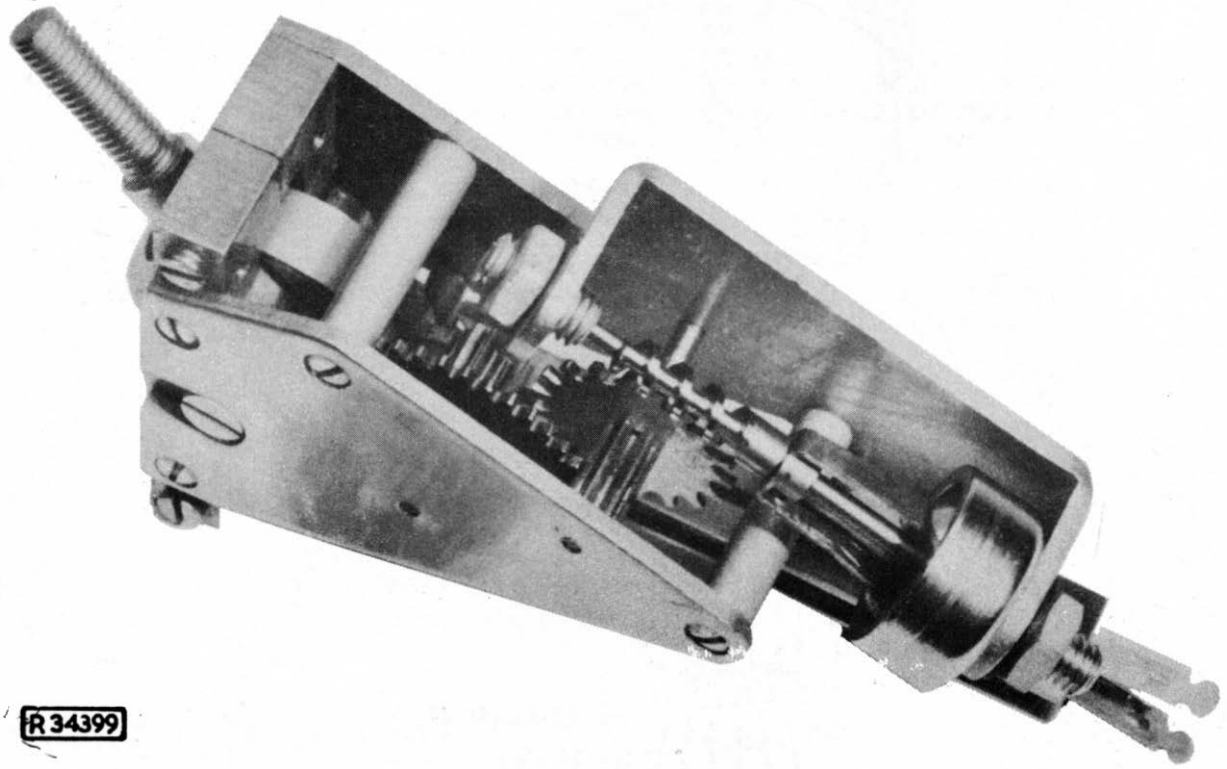

Fig. 18

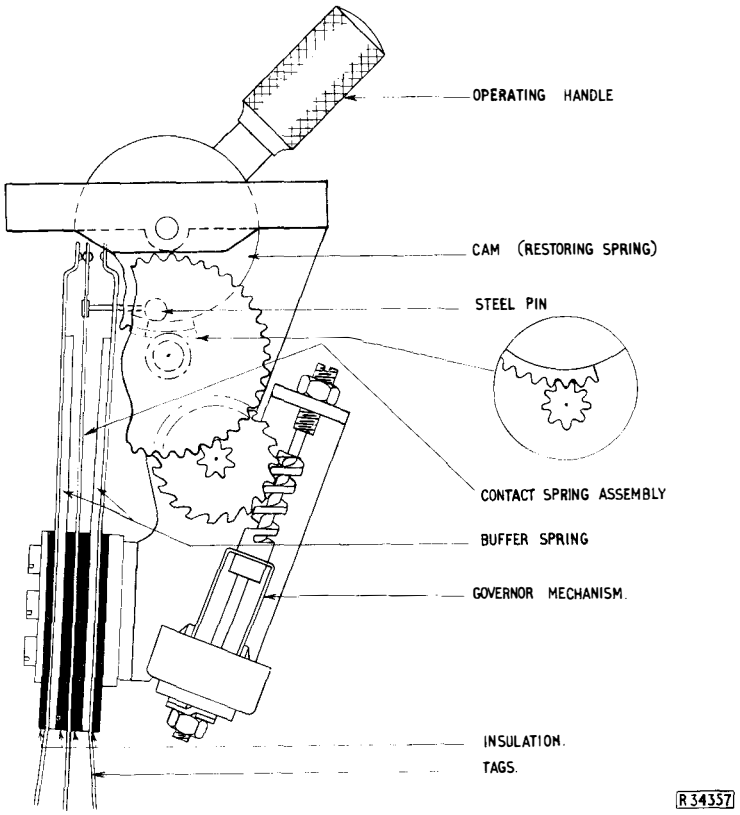

Fig. 19

PLUNGER KEYS

Two typical plunger keys are shown in Figs. 20 and 21. They are of the non-locking type. The locking type have no restoring spring and the insulating tip of the plunger is of different shape.

The frame of the key shown in Fig. 20 is pressed from a mild steel sheet and is zinc plated, whereas that of Fig. 21 is an alloy or brass casting.

The springs are of nickel-silver and are provided with gold-silver contacts of the point and disc type as shown in Fig. 23. The restoring springs are of hard drawn phosphor-bronze wire.

