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3,465,197

MICROMINIATURE LAMP ASSEMBLIES

Filed May 1, 1967

2 Sheets-Sheet 1

FIG. 1.

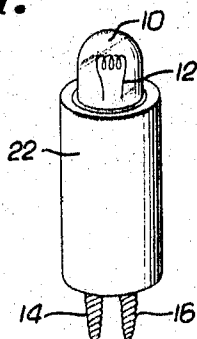


FIG. 2.

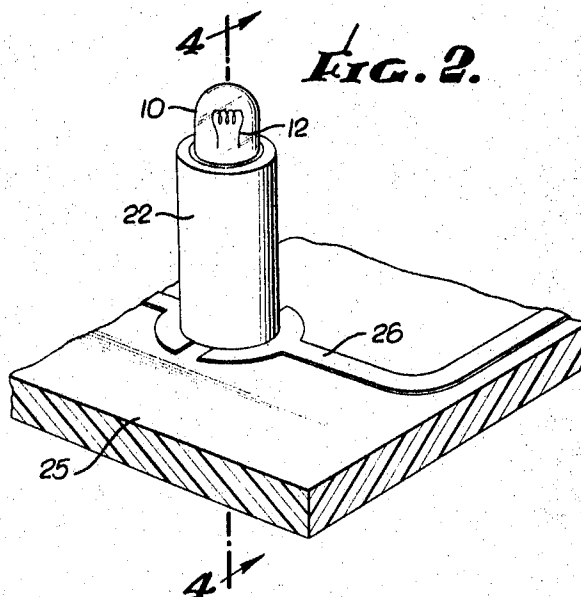


FIG. 3.

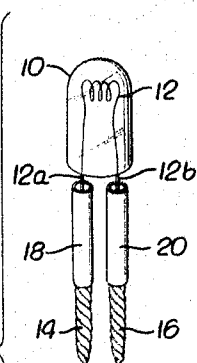


FIG. 5.

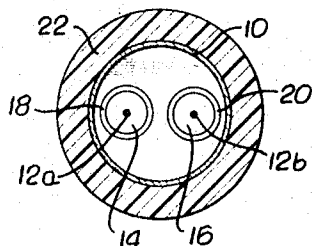


FIG. 4.

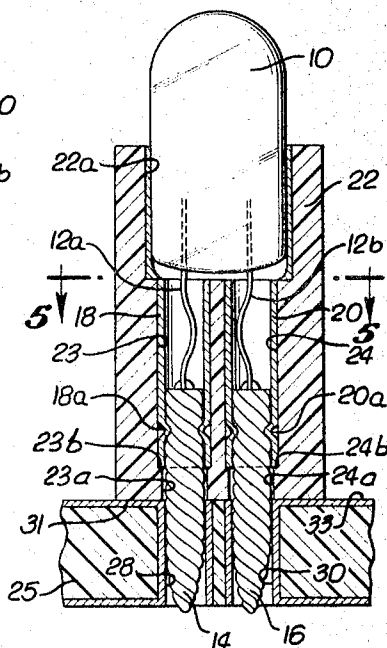
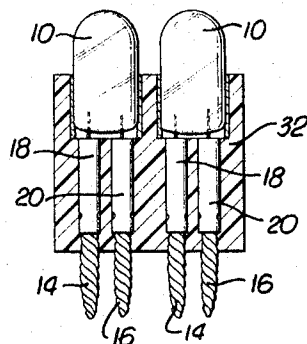


FIG. 6.



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FIG. 7.

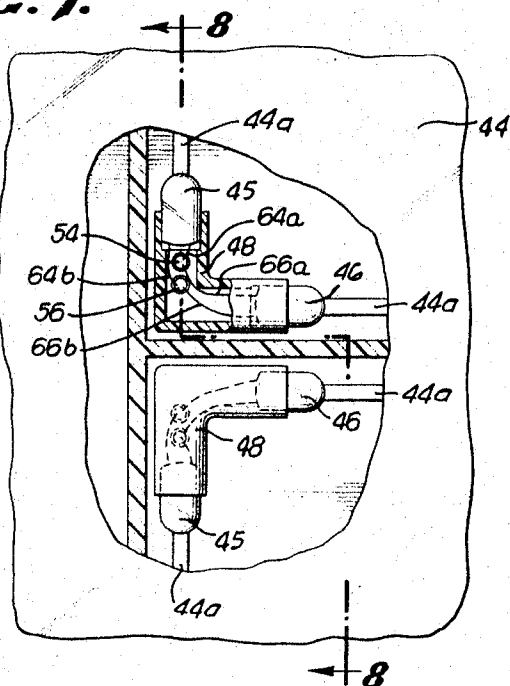


FIG. 8.

