Oct. 7, 1969 J. F. THOMPSON 3,470,616

FORMED RETICLE FOR OPTICAL SIGHTING INSTRUMENTS

Filed July 12, 1967

Fig. 1

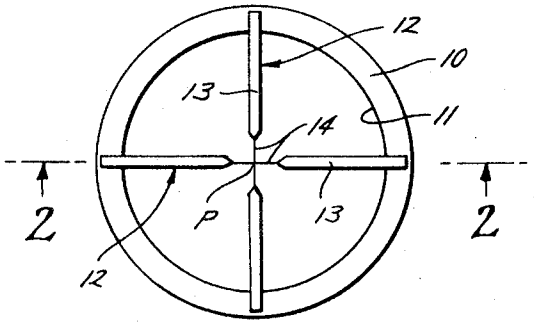


Fig. 2

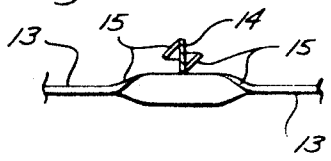


Fig. 3

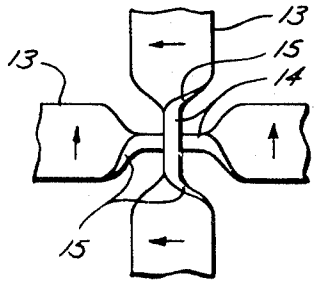


Fig. 4

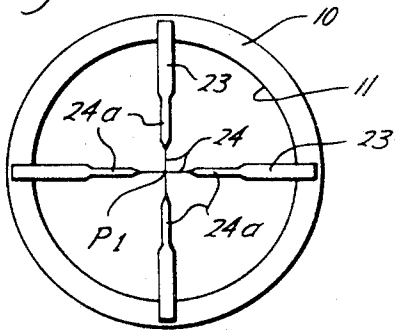


Fig. 5

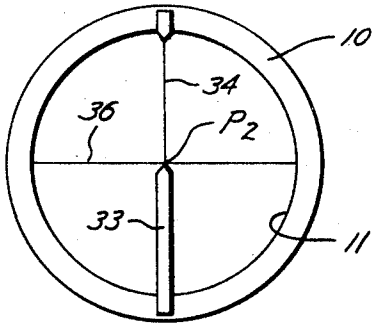
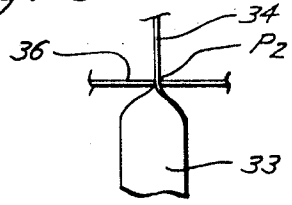


Fig. 6



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FORMED RETICLE FOR OPTICAL SIGHTING INSTRUMENTS

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U.S. Cl. 33—50 18 Claims

ABSTRACT OF THE DISCLOSURE

A reticle for sighting instruments employing ribbon-like filaments having integral portions thereof which form the crossover or aiming portions formed and permanently set at an angle to the plane of the broadest filament surface, so as to provide an aiming point at the center of the reticle, which is narrower than the adjacent portions of the filaments.

BACKGROUND

Many reticles for optical sighting instruments have been devised. Among the most common is the crosshair reticle comprised of two filaments crossing each other at right angles at a point corresponding to the center of a circular field of view defined by a supporting member or by some other element in the optical instrument.

Recent variations in the design of crosshair reticles for use in telescopic rifle sights have provided improved sighting marks for giving the shooter fine crossover portions which do not obstruct large portions of the target, and wider outer portions which are quickly seen with relation to the target and serve to guide the eye toward the center aiming point.

Heretofore, crosshair elements providing such improved sighting marks have been constructed by etching glass, by twisting flat wire, by flattening round wire, and by painting substances between wires mounted so as to define the desired shape. Chemical milling and electrical discharge methods are coming into use. However, all have inherent disadvantages.

Etched glass has proven undesirable as a reticle by reason of its expense of construction, its tendency to attract dirt in a focal plane of the instrument, the adverse effect on its light transmission qualities by reason of adding two air-glass surfaces to the optical system, and its lack of durability.

The tapered form of reticle has been constructed by securing one end of a ribbon-like wire to a reticle support, then twisting the wire 180° and securing the opposite end to the reticle support. This form of reticle is disclosed in Benford U.S. Patent No. 3,023,504. While the twisting method in this Benford patent allows the use of relatively strong and bulky material and presents a reticle which appears narrow at the crossover portions and wide at the outer portions, the narrow appearing portion does not always stay in place at the crossover point, in that the impact and vibrations caused by rifle recoil can cause the narrow appearing portion to move short distances up and down the length of the wire by reason of the spring-like action of the twisted filaments. Twisting such a filament 180° throughout its length will not cause it to take a permanet set form.

