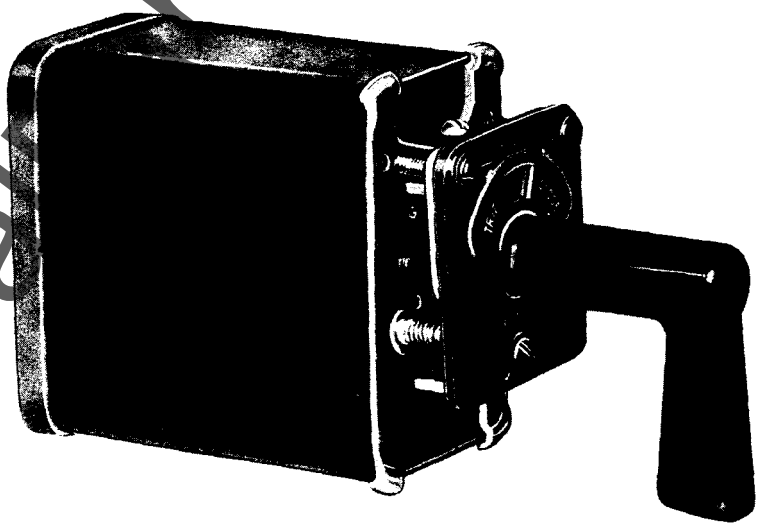
GEH-908M

INSTRUCTIONS

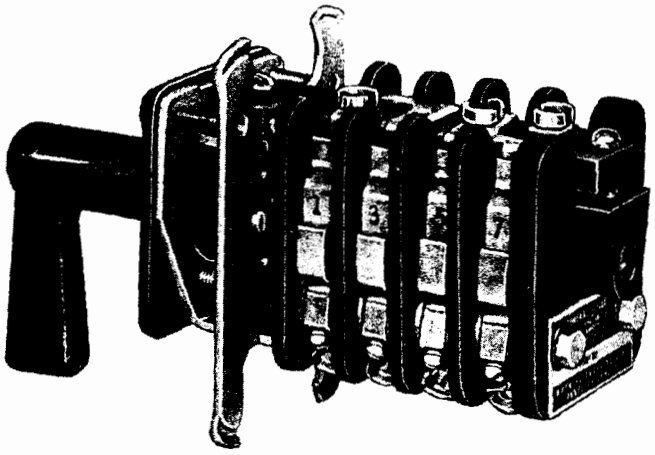
Switchgear

CONTROL AND INSTRUMENT SWITCHES



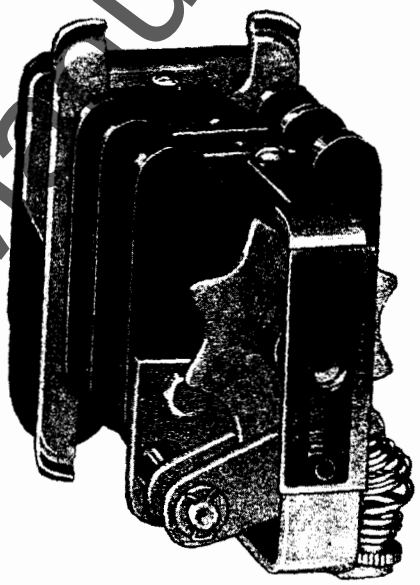
Types
SB-1, SB-9,
and SB-10

GENERAL ELECTRIC



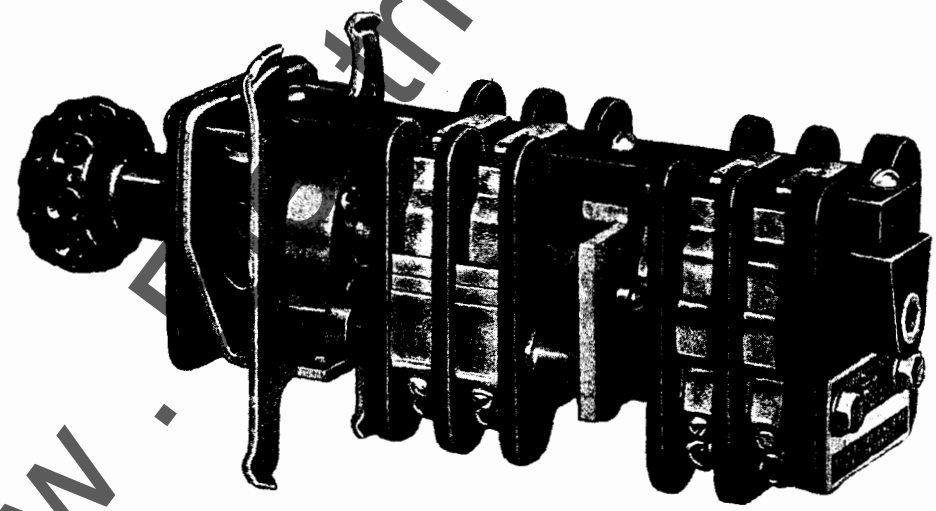
(8008678) Fig. 1

Fig. 1 Type SB-1 Switch without Cover



(8008677) Fig. 2

Fig. 2 Type SB-9 Switch without Cover



(8008679) Fig. 3

Fig. 3 Type SB-10 Switch without Cover

(8008680) Cover

CONTROL AND INSTRUMENT SWITCHES
TYPES SB-1, SB-9, AND SB-10

INTRODUCTION

The Type SB-1 switches (see cover illustration and Fig. 1) are multi-pole rotary switches with cam-operated contacts. They have their positioning device or return spring located between the front support and first barrier while the Type SB-9 (see Fig. 2) has the positioning device or return spring located at the rear of the switch. The Type SB-9 also has better insulation to ground, more substantial bearings, and long life cams.

The Type SB-10 switches (See Fig. 3) combine contacts operated by rotation of the shaft, as in the SB-1 and 9 switches, with contacts operated by a lateral motion (push or pull) of the shaft. Only two lateral positions of the shaft are possible. Interlocks are usually provided so the push-pull contacts can be operated only in specific rotary positions of the switch, and also so the rotary contacts can be operated in only one lateral position of the shaft--either push or pull.

NOTE: Instructions for Type SB-1 switches also apply to superseded Type SB-7 switches.

APPLICATION