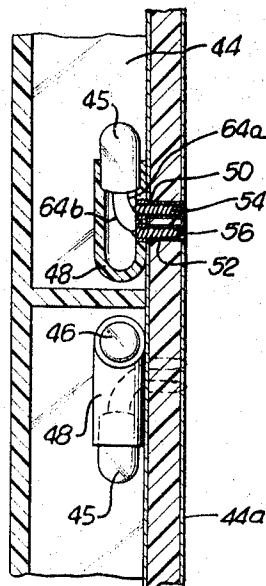


FIG. 9.

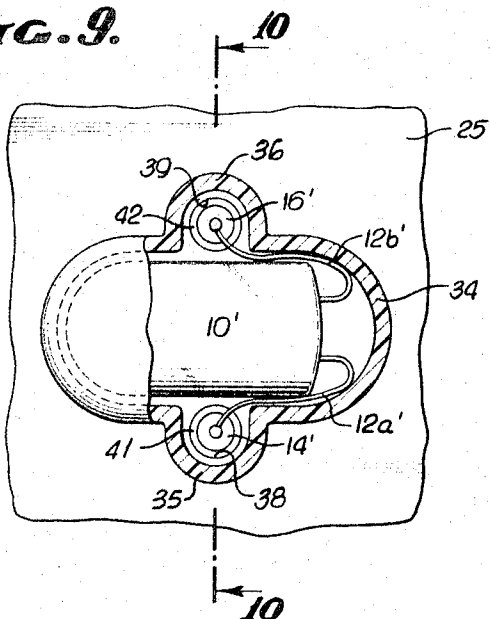
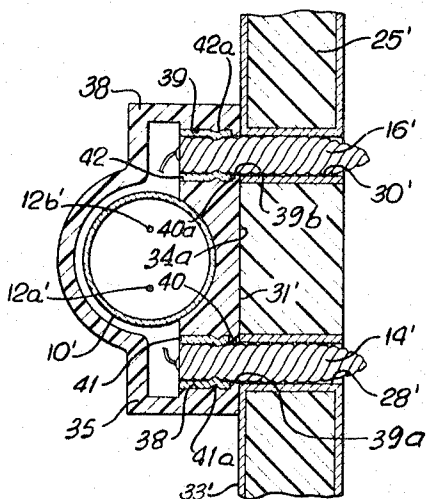


FIG. 10.



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MICROMINIATURE LAMP ASSEMBLIES

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8 Claims

ABSTRACT OF THE DISCLOSURE

Microminiature lamps formed with an envelope containing an illuminating filament electrically connected by a pair of filament wires to a pair of pin connectors of the type which are comprised of a group of spiral wound wire strands which resiliently compress to provide a tensioned fit within mating electrical contact sockets. A collar surrounds the filament wires and is overlappingly attached to the interconnected portions of the envelope and the pin connectors.

BACKGROUND OF THE INVENTION

This invention relates to illuminating lamp assemblies, and more particularly to microminiature lamp assemblies having twisted wire pin connectors especially adapted for utilization in printed circuit boards and the like.

Prior to this invention microminiature lamp assemblies, such as were commonly used in conjunction with printed circuit boards, were not readily removable from the boards. Generally, the need for secure attachment to maintain uninterrupted electrical contact when subjected to vibration necessitated a relatively permanent attachment of the lamp assemblies to the board. Thus, replacement of the lamp assemblies required cutting of the connectors and attachment of the new lamp assemblies by such time-consuming methods as soldering. Moreover, the lamp assembly units were often not interchangeable so that a number of different types of replacement units were required.

