C. L. BERGER.

MAGNETIC NEEDLE.

APPLICATION FILED OCT. 30, 1909.

1,016,732. Patented Feb. 6, 1912.

Fig. 1.

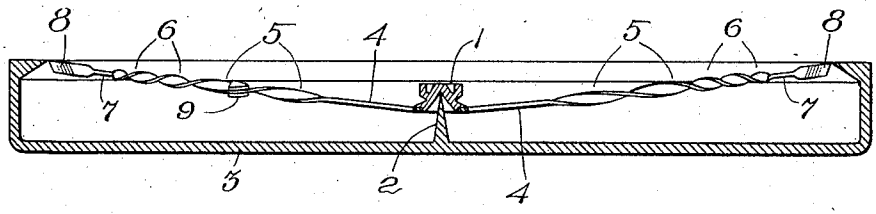


Fig. 2.

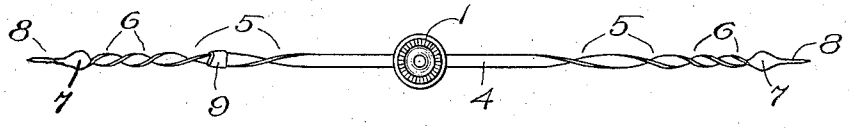


Fig. 3.

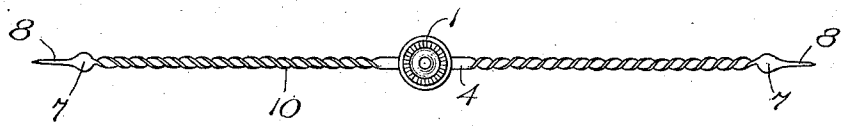
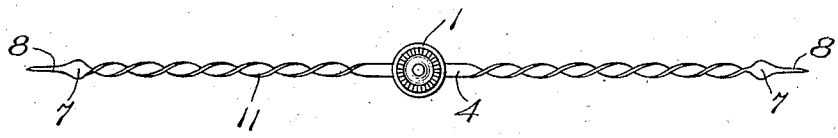


Fig. 4.



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UNITED STATES PATENT OFFICE.

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MAGNETIC NEEDLE.

1,016,732. Specification of Letters Patent. Patented Feb. 6, 1912.

Application filed October 30, 1909. Serial No. 525,527.

To all whom it may concern:

Be it known that I, CHRISTIAN L. BERGER, a citizen of the United States, and resident of Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Magnetic Needles, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

The object of the present invention is to increase the efficiency and improve the construction and usefulness of magnetic needles such as are used in compasses, galvanometers, and other instruments for scientific purposes. To this end, I provide means for increasing the lightness without decreasing the magnetic intensity, and means for maintaining the magnetic axis coincident with the geometrical axis. Instead of making the needle of a plane and comparatively heavy straight bar, I make it extremely thin, and hence light, and twist the metal more or less. By twisting the bar, the trend of the grain of the steel which is imparted when the sheet of steel is rolled, ceases to lie all in one direction and hence the magnetic effect of the direction of said grain is destroyed by the twisted shape so that the magnetic direction of the needle (which tends to follow the direction of the grain of the steel) does not diverge from the geometrical axis, but coincides therewith. By making the needle light and twisting it, it has a greater rigidity and strength as well as a greater surface area than if flat or not twisted and hence greater magnetism or intensity, so that a needle of the same efficiency need contain only approximately half as much metal. It has therefore not only greater lightness and in consequence less wear on its pivot, but greater directing force and better retention of magnetism.

Further advantages, and the constructional features of my invention, will be pointed out in the course of the following description, taken in connection with the accompanying drawings, in which various forms of the invention are shown.

In the drawings, Figure 1 shows my needle in side elevation, a compass box being conventionally shown in vertical section; Fig. 2 is a plan view of this preferred form of needle; and Figs. 3 and 4 are similar views of modified constructions of the needle.

