AUSTRALIA
COMMONWEALTH OF AUSTRALIA.

Patents Act, 1952.

Convention Application for a Patent.

K. (w) SQUARE D COMPANY of
Executive Plaza, Park Ridge,
Illinois, United States of
America

a corporation organized and existing under the
laws of the State of Michigan, United States of
America,

hereby apply for the grant of a Patent for an invention
entitled HEATING ELEMENT TERMINAL

which is
described in the accompanying complete specification.

This application is made under the provisions of Part XVI. of the Patents
Act 1952 and is based on an application for a patent or similar protection
made in United States of America on March 31, 1976 as
Serial No. 672,102. and made in United States of America
on March 31, 1976 as Serial No. 672,372.

Xxx (our) address for service is

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Dated this 25th day of February, 1977

SQUARE D COMPANY

by General Patent Counsel

To:
The Commissioner of Patents
DECLARATION FOR CONVENTION PATENT APPLICATION

(Note: (1) To be signed by the applicant(s), if individual(s). If applicant is a Company, to be signed by a person on its behalf. (2) This is a comprehensive form, and parts inappropriate to a particular application should be cancelled.)

COMMONWEALTH OF AUSTRALIA
Patents Act 1952-1954

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION UNDER PART XVI FOR A PATENT OR PATENT OF ADDITION

In support of the Convention application No. (a) made under Part XVI of the Patents Act 1952-1954 by (b)

SQUARE D COMPANY

for a patent/patent of addition for an invention entitled (c)

HEATING ELEMENT TERMINAL

I/We, (d) Richard T. Guttman of (e) 208 Stonegate Buffalo Grove, Illinois 60030

United States of America

do solemnly and sincerely declare as follows:

1. I am/We are the applicant(s) for the patent/patent of addition

   (or, in the case of an application by a body corporate)

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:

   in (f) United States of America on (g) March 31st, 1976 by (h) Felix Michael Atwood, James Earl Murphy, Harold Dean McDonald and Clarence Jack McDonald

3. I am/We are the actual inventor(s) of the invention

   (or, where a person other than the inventor is the applicant)

4. The basic application(s) referred to in paragraph 2 of this Declaration was/were the first application made in a Convention country in respect of the invention the subject of the application.

Declared at Park Ridge, Illinois (this) 25th day of February 1977

SQUARE D COMPANY

To: The Commissioner of Patents,
Commonwealth of Australia.

Signature(s) of declarant(s)

(Note: No attestation or other signature is required)
AUSTRALIA

PATENTS ACT 1952-1973

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Application Number: 2368277
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Complete specification Lodged: 24-3-77
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US. 31 876; 672,372.

Related Art:

TO BE COMPLETED BY APPLICANT

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Complete Specification for the invention entitled

"HEATING ELEMENT TERMINAL"

The following statement is a full description of this invention,
including the best method of performing it known to me:

Commonwealth

ASC-49
Background of the Invention

This invention relates to the field of terminals for electric heating elements, in which the elements comprise a resistance coil supported within a frame on insulating grommets or disks, and with a terminal projecting outwardly of the frame for connection to an electrical source, the terminal being connected inwardly of the frame to the resistance coil.

In prior art devices, such means as bolts were used as terminals, with the threaded shank extending through the central bore of a two-piece insulating member such as mated ceramic discs.
and through the aperture of the frame of the heating element
sandwiched between the ceramic disks. Lock nuts were provided
on each side of the two-piece insulating member for tightening
thereagainst to securely clamp the disks together with the frame
therebetween, and additional lock nuts were then threaded on the
bolt shank to fasten the supply conductor to the bolt end
extending outwardly from the frame and to fasten the resistance
coil wire to the other bolt end extending inwardly of the heating
element frame. Such complicated terminal means are both expensive
and time consuming to properly install. A problem also arises
with such terminals when the lock nuts are not properly tightened,
resulting in a high resistance connection. The lock nuts may
even become loose enough for either the external supply conductor
or internal resistance wire to become electrically disconnected
from the terminal.

The present invention overcomes such disadvantages and
problems.

Summary of the Invention

It is an object of the invention to provide an electric
heating element terminal which is inexpensive to make and easy to
install in the element as well as to connect to an external supply
conductor and the internal resistance wire of the heating element.

