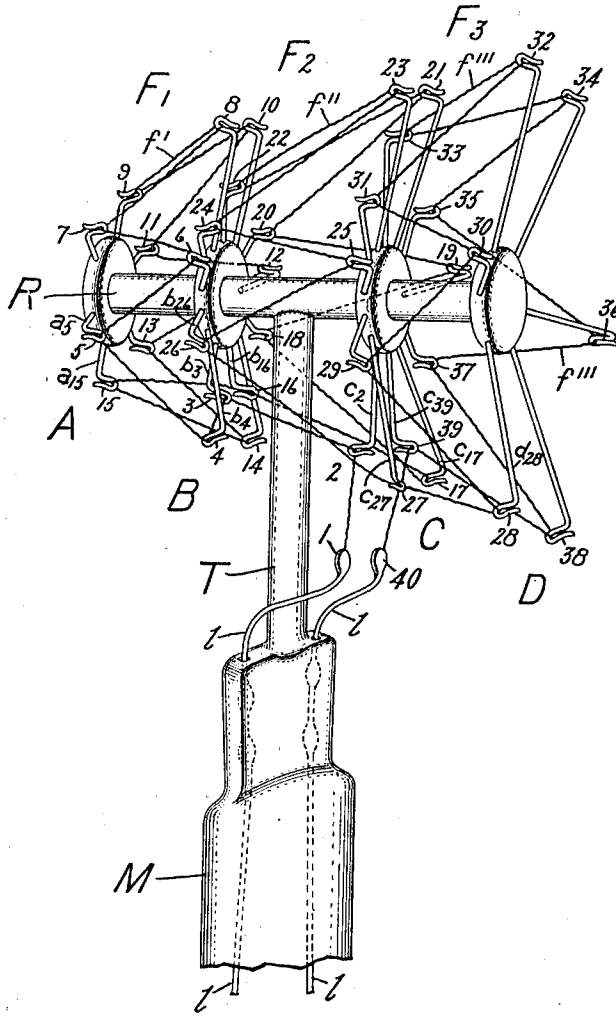


E. S. GARDNER.  
FILAMENT MOUNTING.  
APPLICATION FILED DEC. 28, 1910.

1,001,382.

Patented Aug. 22, 1911.



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# UNITED STATES PATENT OFFICE.

EDGAR S. GARDNER, OF ACQUACKANONCK, NEW JERSEY, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

## FILAMENT-MOUNTING.

1,001,382.

Specification of Letters Patent. Patented Aug. 22, 1911.

Application filed December 28, 1910. Serial No. 599,691.

### To all whom it may concern:

Be it known that I, EDGAR S. GARDNER, a citizen of the United States, residing at Acquackanonck, county of Passaic, State of New Jersey, have invented certain new and useful Improvements in Filament-Mountings, of which the following is a specification.

My invention relates to filament mounting, and its object is an improved mounting which possesses various desirable characteristics and is suitable for filaments and other conductors.

Among the advantages which may be secured in a mounting constructed according to my invention are: first, the mounting of a great length of conductor in a small space; second, avoidance of risk of short circuiting and of breakage; third, facility as regards the application of the conductor to its supporting system; fourth, an arrangement of lamp filaments which will give a good distribution of illumination, and, in particular, special concentration of the illumination when desirable. Other advantages will hereinafter appear.

My invention is very useful in incandescent filament electric lamps. I have hereinafter particularly described a construction embodying it that is well suited for this purpose, referring to the conductor as a filament and to the apparatus in which it is employed as a lamp; but my invention can be otherwise carried out and applied. It may be used to advantage with filaments of tantalum, tungsten, or any other materials, and especially with materials of high conductivity.

The accompanying drawing gives a view of one embodiment of the invention, the same being shown as broken away from the globe and removed therefrom for clearness of illustration.

The filament system or mount here shown comprises a plurality of carrying elements or arms of iron, nickel, copper, molybdenum or other suitable material (due regard for the material of the filament being of course had in the selection of the material of the arms) having suitable filament-engaging portions and projecting from a suitable supporting member R. The member R is shown as mounted crosswise on a member or standard T; but it may obviously be arranged to form a longitudinal prolongation

of the member T if desired. The member T is itself shown as secured to the ordinary glass stem M by which the current supply-conductors  $l, l$  are introduced into the lamp. The members R and T, or R, T, and M, may for convenience be regarded as in effect constituting a single supporting member.