The Type SB-1, SB-9 and SB-10 switches are primarily intended for the control of electrically operated circuit breakers, small motors, magnetic switches and similar devices, and for the transfer of meters, instruments and relays. The Type SB-1 switch is suitable for most applications, but where the switch is subject to abnormally frequent operation (approximately 100 operations or more per hour), more durable cams are required, in which case the Type SB-9 switch should be ordered.

RATINGS

The switch rating is 600 volts, 20 amperes continuous, and 250 amperes for 3 seconds.

The interrupting rating depends on several factors; namely, voltage, current, and inductance of the circuit. It is often necessary to connect several contacts in series to secure sufficient interrupting capacity. The interrupting ratings in the table below are based on the inductance of the average trip coil.

INTERRUPTING RATINGS - AMPERES

CIRCUIT VOLTS	NON-INDUCTIVE CIRCUIT			INDUCTIVE CIRCUIT		
	NUMBER OF CONTACTS					
	1	2 in Series	4 in Series	1	2 in Series	4 in Series
24 d-c	6.0	30.0		4.0	20.0	30.0
48 d-c	5.0	25.0	40.0	3.0	15.0	25.0
125 d-c	2.7	11.0	25.0	2.0	6.25	9.5
250 d-c	0.75	2.0	8.0	0.7	1.75	6.5
600 d-c	0.25	0.45	1.35	0.15	0.35	1.25
115 a-c	40.0	75.0		24.0	50.0	
220 a-c	25.0	50.0		12.0	25.0	40.0
440 a-c	12.0	25.0		5.0	12.0	20.0
550 a-c	6.0	12.0		4.0	10.0	15.0

RECEIVING AND STORAGE

RECEIVING

Immediately upon receipt of a switch, examine it for any damage sustained in transit. If injury or rough handling is evident, file a damage claim at once with the transportation company and promptly notify the nearest General Electric Apparatus Sales Office.

The switches are completely assembled and packed in individual cartons before shipment.

