2 Sheets—Sheet 1.

J. F. KLINGLESMITH.

BEVEL.

No. 189,311. Patented April 10, 1877.

Fig. 1.

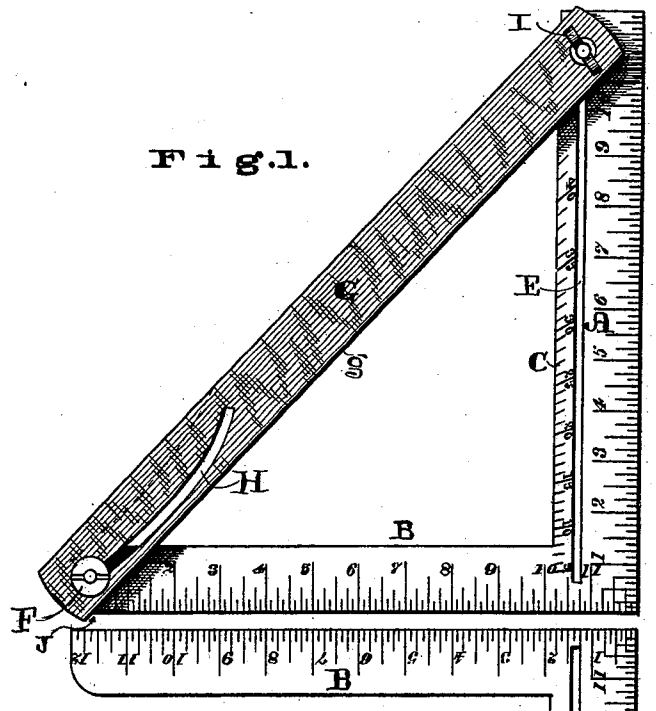


Fig. 2

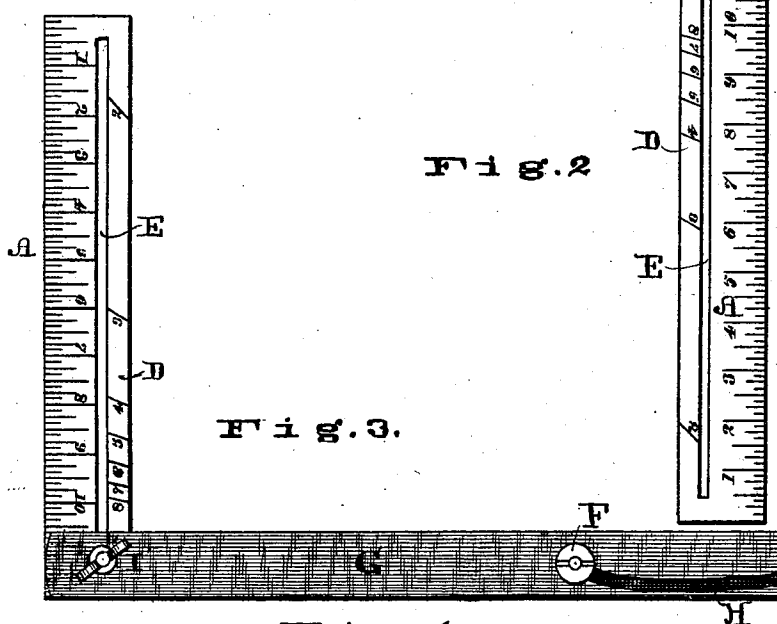


Fig. 3.

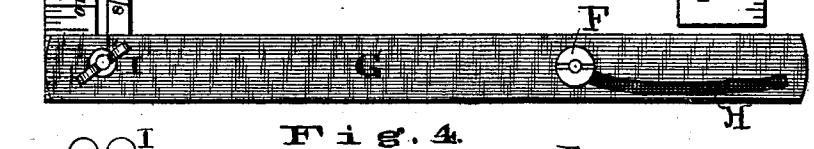
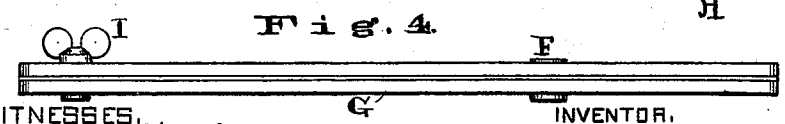


Fig. 4.



WITNESSES.

