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Applicant:

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Title of invention:

Electrical apparatus having a screw terminal

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5 The present invention concerns electrical apparatus comprising a plastics material cover or cap and having at least one connecting terminal using a conductor clamping screw whose screwthreaded shank can be screwed into a screwthreaded clamping hole in a fixed connection part and whose head is itself screwthreaded to retain the head in a cylindrical retaining hole in the cap at the end of unscrewing the screw.

10 Apparatus comprising connecting terminals of this type is described in patent FR-A-2 667 989. Users of such terminals encounter some difficulty in screwing in or unscrewing the screw when the screwthreads on the head and on the corresponding screwthreaded hole in the cap are in mesh.

15 An object of the invention is to overcome this problem by enabling electrical apparatus to accept the connection of cables or closed tags by means of screw terminals requiring less force to turn the screws.

20 Another object of the invention is to prevent deterioration of the alignment of the screw and the screwthread in the cap.

25 In accordance with the invention the retaining screwthread is provided on an inner part of the cylindrical hole in the cap, the remaining outer part of the cylindrical hole having a length sufficient to accommodate most of the length of the screwthreaded part of the screwhead. This significantly reduces the force required to turn the screw.

30 The screw is preferably provided with a captive clamping washer one side of which is applied to the conductor to be clamped and the other side of which is applied to the abutment surface on the cap, the screwthread on the screwhead being substantially free of the retaining screwthread when the washer is in the
35 abutment position. As a result of this the retaining



screwthreads are not damaged if the screw is turned further after the clamping washer reaches the abutment position.

5 The retaining screwthread can advantageously be provided on small radially projecting sector-shaped members which are equi-angularly spaced, for example at 120°, around the circumference of the cylindrical hole in the cap.

10 The diameters of the screwthreaded part and of the unthreaded part of the cylindrical hole in the cap advantageously differ by a small radial clearance to enable satisfactory alignment of the screwthreaded shank with the clamping hole when the screw, whose head is in mesh with the retaining screwthread, must be screwed down
15 to clamp the conductor by means of the washer.

If the retaining screwthread is prethreaded, it is preferably oversized to produce a predetermined clearance to accommodate the angular phase difference between the meshing clamping screwthreads on the shank and the
20 meshing retaining screwthreads on the head.

One non-limiting embodiment of the invention will now be described with reference to the drawings.

- In the drawings, figure 1 is a diagrammatic representation of part of electrical apparatus having a
25 specific screw connecting terminal in accordance with the invention.

- Figure 2 is a view of part of figure 1 in cross-section on the line II-II in figure 1.

- Figure 3 is a partly cutaway perspective view of
30 the same part of figure 1.

- Figures 4 and 5 show the screw terminal at two different stages of its use.

- Figure 6 shows one example of oversizing of the retaining screwthread.

35 The screw terminal shown in the figures comprises a

screw A adapted to cooperate with a fixed conductive part B fixed into a base or casing C of low-voltage electrical apparatus and with a cap E fixed to the base of the apparatus. The term cap as used hereinafter is to be understood in a broad sense, denoting any cap, cover or casing surrounding all or part of one or more terminals of the apparatus.

The screw A includes a head 10, a screwthreaded shank 11 and a core 12 between the head and the screwthreaded shank; a clamping washer 13 is captive on the core 12, with some freedom of movement. The washer 13 can be flat and rectangular or V-shape as shown in the figures. The male screwthread T1 on the shank 11 cooperates with a female screwthread T'1 in a screwthreaded hole in the fixed conductive part B.

The head 10 of the screw has a screwthreaded part 15 whose diameter is greater than that of the shank 11 and a manoeuvring part 16 recessed for a screwdriver; this part 16 is smooth and has a diameter that is small relative to the part 15. The male screwthread T2 on the part 15 cooperates with a retaining female screwthread T'2 in a cylindrical hole 17 in a relatively rigid wall 18 of the cap E which is perpendicular to the axis X-X of the screw. The pitches of the screwthreads T1, T2 are the same and the smaller diameter part 16 serves to centre the screwthread T2 on T'2.

To reduce the force required to turn the screw the retaining screwthread T'2 is formed on an inner part 19 of length l_1 of the cylindrical hole 17 in the cover E; the remaining outer part 20 of the hole 17 is unthreaded and its length is sufficient to accommodate the length of the screwthreaded part 15 of the screwhead, the length l_1 being less than half the total length of the hole. The diameter D of the part 20 of the hole 17 is slightly greater than the diameter D'2 of the part 19 (the outside

diameter of the screwthread T'2) so that the part 15 of the head can move with a small radial clearance in the part 20, to maintain good axial guidance of the screw without increasing the force required to turn it.