Fine round wire is being used in the manufacture of both the so-called "four-post" crosshair and the tapered crosshair by utilizing a flattening process. An example of such a crosshair and its method of manufacture is disclosed in Schray U.S. Patent No. 3,286,352. In accordance with this patent disclosure, the outer portions of

round wire 0.001 to 0.0015 inch in diameter are flattened to provide the post or tapered outer portions of the crosshair, and the central crossover portion is left in its original cylindrical form. Thus, while the outer portions may be 0.003 to 0.0035 inch wide and the thickness is only a small fraction of that width by reason of having been flattened, the flattening process is limited in application by reason of the fact that the strength and bulk of the wire used is ordinarily limited to that of small diameter wire of relatively soft alloy metals. The width to which the outer portions can be flattened is limited by the diameter of the central portions; i.e., a wire 0.0006 inch in diameter cannot be flattened as wide as a wire 0.0015 inch in diameter. The reticle filaments produced by flattening are inherently weak by reason of the stresses developed at the transition area between the round and flat portions and tend to break when subjected to the forces of rifle recoil or rough handling.

Painting substances between wires mounted so as to define the desired filament shape is somewhat tedious and expensive, and generally not satisfactory. Such a filament construction is disclosed in Plisk et al. Patent No. 3,229,370.

Practically any form of cross wire desired can be made through chemical milling and electrical discharge methods. (See, for example, Benford Patent No. 2,800,718.) However, those methods require expensive material and equipment. Also, the products do not withstand the stresses of inexpensive and rapid mounting and assembling process, nor do thay withstand heavy rifle recoil. The narrow crossover portions tend to be the weaker portions of the crosshair but are subjected to the greater stresses, shock and vibrations from rifle recoil. Generally, the cross-sectional areas of the central crossover portions are not as great as the cross-sectional areas of the outer portions, thus the outer portions have greater strength than the central portions, although the latter must bear greater stresses than the outer portions.

SUMMARY

The present invention is directed to an improved reticle and reticle filament which provide improved sighting characteristics while obviating the disadvantages of prior designs, such as described above.

The primary object of this invention, therefore, is to provide a crosshair reticle having narrow appearing crossover portions and wider outer portions having greater strength and durability, and less expensive to manufacture than reticles heretofore made.

An important object of this invention is to provide a reticle filament comprising a flat ribbon-like body having an integral crossover portion formed to a permanent set (which merely means that the filament is formed and permanently set) at an angle to the plane of the body.

In accordance with this invention, the sighting element is made from a flat ribbon-like filament having a portion thereof, ordinarily intermediate the ends of the filament, formed and set by rotating the portion generally about the longitudinal center line of the filament, to thereby permanently set the portion at a selected angle with respect to the plane of the filament, the resultant width of the portion viewed in the plane of the body of the filament being determined by the angle through which the portion has been rotated. It will be understood that, as used herein, the plane of the body of the filament and the plane of the filament refer to the focal plane of the sighting element in which the filament lies.

Other and more specific objects and advantages of this invention will become more readily apparent from the following detailed description when read in conjunction with the accompanying drawing which illustrates several useful embodiments in accordance with this invention.

In the drawing:

FIG. 1 is an enlarged view of a four-post reticle in accordance with one embodiment of the invention, the filaments thereof being enlarged disproportionately for purposes of illustration;

FIG. 2 is a sectional view of an enlarged scale taken generally along line 2—2 of FIG. 1;

FIG. 3 is an elevational view on a greatly enlarged scale of the crossover portions of the filaments in FIG. 1;

FIG. 4 is an enlarged view, like FIG. 1, of another form of four-post reticle in accordance with this invention;

FIG. 5 is an enlarged view of a single post reticle in accordance with another embodiment of this invention; and

FIG. 6 is an elevational view on a greatly enlarged scale of a detail of the embodiment illustrated in FIG. 5.

Referring to the drawing and to FIGS. 1 and 2 in particular, there is illustrated a preferred form of crosshair reticle of the so-called "four-post" type. This includes an annular support **10** of any suitable and conventional construction adapted to be mounted in the sight tube or barrel of an optical sighting instrument, such as a telescope sight for a rifle or the like. Support **10** has a circular opening **11** which ordinarily surrounds or defines the image of the field of view of the sight. Two identical sighting elements or filaments, each designated generally by the numeral **12**, are strung across opening **11** perpendicular to each other and intersecting at the center of opening **11**, a point which ordinarily corresponds to the optical axis of the sight.

