W. F. GRAFTON.

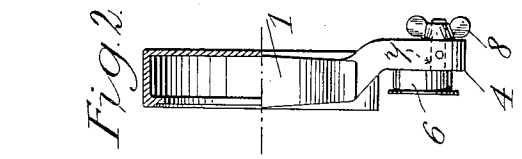
TENSIOMETER.

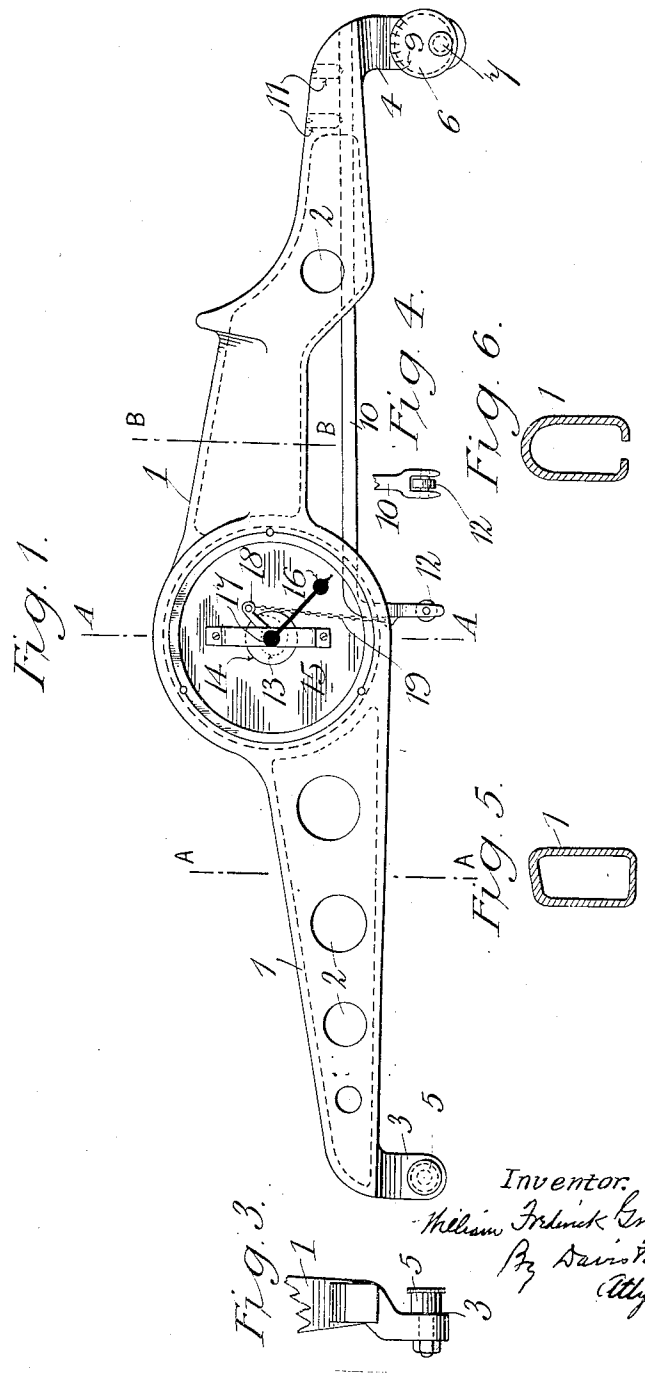
APPLICATION FILED MAY 27, 1918.

1,306,891.

Patented June 17, 1919.

2 SHEETS—SHEET 1.





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2 SHEETS—SHEET 2.

