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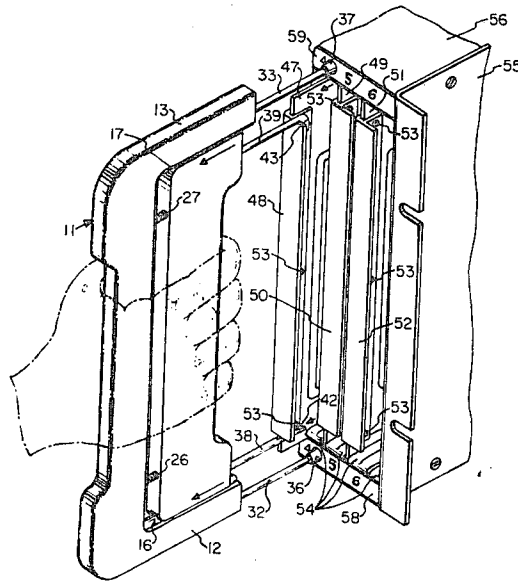
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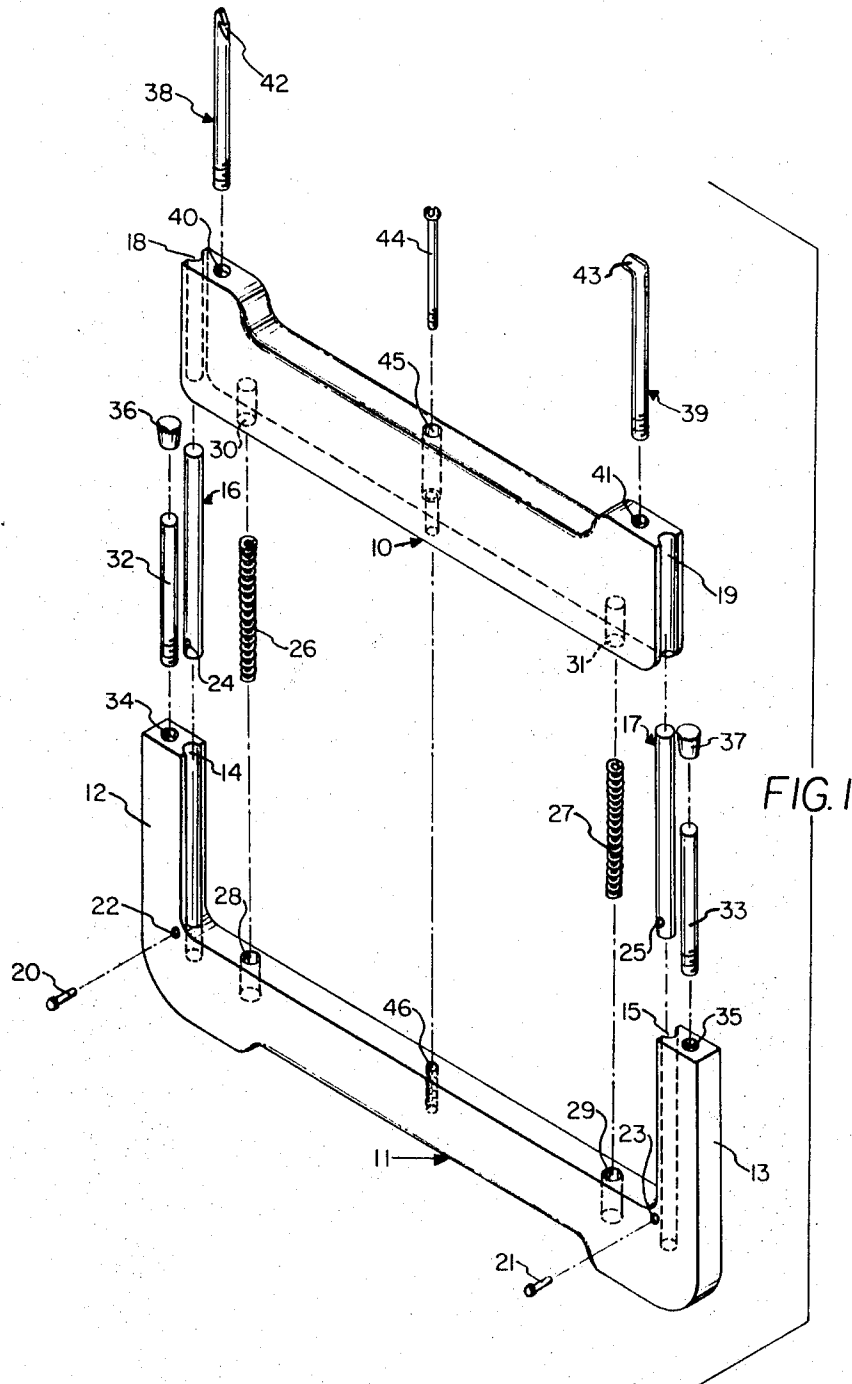
[54] **TOOL FOR EXTRACTING PRINTED CIRCUIT CARDS FROM CARD FILES**  
**6 Claims, 3 Drawing Figs.**