Each of the filaments **12** comprises a substantially flat ribbon-like body **13** having substantially greater width than thickness, and having an integral short length portion **14** intermediate the ends of the filament. The short length portion **14** is herein termed the "crossover" portion which has been suitably formed from the body of the filament to a permanent or set position so as to be disposed at an angle to the plane of body **13**.

In the embodiment illustrated in FIGS. 1 and 2, the crossover portion of the filament is formed from the body by subjecting the crossover portion to a rotational force such as to turn the portion out of the plane of body **13** to a permanent set position of 90° to the plane of the body. The portion **14** is disposed symmetrically with respect to the plane of body **13**. When the crossover portions are disposed in perpendicular intersecting relation, the relative positions thereof will be as illustrated in exaggerated scale in FIG. 2. To the observer the silhouette of the reticle will appear as seen in FIG. 1; namely, as an intersection of fine or narrow crossover elements **14**, the intersection defining the aiming point P, connected to relatively wide outer light-excluding portions **13** which tend to direct the viewer's eye toward the aiming point P.

Various methods and apparatus useful for rotating portion **14** out of the plane of body **13** to the desired angular position relative thereto, will be readily apparent to those skilled in the art. One arrangement of apparatus for forming the filament to the desired shape involves the use of clamp means for fixedly clamping portions of the filament, the clamp means being spaced apart a distance substantially corresponding to the desired length of the crossover portion. Another clamping means fitting closely over substantially the full length of the desired crossover portion will be secured thereto and by effecting relative rotation between the latter clamping means and the means clamping the end portions of the filament, the desired degree of rotation of the crossover portion may be accomplished. By positioning the moving clamp in closely spaced relation to the fixed clamps, the crossover portion may be turned so as to attain a permanent set at whatever angle it is desired to position it relative to the plane of a filament.

While small, generally triangular laps **15** (FIGS. 2 and 3) will be developed at the junction of the crossover portion with the adjacent portions of the filament, it is found that these will not weaken the filament at these junctions, but will, if anything, increase the strength at these points, which, in more conventional designs, constitute the weak points of the reticle. Furthermore, the crossover portion in the present case will retain the identical cross-sectional dimensions of the original ribbon-like filament and thus will retain the full strength of the original filament body. This has been effectively demonstrated by subjecting filaments formed as described, and reticles constructed therefrom, to very severe impact testing, without breakage under conditions far exceeding forces to which reticles would normally be subjected when in use in firearm sights.

FIG. 3 illustrates on a greatly enlarged scale, the deformation effected in forming the crossover portions from the bodies of the filaments. The arrows on the respective filaments designate the direction in which the crossover portions are turned in rotating them out of the planes of the filament bodies.

The material from which the filaments are constructed in accordance with this invention, may be any suitable metallic material and may be constructed, as by molding, from some of the newer plastic materials having the appropriate physical properties.

It will be understood that the dimensions of the crossover portions, as well as those of the filament as a whole, may be varied widely, depending upon the instrument in which the reticle is to be used and other conditions of use familiar to those skilled in the art.

In general, a ribbon-like filament ranging in width from about 0.002 to 0.005 inch and having a thickness ranging from about 0.0005 to 0.002 may be employed. Crossover portion **14** will generally range from about 0.020 to 0.060 inch, but the preferred length for portion **14** will range from about 0.035 to 0.040 inch.

While in most instances the crossover portions will be set at an angle of 90° to the plane of the body of the filament and thereby produce the narrowest silhouette possible for the crossover portion, it may be desirable to have the silhouette of the crossover portion appear somewhat wider than the narrowest dimension, that is, the thickness of the filament. In such cases, the angle at which the crossover portion is set may be made less than 90°. In general, the angle of the crossover portion relative to the plane of the filament body will be in the range of from about 10° to 90°. By thus varying the angle between the planes of the crossover portion and of the filament body the apparent width of the crossover portion, when viewed in the plane of the filament body, may be widely varied, and this variation in width, relative to the width of the filament body, may range from 1:1.5 to 1:10, but preferably will be in the range of 1:3 to 1:5.

Considered in another aspect, the length of the crossover portion may be determined in terms of the diameter of the field of view, as defined by the reticle support or other element of the sighting instrument. Considered in this aspect, the length of the crossover portion may be varied widely from about 2% to about 50% to the diameter of the image of the field of view. A preferred length for a rifle telescope sight will be calculated at about 5.5% to the diameter of the field of view, or about 0.040 inch for a sight having a three-quarter inch image of the field of view.