5 Abutment surfaces 21 are provided on the inside of the cap E to prevent further movement of the washer 13 and extraction of the screw A from the apparatus. When the washer 13 is abutted against the surfaces 21 there is an axial clearance a between the head 10 of the screw and
10 the screwthreaded part 19 of the hole 17. The cap E is fixed to the base C of the apparatus by permanent or demountable lateral connections 22, for example clips, adapted to resist forces exerted in the direction X-X on the wall 18 when the screwthreads T2, T'2 come into mesh
15 with the screwthreads T1, T'1 still in mesh.

 The retaining female screwthread T'2 can be provided around all of the circumference of the cylindrical hole 17 (figure 1). It is preferably formed on small radially projecting sectors 23 spaced at 120;
20 for example (figures 2 and 3). The total length of the threads of the screwthread T'2 is significantly less than that of the threads of the screwthread T2. Baffles 24 are provided in the casing C and/or the cap E to isolate the terminal and to guide movement of the washer 13 in
25 translation along the X-X axis.

 The retaining female screwthread T'2 can be formed by a self-tapping action of the male screwthread T2 of the metal head of the screw on the hole 17 in the plastics material wall 18 or the hole 17 can be
30 prethreaded with sufficient clearance to absorb the angular phase difference between the meshing screwthreads T1, T'1 of the shank 11 and T2, T'2 of the head 10.

 The operation of the terminal as described will now be described with reference to figures 1, 4 and 5.

35 To clamp the bared end of a conductor or cable F

into the terminal the screw A is rotated (by means of a screwdriver inserted through the cylindrical hole 17) from the "open" position in figure 4 or 5 in which the screwthreads T2, T'2 are in mesh or an intermediate position in which the screwthreads T2, T'2 are not in mesh to the clamping position shown in figure 1. The washer 13 which is captive on the core 12 of the screw is guided by the baffles 24 and pivots to fit to the conductor F so that the latter is clamped between the washer, which is abutted against the bottom surface of the head of the screw, and the fixed conductive part B.

To open the terminal fully and in particular to enable it to accept the insertion of closed tags G (figure 5), the screw (figure 4) is rotated to engage at least a first thread of the screwthread T2 in the screwthread T'2 with the screwthreads T1, T'1 remaining in mesh. The head 10 is centred in the hole 17 by its smaller part 16 and/or by a centring arrangement on the cap E. If the hole 17 is not prethreaded the male screwthread T2 cuts the female screwthread T'2 in the radially projecting members 23 while the fixed part B absorbs the corresponding forces via the screwthreads T1, T'1. If the hole 17 is prethreaded with a screwthread T'2 the angular phase difference of the meshing screwthreads T1, T'1 of the shank and T2, T'2 of the screwhead can be absorbed by forming the screwthread T'2 oversized to produce a radial clearance 25 and an axial clearance 26.



CLAIMS

1. Electrical apparatus comprising at least one connecting terminal which includes a screw with a head, a screwthreaded shank and a captive clamping washer between
5 the head and the screwthreaded shank,

- the screwthreaded shank being adapted to cooperate with a screwthreaded clamping hole provided in a fixed conductive part of the apparatus to enable clamping of a conductor between the clamping washer and
10 the fixed part,

- the screwhead having a screwthreaded part adapted to cooperate with a retaining screwthread in a cylindrical hole in a cap of the apparatus,

characterised in that

15 - the retaining screwthread (T'2) is provided on an inner part (19) of the cylindrical hole (17) in the cap (E),

- the remaining outer part (20) of the cylindrical hole (17) is long enough to accommodate most of the
20 length (l₂) of the screwthreaded part (15) of the head (10) of the screw (A).

2. Apparatus according to claim 1 characterised in that the clamping washer (13) can be applied against an abutment surface (21) of the cap (E) so that the screw
25 (A) is captive, the screwthread (T2) on the screwhead (10) being essentially free of the retaining screwthread (T'2) when the washer is so abutted.

3. Apparatus according to claim 1 characterised in that the retaining screwthread (T'2) is provided only on
30 small radially projecting sector-shaped members (23) around the circumference of the cylindrical hole (17).

4. Apparatus according to claim 3 characterised in that the radially projecting members (23) are spaced by 120°.

35 5. Apparatus according to claim 1 characterised in



that the screwthreaded part (T2) of the screwhead (10) is accommodated in the unthreaded part (20) of the cylindrical hole (17) in the cover (E) with a small radial clearance.

5 6. Apparatus according to claim 1 characterised in that the screwhead (10) has a smooth part (16) of smaller diameter for centring the screwthreaded part (T2) of the screwhead on the retaining screwthread (T'2).

10 7. Apparatus according to claim 1 characterised in that the retaining screwthread (T'2) is self-tapped onto radial projections (23) of the cylindrical hole (17) in the cap (E) by the screwthread (T2) on the screwhead (10).

15 8. Apparatus according to claim 1 characterised in that the retaining screwthread (T'2) is prethreaded into the cylindrical hole (17) and oversized to produce a predetermined clearance (25, 26) absorbing the angular phase difference between the meshing clamping screwthreads (T1, T'1) on the shank and the meshing
20 retaining screwthreads (T2, T'2) on the head.