[52] U.S. Cl. .... **294/15,**  
 294/1, 29/278, 254/28  
 [51] Int. Cl. .... **B65g 7/02**  
 [50] Field of Search ..... 294/1, 15,  
 26, 34; 29/278; 254/28; 317/101, 119

[56] **References Cited**  
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**ABSTRACT:** A tool, for extracting printed circuit cards from a card file, having an inner grip section interlocked and slidably mounted within a U-shaped outer grip section, and held in this mounting by a slide-limiting screw having its threaded end secured in the outer grip and its head end slidably engaged by the inner grip. The inner grip is normally biased away from the outer grip and into engagement with the limiting screw by compression springs engaging both grips. Card extractor arms are permanently installed in the outer side edge of each end of the inner grip, and a pushoff rod is permanently installed in the end of each U-leg of the outer grip, with each rod extending in a plane parallel with the adjacent associated extractor arm.





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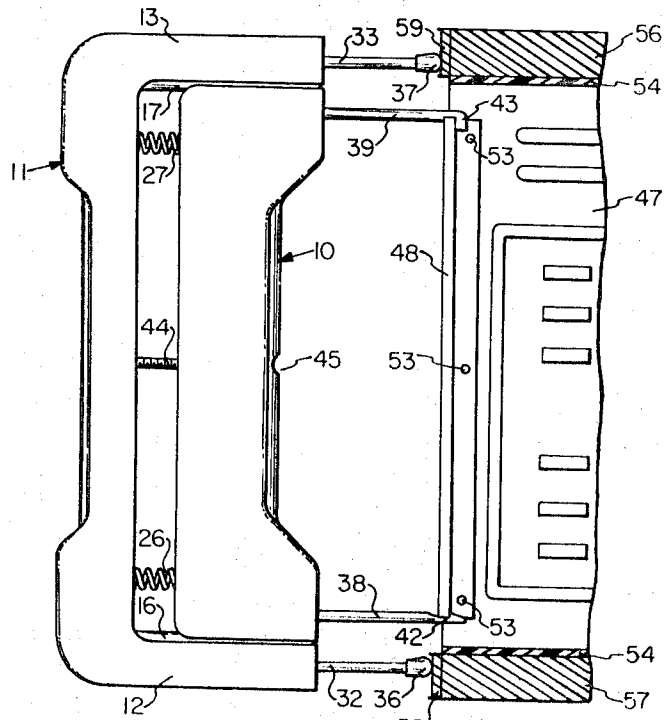


