

[54] **SPARK GAP PROTECTIVE DEVICE FOR CATHODE RAY TUBES**

[75] Inventor: **Tore Rudolf Johnson**, Harrisburg, Pa.

[73] Assignee: **AMP Incorporated**, Harrisburg, Pa.

[22] Filed: **Nov. 19, 1973**

[21] Appl. No.: **417,029**

[52] U.S. Cl. **317/61.5, 313/318, 317/69, 339/111**

[51] Int. Cl. **H02h 9/06**

[58] Field of Search **317/61, 61.5, 69; 339/111, 339/194 R, 194 N, 64 R, 258 A, 217 S, 59 R, 147, 64 M, 147 P, 127, 128; 313/318**

[56] **References Cited**
UNITED STATES PATENTS

2,476,671	7/1949	Leighton.....	313/318
3,227,910	1/1966	Pittman.....	313/318

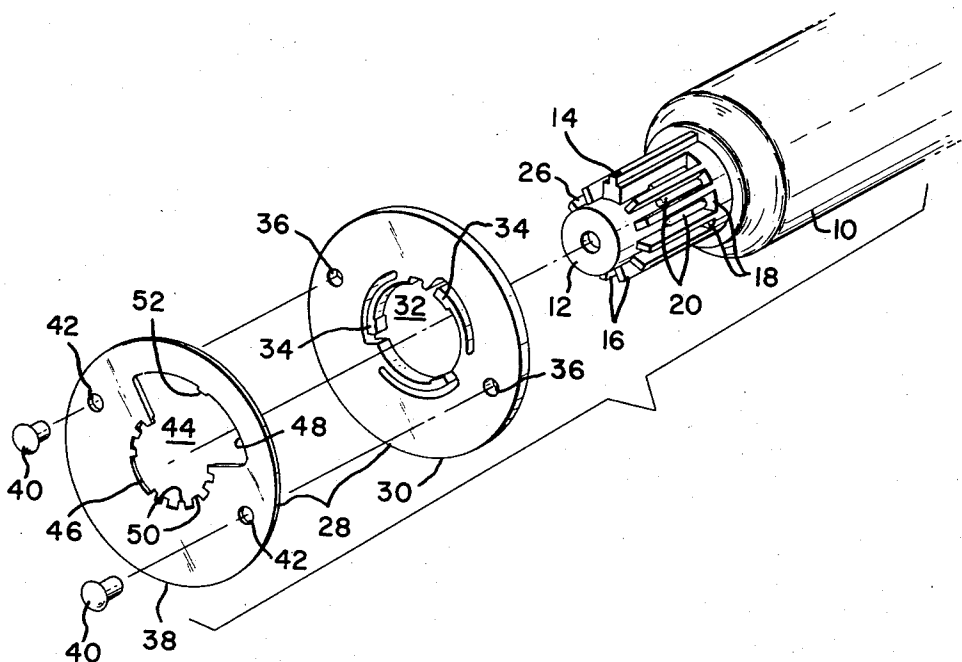
3,278,886	10/1966	Blumenberg et al.....	339/111 X
3,281,620	10/1966	Miller	313/318 X
3,502,933	3/1970	Leimontas et al.	317/61.5
3,683,228	8/1972	Kleen.....	313/318

Primary Examiner—James D. Trammell

[57] **ABSTRACT**

A device is disclosed for providing spark gap protection between the several pins of a cathode ray tube and solid state circuitry associated therewith. The device includes an insulated substrate having resilient arms disposed about a central opening in the substrate for centering the device on the tube base and a metallic layer fixed to the substrate and to a mounting strap. The device is mounted on the base of a cathode ray tube with projections of the metallic layer extending to within a predetermined distance from the tube pins to provide a spark gap therebetween.

