D. W. McDONALD.

ADJUSTABLE ELBOW PATTERN.

APPLICATION FILED MAY 11, 1908.

923,875. **Patented June 8, 1909.**

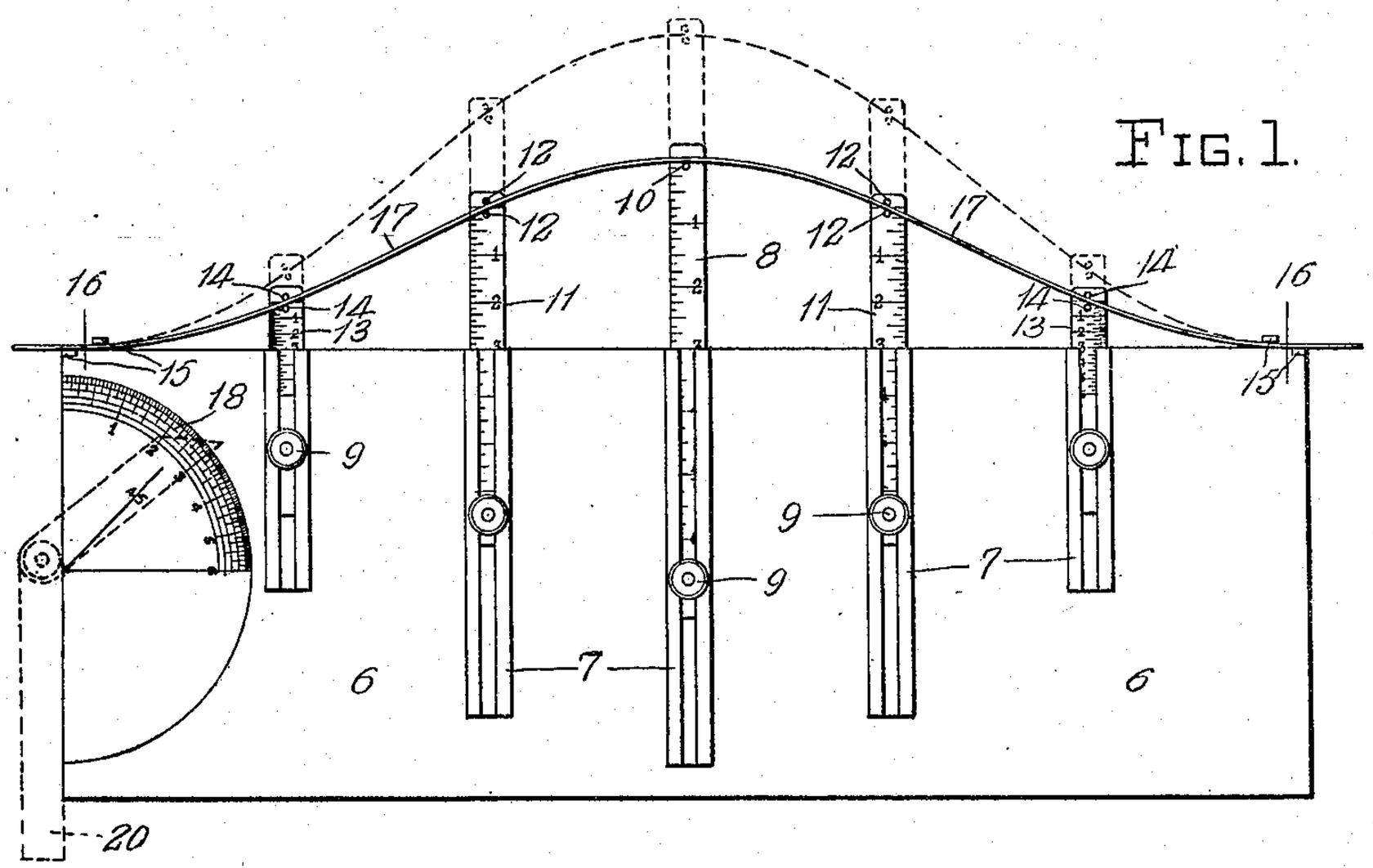

FIG. 1.

