H. B. GAFFERS.

BRACE OR KNEE.

APPLICATION FILED MAY 23, 1919.

1,343,445. **Patented June 15, 1920.**

Fig. 1.

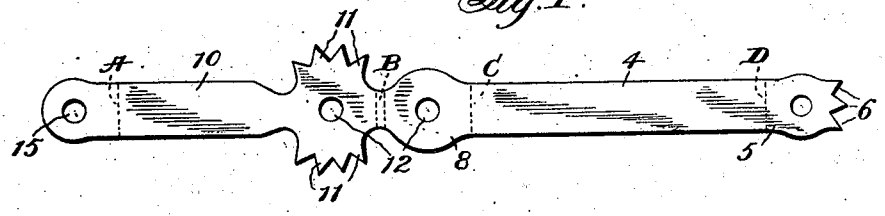
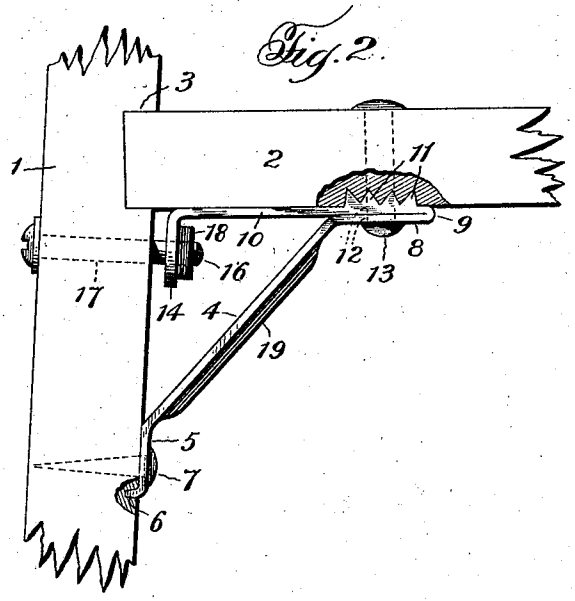


Fig. 2.



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UNITED STATES PATENT OFFICE.

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BRACE OR KNEE.

1,343,445. Specification of Letters Patent. Patented June 15, 1920.

Application filed May 23, 1919. Serial No. 299,096.

To all whom it may concern:

Be it known that I, HERMAN B. GAFFERS, a citizen of the United States, residing at Watervliet, in the county of Albany and State of New York, have invented certain new and useful Improvements in Braces or Knees, of which the following is a specification, reference being had therein to the accompanying drawing.

The invention relates to improvements in a brace or knee, primarily adapted for use in uniting and bracing the step of a ladder with the side rails thereof.

It is an object of this invention to provide a knee or brace that is struck up from a single piece of metal, simple in construction and inexpensive to manufacture, yet highly efficient in serving to support and anchor the steps of a ladder to the side rails thereof.

It is a further object of the invention to provide a one-piece ladder brace or knee that is stamped from a suitable blank of metal and then folded at different points to provide a diagonal brace adapted to be united to the side rail, and a horizontal step engaging portion formed with struck up teeth and receiving a tie bolt passing through the rail, by which the step is drawn toward and united with the rail.

The invention further consists in the provision of a knee or brace of this character formed from a single piece of sheet metal suitably bent to provide an upstanding brace portion secured to the ladder rail and having a horizontal part extending backwardly from its point of connection with the diagonal portion and fastened to the step, said horizontal portion being normally spaced from the side rail and adapted to receive a suitable tie bolt connected with the rail for tightly drawing the step into its socket formed in the rail to always form a tight connection between these parts.

In the accompanying drawings I have disclosed the preferred embodiment of the invention, but it will of course be understood that this disclosure is merely for the purpose of illustration and that many changes can be made without departing from the spirit of the invention.

In the drawings—

Figure 1 illustrates the struck up brace before it is folded; and,

Fig. 2 discloses the brace as applied to a ladder.

Referring now more particularly to the drawings, wherein like reference characters indicate corresponding parts, the numeral 1 designates the side rail of a ladder, while the numeral 2 indicates a step extending at right angles thereto. The ladder in the present disclosure is shown as having a seat 3 formed therein to receive the end of the step thereby serving to support the same. While the invention is to be disclosed as applied to a ladder, it will of course be understood that the brace can be equally as well used for service in other fields, and will be now described.

The improved brace or knee is of a very rigid and strong character, being struck up from a piece of metal which may be sheet metal or the like, having an upstanding diagonal brace portion 4 formed at its lower end with a vertically disposed offset part 5 having a plurality of inwardly bent prongs 6 adapted to be driven into the ladder rail, the brace being secured to said rail by an auxiliary fastening nail or bolt 7 passing through an aperture therein. The diagonal portion of the brace at its upper end is bent to form the horizontal portion 8 which is slightly widened and this horizontal portion is then rebent at the point 9 to form a horizontal bracing and connecting part 10 adapted to engage the ladder step. The rebent part 10 is fashioned with a plurality of upstanding teeth 11 formed with a widened part thereof adapted to overlie the widened part 8 of the horizontal portion. These widened portions have alined apertures 12 therein receiving a rivet 13, by which the brace is firmly united to the step and the prongs 11 in the rebent part 10 firmly embedded therein. The rebent part 10 or horizontal brace extends along the under side of the step and near its end is formed with a down turned flange 14 having an aperture 15 therein.