FIG. 2

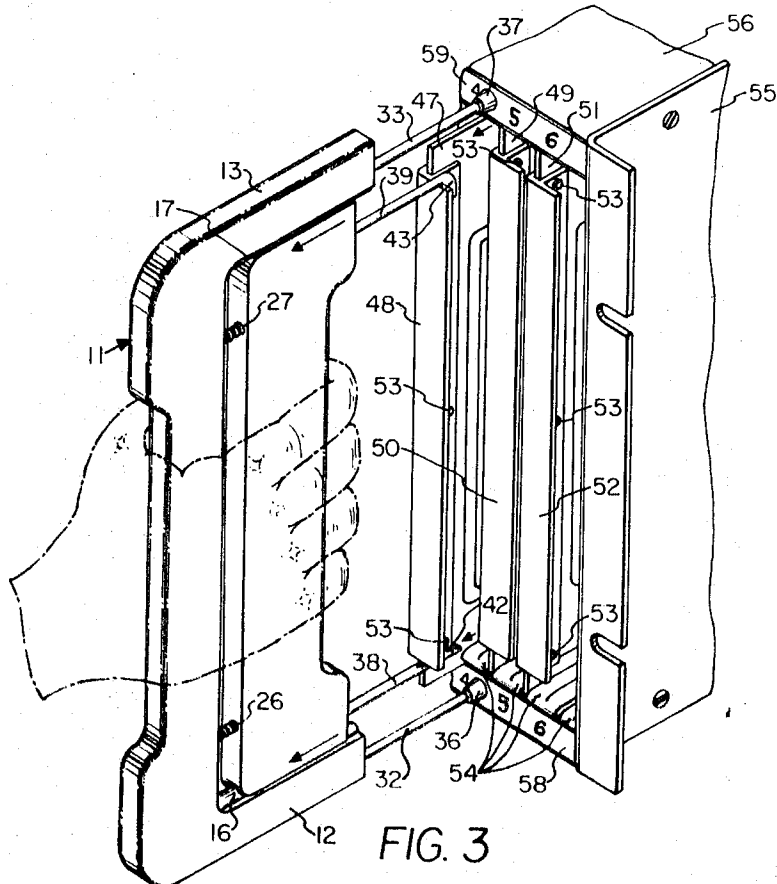


FIG. 3

## TOOL FOR EXTRACTING PRINTED CIRCUIT CARDS FROM CARD FILES

### BACKGROUND OF THE INVENTION

#### 1. Field

This invention relates in general to tools, and more specifically to hand-operated tools of the type adapted for use in extracting printed circuit cards from card-mounting files or racks.

#### 2. Prior Art

Since the advent of solid-state circuitry, as applied to the various types of circuit and switching techniques, there has been an ever-increasing demand on the quantity and quality of printed circuit cards for use therein. With this type of circuitry, it is considered standard procedure to either correct faulty components or to incorporate changes in an existing circuit merely by removing the faulty cards, or the cards requiring the circuit change, and substituting new cards in their place. As a result of the above procedure, it has been found necessary to devise some means for extracting the particular cards from the files without damaging the file spacers, the associated connector, adjacent cards, or the cards during their extraction.

Among the prior art devices for removing printed circuit cards from files and currently known to applicants are those wherein each printed circuit card has an individual built in handle, or bail, permanently attached thereto for removing the card from the file; and the arrangement disclosed in U.S. Pat. No. 3,271,626, issued Sept. 6, 1966 to P. P. Howrilka, wherein a pivotal manually operable ejector member is slidably positioned on a longitudinal rod individual to each printed circuit card file, or rack, for engaging a notch in the lower edge of the card to pull the card from the printed circuit connector.

It will be noted that both of the above-mentioned prior art devices for removing printed circuit cards are faced with the particular disadvantage, wherein their usage in an installation employing a large quantity of cards results in a considerable increase in the total cost of the installation due to the necessarily large number of extracting devices required for the installation. Since the printed circuit cards are closely mounted within adjacent spacers, and each of the cards are tightly engaged by their respective connectors, the prior art devices do not provide an extracting force that is equally distributed along the front edge of the card, whereby extraction of the card by the prior art devices often result in permanent damage to the card and/or its components.

Accordingly it is an object of the present invention to provide an improved hand-operated tool for extracting printed circuit cards from files, wherein the tool is economical and easy to manufacture, it requires no maintenance or adjustment, is rugged in construction, positive and effortless in operation, is easily portable to serve entire installations and does not damage the printed circuit card or components when properly used.