STORAGE

If the switches are for stock purposes or not for immediate installation, they should be left in the shipping carton and stored in a clean dry location.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the General Electric Company.

DESCRIPTION

CONSTRUCTION

All types of these switches are built up of a series of individual stages, each nested into the other, plus a common fixed contact support, operating shaft, front support and rear support (see Fig. 5). The complete stack is tied together with two tie bolts threaded into the front support. Each rotary stage consists of an insulating barrier carrying one or two moving contacts, and two or three cams on the shaft which operates the moving contacts. A push-pull stage is similar to the rotary stage except only one cam is used. Each moving contact and its associated fixed contact on the fixed contact support constitute a complete switch contact.

CONTACT IDENTIFICATION

The movable contacts are marked for identification following a standard system. Starting with the stage next to the panel, the contacts on the right side--looking toward the rear--are given odd numbers beginning with "1" (see Fig. 1), and the contacts on the left side even numbers beginning with "2". Occasionally, a contact is omitted from a stage. If so, the corresponding number is also omitted.

ENCLOSURES AND MOUNTING

The basic switch design is for panel mounting and includes a molded cover as shown on the front cover. When requested, switches are furnished assembled in various enclosures, such as the fabricated-metal enclosure for wall mounting, the watertight enclosure, and the explosion-proof enclosure. When conditions require the switch to be operated immersed in oil, it is furnished mounted in an enclosure similar to the watertight enclosure except that the lower removable portion is filled with oil.

Switches for panel mounting are furnished with shafts and mounting screws suitable for mounting on panels 1/8 inch to 3/16 inches thick. When requested, shafts and mounting screws are furnished for 1, 1 1/2, or 2 inch panels. For intermediate thicknesses of panels, spacers are furnished to fill the excess space between the front support and the panel.

INSTALLATION

For panel-mounted switches, holes should be provided in the panel as shown in Fig. 4. The shaft hole is shown with a 1 1/8 inch diameter. This is done to provide one panel hole for all switches. The removable handle and lock handle switches require the 1 1/8 inch diameter hole, while a 1/2 inch diameter hole suffices for all other switches. For switches furnished in metal enclosures, mounting dimensions should be obtained from the approved outline drawings, or from the switches themselves.

To mount a fixed-handle switch on a panel, first remove the handle and escutcheon, including where provided, the position-indicating pointer and curved spring washer (saddle spring). Next, hold the switch in place on the back of the panel and insert the mounting screws through the escutcheon and panel into the switch front support, but do not tighten the mounting screws. Attach the pointer, saddle spring and handle. Align the escutcheon on the panel. Insert the mounting screws through the escutcheon and panel and place the spacers (if used) on the screws before putting the switch in place.

When mounting removable-handle switches be certain that the shaft of the switch is properly positioned, so the handle is easily removed, before the mounting screws are tightened.

Switches with a key lock in the handle have the handle attached to the escutcheon so the two parts are removed or installed as a unit. The shaft and handle are joined by a slotted coupling on the back of the excutcheon and these parts should be lined up before inserting the mounting screws.

When a back-of-board locking mechanism and separate (Yale) lock are furnished with a switch, the panel drilling shown in Fig. 4 is required. The lock should be installed first. Turn the key until the lever at the back of the lock is entirely within the barrel diameter, and remove the two knurled rings. Insert the barrel through the panel, from the front, with the spacing ring (where used) at the front of the lock and fasten it in place by tightening the knurled rings on the barrel behind the panel. With the cylinder in the locked position the lever on the back of the barrel should extend on the vertical center line towards the switch shaft. Turn the switch shaft to a locked position and mount the switch on the panel as directed in a previous paragraph, being careful to put the pin on the lock lever into the slot in the locking bolt of the mechanism. Operate the switch and check to see that the locking

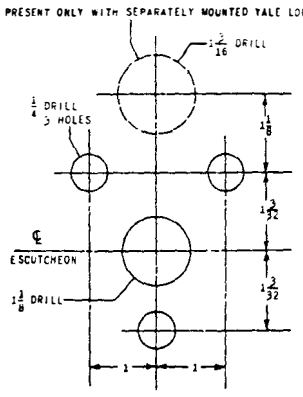


Fig. 4 Panel Drilling - Front View

Fig. 4 (K-6496738)

bolt will easily enter each slot in the locking wheel. It may be necessary to loosen the lock and shift its position slightly to secure satisfactory operation of the locking mechanism. When the mechanism operates correctly, the lock must be re-tightened on the panel.