FIG. 4 illustrates another embodiment in which the crossover portions are formed to produce a stepped narrowing of the reticle silhouette to the crossover point. This form may be produced by setting the crossover portion at two different angles relative to the plane of the filament. Thus, the crossover portions **24**, the intersection of which defines the aiming point P_1, may be set at 90° to the plane of the filaments **23**, while a portion **24***a* extending outwardly from portions **24** may be set at an angle less than 90°; for example, 45°, so as to

provide the stepped-down silhouette illustrated in FIG. 4. It will be understood that various combinations of angular relationships may be employed to modify the silhouette of the reticle in a similar manner.

FIGS. 5 and 6 illustrate what may be termed "a single post" form of reticle, constructed by extending the crossover portion **34** to a length such as to extend from the center of reticle support **10** to the inner periphery of the support, thus making the length of crossover portion **34** substantially equal to one-half the diameter of the field of view defined by opening **11**. The junction between crossover portion **34** with body **33** of the filament will define the aiming point P_2 at substantially the center of opening **11**. The configuration which produces the aiming point is illustrated on an enlarged scale in FIG. 6. A cross wire **36** may be employed, if desired, to intersect the aiming point at right angles to filament **33**, but will not be required in this single post design.

It will be understood that various changes and modifications may be made in the details of the illustrative embodiments within the scope of but without departing from the spirit of this invention.

What I claim and desire to secure by Letters Patent is:

1. In a reticle for an optical sighting instrument, a sighting element in close proximity to the focal plane thereof, comprising: a ribbon-like filament body having a substantial length with a width which is substantially greater than its thickness to provide relatively broad side surfaces, said side surfaces lying in planes substantially parallel to the focal plane of said instrument except for an integral portion intermediate the ends of said filament body which is formed and permanently set at an angle to the focal plane.

2. A filament body as set forth in claim **1** in which said portion has a length of from about 0.020 to about 0.060 inch.

3. A filament body as set forth in claim **1** in which said portion has a length of from about 0.035 to 0.040 inch.

4. A filament body as set forth in claim **1** in which the ratio of the width of said portion viewed in the focal plane to the width of said filament body is in the range of from 1:1.5 to 1:10.

5. A filament body as set forth in claim **1** in which the ratio of the width of said portion viewed in the focal plane to the width of said filament body is in the range of from about 1:3 to 1:5.

6. A filament body as set forth in claim **1** in which said angle is in the range from about 10° to 90°.

7. A filament body as set forth in claim **1** substantially horizontally disposed in which said portion is symmetrically disposed about the longitudinal center line of said filament body.

8. A filament body as set forth in claim **7** in which said portion is centrally disposed about the longitudinal axis of the optical instrument.

9. In combination with a support for an optical sighting instrument, the support having a sighting opening therethrough, a sighting reticle located in said opening, comprising: a pair of ribbon-like filaments spanning said opening in close proximity to the focal plane and having mid-portions intersecting in the center thereof, each of said filaments having a substantial length with a width which is substantially greater than its thickness to provide relatively broad side surfaces, said side surfaces lying in planes substantially parallel to the focal plane of said instrument except for a short integral portion including its mid-portion which is formed and permanently set at an angle to the focal plane, whereby the intersection of said mid-portions defines a sighting point at said center narrower than said width of said filament.

10. A reticle according to claim **8** wherein the length of each of said mid-portions is in the range from about 2% to about 50% of the diameter of said opening at the focal plane.

11. A reticle according to claim **9** wherein each of said mid-portions has a length of from about 0.020 to about 0.060 inch.

12. A reticle according to claim **9** wherein each of said mid-portions has a length of from about 0.035 to 0.040 inch.

13. A reticle according to claim **9** in which the ratio of the width of each of said mid-portions viewed in the focal plane to the width of the filament with which said mid-portion is integral is in the range from about 1:3 to 1:5.

14. A reticle according to claim **9** wherein said angle is in the range from about 10° to 90°.

15. A reticle according to claim **9** wherein said filaments are respectively horizontally and vertically disposed and wherein the angularly set portion of each of said filaments is symmetrical about the longitudinal center line of said filament.

16. A reticle according to claim **8** in which the ratio of the width of said mid-portion of each filament viewed in the focal plane to the width of said filament with which said mid-portion is integral is in the range of from 1:1.5 to 1:10.

17. A reticle according to claim **9** wherein the length of each of said mid-portion is about 5.5% of the diameter of said opening at the focal plane.

18. In a reticle for an optical sighting instrument, a sighting element in close proximity to the focal plane thereof, comprising: a straight, horizontally-disposed, ribbon-like filament body having a substantial length with a width which is substantially greater than its thickness to provide relatively broad side surfaces, said side surfaces lying in planes substantially parallel to the focal plane of said instrument except for an integral portion intermediate the ends of said filament body which is formed and permanently set at an angle to the focal plane.

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