Although microminiature lamp assemblies having quickly detachable pin and socket type electrical connectors were considered desirable, the sacrifice involved in size, weight and reliability using conventional connectors was too great to render their utilization practical. To understand the problems involved, the extremely small size of microminiature electrical components should be appreciated. Thus, generally speaking, microminiature components can be categorized by reference to the size of their socket contacts as those which are .031 inch or less in diameter.

Conventional pin and socket type connectors require substantial space and weight allowances that decrease the advantages of utilizing microminiature lamps. In addition, they are not capable of solving the critical design problems presented by microminiaturization of maintaining electrical contact within a small surface area while providing positive electrical connection during vibration and shock condition.

SUMMARY OF THE INVENTION

Therefore, it is a primary object of this invention to provide a lamp assembly, suitable for utilization with printed circuits, which is readily replaceable, interchangeable, and securely connected to provide uninterrupted electrical contact under adverse environmental conditions.

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A microminiature lamp assembly, in accordance with the objectives of this invention, includes a sealed illuminating envelope within which is contained a light-emitting filament that is electrically connected to twisted pin type base contact members. A group of helically wound strands of wire comprises the outer periphery of the contact members which are adapted to be inserted in complementary sockets or plated through holes of a printed circuit board so as to resiliently engage the interior walls thereof, and thereby eliminate disengagement induced by vibrational stress.

Another advantage of this assembly is that it may be used with circuit boards of different thickness depending upon application.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a perspective view of a vertical-type microminiature lamp in accordance with this invention.

FIGURE 2 is a perspective view of a microminiature lamp, as in FIGURE 1, inserted in operative position in a printed circuit board.

FIGURE 3 is an exploded perspective view of the separated components of a microminiature lamp, as shown in FIGURE 1.

FIGURE 4 is an enlarged, vertically sectioned view of a microminiature lamp inserted in a printed circuit board, taken through 4—4 in FIGURE 2.

FIGURE 5 is a cross-sectional view of a microminiature lamp taken through 5—5 in FIGURE 4.

FIGURE 6 is a vertically sectioned view of a pair of vertical type microminiature lamps which have a common collar assembly.

FIGURE 7 is a fragmented top plan view of two pairs of horizontal type microminiature lamps in accordance with this invention, disposed in the corners of an annunciator assembly utilizing a printed circuit board.

FIGURE 8 is a sectioned view of the microminiature lamps and annunciator panel taken through 8—8 in FIGURE 7.

FIGURE 9 is a partly sectioned, top plan view of another horizontal type microminiature lamp inserted in a printed circuit board.

FIGURE 10 is a cross-sectional view taken through 10—10 in FIGURE 9 of the microminiature lamp and portion of the printed circuit board within which it is mounted.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A single bulb microminiature lamp assembly embodying a vertical type form of this invention is illustrated in FIGURES 1-5. Basically, as best viewed in FIGURE 3, the lamp assembly is comprised of a sealed, transparent—or at least translucent—cylindrically elongated illumination envelope 10, which is bulb-shaped at its free end and contains a partly curled, slender, wire-type, light emitting filament 12 within it. Two spaced portions of filament wires 12a and 12b, extending from and supporting the opposite sides of filament 12, protrude through the somewhat flattened end of the envelope 10, which is opposite from the bulb-shaped end thereof. Such an assembly is known as an incandescent miniature lamp. After extending a short distance exterior of envelope 10, the wires are attached by soldering or other means to spaced, axially parallel, elongated, twisted pin connectors 14 and

16, respectively. The size of this envelope is about .096 inch in diameter, and about .210 inch long.

Pin connectors 14 and 16 are preferably of the type which are comprised of seven strands of .005 inch diameter spring copper wire wound helically around a copper core of three strands of .0035 inch diameter soft copper wire. Such a connector bulges centrally to about .025 inch in diameter and terminates in a smaller rounded end. It is substantially axially rigid, though it can be resiliently compressed in diameter.

Surrounding the portions of the wires 12a and 12b that extend between the envelope 10 and the attached connectors 14 and 16 are rigid, hollow, cylindrical sleeves 18 and 20, respectively. These sleeves are slightly larger in internal diameter than the adjacent portion of the connectors 14 and 16. Moreover, they are preferably long enough to extend from adjacent the envelope 10 to slightly overlap the connectors 14 and 16 to which they are secured by circumferentially indented gripping crimps 18a and 20a, respectively.

