July 22, 1958 H. W. HERMANCE 2,843,869

ROTARY CLEANING TOOL

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FIG. 1

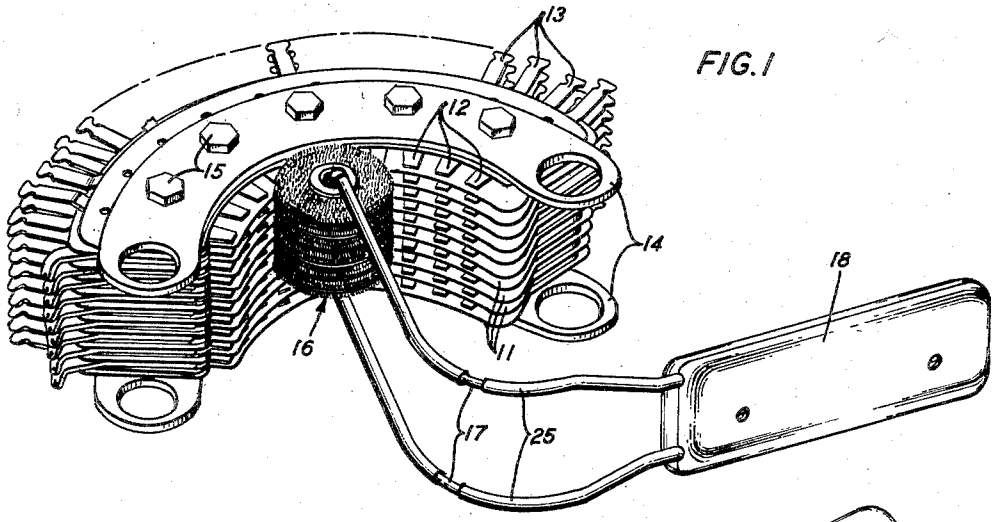


FIG. 2

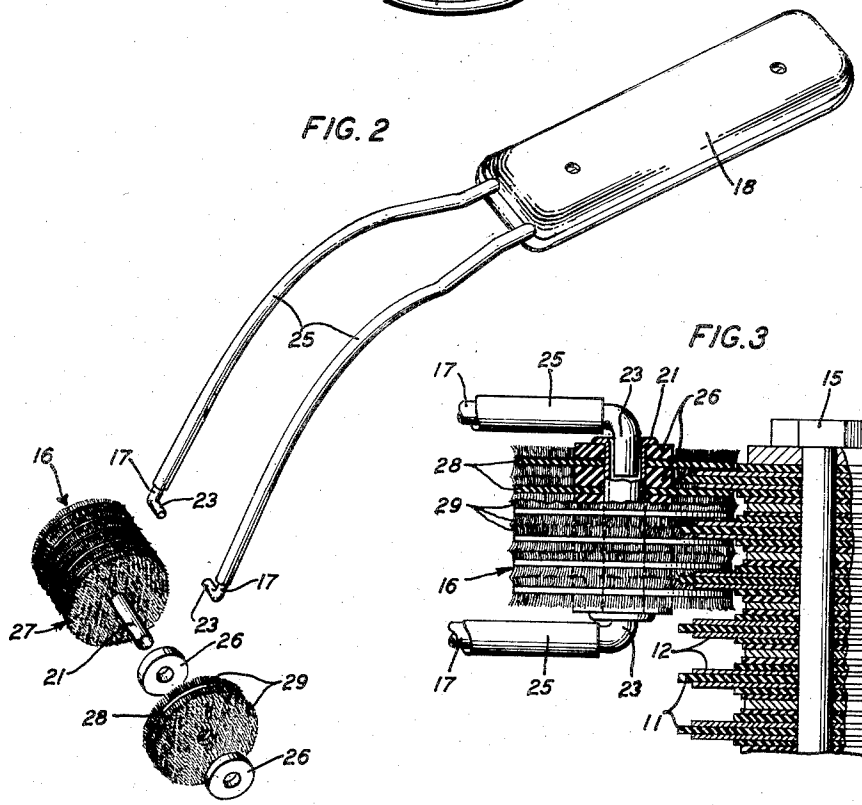


FIG. 3

INVENTOR
H. W. HERMANCE

BY Edwin B. Cave

ATTORNEY

United States Patent Office

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ROTARY CLEANING TOOL

Harold W. Hermance, Montclair, N. J., assignor to Bell Telephone Laboratories, Incorporated, New York, N. Y., a corporation of New York

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5 Claims. (Cl. 15—230)

This invention relates to a cleaning tool.