In both cases the key tops are removable and have a recess for the location of a designation label.

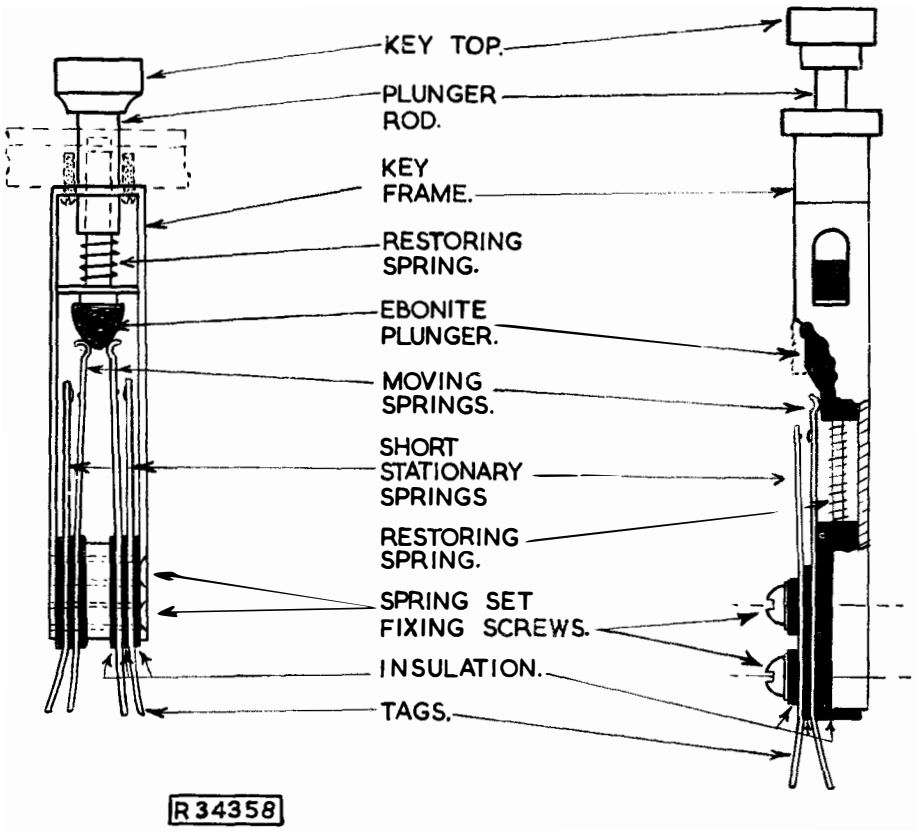

Fig. 20

Fig. 21

Another type of plunger key which is used by the British Post Office is shown in Fig. 22. This key was originally designed for use on Voice-Frequency Keysending positions, because on these positions the keys were required to be operated in rapid succession and give a particularly light and smooth action. The lever springs are fitted with rollers which engage with the wedge of the plunger.

This type of key may be used on signalling units for telegraph switching.

The key illustrated has two change-over contacts, but any contact arrangement may be provided.