1 Claim, 4 Drawing Figures



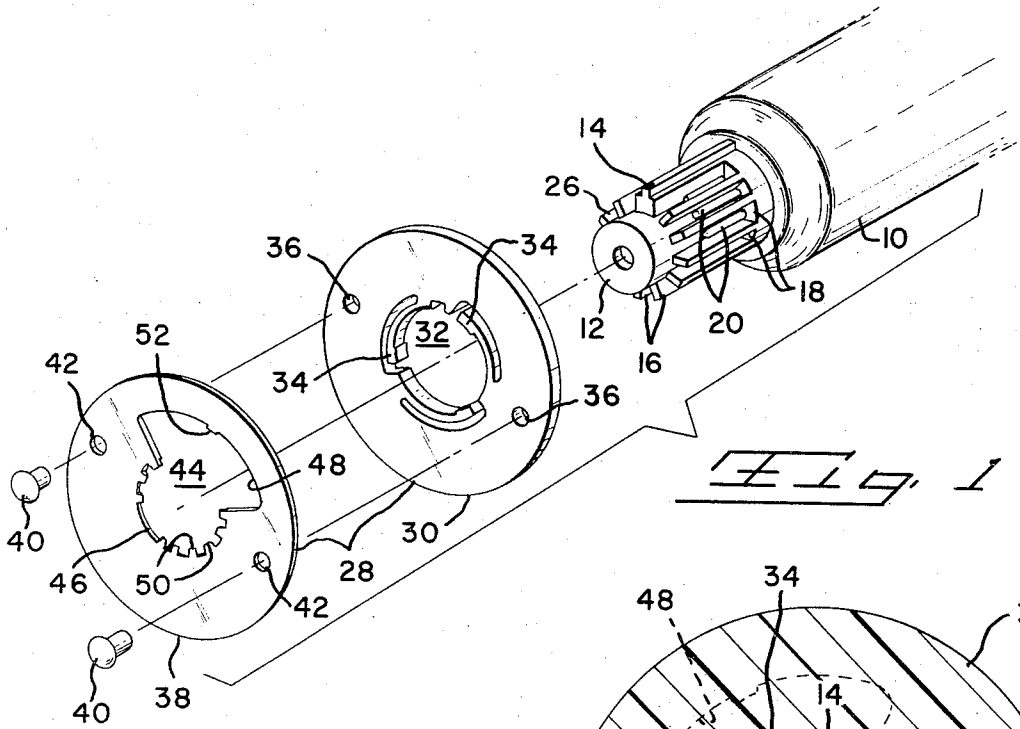


Fig. 2

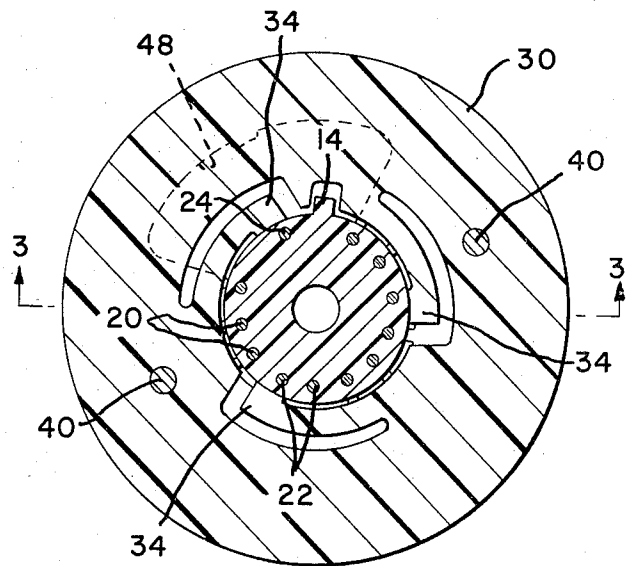
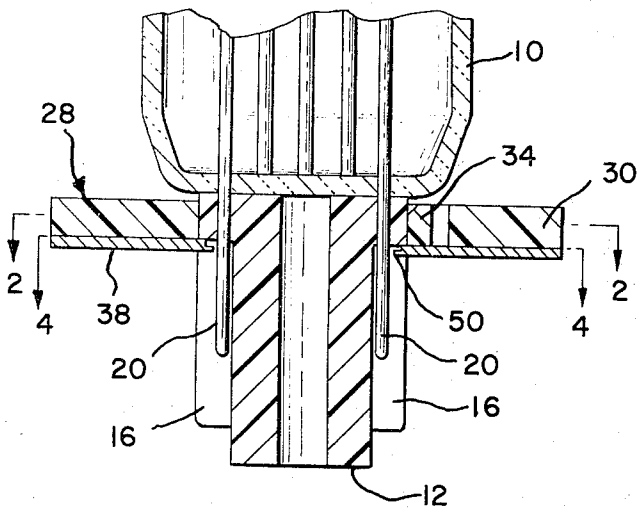


Fig. 3

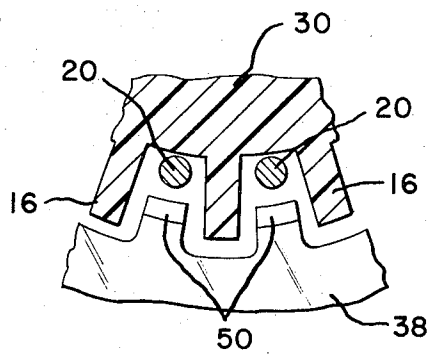


Fig. 4

SPARK GAP PROTECTIVE DEVICE FOR CATHODE RAY TUBES

BACKGROUND OF THE INVENTION

1. The Field Of The Invention

The present invention is related to a device for providing spark gap protection between the separate pins of a cathode ray tube and solid state circuitry associated with the control elements of the tube and in particular to a device for providing high voltage spark discharge emanating from the anode of the tube.