OPERATION

Type SB-1 and SB-9 switches are rotary cam-operated switches. Rotation of the switch shaft causes contacts to close or open according to the shape and setting of the cams in the various stages. Each stage has one or two contacts with two or three cams. On drawings these cams are designated A, B and C. (see Fig. 5). Cam (A) is the one nearest the panel and is the closing cam for the even numbered contacts. The (B) cam is next and is the opening cam for both contacts; cam (C) is farthest from the panel and is the closing cam for the odd numbered contacts. When a contact is omitted, its corresponding closing cam is omitted and a spacer substituted.

When the total rotation of the switch is more than 150 degrees, there is, due to the common opening cam (B), a certain limitation to the opening and closing of the contacts (see Fig. 6). If the No. 2 contact is closed at zero degree, then after the shaft has been rotated 180 degrees, the notch in the cam (B), which allows the contact to close, will be opposite the No. 1 contact and there will be nothing to hold the No. 1 contact open. Therefore, the No. 1 contact must be closed at this point or it must be omitted from the switch. In other words, whatever happens to one contact at any point in the periphery of the switch rotation must happen to its companion contact in the same stage when the switch is rotated 180 degrees from that point.

Generally, it is possible to design the switch so those contacts that close 180 degrees opposite

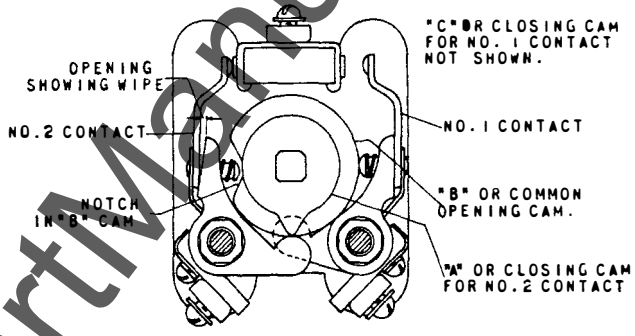


Fig. 6 Typical Section Showing Operation of Cams - Front View

(8009283) Fig. 5

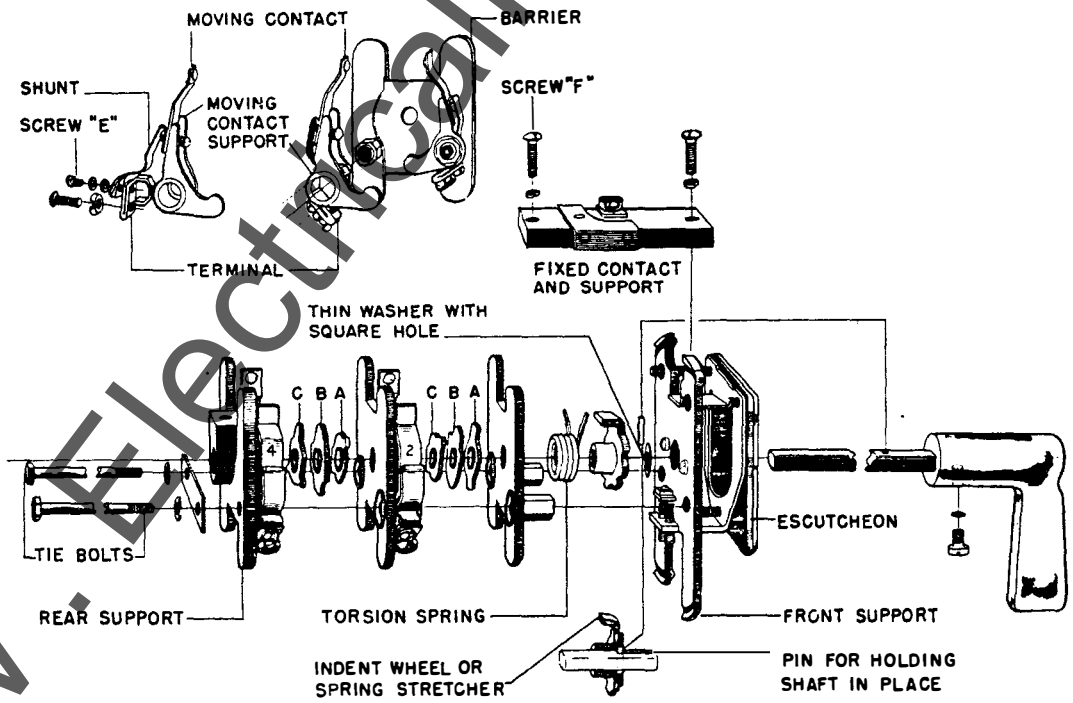


Fig. 5 Exploded View of Type SB-1 Switch

Fig. 6 (K-6507946)

each other are in the same stage, but sometimes it is necessary to design the switch with only one contact per stage.

Some applications, particularly of momentary contact switches, which have a torsion spring to return the switch to a central-neutral position, require a contact action which lags behind the switch motion (lost motion or slip contacts). Such contacts use cams with a special loose fit on the shaft. When the shaft has turned far enough to close or open these contacts, it can be rotated 45 degrees in the reverse direction without moving the cams, but beyond this point, the cam moves with the shaft, and the contacts either open or close as the case may be.

