

SPECIFICATION

A tie

5 This invention relates to a tie for use, in particular but not exclusively, to attach tags to articles or to bundles of articles held together by the tie.

There are already known ties of the type comprising a filament with portions at either end that are adapted to be connected one to the other. With these known ties it is usually only possible to attach one end portion to the other from one direction. This necessitates prior determination of which way round the tie may be fastened, and accordingly the operation is more troublesome than it need be and the efficiency of the operation is relatively low.

With a view to eliminating these disadvantages, there was proposed in U.S. Patent No. 3,816,879 a tie in which the first end portion could be inserted into a passage in the second end portion from either end of the passage. Longitudinally extending laterally deflectable locking vanes were formed inside the passage, and a ridge was formed at the back of the first portion. Thus when the first portion was inserted into the passage, the locking vane was laterally deflected. When the tip of the first end portion had passed through the vane, the vane regained its original state and the ridge on the first portion butted against the edge of the vane thereby preventing the first portion from falling out of the passage. However, in this tie, the vane must be formed on the inside of a small passage, and therefore production of the tie is somewhat difficult. Also, when the first portion has been located in the passage, a clearance exists between it and the passage and therefore it may move and twist in the passage and there is some risk of it falling out.

According to the present invention, there is provided a tie comprising a filament, a transversely extending socket at one end region of the filament which socket is formed with a passage extending therethrough and with two abutment surfaces constituted either by at least one transversely extending flange member extending into the passage from the wall thereof or by exterior surface portions of the socket adjacent ends of the passage, and a head portion at the other end region of the filament having an anchoring portion formed with at least one projection which, when unconstrained projects from the head portion at an acute angle to the axis of the filament but which is capable of being constrained such that it can be passed through the passage from either end thereof towards the other end thereof and returning to its unconstrained state to abut against one of said abutment surfaces whereby said tie is securely closed.

A tie of the invention thus has a relatively simple shape and may be mass produced at relatively low cost.

60 The configuration of the socket and the anchoring portion are such that once the anchoring portion has been inserted into the passage, it is almost impossible to remove it.

For a better understanding of the present invention, and to show how the may be carried into effect,

reference will now be made, by way of example, to the accompanying drawings, in which:-

Figure 1 shows a plan view of one form of tie of the invention;

70 Figure 2 shows a side elevation of the tie of Figure 1;

Figure 3 shows, to a larger scale, a plan view of the tie of Figure 1;

Figure 4 shows, partly in elevation and partly in section, a side view of the tie of Figure 3;

75 Figure 5 shows part of the tie of Figures 3 and 4 during the process of insertion of the anchoring portion thereof into the passage;

80 Figure 6 shows part of the tie of Figures 3 and 4 with the anchoring portion fully inserted in the passage;

Figure 7 shows part of the tie of Figures 3 and 4 with the anchoring portion fully inserted in the passage and being subjected to a tensile stress;

85 Figure 8 shows a view similar to Figure 7 in which the anchoring portion is being subjected to a larger tensile stress;

Figure 9 shows a plan view of a second form of tie of the invention;

90 Figure 10 shows, partly in section and partly in elevation, a side view of the tie of Figure 9;

Figure 11 shows a transverse section taken on the line 11-11 of Figure 10;

95 Figure 12 shows part of the tie of Figures 9 and 10 with the anchoring portion fully inserted in the passage;

Figure 13 shows a modification of the socket of the tie of Figure 10;

100 Figure 14 shows an end-on view of a variant form of head portion of a tie of the invention;

Figure 15 shows a plan view of part of the head portion of Figure 14;

Figure 16 shows a plan view of another form of tie of the invention;

105 Figure 17 shows partly in elevation and partly in section, a side view of the tie of Figure 16;

Figure 18 shows part of the tie of Figures 16 and 17 with the head portion inserted in the passage of the socket;

110 Figure 19 shows a modification of the socket of the tie of Figures 16 and 17;

Figure 20 shows a further form of tie of the invention in plan view;

115 Figure 21 shows, partly in elevation and partly in section, a side view of the tie of Figure 20;

Figure 22 shows part of the tie of Figures 20 and 21 with the head portion fully inserted in the passage;

120 Figures 23 and 24 show in, transverse section and side elevation respectively, a second variant of the head portion of a tie of the invention;

Figures 25 and 26 show in transverse section and side elevation respectively a third variant of the head portion of a tie of the invention;