It is an object of the invention to provide an electric
heating element terminal comprising a tubular conductor having a
central bore therein.

It is an object of the invention to provide an electric
heating element terminal which simultaneously provides connector
means at each opposite terminal end and clamping means to clamp
a two-piece insulating clamp member together to hold the element
frame therebetween by virtue of the same respective compression
operations performed at each opposite end of the terminal.

It is an object of the invention to provide an electric
heating element terminal comprising a tubular conductor including
a flattened end projecting externally for connection to a supply
conductor, a compression sleeve end projecting interiorly of the
element for connection to the resistance wire, and an intermediate
tubular section for projection through an aperture of the element
frame and mounting of insulating members thereon to hold said
tubular section in insulated relationship with said frame.

**Brief Description of the Drawings**

Fig. 1 is a perspective view of an electrical heating
element which includes terminals in accordance with this invention.

Fig. 2 is a side elevation view of terminal member in accord-
ance with this invention before the compression sleeve end has
been crimped.

Fig. 3 is a plan view of the terminal member illustrated in
Fig. 2.

Fig. 4 is a side elevation view of a fragment of the heat-
ing element illustrated in Fig. 1, illustrating a terminal member
insulatingly supported in a front panel thereof having one end
projecting exteriorly for connection to an electrical supply
conductor and the opposite end projecting interiorly for
connection to the resistance wire of the heating element.

Fig. 5 is an exploded perspective view of a two-piece
insulating and clamping member, a fragment of the heating element
frame for clamping therebetween, and a terminal member as shown in
Figs. 2 and 3 before insertion through the aligned bores of the
two-piece insulating member and aperture of the heating element
frame.

Fig. 6 is a side elevation view of the structure shown in
Fig. 4 in which the resistance wire is connected to the terminal
member and crimped therein.

Fig. 7 is a front elevation view of the structure shown in
Fig. 6.
Fig. 8 is a section taken on line 8-8 of Fig. 7.

Fig. 9 is a side elevation of a modified terminal member in accordance with this invention.

Fig. 10 is a plan view of the terminal member illustrated in Fig. 9.

Fig. 11 is a side elevation of a two-piece insulating member, a fragment of a frame panel clamped therebetween, and the modification of the terminal member as shown in Fig. 10.

Fig. 12 is a perspective view of another modified terminal member in accordance with this invention, showing one side.

Fig. 13 is a perspective view of the terminal member in Fig. 12 showing the other side.

Fig. 14 is a side elevation view of another modified terminal member in accordance with this invention, shown mounted in a heating element with portions thereof shown in section.

Description of Preferred Embodiment

An electrical heating element 1 includes a frame 2 having a front panel 3, a rear panel 4, side panels 5 and 6, and lateral panels 7 and 8 spaced apart intermediately between front panel 3 and rear panel 4.

Ceramic insulating grommets 9 are mounted in apertures 10 spaced apart laterally in each lateral panel 7 and 8 and in rear panel 4, each aperture 10 in one panel being axially aligned with the corresponding aperture 10 of the other two of said panels.

A coiled resistance wire 11 extends through said insulating grommets 9 to provide a heating grid when connected to an electrical source at terminals 12 and 13. One end 14 of resistance wire 11 is connected interiorly of the element frame 2 to terminal 12, and the other end 15 of the resistance wire 11 is connected interiorly of the element frame 2 to terminal 13.

Terminals 12 and 13 extend through apertures 16 in front panel 3 of frame 2, and are insulatingly supported therein by an
insulating two-piece clamp member 17 comprising a first ceramic
disk 18 positioned on the interior facing side 19 of front panel
3, and a second ceramic disk 20 positioned on the exterior facing
side 21 of front panel 3.

The insulating ceramic disks of two-piece clamp member 17
are mated together, one having a projecting element centrally
thereof and the other having a corresponding recess, so when mated
together the two pieces or disks remain in axial alignment. In
the embodiments illustrated in the drawing, the ceramic disk 20
positioned on the exterior facing side includes the projecting
element 22 and ceramic disk 18 positioned on the interior facing
side includes a corresponding recess 23.

The cross-sectional dimension of projecting element 22
corresponds with the dimension of aperture 16 for seating engage-
ment therein and projection therethrough.

Ceramic disk 20 includes an additional recess 24 of angular
configuration on the side opposite the side from which projecting
element 22 extends.