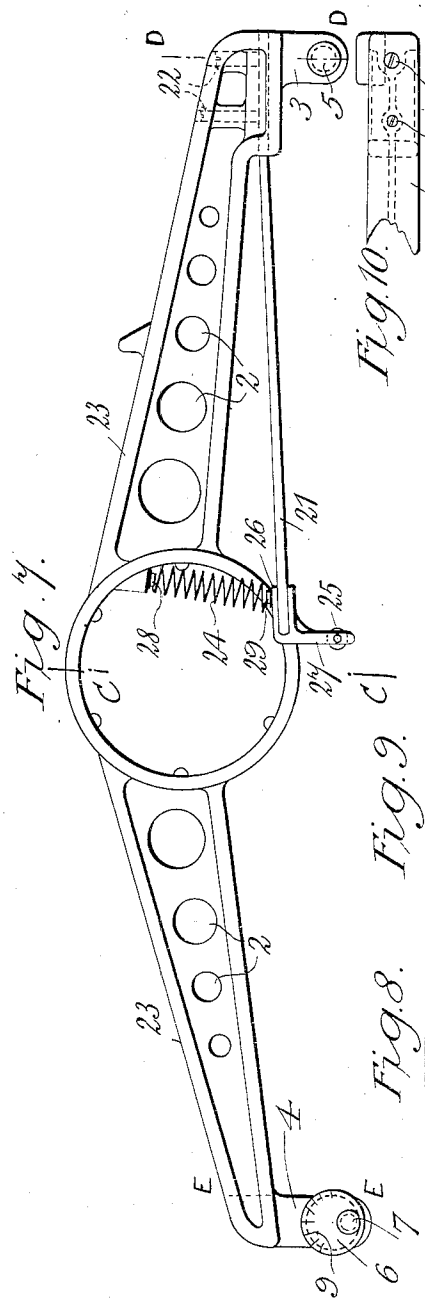


Fig. 1.

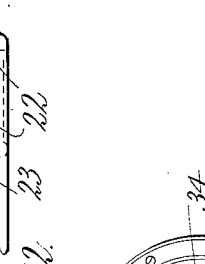


Fig. 10.

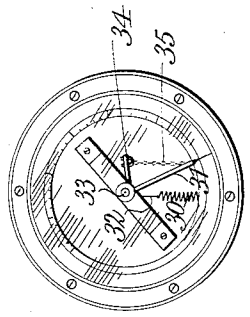


Fig. 12.

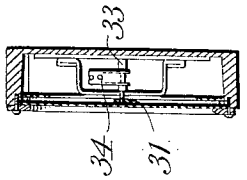


Fig. 11.

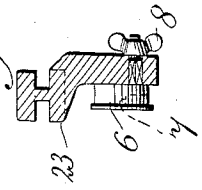


Fig. 9.

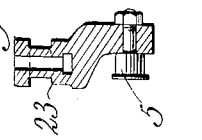


Fig. 8.

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UNITED STATES PATENT OFFICE.

WILLIAM FREDERICK GRAFTON, OF GLASGOW, SCOTLAND.

TENSIOMETER.

1,306,891. Specification of Letters Patent. Patented June 17, 1919.

Application filed May 27, 1918. Serial No. 236,801.

To all whom it may concern:

Be it known that I, WILLIAM FREDERICK GRAFTON, a subject of the King of Great Britain and Ireland, residing at Glasgow, in the county of Lanark, North Britain, have invented Improvements in Tensiometers, of which the following is a specification.

This invention has reference to tensiometers suitable for ascertaining the tension of wires, cords, cables and the like, hereinafter termed wires, such for instance as those constituting the rigging of aircraft of the kind comprising a carrier having end members that impinge on the same face and side of the article to be tested, an intermediate member that impinges on its opposite face or side, and a spring element adapted to be strained correspondingly to the tension of the said article with means for indicating the extent of such strain and it has for object to provide for the said purpose an instrument practically free from friction, and light enough to be manipulated with one hand only.