Momentary contact switches have a torsion spring that returns the switch to a central or neutral position when the handle is released after operation to a side position or positions. This torsion spring is designed for a maximum of 90 degrees operation to each side of the central position. The torsion spring may have one end cut off or tied back in such a manner as to be effective on one side of the central position only. That is, the switch may have momentary contact to one side of the central position and maintaining contacts to the other side. Switches may also be furnished that are spring return from the extreme-end positions to a position in between the end position or positions and the central position.

In some momentary contact (spring return) switches, a locking device is provided by which the shaft may be held against the action of the torsion spring by pulling out the handle when the switch is turned to one of the side positions.

Type SB-10 switches, in addition to rotary contacts using SB-1 cams, have contacts operated by pulling out or pushing in the switch handle. The push-pull contacts are located at the front of the switch, with closing action provided by leaf springs and opening action by a cylindrical cam which slides over the shaft to the rotary contacts.

MAINTENANCE

At regular intervals, switches should be inspected for burning of the contacts, for broken shunts on the moving contacts and for contact wipe.

If contacts are slightly pitted, or coated with sulphide, scrape them gently with a sharp knife or dress with a fine file, such as a #00 dental file.

If the shunts are broken or the contacts badly pitted, they should be replaced as directed under "Repair and Replacement".

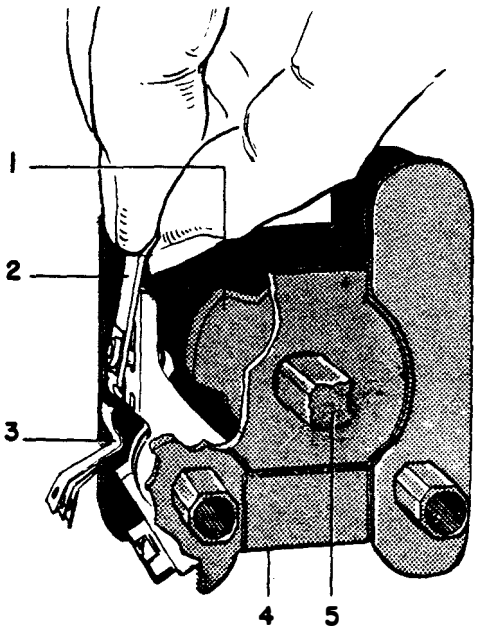
Contacts have sufficient wipe as long as there is an appreciable opening, with the contact closed, between the moving contact and the moving contact support (see Fig. 6) If there is no opening, it indicates that the parts of the moving contact support that bears on the cam or the cam itself has become worn and needs replacing as directed under "Repair and Replacement". Sometimes it is possible to secure a temporary repair by bending the moving contact so it has a smaller separation from the fixed contact when in the open position.