The arms or carriers  $a$  and  $d$  at opposite ends of the filament system are shown as forming groups or sets A and D respectively, the carriers  $a$  being shown as very short and the carriers  $d$  as relatively quite long. The intermediate carriers  $b$  and  $c$  are shown as forming groups B and C. In each of these groups B and C the carriers are shown as varying as regards projection of their filament-engaging portions from the member R. As shown, moreover, successive carriers in each of the groups B and C differ in character as regards projection of their filament-engaging portions from the member R (except in a single instance hereinafter set forth); and in the particular structure illustrated the carriers in these groups are (with one exception) relatively "long" and "short" alternately, so that when the system is viewed end-on, the filament-engaging portions of the carrier in each of these appear as staggered. Furthermore the relatively long carriers in each of the groups B and C are shown as intermediate in length between the carriers of the same character in the neighboring groups, and the shorter carriers as varying from group to group in like manner. For the purpose of this statement and with the illustrated arrangement of the filament on the supporting system, it is convenient to regard the carriers  $a$  as "short" and the carriers  $d$  as "long." The long carriers and the short carriers of each of the groups B and C are shown as making somewhat different angles with the member R, and their filament-engaging portions are shown as lying in planes a short distance apart and (with exception to be hereinafter noted) as "facing" toward each other; but it will be understood that the filament-engaging portions of the carriers of each of these groups may lie in the same plane and "face" away from each other, etc. The carriers of all the groups are shown as projecting from relatively narrow zones in the length of the member R, and, specifically, as fused into

glass enlargements or disks on the member R.

On the supporting system are arranged the filament lengths or sections  $f'$ ,  $f''$ ,  $f'''$  (shown as slightly crimped): These filament sections may be regarded as forming sets or banks  $F_1$ ,  $F_2$ ,  $F_3$ . From its connection with the end 1 of the left-hand current lead  $l$ , the filament extends to the engaging portion 2 of a short carrier  $c_2$  projecting from the side of the member R to which the member T is secured, thence back to a similarly located short carrier  $b_3$ , thence to the long carrier  $b_4$  adjoining it on the left, and thence, finally, on back to a carrier  $a_5$ . It is then wound back and forth in a "clockwise" direction between the carriers  $a$  and the long carriers  $b$ , finally passing forward from the carrier  $a_{15}$  via the short carrier  $b_{16}$  (adjoining the short carrier  $b_3$  mentioned above on the right) to a long carrier  $c_{17}$  (adjoining the short carrier  $c_{39}$  hereinafter mentioned on the right). It is then wound back and forth "counterclockwise" between the long carriers  $c$  and the short carriers  $b$ . It next passes from the short carrier  $b_{26}$  via the long carrier  $c_{27}$  (adjoining the short carrier  $c_2$  mentioned above on the left) to a carrier  $d_{28}$ . It is then wound back and forth "clockwise" between the carriers  $d$  and the short carriers  $c$ , finally passing from the short carrier  $c_{39}$  (adjoining the short carrier  $c_2$  mentioned above on the right) to the filament-engaging portion 40 of the right-hand current lead  $l$  and being suitably secured thereto. To avoid confusion of the drawing, only the carriers herein specifically mentioned have been marked with their appropriate subscript letters; but the filament-engaging portions of all the carriers have been marked with their proper reference-numerals in order that the filament may be easily followed throughout its entire length. It will be understood that the filament-engaging portions of the various carriers may have the form of hooks while the filament is being applied to the supporting system and that such hooks may afterward be closed to form eyes; also that the carriers may be bent and manipulated after the filament has been placed on them, and that their original angles with the member R may be altered so as to bring the filament sections to a proper degree of tautness.

In the drawing the groups A and D are shown as containing the same number of carriers and the groups B and C as each containing the same number of long carriers as the groups A and D and a number of short carriers which is one greater than the number of long ones. Accordingly, there are in each of the groups B and C two short carriers ( $b_3$ ,  $b_{16}$  and  $c_2$ ,  $c_{39}$ , respectively) without an intervening long carrier, these

short carriers projecting from the side of the member R on which it is secured to the member S. The short carrier  $b_{16}$  and the long carrier  $c_{27}$ , however, are employed for the transmission of the filament from the bank  $F_1$  to the bank  $F_2$  and from the bank  $F_2$  to the bank  $F_3$ , as above described; and in consequence of this and of the employment of the carriers  $c_2$  and  $b_3$  for the transmission of the filament between the left-hand current lead and the bank  $F_1$ , the bank  $F_2$  contains (including the transmission section 2—3) one filament section less than either of the banks  $F_1$  and  $F_3$ . The number of filament sections in the several banks could be made the same by bending the left-hand current lead  $l$  in the opposite direction from that shown and leading the filament from it directly to the long carrier  $b_4$ . This would allow the filament to extend from the short carrier  $b_{26}$  to the long carrier  $c_{27}$ , back to the short carrier  $b_3$ , and then to pass forward via the short carrier  $c_2$  to the bank  $F_3$ , thus giving three filament sections 26—27, 27—3, and 3—2 in place of the two sections 2—3 and 26—27. It will be noted that two of the "transmission" carriers—the short carrier  $c_2$  and the long carrier  $c_{27}$  adjoining it on the left—are shown as "facing" in directions which are the opposite of those in which the other carriers of their respective characters face.