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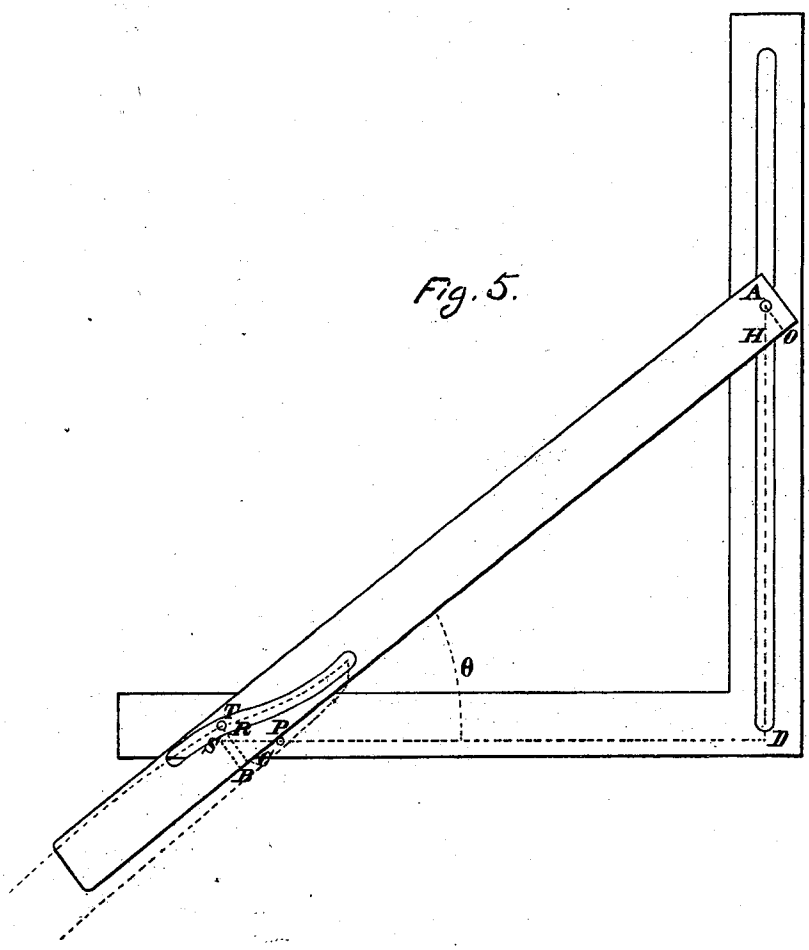
2 Sheets—Sheet 2.

J. F. KLINGLESMITH.

BEVEL.

No. 189,311 Patented April 10, 1877.

Fig. 5.



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UNITED STATES PATENT OFFICE.

JOHN F. KLINGLESMITH, OF ST. LOUIS, MISSOURI, ASSIGNOR OF ONE-HALF HIS RIGHT TO CONRAD FARNER, OF SAME PLACE.

IMPROVEMENT IN BEVELS.

Specification forming part of Letters Patent No. **189,311**, dated April 10, 1877; application filed April 28, 1876.

To all whom it may concern:

Be it known that I, JOHN F. KLINGLESMITH, a resident of St. Louis, Missouri, have invented a new and useful Improvement in Bevels, of which the following is a full, clear, and exact description, reference being had to the annexed specification, in which—

Figure 1 is a side view of the invention, showing the side of the square that is graduated into degrees; Fig. 2, a view showing the reverse side of the square and the one provided with the pitch-scale; and Fig. 3, a view of the invention presenting the same side of the square shown in Fig. 2, but with the straight-edge closed upon one arm of the square; and Fig. 4, an edge elevation of the straight-edge. Fig. 5 represents a diagram illustrating the mathematical analysis of the slot H, the lettering of this figure being peculiar to itself.

In the remaining figures the same letters refer to the same parts.

My aim is to furnish means for readily and accurately laying off a bevel of any desired degree or pitch. The improvement also combines the advantages of an ordinary square, try-square, rule, and protractor.

Referring to the annexed drawing, A B, Figs. 1, 2, 3, represent two arms joined at right angles to each other, forming a square. The arm A, on the side or face shown in Fig. 1, is, at its inner edge C, graduated into degrees, and on the reverse side or face (shown in Figs. 2 and 3) provided with a pitch-scale, D, or a series of divisions for laying off a roof of any desirable pitch. This arm also has a slot, E, extending longitudinally therein, and far enough toward either end of the arm to enable the straight-edge (hereinafter described) to be suitably moved thereon. The arm B, toward its outer end, is provided with a pivot, F, preferably in the form of a pin, projecting similarly from both sides of the arm, as shown in Figs. 1, 3, and 4. G represents a straight-edge, that is connected with the square, and constructed to move thereon from the position shown in Fig. 3, where it is closed upon the arm B, outward to any desired angle with that arm, as in Fig. 1. For this purpose the straight-edge, toward what may be termed its outer end, has a peculiarly-shaped slot, H, (hereinafter more fully described,) in which the pin F engages, and toward its other (or inner) end is provided with a pin, I, preferably in the form of a clamp-screw, that engages in the slot E of the arm A. The straight-edge is preferably made of two similar pieces, arranged, respectively, against the face of the square shown in Fig. 1, and that shown in Fig. 2, and held together by any suitable means.

Now, the straight-edge is constructed and arranged to move upon the square in the following manner: The inner end, being guided by the pin I in the slot E, is moved in and out upon the arm A, but never projecting crosswise beyond that arm, while the other (or outer) end of the straight-edge is guided upon the arm B, by reason of the pin F engaging in the slot H, so as to cause its inner edge *g* to always pass over a point, J, on the arm B, and which is the center from which the scales C and D are laid off. This peculiar movement of the straight-edge over the center J is the especial feature of this improvement; and, to enable it to be performed properly and automatically, the slot H must be shaped peculiarly, and this peculiar shape or curvature is determined by the relation of the pivot F to the center J; for, according to the distance and direction of the pivot from the center must be the shape or curvature of the slot. This shape or curvature may be determined, practically, as follows: Let the straight-edge be moved upon the square as in use—that is, the inner end being guided along the slot E, and the inner edge of the outer end being caused to move over the center J; then, during the movement, and, say, by means of a pencil-point, occupying the intended position of the pivot F, and bearing against the straight-edge, let a line be traced upon the latter. This line indicates the position and shape of the intended slot.