125 Figure 27 shows in side elevation a fourth variant of the head portion of a tie of the invention;

Figure 28 shows in side elevation a fifth variant of the head portion of a tie of the invention;

Figure 29 shows, in side elevation, a sixth variant of the head portion of a tie of the invention;

130 Figure 30 shows, in plan view, a seventh variant of

the head portion of a tie of the invention;

Figure 31 shows, in plan view, an eighth variant of the head portion of a tie of the invention;

Figure 32 shows, in plan view, yet a further form of tie of the invention having a characteristically formed socket;

Figure 33 shows, partly in elevation and partly in section, the tie of Figure 32;

Figure 34 shows, in plan view another form of tie of the invention;

Figure 35 shows, in plan view, a tie of the invention whose filament has been modified;

Figure 36 shows a tie of the invention used in a first manner;

Figure 37 shows a tie of the invention used in another way;

Figure 38 shows a detail of Figure 37 and to a larger scale;

Figure 39 shows a variant of the tie of Figure 35 having a defined tag-holding position on the filament of the tag;

Figures 40 and 41 show two alternative tag-holding means formed on the filament of a tie of the invention; and

Figure 42 shows in plan view an array of a plurality of ties of the invention arranged in parallel as produced by injection moulding.

Referring firstly to Figures 1 and 2, there is shown a tie 1 comprising a socket 2, a head portion 4 and an intermediate filament 3. Preferably the tie is integrally formed from a synthetic plastics material the strength of which is increased by stretching. Preferred plastics materials include nylon and polypropylene. The tie may be formed in a mould such that the filament is relatively thick and short, the filament then being stretched by the mould *per se* or by other drawing means. This stretching of the filament has the effect of increasing strength and elasticity in the filament. Alternatively, if the tie is to be used in conjunction with an article of small size or if it is not necessary for the filament to have a high strength the tie may be used in the "as moulded" condition.

A first form of tie of the invention is illustrated in more detail in Figures 3-8. Referring firstly to Figures 3 and 4, there is shown a tie 5 having a head portion 6 which comprises a tip 7 of substantially conical shape behind which is an anchoring portion formed with two projections in the form of tongues 8 followed by a first cylindrical connecting portion 9, a first protrusion 10, a second cylindrical connecting portion 11, and a second protrusion 12. At the other end of the filament 3 of the tie is provided a socket 13 formed with a passage 14 extending therethrough. Inside this passage 14 is provided a flange 15 having an inner face 15a defining a passage coaxial with the passage 14 and two abutment surfaces 15b substantially perpendicular to the axis of the passage 14. Preferably, as shown in the drawing, the socket 13 is formed symmetrically about the axis of the filament 3. The maximum diameter of the tip 7 is smaller than the inner diameter of the face 15a so that the head portion, as far as the first protrusion 10, can be inserted into the passage 14 and passed through the region of the passage between the abutment sur-

faces 15b. As may be seen from the drawing, the two tongues 8 are connected to the head portion behind the tip 7 and extend at an acute angle to that portion of the tie behind the tip. In the unconstrained state, the distance between the free ends of the tongue is larger than the diameter of the passage between the abutment surfaces 15b. However the sum of the thickness of the two tongues and the diameter of the first connecting portion 9 is smaller than the inner diameter of the passage 14 between the abutment surfaces 15b. The diameter of the first protrusion 10 however is smaller than the diameter of the passage 14 at either end thereof but is larger than the diameter of the passage between the abutment surfaces. It should be understood that protrusion 10, although preferably of a spherical shape, need not necessarily have this shape, and in the latter case, the word diameter refers to the largest dimension of the protrusion in a plane perpendicular to the axis of the filament. Similarly, it is preferable for the second protrusion 12 to have a substantially spherical shape.

The process of insertion of the head portion of the tie into the socket will now be described with reference to Figures 5 and 6. In Figure 5 the tie is shown with the head portion partially inserted in the socket. The filament 3 is shown, diagrammatically, to be curved as if round an article a tag T having been previously passed over the head portion. The tip 7 has been inserted into the passage 14 in the direction indicated by arrow A. The tip 7 and tongues 8 have then been passed into the narrower passage defined by the annular flange 15 and the tie is shown in Figure 5 with the tip 7 clear of the abutment surfaces 15b. The tongues are thus shown in the constrained state. In Figure 6, the tongues have completely passed through the narrower region of the passage 14 and have regained their original state. The distance between the free ends of the tongues is thus larger than the inner diameter of the passage between the abutment surfaces 15b. If it is attempted to push the head portion 6 any further in the direction indicated by the arrow A, the first protrusion 10 abuts against the lower abutment surface 15b, and prevents further insertion of the head portion 6.