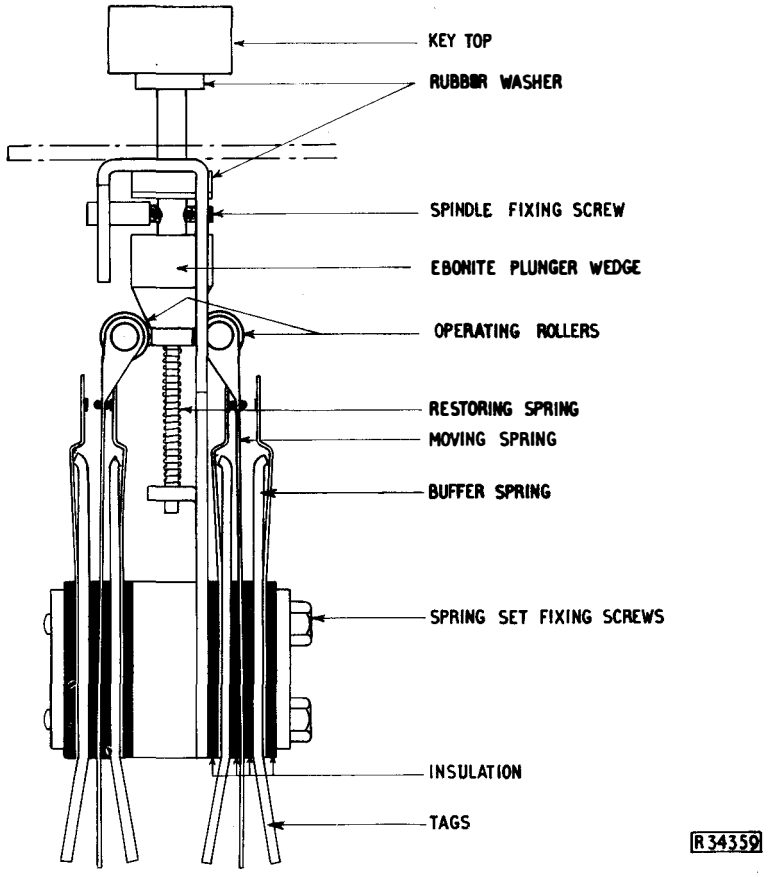

Fig. 22

CONTACTS FOR KEYS, JACKS ETC.

Three shapes of contact are frequently met in telecommunications, they are

(a) point and disk.
(b) dome.
(c) cylindrical, found with tungsten contacts.

Fig. 23 illustrates the different types.

Contact points are normally of a silver-gold alloy (90% silver, 10% gold).

Point and disk contacts are usual in the case of keys and jacks. Relay springs, however, use a dome shaped contact, as these tend to rub or "wipe" when making connexion with each other and so keep themselves clean. Tungsten, owing to manufacturing difficulties, is made into cylindrically-shaped contacts.

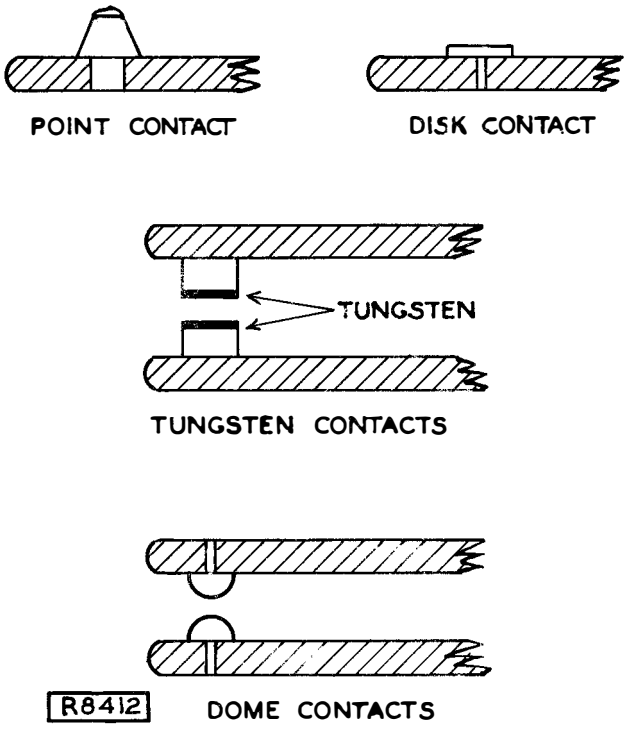

Fig. 23

Reliable contact pressure is obtained by keeping springs straight and tensioning them at the point where they are fixed. In some cases the springs are tensioned against a buffer spring.

END