### SUMMARY OF THE INVENTION

Briefly, in accordance with the invention, a hand-operated tool for extracting printed circuit cards from card mounting files is provided, whereby the tool comprises an inner grip section in an interlocking slidable mounting within a U-shaped outer grip section. This combined interlocking slidable mounting is provided by means of a length of guide rod, having a diameter substantially less than the thickness of the grip sections, being securely mounted within a longitudinal concave surface formed in each inner side edge of each leg of the U-shaped outer grip, with each of the guide rods engaged by a corresponding longitudinal concave surface formed in each outer end edge of the inner grip. This inner grip section is held in the slidable mounting arrangement by means of a locking bolt extending through a centrally located hole provided therein and secured in a threaded hole in a corresponding location in the outer grip. The head of the locking bolt is en-

gaged by the inner grip at a particular point in the outward sliding movement of the inner grip for limiting this outward movement. The inner grip section is normally biased away from the outer grip section by means of compression springs inserted into opposite, or facing, retaining holes provided in both grip sections, whereby the locking bolt head is engaged by the inner grip section as mentioned above. A threaded pushoff rod is permanently installed in threaded holes provided in the ends of each leg of the U-shaped outer grip and a threaded extractor arm is permanently installed in threaded holes provided in the outer side ends of the inner grip, with each extractor arm being adjacent to and parallel with a corresponding pushoff rod.

It will be noted that the two grip sections and the guide rods are preferably of a plastic type material, whereby the noncorrosive, self-lubricating and electrically nonconductive properties of the plastic are incorporated as desirable features in the construction and use of the tool.

### DESCRIPTION OF THE DRAWINGS

The nature of the invention and its distinguishing features and advantages, which reside in the construction and arrangement and combination of parts thereof, will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is an exploded isometric view of the card-extracting tool;

FIG. 2 is a side view of the tool showing it in the proper card-engaging position; and

FIG. 3 is an isometric view showing the tool in an extracting operation.

### DETAILED DESCRIPTION

#### Structure

Referring now to the drawings, and in particular to FIG. 1, the printed circuit card-extracting tool consists of a substantially flat, rectangular-shaped inner grip section 10 arranged in an interlocking slidable mounting within legs 12 and 13 of correspondingly flat U-shaped outer grip section 11. This combined interlocking and slidably mounting arrangement is provided by permanently mounting guide rods 16 and 17 in respective longitudinal, concave surfaces 14 and 15, which are formed in the inner side edges of legs 12 and 13 of the outer grip 11. Permanent mounting of the guide rods 16 and 17 is accomplished by respectively inserting dowel pins 20 and 21 through holes 22 and 23 of legs 12 and 13 and into holes 24 and 25 of guide rods 16 and 17. It will be noted that the overall length of inner grip 10 is slightly less than the distance from the inner side edge of leg 12 to inner side edge of leg 13, and that longitudinal concave surfaces 18 and 19 are formed in the outer end sides of inner grip 10 for respectively engaging guide rods 16 and 17, in response to assembly of the inner grip 10 within the outer grip 11.

Retaining holes 28 and 29, of a diameter sufficiently large enough to accommodate respective ends of compression springs 26 and 27, are drilled into the inside bottom edge of outer grip 11 to a depth sufficient to hold at least half of each of the compression springs 26 and 27 when they are compressed. Corresponding 19 21 holes 30 and 31, positioned wherein they face holes 28 and 29 respectively, are drilled into the bottom edge of inner grip 10 to a depth similar to that of holes 28 and 29 to accommodate the respective other ends of compression springs 26 and 27, whereby they will hold the remaining halves of the compression springs 26 and 27 when they are compressed.

Locking bolthole 45 is drilled in a lateral direction from the midpoint of the upper side edge through inner grip 10, with it being noted that the diameter of the upper, or outer, portion of the hole is sufficient to accommodate the head of locking bolt 44, while the diameter of the lower portion of the hole is reduced to accommodate only the threaded body portion of the locking bolt. Threaded hole 46 is provided at the midpoint

of the inside bottom edge of outer grip 11, whereby the threaded end of locking bolt 44 may be secured therein as will be described hereafter.