A hollow, cylindrically shaped collar 22 overlappingly extends from and encompasses the connected end portion of the envelope 10, surrounds entirely the sleeves 18 and 20, and terminates surrounding the attached end portions of the connectors 14 and 16. This collar 22 serves as an insulator, lamp mounting structure and spacer for the lamp assembly which, as shown, is about .260 inch long. The internal shape of collar 22 is formed to conform with the external configuration of the portion of the lamp assembly which it encompasses. It is secured in place by the application of a clear, transparent, sealant type potting compound between its internal surfaces and the external surfaces of the adjacent components of the lamp assembly. Thus, as shown in FIGURE 4, the collar 22 is formed with a cylindrical cavity 22a conforming to and receiving the connected end portion of envelope 10. Communicating herewith and in axial alignment with said cavity 22a are parallel elongated bores 23 and 24 to receive sleeves 18 and 20 respectively. Also the collar 22 includes two generally parallel bores 23a and 24a of reduced size which extend from the end 31 of the collar 32 and communicate with bores 23 and 24. Because of the reduced diameter of the bores 23a and 24a shoulders 23b and 24b are formed at the bottom of bores 23 and 24, which act as stops for the sleeves 18 and 20.

The lamp assembly is intended to be inserted into the circuit of a printed circuit board 25. Thus, a printed circuit 26 in board 25 incorporates a pair of plated through holes 28 and 30 which act as electrical sockets and are slightly smaller in diameter than the pin connectors 14 and 16. These holes 28 and 30 have the same relative spacing as the pin assembly 14 and 16 in order to provide continuous electrical contact with the circuit 26. The interior plating of the sockets is with an electrically conductive material which provides an uninterrupted continuation of the printed circuit 26 therein. The interchangeability of these lamp assemblies permits the use of circuit boards with different thicknesses ranging from .062 to .125 inch, depending upon the application. Other assemblies can be used to expand this range depending upon the particular requirement.

When the pin connectors 14 and 16 are inserted into the mating sockets 28 and 30, the connectors elongate and twist as the wire strands of which they are comprised are abuttingly compressed within the walls of the sockets. Insertion of the lamp assembly connectors is limited by the abutment of the bottom surface 31 of collar 22 against the top surface 33 of the portion of printed circuit board 25 which surrounds sockets 28 and 30, as best viewed in FIGURE 4. Tight spring-tensioned electrical contact between each of the connectors and its mating socket is maintained along seven spiral lines corresponding to the outer strands of the twisted wire comprising the connectors.

In another form of this invention, shown in FIGURE

6, a vertical type pair of lamp assemblies, as previously described and with like numerals designating like parts, is encompassed by a single insulator collar 32 having an interior hollow shape complementary with both assemblies, instead of each lamp assembly having a separate collar. The sockets for these connectors are located in the circuit (not shown) into which these lamp assemblies are to be inserted, to provide a suitable mating engagement therewith. The collar 32, like collar 22, encompasses the sleeves and overlappingly extends from an intermediate portion of the envelope 10 to an intermediate portion of the connectors 14 and 16, which limits their insertion in the sockets.

In still another form of this invention, as shown in FIGURES 7, 8, 9 and 10, the lamp assemblies are of the horizontal type. That is, these lamp assemblies are comprised of the same basic components (which carry like prime numbers) as previously described, but the axes of the pin connectors 14 and 16 are perpendicular to the axis of the miniature lamp envelope 10 instead of axially parallel to a common line, as in the vertical type of lamp assembly.

Thus, when the pin connectors 14' and 16' of a horizontal type lamp assembly, as in FIGURES 9 and 10, are inserted in the complementary mating plated through holes 28' and 30' of a printed circuit board 25', the envelope 10' thereof lies flat adjacent to the top surface 33' of the circuit board 25', with its axis substantially parallel with the plane of the circuit board. In this form the long, tubular sleeves 18 and 20 are eliminated to allow for the turning of the filament wires 12a' and 12b' between their entry into the envelope 10' and their attachment to the pin connectors 14' and 16', respectively.