The invention is hereinafter described with reference to the accompanying drawings wherein Figure 1 is a front view illustrating one construction of tensiometer according to the invention, Fig. 2 is a right-hand end view of the same, partly in section on the line A—A of Fig. 1, Fig. 3 is a partial left-hand view thereof, Fig. 4 is a lateral view of a detail shown in Fig. 1, and Figs. 5 and 6 are detail views showing the cross section of the base-bar on the lines A—A and B—B respectively of Fig. 1. Fig. 7 is a front view of a modified construction of tensiometer, also according to the invention, Figs. 8 and 9 are respectively partial right and left hand sectional views of the same on the lines D—D and E—E respectively of Fig. 7. Fig. 10 is a plan view of the portion shown in Fig. 8. Fig. 11 is a vertical sectional view of the base-bar on the line C—C of Fig. 7, showing also the indicating dial and mechanism pertaining thereto, and Fig. 12 is a front elevation of said dial and pertaining mechanism.

In the construction illustrated in Figs. 1 to 6, the apparatus comprises a base-bar 1, preferably hollow or of channel or cellular construction and advantageously having its web-portions pierced by apertures or holes 2 that reduce its weight without impairing its rigidity such apertures or holes being preferably of circular form and of different diameters to serve as wire gages. The bar 1 is provided at its ends with projecting portions 3 and 4 carrying contact devices such as steel studs or rollers 5, 6 respectively, adapted to bear against the wire being tested. One of these contact devices, for instance the device 6 shown to the right in Fig. 1 and also in Fig. 2, is preferably, as shown, so constructed as to be adjustable corresponding with variations in the gage of the wire.

Such adjustment may be provided for by forming the movable contact 6 as an eccentric that is rotatable about a pin 7 in the base-bar and can be clamped in the desired position by means of a wing-nut 8 or the like, the face of the eccentric being provided with a dial or gage-disk 9 which in practice bears readings corresponding to several sizes or gages of wire thus doing away with the necessity for a separate contact for each size of wire.

Upon the base-bar there is mounted the actuating and indicating mechanism of the instrument, which comprises a spring steel bar 10 firmly held at one end, as by a pair of binding screws 11 securing it to the base-bar, and furnished at its other end, which is freely movable, with a central contact 12 (Figs. 1 and 4) arranged intermediately of the terminal contacts 5 and 6. The free end of the spring bar 10 is connected with the indicating mechanism, which is carried by the central portion of the base-bar 1 and preferably comprises a light coil spring 13 that takes the weight of the indicating gear and is inclosed within a spring drum 14, and a graduated dial 15 provided with an indicating pointer 16 on the spindle 17 on which there is secured a lever 18 connected by a light chain 19 with the free end of the spring bar 10. As will be readily understood, with such a spring bar as 10 the movements per inch of pressure at the beginning of its deflection is much greater than when nearing the limit of its travel, so that for the first 25 lbs. wire tension there would be a very much greater pointer travel than for the last 100 lbs. To rectify this and secure a fairly uniform scale reading, the chain 19 it attached to lever 18 and with the movement of spring 10 the leverage is gradually decreased on lever 18 until this lever assumes a position at right angles to the spring bar 10 whereupon the chain 19 comes into contact with the spindle 17 of the pointer 16

which gives the minimum leverage and therefore the maximum movement of the pointer relatively to the movement of the spring bar 10, thus enlarging the scale reading toward the latter end of the spring bar's travel and securing a more uniform scale. The spring 13 contained in the drum 14 takes the weight of the pointer 16 and chain 19 and causes the pointer to follow without backlash the movement of the spring bar 10.

In use, the adjustable end contact 6 of the instrument is first set to the size of the wire to be tested, and the instrument is then applied in such manner that the wire passes over the terminal contacts 5 and 6 and under the central contact 12, which is consequently displaced to an extent dependent on the tension of the wire, this displacement being transmitted through the chain 19 and lever 18 to the indicating gear which has been calibrated to accurately indicate the tension.

While a tensiometer constructed as hereinbefore described with reference to Figs. 1 to 6 has proved itself very satisfactory in practice within a certain range of variation of tension, the modified construction described with reference to and shown in Figs. 7 to 12 possesses an advantage in the case of a more extended range of variation since the spring device for actuating the indicating mechanism is so constructed and arranged as to render it less liable to derangement and such that any one instrument can more conveniently be adapted according to requirement for any given one of various, but possibly widely differing, ranges of applicability, while the manufacture of parts of the device is at the same time somewhat simplified.