REPAIR AND REPLACEMENT

MOVABLE CONTACTS

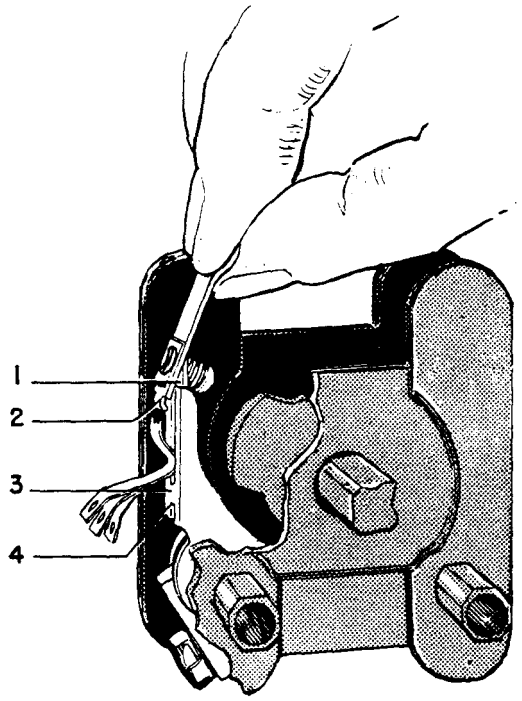
If a movable contact is burned, or has a broken shunt, replace the entire contact assembly. To do this, position the switch so the contact to be replaced is open. Remove screw (E, Fig. 5) and its clamping washer. Press in on the top of the contact to release the tongue at the lower end and pull the assembly upward and off (see Fig. 7).

To replace the new contact assembly, slide it downward with its shoe (1, Fig. 8) on the inside of the support (3, Fig. 8), until the tongue (2, Fig. 8) at the lower end of the contact drops into the holding notch (4, Fig. 8) on the support. Bring the loose end of the shunt (3, Fig. 7) down to the terminal and fasten it in place with the clamping washer and



1. Cam
2. Movable Contact
3. Shunt
4. Barrier
5. Operating Shaft

Fig. 7 Removing Contact Finger



1. Shoe
2. Tongue
3. Support
4. Holding Notch

Fig. 8 Installing New Contact Finger

screw (E). Avoid creasing or kinking the thin metal strips of the shunt. Operate the switch and observe whether the contacts meet squarely and simultaneously. The contacts can be adjusted by bending slightly with smooth-faced pliers. After adjustment there should be an appreciable opening, with the contacts closed, between the moving contact and the moving contact support.

FIXED CONTACTS

Damage to a fixed contact requires replacement of the complete assembly of fixed contacts and support. Remove screws (F, Fig. 5), change assemblies and replace the screws. Operate the switch and check the contact alignment.

On some switches the ball and spring of the positioning device are carried in the fixed-contact support. Care must be exercised to prevent losing the ball and spring when removing the fixed-contact support. The ball and spring are replaced best, after the new fixed-contact support has been assembled on the switch, by removing the spring retainer on the top of the fixed-contact support, inserting the ball and spring, and replacing the retainer.

CAMS, BARRIERS, MOVING-CONTACT SUPPORTS, ETC.

When cams, barriers, moving-contact supports, etc., need to be replaced or changed, the switch should be removed from the panel and disassembled on a bench and re-assembled with replacement parts. The moving-contact support and terminal are tightly assembled on the barrier in the factory. It is practically impossible to remove them from the barrier without damage to the parts or the barrier. If any of the parts require replacement it is best to secure a complete assembled replacement unit, including the barrier, moving contact support, and terminal, from the factory.

SWITCH DIS-ASSEMBLY

Before dis-assembling the switch, secure a drawing showing the cam arrangement in all the stages of the switch. Turn the switch shaft to the switch position corresponding to the cam arrangement. This is a twelve-o'clock position unless otherwise noted on the drawing. Remove the handle and fixed-contact support. Unscrew the tie bolts from the switch support, but leave them in the switch. Stand the switch on the bench, resting on the rear support, and slip the front support off the shaft being careful to hold the shaft in the switch so as not to pull it out of the cams in the rear stages. Do not lose the ball from the positioning device. Slide the shaft out just enough to remove the pin, through the shaft, which seats in the counterbore in the indent wheel or spring-stretcher (refer to Fig. 5). Do not slide the shaft out of the cams in the rear stage. Push the shaft back into the switch and slip off the indent wheel and thin washer that is assembled between the indent wheel and front support. Remove the first barrier to expose the cams for contacts No. "1-2".