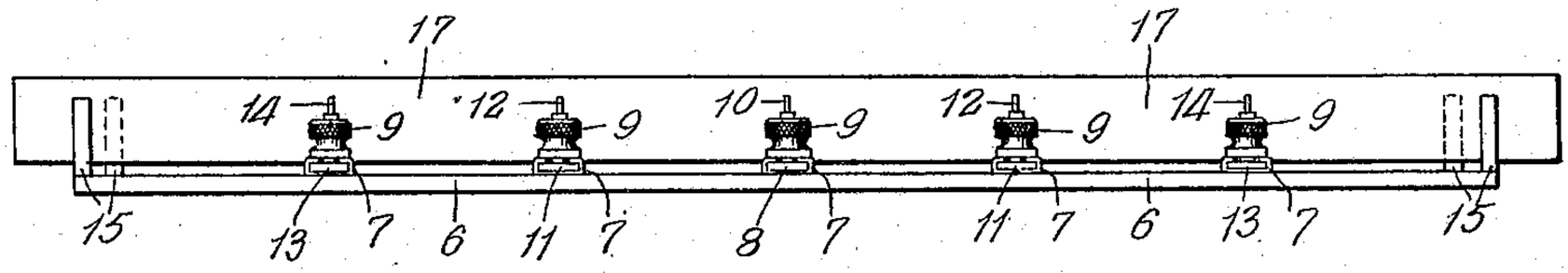

FIG. 2.

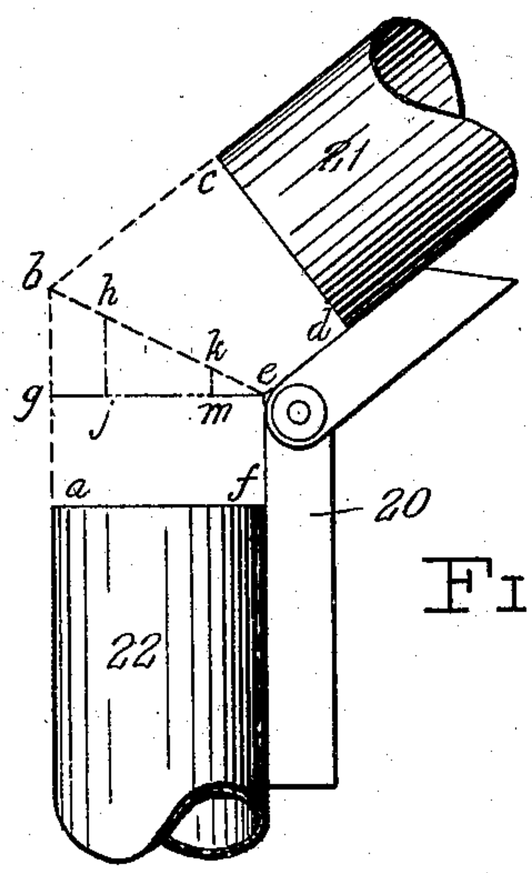

FIG. 5.

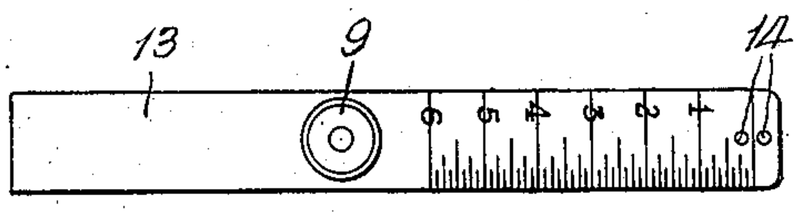

FIG. 3.

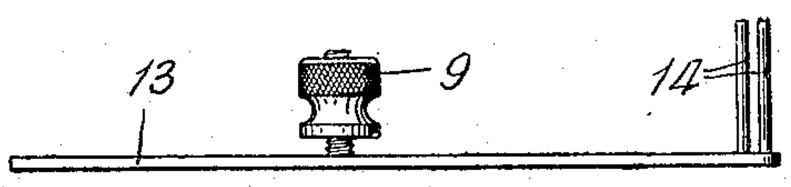

FIG. 4.

WITNESSES

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ADJUSTABLE ELBOW-PATTERN.

No. 923,875. Specification of Letters Patent. Patented June 8, 1909.

Application filed May 11, 1908. Serial No. 432,281.