Each ceramic disk 18 and 20 includes a central bore 25
therethrough, the cross-sectional dimension of the bore 25 being
smaller than that of projecting element 22 through which it also
extends. Thus, when ceramic disk 20 is positioned adjacent
aperture 16 of frame panel 3 with projecting element 22 seated
therein and extending therethrough, and ceramic disk 18 is posi-
tioned adjacent aperture 16 on the opposite side of frame panel 3
with its recess 23 receiving projecting element 22 therein, the
central bores 25 of each disk 18 and 20 are axially aligned to
provide a through passageway which is insulated by the ceramic
disks 18 and 20 from the frame panel 3.

The two-piece insulating clamp and support members 17 are
identical for both of the two apertures 16 in front panel 3 through
which terminals 12 and 13 extend. Terminals 12 and 13 are also
essentially the same insofar as construction is concerned, and the
description of one applies equally to the other.

Terminal 12 comprises a tubular member 26 of copper, or other
electrically conductive metal, having a cross-sectional peripheral
configuration and dimension corresponding to that of the aligned
central bores 25 of ceramic disks 18 and 20, for a relatively snug
fit when inserted therethrough with a portion of tubular member 26
extending from both ends of the two-piece members 17. The length
of tubular member 26 is such that flattened terminal plate 27
can be formed on the end which projects outwardly or exteriorly
of the heating element frame 2 and compression sleeve portion 28
can project interiorly of the frame 2 a sufficient distance to be
crimped by a crimping tool (not shown) after end 14 of resistance
wire 11 has been inserted into the core 29 of tubular member 26.
When so crimped, the resistance wire is securely connected
both electrically and mechanically to the terminal 12.

The tubular member 26, on which flattened terminal plate
27 has first been formed by a crimping or compressing operation,
is inserted through the aligned central bores 25 of disks 18 and
20 until the inner edges 30 of terminal plate 27 which extend
laterally beyond the peripheral wall 31 of tubular member 26
become lodged in angular recess 24 and abut against the edge region
of ceramic disk 20 surrounding the entrance to central bore 25.

When compressing or otherwise flattening the end of tubular
member 26 to form terminal plate 27, the sides thereof flare
outwardly as a result of such flattening and thus extend laterally
or radially beyond the peripheral wall 31 of the remaining un-
flattened portion of tubular member 26.

After tubular member 26 has been fully inserted through the
aligned central bores 25 of the mated two-piece insulating member,
with front panel 3 of the frame 2 sandwiched therebetween, and
the end 14 of resistance wire 11 has been inserted into the
compression sleeve portion 28 and crimped, the next step is to flatten by crimping, compression or otherwise that portion of tubular member 26 which lies immediately adjacent the entrance region 32 of ceramic disk 18 to central bore 25, and outwardly thereof. Such flattening operation causes the peripheral wall 31 of tubular member 26 to bow outwardly radially beyond the corresponding dimension of central bore 25, thus effectively providing a barrier or locking region 33 on tubular member 26 which prevents axial movement of tubular member 26 relative to the two-piece insulating and clamping member 17 in the direction of withdrawal therefrom. The flattened terminal plate 27 lodged in recess 24 on the opposite side of the said two-piece member 17, and abutting against the edge region of ceramic disk 20 surrounding the entrance to central bore 25 on that side, prevents further axial movement of the terminal member 26 relative to the two-piece member 17 in the direction of insertion therein.

In this manner, when locking region 33 is formed on tubular member 26 in the manner stated, the terminal 12 is effectively locked in place insulated from the frame; and the two-piece insulating and clamping member 17 is effectively clamped together with front panel 3 of the heating element frame 2 clamped therewith.

The flattening operation which forms the said locking region 33 may be performed by a crimping tool. The same crimping tool may be used to perform the three separate operations of (1) forming the flattened terminal plate 27; (2) crimping the end of resistance wire 11 in the compression sleeve portion 28; and (3) flattening tubular member 26 to form locking region 33. Alternatively, each operation may be performed by a separate tool if desired for a particular purpose or a particular use. For example, the flattened terminal plate 27 may be machined, coined, and shaped to mate with a corresponding connecting element leading
from the electrical power source.

An aperture 34 may be provided in terminal plate 27 for connection of a supply conductor thereto by means of a screw or other connecting means.