It is found that in instruments intended for indicating relatively high tensions and even to some extent in those for medium tensions, inimical straining of the spring is apt to or does occur particularly when permitting certain extents of amplitude of movement of the free end of the spring bar otherwise suited to advantageous use for the range of the instrument.

In a tensiometer of this modified construction the spring bar 21 firmly secured at one end by screws 22 to the base bar 23 and freely movable at its other end is combined with an auxiliary spring member 24, the two jointly contributing in exercising the function of the instrument, injurious strain to either within the predetermined range of the device being avoided.

In practice the principal spring 21 can conveniently be alike in all respects in each instrument irrespective of its intended range of use, the auxiliary spring 24 being in each case so selected as to meet the particular requirement of the instrument in which it is to be used and advantageously so that the amplitude of movement of the free end of the principal spring 21 is materially less than would be needful, or at least desirable, when used alone thus avoiding exceeding the limit of elasticity of the said spring.

For simplifying the manufacture and facilitating the tempering of the principal spring 21 such spring instead of being formed in one with the element carrying the central or intermediate contact device 25 can be constituted by a plain straight bar at the free end of which there is fitted a separate member carrying the said contact device. Preferably this contact device carrier comprises a member having a substantially horizontal element 26 and a substantially vertical element 27 the former whereof is, in the example, tubular and is securely fitted over the free end of the principal spring 21, the contact device 25 being carried on the lower end of the said vertical element 27. The auxiliary spring 24 is constituted in the example by a helical spring disposed approximately vertically between abutments, the upper side of the horizontal element 26 serving as one abutment, the other abutment being provided above it on a suitable part of the casing, and these abutments, having studs or projections 28, 29, respectively to retain the spring in position. As previously mentioned this spring 24 can be of any strength suited to the intended range of the instrument the principal spring 21 being advantageously of like strength in every case.

The spring 30 for taking the weight of the pointer 31 in this construction consists of an ordinary helical spring (Fig. 12) with a flexible connection 32 extending around the spindle 33 of the pointer and this spindle carries a lever 34 connected by a chain 35 to the vertical element 27.

Tensiometers such as described possess the following important advantages:—

In effecting contact between the wire to be tested and the free end of the spring bar no friction arises between the central contact thereon and the wire; there are no journals or sliding surfaces liable to bind or lock on change of temperature or to be otherwise affected by climate. The spring bar being free, an inaccuracy in the zero point of the dial due to accidental fall, the aging of the spring, or the like can be instantly corrected, as by adjustment of the dial, while each instrument can be independently calibrated, empirically if desired, so as to eliminate all errors of calculation.

What I claim is:—

1. A tensiometer comprising a base bar, terminal and central contact device carried by said base bar and adapted to bear against a wire being tested, a spring device supported at one end by said base bar, its other end constituting a freely movable carrier, a device rotatably mounted on said carrier and constituting said central contact, tension-in-

dicating means supported by said base bar, and means connecting said spring carrier for said contact device with said indicating means.

2. A tensiometer comprising a base bar, terminal and central contact devices carried by said base bar and adapted to bear against a wire being tested, a spring blade supported at one end by said base bar, its other end constituting a freely movable carrier, a device rotatably mounted on said carrier and constituting said central contact, tension-indicating means supported by said base bar and means connecting said spring carrier for said contact device with said indicating means.

3. A tensiometer comprising a base-bar, terminal contact devices carried by said base-bar and adapted to bear against one side of a wire being tested, a central contact device adapted to bear against the opposite side of said wire, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, a tension indicating dial supported by said base-bar, a spindle arranged axially of said dial, a pointer and a lever each carried by said spindle, a member extending between and connecting the free ends of said lever and aforesaid said spring device that supports the central contact, and a spring connected with said spindle and adapted to oppose the movement of said lever.