Pushoff rods 32 and 33 are permanently attached to legs 12 and 13 of outer grip 11 by securing their threaded ends within the threaded holes 34 and 35, respectively. The outer ends of pushoff rods 32 and 33 are respectively covered by rubber-type tips 36 and 37, which not only insulate, but also tend to prevent slipping of the pushoff rods on the racks during operation of the tool.

Extractor arm 39 is permanently attached to the inner grip 10 by securing its lower threaded end within threaded hole 41, with arm 39 being rotated to a specific point, whereby the upper end hook portion 45 points inward in a direction parallel with the upper side edge of inner grip 10.

Extractor arm 38 is also permanently attached to inner grip 10 by securing its lower threaded end within threaded hole 40, with arm 38 being rotated to the point, whereby the upper end notched portion 42 points inward toward the hook portion 45 of arm 39.

Final assembly of the tool is accomplished by inserting one of the ends of compression springs 26 and 27 into the respective retaining holes 28 and 29, and thereafter sliding inner grip 10 down within legs 12 and 13 of outer grip 11, with concave surfaces 18 and 19 respectively engaging guide rods 16 and 17. As inner grip 10 slides downward toward the bottom portion of outer grip 11, the other ends of the compression springs 26 and 27 will enter the retaining holes 30 and 31, and after reaching the bottom thereof will oppose further movement of inner grip 10 toward outer grip 11. Locking bolt 44 is thereafter inserted through locking hole 45 and screwed into threaded hole 46 until the outward biasing action of compression springs 26 and 27 is sufficiently overcome, whereby the head of bolt 44 engages the bottom of the large diameter portion of hole 45.

Inner grip 10 is thus interlocked within outer grip 11, whereby only a slidable longitudinal movement of inner grip 10 with respect to guide rods 16 and 17 in outer grip 11 is allowed. The extracting tool is now completely assembled as shown in its normal inoperative condition in FIG. 2.

#### Operation

An operational description explaining the extraction of a printed circuit card from a file by means of the tool will now be covered, reference being had with FIGS. 2 and 3 in particular.

In order to more readily understand the extracting operation, a brief structural description of a typical printed circuit card file will first be given, wherein it will be seen that the file consists essentially of top wall 56 and bottom wall 57 being held in the proper position by a right end plate 55 and a similar left end plate (not shown). Combined card guides and spacers such as 54 are mounted to the respective inside bottom and top surfaces of top wall 56 and bottom wall 57. The card guides and spacers 54 serve the dual function of holding the printed circuit cards in their proper spaced relationship with one another, and of guiding the rear, or terminal ends, of the printed circuit cards into a tensioned frictional engagement with their respective connectors (not shown), which are located and attached to the rear of the file. It will be noted that the printed circuit cards 47, 49, and 51, such as shown in FIG. 3, each have a respective stiffener, or handle, 48, 50, and 52 attached to their front edges by means of rivets 53. These stiffeners not only serve to prevent the cards from bending so as to protect their delicate circuitry but also serve as an easy means for proper handling of the cards.

Although the extracting tool will function equally well in either of two extracting positions, it will be assumed for the purpose of this description that the tool is held in the preferred position such as shown in FIGS. 2 and 3, wherein the extractor arm 39 and its associated hook 43 is the upper, or top, arm.

It will also be assumed for the purpose of this description that printed circuit card 47 will be removed from the file. The extracting tool is attached to stiffener 48 of card 47 in the fol-

lowing manner, wherein hook 43 of arm 39 is first positioned on the top end of stiffener 48, with the bottom part of the tool-containing arm 38 and its associated notch 42 being rotated outward away from the stiffener 48 a sufficient amount whereby hook 43 is positioned behind the top end of stiffener 48. The bottom part of the tool is then rotated inward toward stiffener 48, with the lower end thereof sliding up the slanted point of extractor arm 38, against a slight amount of spring action of arm 38, until notch 42 snaps into positive engagement with the lower end of stiffener 48. At this point in the description, the extracting tool is in the position such as specifically shown in FIG. 2, wherein the upper and lower ends of stiffener 48 are respectively engaged by hook 43 and notch 42 of arms 39 and 38, and tips 37 and 36 of pushoff rods 33 and 32 are resting against number plates 59 and 58 of top and bottom walls 56 and 57, respectively.