Referring now to Figures 7 and 8, the effect of pulling the head portion of the tie in a direction opposite to that indicated by the arrow A is shown. If the force used is relatively low, the tongues 8 are caused to abut against the upper abutment surface 15b and the head portion 6 is thus prevented from leaving the socket. However, if the force used is considerable or relatively large then as shown in Figures 7 and 8 respectively the tongues 8 are bent with the effect of increasing the angle between each tongue and the axis of the filament. Again, the tongues abut against the upper abutment surface 15b and the head portion is thus prevented from leaving the socket. In other words, the head portion cannot be pulled out of the socket unless the tongues are broken off.

It is obvious, from a consideration of Figures 5 to 8, that the head portion 6 can be inserted into the socket in a direction opposite to that indicated - that

is from the upper end of the socket in a direction opposite to that shown by the arrow A.

- A second form of tie of the invention will now be described with reference to Figures 9 to 13. Referring firstly to Figures 9 and 10, the tie is shown to comprise a socket 17 formed with a passage 18 therethrough, there being provided in the passage 18 an annular flange 19 having an inner face 19a defining a passage coaxial and continuous with the passage 18, and having abutment surfaces 19b substantially perpendicular to the axis of the passage 18. An annular projection 20 extending in the same direction as the passage 18 is formed on the edge of each abutment surface 19b at a position remote from the passage walls. The inner circumferential face of each projection 20 has the same diameter as that of the face 19a and is on the same plane as that face. Spaces B are thus defined by the outer circumferential face of each projection 20, the associated abutment surface 19b and the inner wall of the passage 18. The socket 17 is connected by the filament 3 to a head portion 21 which comprises a tip 22 having a substantially conical shape followed by an anchoring portion including two projections in the form of tongues 23, a first connecting portion 24, a first cylindrical connecting portion 25, a first protrusion 26, a second cylindrical connecting portion 27 and a second protrusion 28. The portion 24 has cylindrical faces 24a and flat faces 24b. The diameter of the portion 24 from one cylindrical face to the other is the same as the diameter of the portion 25 and is such that, when the head portion is inserted in the socket, the portions 24 and 25 may be snugly engaged in the passage between the abutment surfaces 19b. The tongues 23 are connected to the head portion behind the tip 22. In the unconstrained state, the distance between the free ends of the tongues 23 is equal to the distance, across the passage 18, between spaces B.
- When the head portion 21 is fully inserted in the socket 17, the free ends of the tongues 23 are in the upper space B as shown in Figure 12. As a result of the snug engagement of the portions 24 and 25 in the passage between the abutment surfaces 19b, the tie cannot move in the lateral direction and the head portion is thus anchored in the socket somewhat more securely than in the first form of tie described with reference to Figures 8 to 3. The configuration of the portions 24 and 25 and the tongues 23 is shown more clearly in Figure 11.
- As shown in Figure 13, the inner diameter of the flange 19 may be slightly reduced adjacent the abutment surfaces 19b with respect to the inner diameter of the flange 19 intermediate the abutment surfaces. This is achieved, in the construction shown in Figure 13, by provision of annular projections 30 formed in the interior of socket 29, the inner face of each projection 30 being at an angle α to the face 19a. Using this construction, the portion 25 of the tie is elastically held by the projections 30 and thus any shaking of the head portion in the socket can be substantially prevented. It is preferred that the angle α should be about 10° .
- A variant form of tie head portion will now be described with reference to Figures 14 and 15. In

Figures 14 and 15 there is shown a tie with a head portion 31 which terminates in an anchoring portion from which extend, at an acute angle to the remainder of the head portion, two projections formed by tongues 32. The head portion 31 further includes a first connecting portion 33, a first protrusion 34, a second connecting portion 35 and a second protrusion 3. The structure of the head portion 31 is relatively simple and therefore it may be moulded very easily.