2. The Prior Art

Many modern television receivers, especially color television receivers, are presently manufactured with solid state circuitry replacing the previously well known vacuum tubes in order to reduce weight, cost, and service problems related to the comparatively short service life of vacuum tubes. The most commonly used solid state device is the transistor which consists of two types of semi-conducting materials separated by a thin membrane of semi-conducting material, which usually acts as a controlling element. While such devices have a high degree of reliability and comparatively long life when used within their ratings, they are subject to rapid destruction when their ratings are greatly exceeded.

Large color television tubes are usually operated with an anode potential of 25,000 volts. The anode capacity to ground is approximately 2,000 picofarads which permits the storage of appreciable energy at this high potential. Since the energy stored is equal to $\frac{1}{2} CE^2$ joules, the anode can store 0.625 joules or watt-seconds. If this energy were to be discharged in 10 microseconds, it would produce 62.5 kilowatts of instantaneous power. The destructive effects of such anode discharges on associated transistorized circuitry is readily apparent. Anode discharges can occur within the picture tube to any of the tube electrodes so that all semi-conductor circuits associated with the picture tube must be protected.

It has been common practice to provide means of redirecting this energy so that it will not pass through the semi-conductors. One method of reducing the energy passing through the semi-conductors is to use a high resistance between the semi-conductor and the picture tube element. However, even a 1,000 ohm resistor will allow an initial current of 25 amperes to pass through the transistor while a resistor as large as 2,500 ohms limits the initial current to 10 amperes. Resistors of greater value would seriously impair the efficiency of the control circuit and thus are not practical.

Another method of redirecting the stored energy in the anode is to provide a low voltage spark gap to permit discharge to ground. These spark gaps usually discharge at 1,000 to 1,500 volts. The focusing grid, which operates at 6,000 volts d.c., is operated with a 10,000 spark gap. Thus the present practice usually provides a resistor of 1,000 to 3,000 ohms in series with the output of the semi-conductor circuit connected to the picture tube elements and a spark gap to ground for each of the electrodes of the picture tube. Such a circuit is disclosed in U.S. Pat. No. 3,733,522.

One method of providing spark gaps for the picture tube electrodes is to incorporate a grounded metal ring within the picture tube socket closely spaced to the socket terminals. An example of this type of device may be found in U.S. Pat. No. 2,850,714. While this

method has the advantage of simplicity of installation, it has the disadvantage of not permitting inspection of the gaps for short circuits or excessively large gaps. Another disadvantage is that the length of the spark gap, and hence its discharge voltage, depends upon the cumulative sum of several dimensional tolerances so that the discharge voltage is subject to considerable variation. A further disadvantage is that the ground return strap must be attached to the socket in addition to all of the other control leads which forms a cumbersome assembly for handling during manufacture of the socket assembly and also during production of the complete television receiver. A still further disadvantage is that a short circuited spark gap (which renders the receiver inoperative) requires replacement of the entire socket, an expensive service operation requiring soldering and replacing over a dozen connection wires.

A further disadvantage of the previous spark gaps arrangements is that they will be completely unsuitable for use with the recently introduced 110° tube base (RCA JEDEC Base No. B12-260) which will be the new standard for the cathode ray tube industry. In the new tube base the individual pins lie in channels extending along the periphery of the base rather than individually projecting from the bottom of the base where they are subject to being bent and/or broken.

SUMMARY OF THE INVENTION

The present invention is a spark gap protection device providing a plurality of individual spark gaps between the pins of a cathode ray tube and associated solid state circuitry and includes an insulating substrate adapted to be mounted on the base of the picture tube, means on said insulating substrate for centering the device with respect to the picture tube base, a metallic layer attached to the substrate providing multiple spark gaps between the metallic layer and each pin of the tube and a common ground connected to the metallic layer.

Accordingly, one of the objects of this invention is to construct a multiple spark gap protection device which is entirely separate from a cathode ray tube socket and which can be readily replaced by detaching a single lead wire, namely the ground strap.

Another object of this invention is to produce a multiple spark gap protective device which can be easily inspected for short circuited spark gaps or excessively large spark gaps without disassembling any components.

Yet another object of the present invention is to construct a multiple spark gap protective device which is suitable for use with the new standard cathode ray tube base in which the pins do not project from the bottom of the base but rather are exposed in longitudinal channels formed along the periphery of the base.