It will be observed that according to the arrangement illustrated the filament banks  $F_1$ ,  $F_2$ ,  $F_3$  are more or less nearly conical; that these banks are successively somewhat larger; and that the small "base" of one bank and the large "base" of the preceding bank are juxtaposed. The progressive enlargement of the banks is, of course, due to the progressively greater length of the carriers in successive groups; by a suitable proportioning of the carriers, individual banks of any desired shape or any desired succession of banks can be obtained. The succession of the preceding and succeeding banks of increasing size with bases respectively large and small juxtaposed is due to the stringing of the filament between the short and long carriers respectively in preceding and succeeding groups: the progressive relation between the bases could be reversed by reversing the mode of stringing, the carriers  $a$  and  $d$  being then regarded as "long" and "short" respectively. For reasons which will be apparent to those skilled in the art, however, the relation shown possesses greater advantages.

Any number of filament banks from two up may be employed. It is to be understood, of course, that the number of carriers in the several groups may vary in a variety of ways, and also the arrangement of the carriers in a group. With the particular type of filament system shown, for

example, the number of carriers may increase as the banks grow larger—the result of course being an increase in the number of filament sections in successive banks, which may in some cases be desirable. Moreover, a group of filament carriers which vary in length can be advantageously embodied in filament systems or mounts of many types and employed in various ways; and such a group of carriers is on this account itself a very useful device in the art, aside from any particular arrangement of filament sections with reference to it.

It will be observed that except where the filament passes from the current leads to the banks  $F_1$  and  $F_2$  and between adjacent banks, the change in the direction of the filament at the carrier between contiguous sections is in every case very considerable,—so that even when the filament (as shown in the drawing) is continuous at these points, such sections are almost entirely independent of each other as regards behavior under shock or vibration and there is little tendency for two sections to vibrate or move in unison. Hence the strain to which the filament is subjected by vibration is a minimum, and it is supported in the most efficient manner and with the least risk of breakage. The arrangement of neighboring filament banks (of whatever form) with large and small “bases” juxtaposed results in thorough separation of the adjacent ends of the filament sections in such banks and elimination of any risk of short circuits occurring between them; and it is therefore especially advantageous when the carriers supporting the adjacent ends of such filament sections are arranged, as shown, so as to allow the filament sections in neighboring banks to overlap somewhat. The overlapping of banks and their conical form tend toward compactness and concentration of the luminous filament in a small compass. The conical form of the filament banks also makes possible a very good end-on illumination from the filament system. The mount as illustrated lends itself very advantageously to uses in which concentration, evenness, or

symmetry of the source of light is desirable,—as, for example, stereopticon work or the like.

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

1. In a filament mount, the combination of a plurality of groups of filament carriers of varying length projecting from a suitable supporting member, and a plurality of banks of filament sections mounted on said carriers, the filament sections of each bank extending between oppositely facing carriers in adjacent group.

2. In a filament mount, the combination of a plurality of successive conical banks of filament sections, the large and small bases of successive banks being juxtaposed.

3. In a filament system, the combination of a plurality of groups of filament carriers projecting from a suitable supporting member, and a plurality of banks of filament sections supported by said carriers, the adjacent ends of the sections in neighboring banks being supported by carriers which vary as regards projection from the said member.

4. The combination of a plurality of groups of filament carriers suitably spaced apart, and a plurality of filament sections mounted on said carriers in a plurality of banks, the adjacent ends of the sections in neighboring banks being supported by carriers of a single group which are of different length and the carriers by which corresponding ends of successive banks are supported being of the same character as regards length.

5. A filament supporting system comprising a plurality of groups of filament carriers suitably spaced apart, the filament-engaging portions of the carriers in every group except the end ones being staggered.

In witness whereof, I have hereunto set my hand this 27th day of December, 1910.

EDGAR S. GARDNER.

Witnesses:

S. W. WHITEHEAD,  
J. H. ELKINS.