To all whom it may concern:

Be it known that I, DANIEL W. McDONALD, of the town of Westville, in the Province of Nova Scotia and Dominion of Canada, have invented certain new and useful Improvements in Adjustable Elbow-Patterns, of which the following is a full, clear, and exact description.

My invention relates to improvements in adjustable patterns for accurately laying out developed curves on sheet metal and other material; and the general object of the invention is to provide simple and readily adjustable means for laying out a curve of determined curvature without arithmetical calculation.

The invention is particularly adapted to use in cutting sheet metal elbows in which the curves required are developed from the circumference of a cylinder cut at varying angles to the axis thereof, and the invention provides means whereby the properly developed curve may be imparted to a suitable curve outlining member when the angle of the joining pipes alone is known.

Flexible splines have, of course, been used to draw railway and other curves and in shipbuilding it has been proposed to employ a flexible member having arms attached thereto, which were adjustably secured to a suitable bar or plate, but the only use to which this latter device was put was to transfer a curve already laid out from one part to another. The present invention on the other hand provides means for accurately laying out the curve without arithmetical computation, and the flexible member which has this determined curvature imparted to it may be applied to the work to form a guide for marking the same.

In its construction, the invention includes a plate having a flexible curve outlining member at one side thereof connected thereto by means of a plurality of scale members which are adjustable outwardly in parallel and equal-spaced guides, and means for graphically determining the setting for the scale members, all as hereinafter more fully set forth and described in the accompanying specification and drawings.

In the drawings which illustrate my invention:—Figure 1 is a plan view of the device. Fig. 2 is an edge elevation of same. Fig. 3 is an enlarged plan view of one of the sliding scales. Fig. 4 is an edge view of same. Fig. 5 is a diagram showing the method of gaging the angle at which it is desired to construct an elbow.

Referring to the drawings, 6 represents a plate of suitable dimensions; having the curve outlining member 17 at one side of the same. This member in the embodiment illustrated is in the form of a thin, flat spline of suitable metal, such as spring steel. The ends of the outlining member are retained in position by means of a pair of posts 15 at each end of the plate 6. The posts of each pair extend on opposite sides of the spline and retain the same by frictional engagement alone, whereby the flexing of the spline to form the curve will not be interfered with. The curvature of the spline is determined by a plurality of parallel scale members 8, 11, 11, 13, 13, each of which is slidably supported with freedom of longitudinal movement in C-shaped guides 7, and the scale members may be locked in any adjusted position by means of suitable finger nuts 9. In order not to interfere with the gradual curving of the spline 7, the connection between the scale members and the spline is made of such a character as to only frictionally engage the spline with line contact. This is accomplished by providing a pin 10 on the central scale member, adapted to engage the inner side of the spline and pairs of pins 12, 12, and 14, 14, on the scale members 11, and 13, the pins of each pair extending on opposite sides of the spline. For convenience in laying out the curve as will hereinafter appear it is desirable that the scale members be placed at equal intervals and that the distance from the outer scale members and a line 16 drawn centrally between the posts 15 be equal to the intervals between the scale members. Each of the scale members is provided with graduations to enable curves of determined curvature to be formed in the spline, the arrangement being such that when all the scale members are set at a given graduation, the curve formed will be that developed from the joining edge of the elbow for two sections of pipe which meet at the angle corresponding to the particular graduation. In order that this may be so it is necessary that the graduations on each scale member be closer together than those on the adjacent scale member on the side

nearest the center. The graduations on these scales may either be determined empirically or by mathematical calculation. Thus it will be seen that the scale members correspond to the ordinates of the curve while the distances from the ends or center correspond to the abscissæ.

As it would be more or less difficult to mark the angles exactly on the scale members themselves and particularly on the smaller ones, I prefer to provide arbitrary marks 1, 2, 3, on the scales and to provide a fixed scale 18 at one side of the plate A which will graphically give the reading of the scales to be used for any given angle between the pipes. The manner of using this scale is simply to lay the angle gage so against the side of the plate 6, with the pivotal point at the center of the scale and one arm of the scale along the edge of the plate when the other arm will give the scale reading to be used. The number and character of the marks on the scale 18 are purely arbitrary, the ninety degrees angle, as shown, being divided into six parts, marked with the numerals 1 to 6, and each of the scale members will have the numerals reading 1 to 6. Thus, for a forty-five degree bevel, the angle gage would come opposite the figure 3, and then, to outline the curve for this bevel, each of the scales would be set at the number 3. There may be any convenient number of graduations on this scale 18 and the width of the corresponding graduation on the scale members may be conveniently determined empirically.