The needle, as herein shown, is made of a thin bar or stiff strip of steel, originally flat, and then twisted from one end to the other, the twists being preferably reversed from the center toward the opposite ends, *i. e.*, each half of the needle, from the center outward, is preferably exactly the same. In the construction shown in Figs. 1 and 2, a usual center support 1 is provided on which the needle turns on its pivot 2 in a box 3. Secured to said center support is the needle proper, which, in the preferred construction, has a central horizontally flat portion 4 and then a plurality of relatively long twists 5, succeeded by several short twists 6, and then by a flat enlarged horizontal area 7 terminating in a relatively sharp straight part 8 standing vertically edgewise. On the twists 5 I mount a band-shaped rider 9 having a twist corresponding to that of the parts 5 so that it may slide along the parts 5 without binding thereon or becoming loose. In the remaining figures I have shown other arrangements of the twisted steel, Fig. 3 showing a fine twist 10, and Fig. 4 a coarser twist 11. These modified forms show practical constructions, and indicate that I am not limited to the preferred details explained above, but I have found that the finer twist, extending throughout the whole length of the needle as shown in Fig. 3, affords too great magnetic intensity for general use, as the earth's vertical magnetic intensity has too great an effect on such a needle when it is to be used in places widely separated in latitude. In other words, the forms of my needle having more twists would have such a variation of dip when used, for instance, in Boston and in New Orleans, that it would require a change of the counterweight 9, which would be objectionable.

The extreme lightness of my construction renders the needle more sensitive to the earth's vertical magnetism or tendency in a surveyor's compass to produce a dip of the needle, but on the other hand it gives less friction on the pivot and hence less chance to dull the pivot, and enables the needle to retain its fine pointing qualities for a longer time than if heavier. My construction permits me to make a needle much lighter and yet just as stiff as the old heavy needle, and the twist moreover increases the surface area for a given length to such an extent that a much lighter and shorter needle has the same magnetism as the former heavy

larger needle. The twisted construction gives a light thin needle, moreover, practically the same strength for retaining its form as the old heavier needle. The extra twists or finer twists 6 adjacent the ends of the needle provides more metal at the ends and hence provides more magnetism at the ends. The enlarged flat area 7 or arrow-headed end is provided for the same purpose, viz. to increase the magnetism at the ends. A chief advantage of the twisted construction is that it eliminates the consequent poles which have hitherto interfered with the accuracy of the usual flat-bar needles, *i. e.*, it makes the magnetic North and South poles of the needle lie in the geometrical axis of the needle.

It is to be understood that the twisted construction above explained and referred to in the following claims, in its broader interpretation and as required for carrying out my invention in its generic aspects, does not necessarily denote a form of needle which is twisted in its superficial appearance or has any external or visible twisted contour, but the term "twist" is rather intended to designate the special arrangement of the grain of the magnetic material extending diagonally in different directions at different points throughout the length of the needle, and more or less spirally disposed about the longitudinal geometrical axis of the needle. The desired result of causing the magnetic poles to lie in the geometrical axis of the needle, and the corresponding increase of efficiency, are attained by this arrangement of the grain of the metal irrespective of whether the exterior form of the metal presents a twisted or other outline.

Having described my invention, what I claim as new, and desire to secure by Letters Patent is:

1. A magnetic needle for scientific instruments, having a twisted form adjacent its ends.

2. A magnetic needle for scientific instruments, having a plurality of transverse twists therein.

3. A magnetic needle for scientific instruments, having a plurality of twists of different pitches adjacent each end.

4. A magnetic needle for scientific instruments, having an enlarged surface area adjacent each end provided by means of a relatively fine twist.

5. A magnetic needle for scientific instruments, having an enlarged surface area adjacent each end provided by means of a twist and a laterally extended flat end-portion.

6. A magnetic needle for scientific instruments, provided with twists, the twists of the opposite ends being in reverse directions.

7. A magnetic needle for scientific instruments, provided with twists, and with a relatively short band rider having a corresponding twist to permit said rider to slide lengthwise on the needle.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

CHRISTIAN L. BERGER.

Witnesses:
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