With this form of head portion as with the head portion of ties described with reference to the Figures 3 to 8 and with reference to Figures 9 to 13, each tongue is preferably formed so that it has a cross-sectional area which increases gradually from its root to its free end. Tongues which have a reduced cross-sectional area near their roots can more easily flex when the head portion of a tie bearing them is inserted into the associated socket. Further, the provision of increased thickness at the free end of a tongue means that the tongue is more resistant to any force which tends to pull the head portion out of the socket. It is also preferred for the free end of each tongue to be rounded.

- Another form of tie of the invention will now be described with reference to Figures 16 to 19. Referring firstly to Figure 16 and 17, there is shown a tie comprising a socket 38 formed with a passage 39 therethrough, end faces 38a of the socket being inclined to the axis of the filament 3 which connects the socket 38 to a head portion 40. The head portion 40 terminates in an anchoring portion which is split to form two projections 41 each of which terminates in a barb 42. In the unconstrained state the distance between the two barbs 42 is larger than the inner diameter of the passage 39. The barbs are formed with faces 42a having the same inclination as the abutment surfaces constituted by the end faces 38a of the socket 38. Behind the projections 41, there are formed in succession a first cylindrical portion 43, a first protrusion 44, a second cylindrical connecting portion 45, and a second protrusion 46. The diameter of the portion 43 is such that it may snugly engage in the passage 39.
- The insertion of the head portion 40 in the socket 38 will now be described with reference to Figure 18. When the head portion 40 is inserted into the passage 39 from the lower end thereof the projections 41 are constrained such that they can be passed through the passage 39. When the faces 42a of the barbs 42 have completely passed through the passage 39 the projections expand again. The head portion 40 is then moved a small amount in the reverse direction until the faces 42a engage on the abutment surfaces 38a. This form of tie also has a relatively simple structure and may thus be moulded easily.

Preferably, as shown in Figure 19, the inner surface of the passage 39 is formed such that the diameter of the passage increases gradually from the middle thereof to the each end thereof. Such a construction facilitates insertion of the projections 41 into the passage.

A further form of tie of the invention will now be described with reference to Figures 20 to 22. Refer-