The manner of using the device may be readily understood by the following examples:—Supposing it is desired to unite the two pipes 21 and 22 by an elbow. The angle between the pipes is measured by means of the gage 20 which is then laid on the scale 18, as indicated in dotted lines in Fig. 1, where it is seen that the angle is represented by the numeral 3. All the scale members are now set so that the graduations numbered 3 on them are in line with the edge of the plate 6. The adjustment of the scale members causes the spline 17, engaged by the pins on them to assume the curve depicted, the extremities of the spline being held in line with the edge of the plate by the pair of posts 15, one post of each pair being on the inside of the spline, and one on the outside, the outer face of the inner post being flush with the plate 6, and the inner face of the outer post being removed from the face of the plate 6, a distance slightly greater than the width of the spline, as shown in Fig. 1, whereby the spline will be tangent to the face of the plate 6 at the point where the line 16 intersects the surface of the plate. The curve assumed by the spline is the curve on the line *b*. *e*. Fig. 5, if the metal forming the pipe were laid flat. The edge of the plate represents the circumference *g*. *e*. of the pipe. The adjustment of the scale 8 gives the distance *b*. *g*. the scales 11 give the distance *h j* and the posts 15 represent the point *e* which is zero and constant. The measurements *b g*, *h j*, *k m*, are taken at six equidistant points around the circumference *g*. *e*. For this reason it is necessary to have the scales 8, 11 and 13, and posts 15 equidistant, the distance between the lines 16 being equal to the circumference of the pipe for which the elbow is intended. The pattern is now laid on the sheet metal and the curve formed by the spline marked thereon without further calculation or measurement.

Although I prefer to use a separate pattern for each diameter of pipe, it will be obvious that the guides 7 and posts 15 may be adjustable laterally to adapt a single pattern to widely varying sizes of work.

From the above it will be seen that I have provided means for accurately bringing out the curve developed from the circumference of the cylinder cut at any angle to the axis, and the curve when so laid out may be marked directly on the work when the pattern is applied thereto.

While the invention is ascribed as applied to laying out curves of elbows, yet it is readily apparent that the invention might be utilized to lay out other forms of curves with equal facility and it is intended to include all such constructions as generically or specifically fall within the language employed herein.

What I claim as my invention is:—

1. An elbow pattern having a flexible curve outlining member in combination with adjustable scale members holding the same in position, the scales on the said members having readings which correspond respectively to different angles between the pipes for which the elbow is to be cut, whereby when all the scale members are set at the same reading the curve outlined will be that for the elbow to join two pipes meeting at the angle corresponding to said reading.

2. In a device of the character described, a plate, a series of parallel equidistant guides, sliding scales in said guides including a central scale, the side scales arranged in pairs one on each side of said central scale, each pair of scales having closer graduations than the adjacent inner pair which is nearer the center scale, and the graduations of the innermost pair being closer than the graduations of the central scale, a pin at the free extremity of said center scale, a pair of vertical pins at the free extremities of each of the other scales, a pair of fixed posts at each end of the plate, and a flexible spline carried between said pins and posts.

3. A pattern having a flexible curve-outlining member, with means for forming the said member into a continuous curve, having scales for indicating the adjustment, the said scales having corresponding designations,

whereby when all the scales are set at a particular graduation a continuous curve of determined character will be outlined.

4. An adjustable pattern for laying out curves, including a flexible member adapted to assume the shape of the curve, sliding scale members connected to the flexible member and arranged in pairs, each pair of scale members having closer graduations than the adjacent inner pair, and means for supporting and clamping the scale members in adjusted position.

5. An adjustable pattern for laying out curves, including a flexible member adapted to assume the shape of a curve, and pairs of parallel scale members connected at intervals thereto, corresponding with the curvature of the curve to be laid out, the scale on each member having graduations adapted, when the scales are set at the same reading on each, to position the scale members with the flexible member, outlining the curve for an angle indicated by the particular graduations.

In witness whereof I have hereunto set my hand in the presence of two witnesses.

DANIEL W. McDONALD.

Witnesses:
D. W. CIRCKETT,
J. W. MACDONALD.