A modified form of the terminal member in accordance with this invention is shown in Figs. 9–11.

The terminal member 120 comprises a unitary element of copper, or other electrically conductive metal, having a flat terminal plate 270 at one end, integrally joined to a tubular intermediate portion 260 having a central core 290 extending therethrough, which is in turn integrally joined to a compression sleeve portion 280 at the opposite end. As illustrated, the compression sleeve portion 280 may be of smaller diameter, or smaller peripheral dimension, than the tubular intermediate portion 260. The flat terminal plate 270 may be formed to lie in a plane which bisects the cross-section of the tubular intermediate portion 260. An aperture 340 may be provided in flat terminal plate 270 to receive a screw or other connecting means for connecting a supply conductor to the terminal plate 270.

The terminal member 120 is supported through apertures 16 of front panel 3 of heating element frame 2, and insulated therefrom, by means of the two-piece insulating and clamping members 17 as described above with reference to terminal member 12. Connection of the end 14 of resistance wire 11 by crimping in compression sleeve portion 280 is likewise done in a manner similar to that described for terminal member 12. That part of tubular intermediate portion 260 lying immediately adjacent the entrance region 32 of ceramic disk 18 is likewise flattened to bow outwardly radially beyond the corresponding dimension of central bore 25 in similar manner to that described for terminal member 12, to effectively lock the terminal member 120 axially in place through the two-piece insulating member 17, and to
effectively clamp and hold the two-piece member 17 together with
front panel 3 of the heating element frame 2 sandwiched
therebetween.

A further modification of this invention is illustrated in
Figs. 12 and 13. A terminal member 121 is similar to terminal
member 12 described above, and its use with two-piece clamp and
insulating member 17 for mounting in the front panel 3 of frame 2
is substantially the same as described with respect to terminal
member 12. However, the flatted terminal plate 271 of terminal
121 is modified, and includes a longitudinal rib 35 along the
midline of surface 36. The opposite surface 37 includes a slight
recess or depression 38 in the center region thereof.

The terminal member 121 may be formed from a length of copper
tubing or tubing of other electrically conductive metal, having
central bore 291 therein. Flatted plate 271 may be formed by
pressing the cylindrical wall 311 of the length of tubing together
until the interior sides of wall 311 are in mutual contact
throughout substantially their full extent and the exterior sides
form the substantially flat surfaces 36 and 37. In order to form
a terminal member in accordance with this invention by this
method, it is desirable to provide a flow region for the excess
metal which results from pressing a circular portion of tubing
into a flat portion. This flow region in accordance with the
invention is provided by longitudinal rib 35 which is formed
during the operation of pressing the end of the cylindrical
tubing into flattened end plate 271.

The longitudinal rib 35 serves the function of centering
terminal 121 when connecting to electrical clips having a
corresponding recess or channel to receive the longitudinal rib
35. It also provides increased surface contact with such clips
for better frictional hold and improved electrical contact. The
depression 38 formed in surface 37 is located to receive a
corresponding projection or raised portion formed on the inner surface of such electrical clips, for better retention of the clip on the terminal.

An additional modification is illustrated in Figure 14. A terminal member 122 is provided, which is similar to terminal members 12 and 121 described above but which includes a modified external terminal end. The terminal member 122 is formed from a length of copper tubing, or tubing of other conductive metal having central bore 292 therein. The external terminal end is compressed by forging into a cylindrical shank 272 of smaller outer diameter than the outer diameter of the cylindrical wall 312 of the original length of tubing. The excess metal resulting from compressing the external end to form cylindrical shank 272 is caused to flow rearwardly thereof and outwardly around the circumference of the tubing to form annular shoulder 273. The outer diameter of annular shoulder 273 is greater than the outer diameter of cylindrical wall 312, and accordingly provides an abutment means to bear against the edge region of ceramic disk 20 surrounding central bore 25 therethrough. The cylindrical shank 272 includes external threads 274 formed thereon for connection of an eye terminal on the shank 272 and tightening of a nut threaded on shank 272 against such eye terminal.

This modified terminal member 122 is used with two-piece clamp and insulating member 17 for mounting in the front panel 3 of frame 2 in substantially the same manner as described with respect to terminal member 12.
The claims defining the invention are as follows:

1. An electric terminal assembly comprising an integrally formed conductive element, a tubular segment therein, a flat surfaced segment at one end thereof, a central bore in said tubular segment open to the opposite end thereof.