As this curvature is peculiar, and as it may be desirable to determine it theoretically, I beg to submit the following as a correct mathematical statement of the curve used as the axis of the slot H in said straight-edge, and as represented in Fig. 5.

Let O be the origin of rectangular co-ordinates: x=OC and y=TC, the co-ordinates of the tracing-point T, or the point of the pivot F″ of said application. Represent the four constants involved as follows:

AO=a SP—m
PD=b ST=n

P being the point through which OC must always pass.

Let θ = the variable angle OPD. Then,

$x = a \tan. \theta + b \sec. \theta + m \cos. \theta - n \sin. \theta$, (1)

$y = m \sin. \theta + n \cos. \theta$, (2)

which are the equations of the curve.

To eliminate θ, eq. (1) gives

$$x - \frac{a \sin. \theta + b}{\cos. \theta} = m \cos. \theta - n \sin. \theta$$

Squaring this and adding to the square of (2), we have—

$$\left(x - \frac{a \sin. \theta + b}{\cos. \theta}\right)^2 + y^2 = m^2 + n^2;$$

or,

$$x \cos. \theta - a \sin. \theta - b = \pm \cos. \theta (m^2 + n^2 - y^2)^{\frac{1}{2}}, \quad (3)$$

Solving (2) and (3) for sin. θ and cos. θ, we have—

$$\cos. \theta = \frac{ay + mb}{an + mx \mp m(m^2 + n^2 - y^2)^{\frac{1}{2}}}, \quad (4)$$

$$\sin. \theta = \frac{xy - bn \mp y(m^2 + n^2 - y^2)^{\frac{1}{2}}}{an + mx \mp m(m^2 + n^2 - y^2)^{\frac{1}{2}}}, \quad (5)$$

Squaring (4) and (5), and adding, we have—

$$\left[\frac{ay + bm}{an + mx \mp m(m^2 + n^2 - y^2)^{\frac{1}{2}}}\right]^2 + \left[\frac{xy - bn \mp y(m^2 + n^2 - y^2)^{\frac{1}{2}}}{an + mx \mp m(m^2 + n^2 - y^2)^{\frac{1}{2}}}\right]^2 = 1,$$

which is the equation required. When freed from radicals it proves to be an algebraic equation of the eighth degree.

As the constants take new values, the form, though not the law, of the curve will change. A portion of the curve depending upon the values assumed in Fig. 5 is approximately drawn. It has two asymptotes, both parallel to the axis of X, and the maximum value of Y is $(m^2+n^2)^{\frac{1}{2}}$.

The slot H is of sufficient length to enable the straight-edge to be closed upon the arm B, as in Fig. 3, where the edge g coincides with the inner edge of the arm B, or to be opened out upon the arm A to any desired degree. By means of the clamping feature of the pin I the straight-edge can be fastened at any point upon the square.

In operation, to lay off a specified bevel, let the straight-edge be opened to the degree in question, as indicated on the scale C, and as shown in Fig. 1. The inner edge g of the straight-edge is then laid against the base-line of the work, and the desired bevel is indicated by the outer edge of the arm B. To lay off any desired pitch, the straight-edge is similarly opened out, reference being had, however, to the pitch-scale D. For instance, for a roof of one-quarter pitch, set the edge at the line of the pitch-scale marked 4. The outer edge of the arm A will then represent the bevel of the crown of the rafter, the outer edge of the arm B the bevel of the foot, while the edge g of the straight-edge represents the rafter. And in similar manner any work in carpentry involving angles and bevels can be laid off. The tool also can be employed by the draftsman and surveyor. By folding the straight-edge upon the arm B the device can be used as a square or try-square. Both faces of the arms A B are graduated into feet and inches, like an ordinary square.

It will be seen that in all cases where the device is used to lay off an angle this important advantage is obtained from the above-described construction; but one (inner) end of the straight-edge requires adjustment and fastening, the other (outer) end always being guided automatically over the center J.

The work of laying off bevels with the present instrument is greatly facilitated in comparison with that required when both ends of the straight-edge must be fixed.

I am aware that heretofore a straight-edge has been used in combination with a square; but both arms of the square, as well as the straight-edge, were slotted, and all of such slots were straight. Such an instrument, even if new with me, would not answer my present purpose, and I disclaim it; but

What I claim is—

1. The herein-described bevel, consisting of the square A B, having the slot E and pin F, and the straight-edge G, having the slot H, constructed as described, and the pin I, combined and operating substantially as described.

2. The square A B, having the slot E and pin F, and the scales C and D, or either of said scales, and the straight-edge G, having the slot H, as described, and the pin I, combined and operating substantially as set forth.

JOHN F. KLINGLESMITH.

Witnesses:
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CHAS D. MOODY.