To secure the operative components of a horizontal type lamp assembly in position, a specially shaped hollow insulator collar 34 is utilized. This collar 34 is generally oblong and formed with a longitudinal, rounded, internal configuration conforming roughly to the shape of the envelope 10' contained therein. The top surface of collar 34 bulges in conformity with the shape of envelope 10', and the bottom surface 34a is flat so as to correspond with the flat top surface 33' of a printed circuit board 25' against which it is to lie. An opening or translucent portion of collar 34 adjacent to the envelope 10' permits the internal illumination to shine through.

On opposed sides of the collar 34 rounded ear portions 35 and 36 are formed. These ear portions 35 and 36 are each provided with bores 38 and 39 respectively which communicate with the interior of the collar 34 and extend normal to the longitudinal axis of the collar 34. Extending inwardly from flat surface 34a of collar 34 and communicating with bores 38 and 39 are reduced bores 39a and 39b forming annular shoulders or stop means 40 and 40a.

These shoulders 40 and 40a serve as stop means for sleeves 41 and 42 which are seated in bores 38 and 39. The sleeves are formed with crimps 41a and 42a for retaining the pins 14' and 16'. Additionally a potting compound may be used to secure the sleeves 41 and 42 in position in the bores 38 and 39.

Another embodiment of the horizontal type lamp assemblies is illustrated in FIGURES 7 and 8. Here they are being used to illuminate the corners of an annunciator assembly 44 which includes a plated circuit 44a. Thus, instead of one illuminating envelope per lamp assembly, a pair of miniature lamps 45 and 46, which are axially disposed in the same plane but aligned normal to each other, are included in each lamp assembly.

An open-ended L-shaped collar 48, with an internally hollowed configuration adapted to conform at each end to the external periphery, surrounds each of the envelopes 45 and 46. It supports these envelopes in position so that their bulb-shaped filament illuminating ends protrude from the open ends of the collar 48.

A pair of tubular holes extends normally through a central bottom portion of the collar 48. Mounted within these holes is a pair of complementary sleeves 50 and 52, within which a pair of elongated complementary pin connectors 54 and 56 is secured. The pin connectors are the type previously described.

These pin connectors 54 and 56 protrude through the flat bottom surface of the collar 48 and are inserted into the mating plated through holes in the annunciator circuit board 44 to secure the lamp assembly in place and serve as the common electrical contacts for both envelopes 45 and 46. That is, filament wire 64a from envelope 45 and filament wire 66a from envelope 46, extend through collar 48 to become attached to pin connector 54, and filament wire 64b from envelope 45 and filament wire 66b from envelope 46 extend through collar 48 to become attached to pin connector 56.

The microminiature lamp assemblies can be assembled singly or in clusters. In the latter case, the reduction in the size of the sockets permits a greater density of lamps than was heretofore possible. Also the lights, depending upon the circuit board configuration and/or lamp assembly utilized, may be arranged in series or parallel.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and devices.

What is claimed is:

1. A microminiature lamp assembly comprising: a sealed, transparent envelope; an illuminating filament contained within said envelope and adapted to be electrically energized; a pair of axially parallel, elongated, rigid, spaced, electrical pin connectors comprised of resiliently compressible, helically wound strands of wire; a pair of filament wires extending from said filament through said envelope and permanently secured with said pin connectors; a pair of tubular sleeves each formed complementary with and crimped around a portion of each of said pin connectors adjacent said filament wire securements; and a rigid, hollow, translucent insulating collar encompassing a portion of said envelope and extending outward therefrom and encompassing an intermediate point of said pin connectors and completely surrounding said filament wires and said sleeves, said collar being internally formed complementary with the encompassed portion of said envelope and the encompassed portions of said tubular sleeves, whereby said electrical pin connectors are adapted to engage a source of electricity and energize said illuminating filament.

2. A microminiature lamp assembly as defined in claim 1, wherein said sleeves surround each of said filament wires protruding therefrom, said envelope is elongated and axially aligned parallel with the extended axes of said electrical pin connector and said sleeves, said collar is tubular and the encompassing complementary portions of said collar are formed with internal shoulders abutting the termination of said sleeves remote from said envelope and said portions are reduced in diameter complementary with said electrical pin connectors from said shoulders to end of said collar remote from said envelope.