2. An electric terminal assembly as claimed in Claim 1, wherein the width of said flat surfaced segment is greater than that of said tubular segment.

3. An electric terminal assembly as claimed in either Claim 1 or Claim 2, wherein said assembly includes insulating means for mounting association with a panel member, aperture means through said insulating means and panel member, said tubular segment being slidingly received in said aperture means with said opposite end projecting from a first end of said aperture means, said flat surfaced segment projecting from a second end of said aperture means with an edge region of said flat surfaced segment abutting against a portion of said insulating means adjacent said aperture means at said second end.

4. An electrical terminal assembly as claimed in Claim 3, wherein said insulating means includes a two-piece matable insulating assembly, said aperture means includes an insulated central bore through said two-piece matable insulating assembly and a corresponding hole through said panel, said panel being clamped between said two-piece insulating assembly, said insulated bore thereof providing an insulated passage-way through said hole of said panel, the diameter of said insulated passageway being slightly greater than the outer diameter of said tubular segment.
for a snug sliding fit, said opposite end of said tubular segment extending from said first end of said aperture means being deformed adjacent said first end of said aperture means to cause the width of said tubular segment at such location to become greater than prior to such deformation and greater than said diameter of said insulated passageway, whereby said deformed portion of said tubular segment provides an abutment against said insulating means at said first end while said flat surfaced segment provides an abutment against said insulating means at said second end thereby holding said two-piece insulating assembly together with said panel member clamped between, and an undeformed portion of said tubular segment extending from said opposite end having said central bore open at said end to receive the terminating end of a conductor therein.

5. An electric terminal assembly as claimed in Claim 4, wherein said two-piece insulating assembly comprises first and second ceramic disks having central bores therethrough, said first disk including a projecting member extending from a clamping side thereof coaxially surrounding said central bore of said disk, said second disk including a corresponding recess opening to a corresponding clamping side thereof to receive said projecting member therein.

6. An electric terminal assembly as claimed in any preceding claim, wherein said tubular segment includes an intermediate tubular portion and an end tubular portion, the diameter of said end tubular portion being smaller than that of said intermediate portion, said flat surfaced segment comprises a flat plate, the width of said flat plate being greater than the outer diameter of said intermediate tubular segment, said flat plate being integrally
joined to said intermediate tubular segment around a portion of the circumference thereof.

7. An electric terminal assembly as claimed in Claim 6, wherein said flat plate is positioned relative to said intermediate tubular segment to lie in a plane which bisects the cross-section of said intermediate tubular segment in two equal halves, and including an integrally formed junction portion extending at an incline between said flat plate and said intermediate tubular segment.

8. An electric terminal assembly as claimed in any one of Claims 1-5, wherein said flat surfaced segment comprises an end portion of said tubular segment having its peripheral tubular wall pressed flat to form two adjacent flat wall portions integrally joined along each longitudinal side.

9. An electric terminal assembly as claimed in Claim 8, wherein said flat surfaced segment includes a longitudinal rib portion projecting exteriorly from the surface of a one of said two flat wall portions along the midline thereof.

10. An electric terminal assembly as claimed in Claim 9, wherein the other of said two flat wall portions includes a small recess formed centrally therein.

11. An electric terminal assembly, substantially as hereinbefore described with reference to Figs. 1 to 8, or Fig. 9, or Figs. 12 and 13 or Fig. 14 of the accompanying drawings.
12. An electric terminal member, comprising a length of conductive tubing, one end region thereof being compressed into a cylindrical shank, the interior wall of said end region being compressed together, an annular shoulder integrally formed around said length of tubing adjacent the inner end region of said cylindrical shank, a tubular segment having a central bore therein extending from said annular shoulder to a second end, said central bore opening to said second end to receive an electrical conductor therein for crimping connection thereto, the diameter of said cylindrical shank being less than that of said tubular segment, the diameter of said annular shoulder being greater than that of said tubular segment.

13. An electric terminal member as claimed in claim 12, wherein said cylindrical shank is externally threaded to receive an internally threaded nut thereon.

DATED this 10th day of March 1977.

SQUARE D COMPANY
By Its Patent Attorneys
ARTHUR S. CAVE & CO.

Per: R.G. HALLIDAY
DRAWINGS