Sept. 16, 1930. R. B. PRINDLE 1,776,133

FILAMENT SUPPORT

Filed Dec. 15, 1923

Fig. 1.

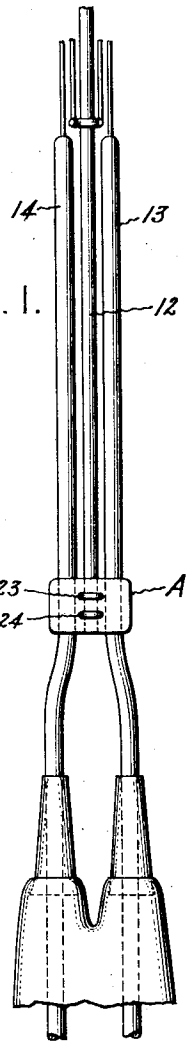
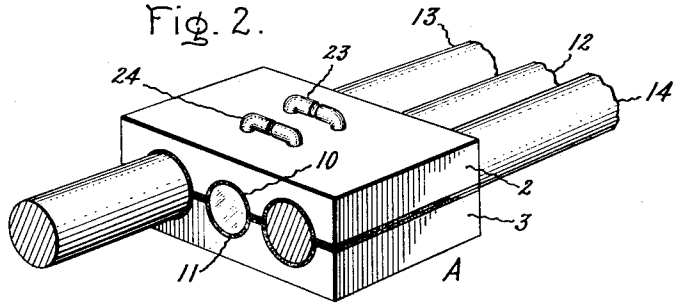



Fig. 2.



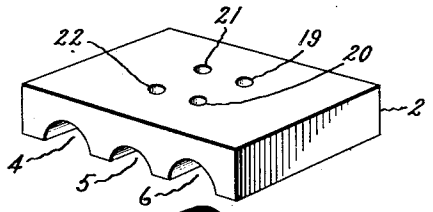




Fig. 3.

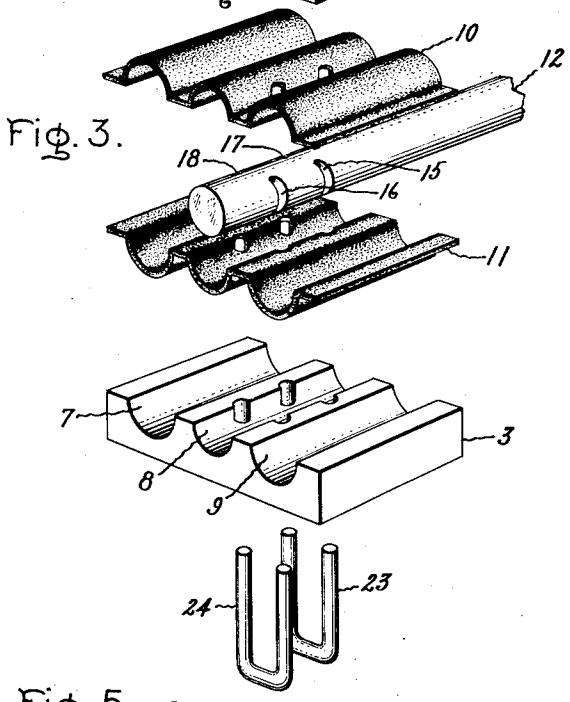



Fig. 4.

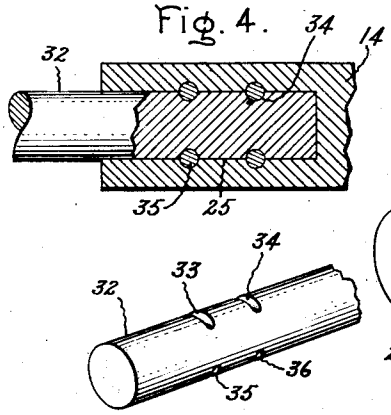
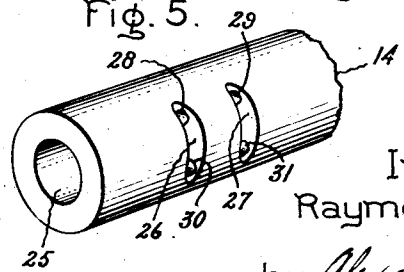



Fig. 5.




Inventor:
Raymond B. Prindle,
by Alexander S. Lunt
His Attorney.

Patented Sept. 16, 1930

1,776,133

# UNITED STATES PATENT OFFICE

RAYMOND B. PRINDLE, OF SCHENECTADY, NEW YORK, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK

## FILAMENT SUPPORT

Application filed December 15, 1923. Serial No. 680,989.