3. A microminiature lamp assembly as defined in claim 2, wherein the spaces between said collar and the encompassed portions of said lamp assembly are filled with a potting compound sealant.

4. A microminiature lamp assembly as defined in claim 1, wherein a plurality of said lamp assemblies is encompassed by a common collar.

5. A microminiature lamp assembly as defined in claim 1, wherein the envelope is elongated and axially perpendicular with the axes of said electrical pin connectors, an

interior portion of the collar substantially conforms to the shape of said envelope and is formed with a pair of opposed hollow ear portions laterally protruding from said collar and communicating with the interior of said collar, said ear portions each has a tubular bore complementary in size with the exterior of the sleeves and extending normal to the axis of the collar and axially parallel with each other, said envelope is mounted within said conforming portion of the collar, said pair of sleeves with the pair of electrical pin connectors fixedly secured therein are mounted within the tubular bores so that the electrical pin connectors protrude therefrom, and stop means in said bores to arrest outward axial movement of said electrical pin connectors.

6. A microminiature lamp assembly as defined in claim 1, which includes two elongated illuminating envelopes with their axes disposed in the same plane perpendicular to each other and the axes of the pair of electrical pin connectors are parallel with each other and perpendicular to the plane of said envelope, the filaments in said envelope are fixedly electrically connected by filament wires to said electrical pin connectors as common electrical contacts, the collar is L-shaped and formed with a hollow interior having openings at each end complementary with the external periphery of said envelopes within which said envelopes are mounted to protrude therefrom, and said collar has a pair of axially parallel holes extending through an intermediate portion thereof perpendicular with the plane of said collar and complementary in size with the external periphery of the sleeves within which said pin connectors are secured, and said sleeves are mounted in said holes so that the electrical pin connectors secured therein protrude from said collar.

7. A microminiature lamp assembly comprising: a sealed illuminating envelope; a light emitting filament carried within said envelope; a pair of adjacent, axially rigid and parallel spaced pin connectors, each comprised of a plurality of twisted wire strands adapted to be resiliently compressed and elongated when inserted in complementary electrical contact sockets, thereby providing tensioned spiral contacts therein; a pair of filament wires electrically connected with the opposite sides of said filament in said envelope, said filament wires extending through said envelope and permanently affixed to said pin connectors, thereby completing an electrical circuit through said filament when inserted in a pair of electrically energized contact sockets; and a rigid tubular support base encompassing said filament wires and overlappingly secured to the connected portions of said envelope and said pin connectors, and wherein the rigid tubular support base is a hollow collar surrounding said filament wires, said collar is formed with an interior end portion conforming to the connected exterior end portion of the envelope for mounting said envelope, and includes a pair of cylindrical counterbores communicating with said interior end portion and which conform with the external shape of said pin connectors within which said pin connectors are mounted to protrude from said collar.

8. A microminiature lamp assembly comprising: a sealed, translucent illuminating envelope, a filament contained within said envelope, elongated pin connectors of the type which are formed of helically wound strands of wire adapted to resiliently compress when inserted in complementary mating plated through circuit board holes, circuit means connecting said filament and said pin connectors, a hollow insulator collar surrounding said circuit means and secured to said envelope and to said pin connectors, wherein said filament, circuit means, and pin connectors are made of electrically conductive material, and wherein encompassing complementary sleeves are permanently crimped to said pin connectors and, in turn, are secured in complementary holes formed in said collar.

(References on following page)

References Cited

UNITED STATES PATENTS

2,132,578	10/1938	Reichel	-----	313—318	X
3,002,174	9/1961	Rafter	-----	313—318	X
3,009,010	11/1961	Stearns et al.	-----	74—72	5
3,283,136	11/1966	Dinkler et al.	-----	313—318	X
3,286,088	11/1966	Ahroni	-----	313—318	X

FOREIGN PATENTS

903,963	2/1954	Germany.
588,406	2/1959	Italy.

OTHER REFERENCES

IBM Technical Disclosure Bulletin, R. J. Keller and
R. F. Spaniol, vol. 7, No. 5, October 1964.

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