Referring now to FIG. 3, it will be seen that printed circuit card 47 is removed from its frictional engagement with its associated connector merely by manually squeezing the fingers against inner grip 10. Since the ends of pushoff rods 33 and 32 are resting against number plates 59 and 58 respectively, as mentioned above, inner grip 10 will move in the direction of the arrows to pull card 47 from its connector, also in the direction of the arrows. The tool may thereafter be detached from card 47 and the card withdrawn from the file by hand, or the card may be completely removed from the file by means of the tool and subsequently detached therefrom. The other printed circuit cards such as 49 and 51 may be removed from the file in the same manner.

From the foregoing it is therefore quite evident that an improved hand-operated tool is provided for extracting printed circuit cards from files, wherein the tool is easy to manufacture and assemble, is simple to operate, requires no maintenance and does not damage the printed circuit cards and components during the removal operation.

Having described our invention, what is considered new and is desired to have protected by Letters Patent will be pointed out in the appended claims.

What is claimed is:

1. A hand-operated tool for extracting printed circuit cards from card-mounting files, comprising: a substantially flat U-shaped outer grip section having a longitudinal concave surface formed in the interior edge of each leg of said U-shaped member; a guide rod securely mounted in said concave surface of each said leg such that a portion of each said rod extends above the inner surface of said leg; a generally rectangular shaped inner grip section having a concave surface at each end for cooperating with said exposed portions of said rods to interlock said inner grip section with said outer grip section and provide for slidable longitudinal movement of said inner grip section within said U-shaped outer section and a printed circuit card extractor arm for each end of said inner grip section, said arms having one end attached to the corresponding end of said inner grip section and extending in a plane parallel with said outer grip section.

2. A printed circuit card-extracting tool in accordance with claim 1, including a locking bolt extending through said inner grip section, in a plane parallel with said extractor arms, and permanently secured in said outer grip section for limiting the maximum outward slidable movement of said inner grip section within said outer grip section.

3. A printed circuit card-extracting tool in accordance with claim 2, further including biasing means mounted in both said outer grip section and said inner grip section, for normally biasing said inner grip section away from said outer grip section and into engagement with said locking bolt.

4. In an arrangement for extracting printed circuit cards from a card mounting file having a plurality of printed circuit cards mounted therein; a stiffener mounted along the front exterior edge of each of said printed circuit cards; a hand-operable tool comprising a substantially flat U-shaped outer grip section having a longitudinal concave surface formed in the interior edge of each leg of said U-shaped section; a guide rod

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securely mounted in said concave surface of each said leg such that a portion of each said rod extends above the inner surface of said leg; a generally rectangular shaped inner grip section having a concave surface at each end for cooperating with said exposed portions of said rods to interlock said inner grip section with said outer grip section and provide for slidable, longitudinal movement of said inner grip section within said U-shaped outer section; and a printed circuit extractor arm for each end of said inner grip section, said arms having one end attached to the corresponding end of said inner grip section and extending in a plane parallel with said outer grip section, the free end of said extractor arms including means for engaging said stiffener.

5. An arrangement for extracting printed circuit cards from a file in accordance with claim 4, including a locking bolt extending through said inner grip section, and permanently secured in said outer grip section for limiting the maximum

outward slidable movement of said inner grip section within said outer grip section; and including a pair of biasing springs secured at one of their ends of said inner grip section, and at the other of their ends in said outer grip section for normally biasing said inner grip section away from said outer grip section and into engagement with said locking bolt.

6. An arrangement for extracting printed circuit cards from a file in accordance with claim 5, wherein said free end of one of said extractor arms is bent to form a hook to engage said stiffener and said free end of the other said extractor arm includes a slanted point and a notch, whereby in preparation for extracting a card said hook is engaged with one end of said stiffener and said tool is rotated to engage said slanted point of said end with the opposite end of said stiffener to snap said notch into engagement with the associated stiffener end.

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