4. A tensiometer comprising a base-bar, terminal and central contact devices carried by said base-bar and adapted to bear against a wire being tested, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, said spring device comprising a spring bar secured at one end to the base-bar and having said central contact mounted on its other end, a coil spring interposed between abutments provided on said spring bar and base-bar, tension indicating means supported by said base-bar, and means connecting said spring carrier for said contact device with said indicating means.

5. A tensiometer comprising a base-bar, terminal and central contact devices carried by said base-bar and adapted to bear against a wire being tested, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, said spring device comprising a spring bar secured at one end to said base-bar, a contact device carrier comprising a substantially horizontal element securely fitted over the free end of the spring bar and a substantially vertical element, carrying on its lower end the central contact device, tension indicating means supported by said base-bar, and means connecting said spring carrier for said contact device with said indicating means.

6. A tensiometer comprising a base-bar, terminal and central contact devices carried by said base-bar and adapted to bear against a wire being tested, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, said spring device comprising a spring bar secured at one end to said base-bar, a contact device carrier comprising a substantially horizontal element securely fitted over the free end of the spring bar and a substantially vertical element carrying on its lower end the central contact device, a coil spring interposed between an abutment on the base-bar and an abutment forming part of the horizontal element of said central contact carriers.

7. A tensiometer comprising a base-bar having perforations adapted to serve as wire gages, terminal and central contact devices carried by said base-bar and adapted to bear against a wire being tested, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, tension indicating means supported by said base-bar, and means connecting said spring carrier for said contact device with said indicating means.

8. A tensiometer comprising a base-bar, terminal contact devices carried by said base-bar and adapted to bear against a wire being tested, a central contact, a resilient support therefor carried by said base-bar, interchangeable supporting means of different degrees of resiliency adapted to be interposed between abutments on said base-bar and said central contact, tension indicating means supported by said base-bar, and means connecting said resilient support for said contact device with said indicating means.

9. A tensiometer comprising a base-bar of cellular construction having web-portions pierced by circular holes of selected diameters adapted to serve as wire-gages, terminal contact devices carried by said base-bar, a central contact device, resilient means for supporting said last mentioned contact device upon said base bar, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, a tension indicating dial supported by said base-bar, a spindle arranged axially of said dial, a pointer and a lever each carried by said spindle, a member extending between and connecting the free ends of said lever and aforesaid spring device that supports the central contact and a spring connected with said spindle and adapted to oppose the movement of said lever.

10. A tensiometer comprising a base-bar,

a pair of terminal contact devices carried by said base-bar, one of said contact devices being formed as an eccentric in the desired position, a graduated gage-disk carried by said eccentric, a central contact device resiliently supported on said base-bar intermediately of said terminal contacts, a spring device connected with said base-bar and having a movable free end constituting a carrier for said central contact device, a tension indicating dial supported by said base-bar, a spindle arranged axially of said dial, a pointer and a lever each carried by said spindle, a member extending between and connecting the free ends of said lever and aforesaid spring device that supports the central contact, and a spring connected with said spindle and adapted to oppose the movement of said lever.

11. A tensiometer comprising a base-bar, a pair of rollers serving as terminals, contact devices carried at the ends of said base-bar, one of these rollers being formed as an eccentric rotatable about a stud carried by the base-bar, a third roller arranged intermediately of said pair of rollers and serving as a central contact device, a spring bar secured at one of its ends to an end portion of the base-bar and extending substantially to the center of the length thereof, a carrier for said central contact adapted to engage with and to be secured to the free end of said spring bar, a dial carried by said base-bar, a spindle centrally arranged with respect to said dial, a pointer on said spindle, a lever secured on said spindle and a flexible member connecting said lever with the free end of said spring bar.

Signed at Glasgow, Scotland, this 6th day of May, 1918.

WILLIAM FREDERICK GRAFTON