It will here be observed that the down-turned flange 14 is spaced from the inner wall of the side rail 1, and is shown as terminating short of the vertical plane of the outer end of the diagonal brace 4. In uniting steps to the rails of ladders and the like, these steps after they are first united frequently become loosened, and it is for the purpose of enabling the steps to be always tightly united with the rails that the horizontal rebent part 10 is spaced from the side rails.

To draw the step and the side rail together a suitable tie bolt 16 is employed, passing through an aperture 17 in the side rail and the opening 15 in the flange 14, the tie bolt having a threaded end and receiving the nut 18. From the foregoing it will be seen that when the brace is applied the prongs 6 are driven into the side rail and the nail 7 inserted through the opening in the vertically disposed part of the brace, while the teeth 11 are likewise embedded in the step and the upper portion of the knee or brace united to the step by the rivet 13. The bolt 16 is then inserted through the opening in the side rail and the opening in the flange in the rebent part 10 and the nut thereon adjusted to tightly draw the step into the seat 3 formed in the rail. The flange 14 by being spaced from the rail permits the step to be tightly drawn together with the rail, and from constant usage should this connection loosen the same can again be tightened by advancing the nut upon the threads of the bolt 16.

The diagonal brace 4 is preferably shown as formed with a corrugation 19 which obviously strengthens the same, and while the brace is preferably formed in the manner hereinbefore described and illustrated in the accompanying drawings, it will be distinctly understood that the construction and formation of the various parts thereof may be changed without in any way departing from the invention.

In Fig. 1, I have shown the brace after the same has been stamped from a sheet of metal and before the blank has been folded or bent to form the brace. The blank is shown as having the fold lines A, B, C and D, it being obvious that the vertical flange 5 is formed by folding the metal at the fold line indicated by the character D, the horizontal portion 8 being formed by bending the metal on the line C, from where it is rebent as indicated by the fold lines B to form the horizontal bracing portion 10 having the down turned flange 14 bent at right angles thereto on the line A. The teeth 6 and 11 are of course bent outwardly at right angles to the upper surface of the vertical flange 5 and the horizontal rebent part 10 to protrude and enter the side rail and the step. The rebent portion 10 having the teeth 11 is preferably of considerable width to offer a number of protruding teeth and also a relatively broad surface upon which the step 2 rests.

Having thus described the invention, what I claim is:

1. The combination with a side rail and a step of a ladder, of a knee therefor having a diagonal brace portion secured to the ladder rail and a part extending rearwardly from its point of connection with the diagonal brace portion fastened to the step and having a downturned flange normally spaced from the side rail, and adjustable means connected with the side rail and the downturned flange for drawing the same toward the rail.

2. The combination with a side rail and a step of a ladder, of a knee struck up from sheet metal having a diagonal portion provided with a vertical flange secured to the ladder rail, said diagonal portion at its upper end having a horizontal part, the metal being then rebent to form a horizontal step engaging portion and means for securing said horizontal portion to the step, and an adjustable element for drawing the brace toward the ladder rail.

3. A knee or brace for ladders composed of a blank of metal bent to provide a diagonal brace and a vertical flange extending therefrom at its lower end, the blank at the upper end of the brace being bent outwardly and thence rebent inwardly to provide a step engaging portion.

4. A knee or brace for ladders composed of a blank of metal bent to provide a diagonal brace and a vertical flange extending therefrom at its lower end, the blank at the upper end of the brace being bent outwardly and thence rebent inwardly to provide a step engaging portion, the inwardly bent portion of the blank being disposed in a horizontal plane and having a downturned flange.

5. A knee or brace for ladders composed of a blank of metal bent to provide a diagonal brace and a vertical flange extending therefrom at its lower end, the blank at the upper end of the brace being bent outwardly and thence rebent inwardly to provide a step engaging portion, the inwardly bent portion of the blank being disposed in a horizontal plane and having a downturned flange, said flange being offset from the vertical plane of the outer end of the diagonal brace portion.

6. A metal knee for ladders composed of a single blank of metal having a diagonal brace, the brace at its upper end being outwardly turned and then rebent to provide a step engaging surface, the rebent portion being slightly widened at one end and formed with struck up teeth.

7. A metal knee for ladders composed of a single blank of metal having a diagonal brace, the brace at its upper end being outwardly turned and then rebent to provide a step engaging surface, the rebent portion being slightly widened at one end and formed with struck up teeth, and having at its opposite end a downturned flange provided with a bolt receiving opening.

8. The combination with a side rail and step of a ladder, of a knee or brace therefor, said knee or brace being formed from a single blank of metal bent to provide a diagonal brace having a vertical flange on

its lower end adapted to engage the side rail, teeth bent from the lower end of the vertical flange to extend at right angles and enter the side rail, the upper end of the diagonal brace being bent outwardly and then rebent inwardly to form a horizontal step-engaging portion, vertically extending teeth formed on the horizontal step-engaging portion and adapted to be embedded in the step, a downwardly extending flange formed on the inner end of the horizontal step-engaging portion, said downwardly extending flange being spaced from the side rail, and means passing through the side rail and downwardly extending flange for drawing the step toward the side rail.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

HERMAN B. GAFFERS.

Witnesses:

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EDNA I. MCCUNE.