A further object of the present invention is to produce a multiple spark gap protective device consisting of an integral unit whose dimensions can be closely controlled, thus allowing close control of the length of each spark gap and hence its discharge voltage, and which device will be accurately centered on the tube base at all times.

Other objects and advantages of the present invention will become apparent to those skilled in the art from the following detailed description taken with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded perspective view showing the subject spark gap protective device together with a new standard base of a cathode ray tube;

FIG. 2 is a transverse section taken along line 2—2 of FIG. 3;

FIG. 3 is a longitudinal section taken along line 3—3 of FIG. 2; and

FIG. 4 is an enlarged detailed section of a fragment taken along line 4—4 of FIG. 2 showing the relationship the subject device to two pins of the tube base.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows one end portion of cathode ray tube 10, which is the type of tube used as the picture tube in a color television receiver. The new standard 110° tube base 12 (RCA JEDEC Base No. B12-260) is a cylindrical body of insulating material. The illustrated base has 14 positions including a keying projection 14 which extends longitudinally outwardly from one side thereof, and thirteen longitudinally extending channels 16. The channels are open ended towards the free end of the base and terminate at a uniform, but interrupted, shelf or step 18 at the end of the base adjacent the tube. The particular cathode ray tube illustrated has 12 pins 20, each lying in a respective one of the channels 16. The pins are not embedded in the base along the channels but preferably are spaced slightly from the bottom of the channels. Pins 22 are used for the tube heater circuit and do not require spark gaps, since they are at nearly ground potential and are not directly associated with semi-conductor circuits. The anode pin 24 is isolated from the remaining pins by the key projection 14 and empty channel 26 and operates at from 4,000 to 6,000 volts, depending upon the anode voltage and the focusing requirement. For this reason it is provided with a much larger spark gap in order to permit breakdown at a higher voltage, usually between 8 and 10 kilovolts. The base 12 is integrally attached to the cathode ray tube 10 by conventional means.

The subject spark gap protective device 28 includes two layers, one of which is an insulating substrate 30 having a keyed central aperture 32, a plurality resilient centering members 34 forming at least a part of the periphery of said central aperture and two smaller apertures 36. The centering members preferably are arcuate cantilever arms, as shown, which contact the base at a plurality of arcuately offset positions to thereby center the device on the base. The substrate 30 is formed from any of the well known insulating materials. A metallic layer 38 is fixedly mounted on the substrate 30 by rivets 40 or the like passing through aper-

tures 42 in the layer 38 and 36 in the substrate 30. At least one of these rivets can be used to attach the device to a grounding strap (not shown). The metal layer 38 has a central aperture 44 of a particular configuration which includes an arcuate portion 46 of a first radius and a second arcuate portion 48 of a larger radius. A plurality of radially inwardly directed points 50 are formed about the first arcuate portion 46 and a single radially inwardly directed point 52 is formed substantially centered in the second arcuate portion 48.

The spark gap protective device is positioned on the base 12, as shown in FIGS. 2 and 3 with the centering key 14 passing through the keyed portion of aperture 32, and moved until the metal layer 38 rests against the interrupted annular shelf 18 of the base. It will be noted from FIG. 3 that the projections 50 of the metal layer extend over at least a portion of the shelf to come within a short distance of the individual pins 20. It should also be noted that the metal layer is slightly undercut to insure that no carbonization will build up from arcing, which then would cause a leakage path between a particular pin and the associated spark gap.

FIG. 2 shows how the centering means 34, which in this case are three arcuate resilient cantilevered arms, serve to always center the spark gap protective device on the tube base so that uniform air gaps are formed between the projections on the metal layer and the individual pins.

The present invention may be subject to many various modifications and changes without departing from the spirit or essential characteristics thereof. The foregoing embodiment is therefor intended to be illustrative and not restrictive as to the scope of the invention.

What is claimed is:

1. A multiple spark gap protective device for protecting solid state circuitry associated with cathode ray tubes from high voltage discharges from such tubes comprising:

an insulating substrate having a keyed central aperture and a plurality of resilient centering means disposed about the periphery of said aperture, said resilient centering means including a plurality of arcuate cantilevered arms integral with said substrate and disposed about the periphery of said aperture; a metallic plate secured to said insulating substrate including a central aperture having a plurality of radially inwardly directed projections extending over the central aperture of said substrate in cantilever fashion whereby a plurality of spark gaps are formed between said projections and pins of a cathode ray tube when said device is mounted on the base of said tube; and

common ground means secured to said plate.

* * * * *