My present invention relates to supports for electrically heated conductors which are used in evacuated or partially evacuated receptacles as sources of electrons or as light sources. It relates more particularly to means for securing a filamentary conductor to a leading-in wire and means for supporting such a conductor by means of the leading-in wires which are employed for supplying current thereto.

Heretofore, the filament in devices of the above character has been welded to the leading-in wires which are sealed into a stem. In some cases an intermediate point in the filament has been provided with an auxiliary support which has been held in place by a clamp bridged between the leading-in wires. In such cases the auxiliary support has been commonly secured to the clamp and the clamp to the leading-in wires by means of screws. The use of such screws has made it necessary that the leading-in wires be kept quite far apart with the result that in devices such as thermionic tubes where a grid is provided the grid has, of necessity, been quite large and the anode has, of necessity, been located further away from the filament than is desirable to obtain satisfactory electrical characteristics.

One of the objects of my invention is to provide a clamp of such construction that the use of such screws may be eliminated. By doing away with the screws, I materially cheapen the construction of such devices inasmuch as I eliminate the necessary taps, countersinks and screws. Furthermore, I am able to use a clamp made up of two members which are alike in all respects. By my new form of construction, the clamp can be readily loosened by means of a file and without the necessity of heating as heretofore if the filament and auxiliary support should need replacing. Furthermore, the clamp can be readily removed without breaking the filament or without damaging the glass seals at the stem, should the clamp be cracked as for example, by vise pressure in the course of construction. Furthermore, the improved form of construction enables me to use over and over again clamps from old tubes.

Heretofore clamps of the character described have been made from such metals as iron, or other similar metal, which under the bombardment in the tube readily releases any occluded gas in the metal, thereby seriously impairing the device. As a partial remedy to this effect, the iron clamps have been usually removed as far as possible from the heated filament or cathode.

Another of the objects of my invention is to substitute for the metals heretofore used for the clamp, molybdenum or other metal which does not readily hold occluded gas and which therefore not only does not give gas trouble at the usual distance at which such clamps have heretofore been located, but which may be brought much nearer to the filament of the cathode without giving gas trouble.

Another object of my invention is to provide other details of improvement tending to increase the efficiency and serviceability of the joint connection between the filament and leading-in wires of thermionic tubes of the above character.

To accomplish the foregoing and other useful ends, my invention makes use of means hereinafter more fully set forth and claimed, reference being had to the accompanying drawing in which

Fig. 1 is a view in elevation of the leading-in wires of a tube with my improved clamp in position and with the auxiliary support attached thereto; Fig. 2 is a large perspective detail view of the clamp showing binding clips or fasteners locking the clamp; Fig. 3 shows the clamp structure in detail spread out and in perspective, and Figs. 4 and 5 show how my invention may be used to connect the filament to the ends of the leading-in wires.

Referring more in detail to the drawing, it will be seen that the clamp A of Figs. 1 and 2 is made up of two like plates or sections 2 and 3 as indicated in Fig. 3, each having respectively three channels 4, 5 and 6 and 7, 8 and 9. Each of the said sections respectively is provided with an insulating shield 10 and 11, made of any suitable insulating material, the first one 10 of which fits into the grooves

of the plate 2 and the second one 11 of which fits into the plate 3. Between these plates 2 and 3 and the shields 10 and 11, the supporting rod 12 is held in the middle groove. Also between these plates and shields, the leading-in wires 13 and 14 are clamped, respectively in the grooves 4 and 7 and 6 and 9, as shown in Fig. 2.

It will be seen that the sides of the supporting rod 12 are grooved, the grooves 15 and 16 being on one side thereof while the grooves 17 and 18 are on the opposite side. Coinciding with these grooves, openings 19, 20, 21 and 22 are drilled all the way through elements 2, 10, 11 and 3. Into these openings the fastening staples 23 and 24 are inserted and their ends are clinched to clamp the plates 2 and 3 in position on the leading-in wires and at the same time the supporting rod 12 is held in its position and prevented from rotating or moving longitudinally. The insulating shields 10 and 11 prevent any electrical connection from being established between the plates 2 and 3 and the leading-in wires. It will be understood that the plates 2 and 3 and the staple fasteners are made of molybdenum or of any metal which has comparatively little tendency to hold occluded gas while the supporting rod 12 may preferably be made of tungsten. Furthermore, the leading-in wires 13 and 14 are also preferably of molybdenum. The provision of molybdenum as thus described ensures against gas trouble as the result of electrical bombardment of these elements.