In the telephone switching art much use is made of rotary switches, as in "step-by-step" switching banks. These "step-by-step" switches commonly comprise a decade of stacked arciform or semicircular insulating plates, each plate bearing, for example, 10 electrical contacts, presenting a total array of 100 contacts available for switching use. An energized wiper arm sweeping over the switch contacts completes the electrical circuit after coming to rest on a selected contact. The switches may be used as connector switches or selector switches, and find many other uses in telephony.

The maintenance of switching banks has heretofore proved an expensive and time-consuming problem, particularly in urban telephone exchange offices. In such offices there are many switching banks whose contacts must be kept clean under difficult conditions. Air-borne mixtures of abrasive particles, fibrous particles, soot, and epidermal particles may be deposited on the contacts of the switching banks. Frictional and abrasive wear on sliding surfaces causes the accumulation of metal particles, and corrosion promotes further contamination of the bank contacts. Oil, used on the contacts, eventually is degraded and oxidized to gummy material. With the particulate matter depositing on the banks, the whole may form a tacky sludge which interferes seriously with proper mechanical and electrical functioning of the switches.

Periodic cleaning of switching banks is a regular chore in central telephone offices. Heretofore the cleaning has been commonly accomplished with a tool having a plurality of steel fingers. Cloth sleeving is drawn over the fingers of the tool, and by insertion and movement of the fingers between the plates of the switching bank the contacts have been cleaned. This method has proved to have many shortcomings.

The loading of the cloth sleeving on the fingers of the tool is tedious and time-consuming. Cleaning is not efficient, as the relatively unresilient fabric of the sleeving, backed by the steel fingers, may not reach sludge deposits deposited on the insulators, especially in the region of the contacts which are raised above the level of the insulators. Mechanical damage may be done to the banks by the force required to draw the steel fingers through the bank levels. Shearing forces are exerted on the fabric of the sleeves, causing tearing and wear of the sleeves. This wear results both in short sleeve life and in the deposit of threads and fibers in the switch bank, causing further contamination.

Accordingly, it is a general object of this invention to provide means for cleaning rotary switching banks in a cheap, rapid, and effective manner.

A further object of the invention is to provide a cleaning tool with cleaning surfaces which may be drawn over switching bank contacts with ease, resulting in less wear on the cleaning surfaces and less contamination of the cleaned contact.

Another object of the invention is to provide a cleaning tool which may be rapidly and cheaply replaced when the cleaning surfaces thereof become worn or soiled.

Other objects of the invention will become obvious in the discussion below of the features and operation of the cleaning tool herein described.

The objects of the invention are accomplished by a scrubbing tool comprising a rotary scrubbing unit, or scrubbing head, and a detachable handle for said unit. The scrubbing head is composed of a series of stacked discs faced with a deep-piled, napped, or tufted fabric. The fabric-coated discs are spaced one from another in the stack by an alternately interposed series of discs of smaller diameter. The entire stack of fabric-coated and spacer discs is mounted axially on a central shaft to make up the scrubbing head, and the ends of the shaft are engaged by the handle of the tool.

For cleaning, the scrubbing unit is slipped over the laminar insulator plates of a switching bank, the leaves of the bank fitting between adjacent fabric-coated discs. The spacer discs control the distance of separation between adjacent fabric-coated discs and may serve also as a stop to prevent too deep an insertion of the discs of the scrubbing unit between the insulator plates, if such is desirable. A simple pulling of the tool along the arc of the switching bank causes rotation of the scrubbing head, due to frictional drag between the cleaning surfaces and the bank being cleaned. A rotary scrubbing motion results which is exceedingly effective in removing adherent accumulated deposits of waste from the areas of the switching bank. If more positive scrubbing action is desirable, the scrubbing head may be fashioned from discs coated with a fabric which has an abrasive material capping the tips of the flexible pile. The scrubbing head may also be moistened in a non-conducting cleaning fluid before use to aid in the solution and dislodging of waste matter, if desired. If a residual oil film is wanted for lubrication purposes, it has proved advantageous to include small amounts of lubricating oil in the cleaner solvent. Evaporation of the solvent leaves the oil evenly distributed over the contacts.