CLAIMS

1. A tie comprising a filament, a transversely extending socket at one end region of the filament which socket is formed with a passage extending therethrough and with two abutment surfaces constituted either by at least one transversely extending flange member extending into the passage from the wall thereof or by exterior surface portions of the sockets adjacent ends of the passage, and a head portion at the other end region of the filament having an anchoring portion formed with at least one projection which, when unconstrained, projects from the head portion at an acute angle to the axis of the filament but which is capable of being constrained such that it can be passed through the passage from either end thereof towards the other end thereof and returning to its unconstrained state to abut against one of said abutment surfaces whereby said tie is securely closed.
2. A tie as claimed in claim 1, which is moulded integrally from a synthetic plastics material.
3. A tie as claimed in claim 2, wherein said synthetic plastics material is nylon or polypropylene.
4. A tie as claimed in any preceding claim, wherein said anchoring portion is formed with two said projections.
5. A tie as claimed in any preceding claim, wherein said head portion further comprises a first protrusion formed behind, and spaced apart from, said anchoring portion which protrusion has a diameter not smaller than the maximum diameter of said passage between said abutment surfaces.
6. A tie as claimed in claim 5, wherein there is provided between said anchoring portion and said first protrusion a cylindrical connecting portion having a diameter such that it can be snugly engaged in said passage between said abutment surfaces.
7. A tie as claimed in claim 5, wherein when said abutment surfaces lie within said passage there is provided between said anchoring portion and said first protrusion a cylindrical connecting portion having a diameter larger than the diameter of said passage between said abutment surfaces.
8. A tie as claimed in claim 5, 6 or 7, wherein said head portion further comprises a second protrusion formed behind, and spaced apart from, said first protrusion.
9. A tie as claimed in any one of claims 5 to 7, wherein the diameter of the head portion behind said first protrusion tapers gradually towards the diameter of said filament.
10. A tie as claimed in claim 8, wherein the diameter of the head portion between said first and second protrusions decreases gradually from the maximum diameter of said first protrusion to said second protrusion.
11. A tie as claimed in claim 8 or 10, wherein the diameter of the head portion immediately behind the first protrusion is reduced to a value less than that of the remainder of the head portion between the first and second protrusions.
12. A tie as claimed in any preceding claim, wherein said filament is formed so as to extend back on itself at a position substantially in the middle thereof.
13. A tie as claimed in any preceding claim, wherein intermediate portions of the filament extend from a portion of increased width in relation to the diameter of the filament, which portion is provided with a passage therethrough in which a tag may be held.
14. A tie as claimed in any of claims 1 to 12, wherein intermediate portions of the filament extend from a portion of increased width in relation to the diameter of the filament, which portion is provided with a stud on which a tag may be releasably held.
15. A tie as claimed in any one of claims 1 to 12, wherein intermediate portions of the filament extend from a portion of increased width in relation to the diameter of the filament, which portion is provided with a notch in which a tag may be releasably held.
16. A tie as claimed in any one of claims 13 to 15 when appended to claim 12, wherein said portion is located at said position.
17. A tie as claimed in claim 12, wherein said filament is formed with an acute angle at said position.
18. A tie as claimed in any preceding claim, comprising a plurality of said anchoring portions disposed at intervals along the head portion.
19. A tie as claimed in any one of claims 1 to 18, wherein said head portion terminates in a tip having a substantially conical shape with a maximum diameter smaller than the diameter of said passage between said abutment surfaces, and the or each said projection is a tongue connected to the head portion behind said tip and extending at an acute angle to that portion of the tie behind the tip.
20. A tie as claimed in any one of claims 1 to 17, wherein said head portion terminates in said anchoring portion from which extend(s) at an acute angle to the remainder of said head portion, at least one said projection constituted by a tongue.
21. A tie as claimed in claim 19 or 20, wherein each said tongue has a cross-sectional area which increases gradually from its root to its free end.
22. A tie as claimed in claim 21, wherein the free end of each said tongue is rounded.
23. A tie as claimed in any one of claims 19 to 22, wherein the head portion is formed with two parallel flats immediately behind the root(s) of said tongue(s).
24. A tie as claimed in any one of claims 1 to 17, wherein said head portion terminates in said anchoring portion which is split to form at least two said projections each of which is provided at its free end with a barb such that, when the anchoring portion is fully inserted into the passage and then retracted, the barbs engage on the appropriate abutment surface.
25. A tie as claimed in claim 24 wherein the abutment surfaces are provided by said exterior surface portions of the sockets and wherein the diameter of the passage increases gradually from the middle thereof to each end thereof.
26. A tie as claimed in any one of claims 18 to 24, wherein said abutment surfaces are provided by an annular said flange.



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27. A tie as claimed in claim 26, wherein said annular flange is formed in the passage symmetrically about the axis of the filament.

28. A tie as claimed in claim 26 or 27, when
5 appended to claim 18, 19 or 20, wherein an annular projection extending in the same direction as the passage is formed on the edge of each abutment surface at a position remote from the passage walls, such that, when the head portion is fully inserted in
10 the socket, the or each said tongue is trapped on the abutment surface between the annular projection and the passage wall.

29. A tie as claimed in claim 26, 27 or 28, when
appended to claim 23 wherein the inner diameter of
15 said annular flange is slightly reduced adjacent said abutment surfaces with respect to the inner diameter of said annular flange intermediate said abutment surfaces.

30. A tie as claimed in any one of claims 18 to 24
20 wherein said abutment surfaces are formed by a plurality of projections extending from the wall of said passage, the projections being segments of the same annulus.

31. A tie substantially as hereinbefore described
25 with reference to, and as shown in, Figures 1 to 8; or Figures 9 to 12 optionally as modified by Figure 13; or Figures 16 to 18 optionally as modified by Figure 19; or Figures 20 to 22; or Figures 32 and 33; the foregoing figures being optionally modified or additionally modified by any of Figures 14 and 15; 23 and
30 24; 25 and 26; 27; 28; 29; 30; 31; 35; 39; 40 and 41 of the accompanying drawings.

32. A tie substantially as hereinbefore described
with reference to, and as shown in Figure 34
35 optionally as modified by any one of Figures 35 and 39 to 41 of the accompanying drawings.

33. An assembly comprising a plurality of ties as
claimed in claim 1 arranged in parallel, sockets of
adjacent ties being connected by a series of first
40 connecting members and-or head portions of adjacent ties being connected by a series of second connecting members.

34. An assembly as claimed in claim 33, which is
moulded integrally from a synthetic plastics material.
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35. An assembly of ties substantially as hereinbefore described with reference to and as shown in, Figure 42 of the accompanying drawings.