Referring to the construction shown in Figs. 4 and 5 for securing the ends of a tungsten filament 32 to the molybdenum leading-wires 13 and 14, the ends of the molybdenum wire are bored as indicated in Fig. 5, the hole 25 indicating how the end of the leading-in wire 14 has been bored out to provide an opening for receiving the end of the tungsten filament 32. As shown in Fig. 5, the sides of the leading-in wire 14 are grooved on both sides, only the grooves 26 and 27 on one side being shown. The opening 25 is made deep enough to extend beyond these grooves. The tungsten wire is also grooved as indicated by the grooves 33, 34, 35 and 36. Furthermore, in the grooves 26 and 27, four openings 28, 29, 30 and 31 are drilled all of the way through. When the filament is pressed home into the hole 25, the grooves 33, 34, 35 and 36 line up with the openings 28, 29, 30 and 31, as indicated in Fig. 4 so that the staple fasteners 34 and 35 similar to the fasteners 23 and 24, may be pressed through to lock the filament as shown in Fig. 4. The protruding ends of the staples on the opposite side are clinched just as they are shown clinched in Fig. 2 and lie within the grooves opposite the grooves 26 and 27.

It will thus be seen that a metal such as tungsten, which is very hard to drill, may be secured to an element such as molybdenum by means of suitable slots and locking staples which when clinched in place, form a substantial joint without the use of any screws, which joint may be taken down whenever necessary without impairing the rest of the structure. Furthermore, such a joint is easily put together and may also take the place of spot-welded joints which tend to make the tungsten brittle.

It will further be seen that with a construction of this type, the leading-in wires 13 and 14 may be brought very close together, more closely than with any constructions of the prior art. The result is that in a three-electrode device the cathode filament may be surrounded by a grid of very small dimensions, smaller dimensions in fact than similar devices heretofore made in tubes of corresponding high power. The result is that the anode can be brought much closer to the filament. The compact structure thus resulting produces a much more efficient tube than with the construction heretofore employed.

It will be understood that while I have illustrated my invention in connection with such specific structures as illustrated, that my invention, in view of the disclosure, may be modified without departing from the scope of the claims herein. I wish to particularly point out that the method of connection described is not restricted to the particular type of equipment shown and described, but is applicable generally to any connection between metals in which it is desired to avoid screw connections and in which a compact construction is desired.

What I claim as new and desire by Letters Patent of the United States, is:—

1. A filament supporting structure comprising a pair of main filament supporting members and an auxiliary filament supporting member, means for securing the auxiliary supporting member to the main supporting members, said means comprising a clamping member having three openings therethrough for receiving the supporting members, said auxiliary supporting member having a groove which is in alignment with a fourth opening in the clamping member, and a pin which extends through said fourth opening and locks the clamping member to the auxiliary supporting member.

2. In a filament supporting structure the combination of a clamping means, a pair of leads, a supporting rod, said clamping means having a plurality of channels therein for the reception of said leads and rod and a plurality of openings transverse to the plane of the channels, and locking means extending through said openings and embracing said supporting rod for securing locking engagement of the several parts.

3. A filament supporting structure comprising a pair of main filament supporting

members and an auxiliary filament supporting member, means for securing the auxiliary supporting member to the main supporting members, said means comprising a clamping member having three openings therethrough for receiving the supporting members, and a pair of openings which are in alignment with a pair of grooves on opposite sides of the auxiliary supporting member and means extending through said pair of openings for locking the clamping member to the supporting members.

4. In a filament supporting structure the combination of a pair of leads, a supporting rod, a pair of clamping members having channels therein and openings at right angles to the channels, and locking means cooperating with said openings and embracing said supporting rod for securing the several parts in engagement.

5. A filament supporting structure comprising a pair of leading-in conductors and a filament supporting member, means for securing the filament supporting member to the leading-in conductors, said means comprising a clamping member having three openings therethrough for receiving the leading-in conductors and the supporting member, and a pair of openings which are in alignment with a pair of grooves on opposite sides of the filament supporting member and a staple extending through said pair of openings and having its ends clinched for locking the clamping member to the leading-in conductors and the filament supporting member, said clamping member being made up of two like elements which are clamped together by said staple and form a bridge between the two leading-in conductors.

In witness whereof, I have hereunto set my hand this 14th day of December, 1923.

RAYMOND B. PRINDLE.