When the fabric of the coated discs becomes excessively soiled or worn, the entire rotary scrubbing head assembly may be dismounted from the handle for cleaning or replacement.

Other features of the invention will become apparent in the following description of the drawings:

Fig. 1 is a perspective view of the tool herein described showing its use as a device for cleaning rotary switches;

Fig. 2 is an exploded perspective view showing the component parts of the cleaning tool; and

Fig. 3 is a front elevation, partly in section, showing the scrubbing head of the tool in position for cleaning a rotary switching bank.

In Fig. 1 is shown a typical rotary switch comprising stacked insulated plates **11**, electrical contacts **12** on said plates, terminals **13** for affixing wires, and means comprising clamps **14** and bolts **15**, for integrating the assembly. A cleaning tool as herein earlier mentioned, consisting of scrubbing head **16** made up partly of stacked discs and means, in this embodiment forked yoke **17** and

handle 18, for holding said scrubbing head, is shown applied to plates 11 and contacts 12 of the rotary switch. Cleaning of the switch is easily accomplished by rolling the rotary scrubbing unit, the component discs of which are interleaved with the stacked plates of the switch, back and forth along the length of the switch. The friction between brush and switch causes the cylindrical rotary scrubbing head to rotate as the tool is moved back and forth, imparting a scrubbing action to the piled fabric cleaning surface of the discs making up the scrubbing head. This rotation gives rise to a wiping or sweeping motion perpendicular to the direction of tool movement which is especially effective in cleaning. As the pile orientation of the fabric used to coat the cleaning discs is also continually changing, less channeling of the pile occurs, giving longer life to the cleaning surfaces of the discs.

Fig. 2 shows the components of the cleaning tool. In this preferred embodiment are shown handle 18, preferably made of some material such as plastic or wood. Bifurcated yoke 17 is preferably made of a rigid, springy material such as metal. In the embodiment shown, each arm of the yoke has been bent inward at its free end 23 to facilitate attachment of the yoke to a brushing head assembly. Tubular sheathing 25, such as of plastic or other insulating material, may be put on the yoke arms to protect against possible shorting of the switches while cleaning, if desired. A scrubbing head assembly comprises alternate spacer discs 26 and rigid or semiflexible discs 27 faced with piled fabric.

In order that discs 27 of the scrubber unit may mesh easily with the leaves of a switch, the discs should be sufficiently firm to resist compression along a line lying in the plane of the disc. There should be no excessive "mushing" or spreading of the discs when insertion between the leaves of a switch is attempted. The individual fabric-coated planar faces of the discs are the important cleaning elements and the integrity of the laminated structure is maintained by the mechanical properties of the discs.

Discs of the type shown as 27 in the figure, may be fabricated by cementing a napped fabric 29 to an inflexible or semiflexible central supporting portion 28. A satisfactory support has been found in phenol-fiber plastic. Another satisfactory structure, not shown, uses no central support but comprises two fabric sheets cemented back-to-back with tufted faces outward. Rigidity is supplied by the cementing agent itself. Neoprene or Buna-N rubber compositions, cured as the two fabric sheets are pressed together, have been used successfully. Some disc flexibility, such as is lent by a rubber type cement, may be desirable to aid in meshing the scrubber head and the switch bank plates without the near perfect alignment that interleaving rigid elements may require. This slight flexibility of the scrubbing disc in and out of its normal plane may be achieved without loss of the property of incompressibility of the disc along a line or lines lying in the plane itself. Both rigid and semiflexible discs may be mounted on the same shaft of a scrubbing unit, if desired.

The fabric coating the scrubbing discs is preferably a resilient piled material resembling velvet. The minute, closely-spaced tufts of the fabric accomplish a soft scrubbing of the parts being cleaned.

As mentioned earlier, the tips of these tufts may be capped with an abrasive. Silicon carbide of an average particle size of 5 microns to 10 microns has been used successfully. Only a small amount of abrasive is usually applied to the fabric surface so that the pile retains its resilience. The abrasive, held to the fabric with a solvent-proof glue, is best not deposited between the fabric tufts, immobilizing them.