Check these cams against the cam arrangement drawing. Be sure the cam arrangement drawing is fully understood before disturbing the cams.

On the drawing, the cams for each stage are usually shown in horizontal rows of three cams, or two cams and a spacer. Beside each horizontal row are the numbers of the contacts, such as "1-2", with which the cams are used. The vertical rows are lettered "A", "B", and "C". Cam (A) is the one removed first, working from the front end of the switch, cam (B) next, and cam (C) last (see Fig. 5). Unless otherwise stated, the position of the cams on the drawing are for the twelve-o'clock switch position.

Remove the cams from the first stage, and after making sure there are no jumpers holding the barriers together, remove the barriers. Continue removing cams and barriers until the damaged part is reached.

SWITCH ASSEMBLY

To assemble the switch, place the rear support on the bench, with the rear side down, and with the

bolt heads against the bench, so they are retained in the rear support, with the threaded ends extending vertically. Place the end of the shaft in the rear support so the shaft stands vertically. Turn the shaft to the twelve-o'clock position, or to the switch postion that agrees with the cam arrangement as stated on the drawing. The cams for the rear stage may now be assembled in the exact position shown on the drawing, cam (C) first, cam (B) second, and cam (A) last. The remaining barriers and corresponding cams are similarly assembled. When the front barrier, which carries no contacts, is in place, assemble the indent wheel (or spring stretcher and torsion spring) with the counterbored end toward the front of the support. Pull the shaft out just enough to permit the locking pin to be inserted through the shaft. Push the shaft back into the switch and slide the thin washer over the shaft. Slide the front support into place. Hold the stack of barriers together and turn the switch to a horizontal position with the moving contacts pointed up.

If it is a maintaining-contact switch with a large indent wheel, that is, with the ball and spring in the fixed-contact support, or if it is a spring-return switch, the tie bolts may now be screwed into the front support. Before tightening the tie bolts be sure the barriers are all properly nested.

If the switch is a maintaining-contact switch with a small indent wheel, slide the front support forward enough so the ball may be placed into the socket in the front support and line up a notch in the indent wheel with the ball in the front support. Then the front support may be slid back into place against the front barrier. Make sure the barriers are all properly nested before tightening the tie bolts.

The fixed contacts and support may now be assembled on the switch. If the switch has a position where all the contacts are open, turn it to this position to assemble the fixed contacts and support.

SHAFT CHANGE

When it is necessary to change the switch shaft, that is, install a longer or shorter shaft, the switch may be dis-assembled as directed, or the new shaft may be used to push out the old shaft as follows:

If there is room enough behind the panel to work on the switch, it is not necessary to remove the switch. Otherwise the switch must be removed to a bench vise where the front support can be supported firmly, with the fixed contact at the top.

Remove the fixed-contacts and support. Remove the rear support, being careful to leave the rear cams on the shaft. Slide the complete stack including the indent wheel or spring stretcher, back on the shaft just enough to remove the locking pin that seats in the counterbore in the front end of the indent wheel. This leaves the shaft free to move through the switch.

First, check and make sure the tapped hole in the new shaft for the handle-holding screw aligns correctly with the hole in the old shaft. Then insert the new shaft into the rear end of the switch, and at the same time withdraw the old shaft from the front of the switch. The front end of the new shaft should touch the rear end of the old shaft at all times so that all the cams are on one shaft or the other and never loose within the switch.

Replace the locking pin. If the positioning ball has become dislodged, replace it in the manner previously described. Replace the rear support, tie bolts, and fixed contacts and support. Check for proper operation of the switch using the new shaft.

RENEWAL PARTS

Refer to Renewal Parts Bulletin GEF-2357. In the absence of a renewal parts bulletin address the nearest General Electric Sales Office, specify the quantity required, describe the part and give the complete data from the nameplate at the rear of the switch.