Spacer discs 26 are preferably made of an insulating material such as rubber or phenol plastic.

All the discs comprising a scrubbing head assembly are conveniently mounted on rigid central shaft 21, made of a material such as brass. The ends of a shaft, if tubular, may be spun over to hold the discs in place on the shaft. The discs are commonly mounted under moderate compression so that, in the area surrounding the shaft, adjacent spacer discs and cleaning discs are fitted tightly together. Lateral wobble of the discs on the shaft is thus prevented. Shaft 21 shown is tubular, and simple insertion of inwardly-bent portions 23 of yoke 17 serve to unite the brushing head with the yoke and handle. This method of joining the brushing head and handle is especially convenient, as replacement of the brushing unit can be made simply. By spreading the arms of yoke 17, the brush may be removed, and a replacement unit inserted. If a solid shaft is used, the female socket may be incorporated into the handle assembly.

In Fig. 3 is shown a sectional view of a brush in position for cleaning a rotary switch. The assembly of yoke 17, covered with insulating material 25, and brushing head by insertion of bent end portions 23 into hollow spun-over shaft 21 is apparent. The alternate disposition of spacer discs and scrubbing discs, the latter comprising a rigid or semiflexible center lamina 28 and fabric facings 29, on shaft 21 can be seen. The fit of the brushing head on stacked plates 11 of a rotary switch is also depicted.

What is claimed is:

1. In a cleaning tool, a scrubbing unit, and means for grasping said unit, said scrubbing unit comprising a plurality of face-opposed planar scrubbing discs having scrubbing surfaces on both faces, which scrubbing discs are resistant to distortion from pressure applied in a direction perpendicular to the normal common to the planes of said scrubbing discs, a plurality of spacer elements of smaller area interposed alternately between said scrubbing discs, and a shaft on which said scrubbing discs and spacer elements are tightly mounted without freedom for lateral movement along the shaft.

2. In a cleaning tool, a scrubbing unit, and means for grasping said unit, said scrubbing unit comprising a plurality of face-opposed planar scrubbing discs having scrubbing surfaces on both faces, which scrubbing discs are resistant to distortion from pressure applied in a direction perpendicular to the normal common to the planes of said scrubbing discs, a plurality of spacer elements of smaller area centrally interposed alternately between said scrubbing discs, and an axial member on which said scrubbing discs and spacer elements are tightly mounted without freedom for lateral movement along the axial member and about which axial member they are rotatable.

3. In a cleaning tool, a plurality of face-opposed planar scrubbing discs having scrubbing surfaces on both faces, which scrubbing discs are resistant to distortion from pressure applied in a direction perpendicular to the normal common to the planes of said scrubbing discs, a plurality of spacer discs of smaller diameter interposed alternately between said scrubbing discs, a shaft on which said scrubbing discs and spacer discs are tightly mounted through their centers without freedom for lateral movement along the shaft, and means for grasping said shaft to permit rotation of said shaft about its longitudinal axis.

4. In a cleaning tool, means, comprising a handle and yoke, grasping a rotatable unit adapted to scrubbing, said rotatable scrubbing unit comprising a stack of planar scrubbing discs faced on both sides with napped fabric, said scrubbing discs being resistant to distortion from pressure applied in a direction perpendicular to the normal common to the planes of said scrubbing discs, a plurality of spacer discs alternately interposed between said scrubbing discs and of smaller diameter than said scrubbing discs, and a shaft on which said alternating scrubbing discs and spacer discs are tightly mounted through their centers without freedom for lateral movement along the shaft.

5. In a cleaning tool, a rotatable cylindrical scrubbing unit comprising a plurality of scrubbing discs faced on both sides with napped fabric, said scrubbing discs being resistant to distortion from pressure applied in a direction perpendicular to the normal common to the planes of said scrubbing discs, insulating spacer discs of smaller diameter alternately interposed between said scrubbing discs, a shaft on which said scrubbing discs and spacer discs are tightly mounted through their centers without freedom for lateral movement along the shaft, and means, comprising a handle and yoke, for grasping said shaft to permit rotation of said cylindrical scrubbing unit about the longitudinal axis of said shaft.

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