

Jan. 29, 1924.

1,482,186

E. F. FALES

SHEET METAL DRAFTING INSTRUMENT

Original Filed Dec. 10, 1919 4 Sheets-Sheet 1

Fig. 1.

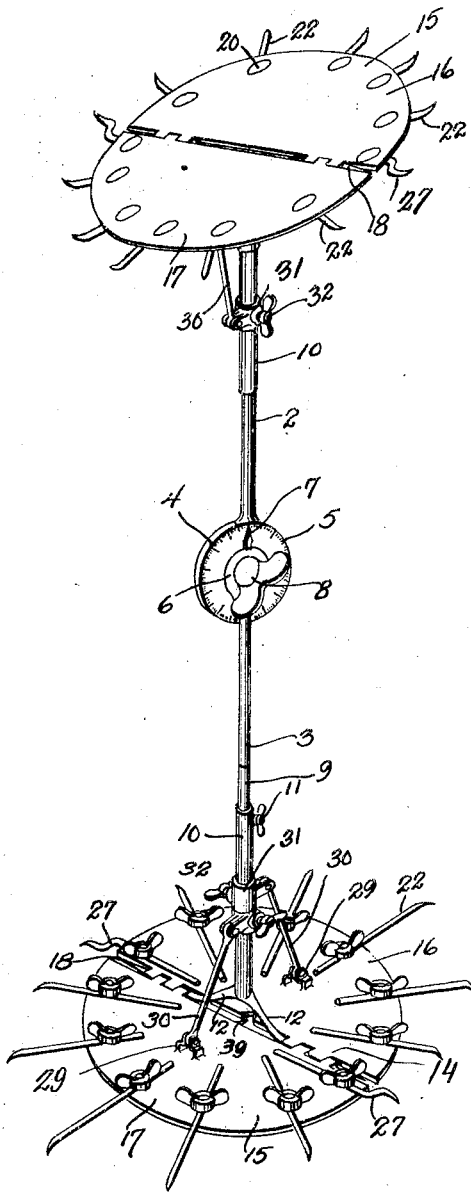
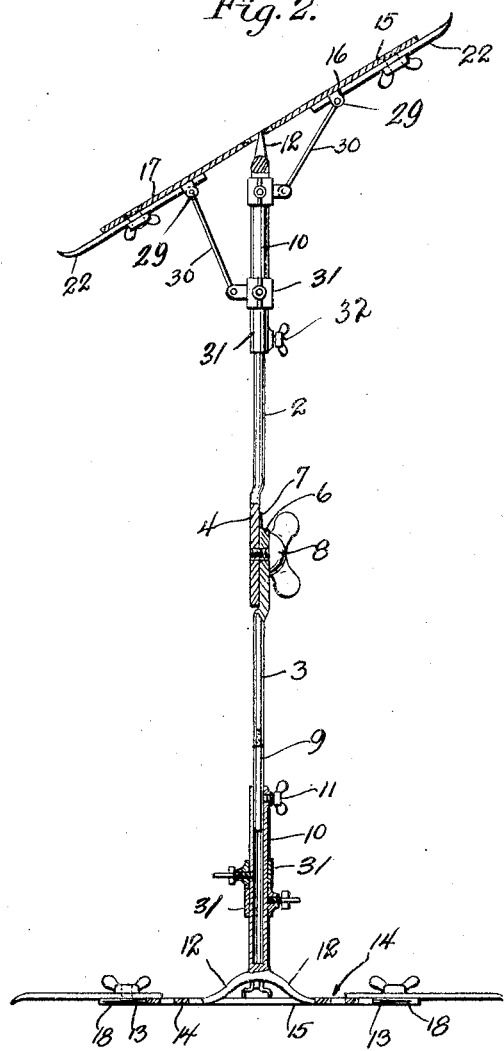


Fig. 2.



WITNESS

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Fig. 3.

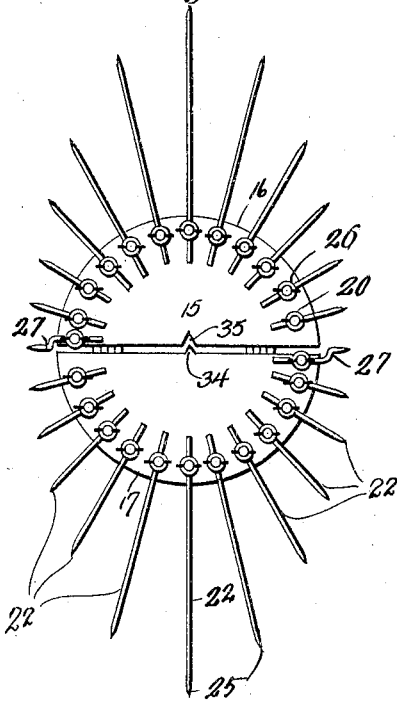


Fig. 4.

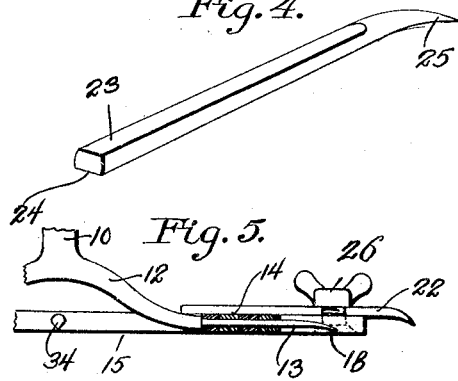


Fig. 5.

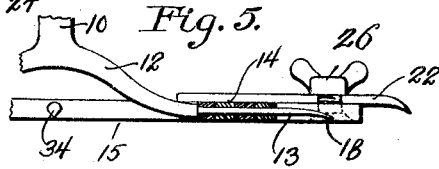


Fig. 6.

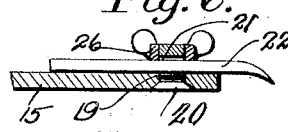


Fig. 7.

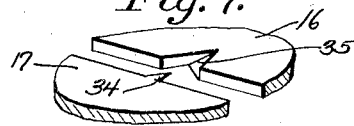


Fig. 8.

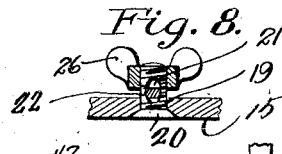


Fig. 10.

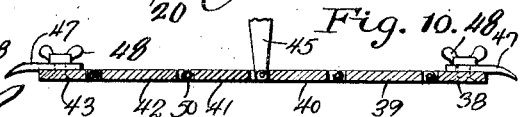


Fig. 9.

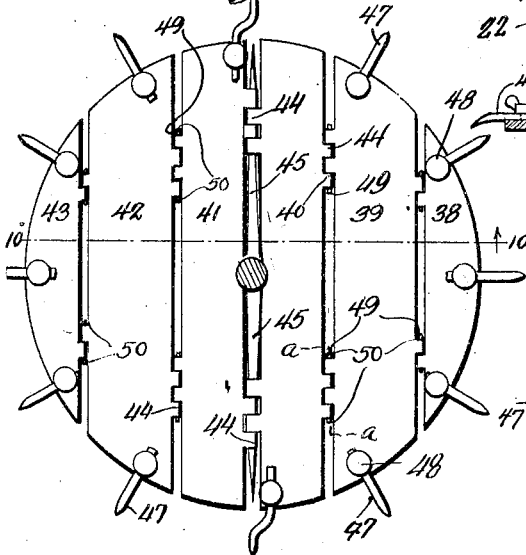
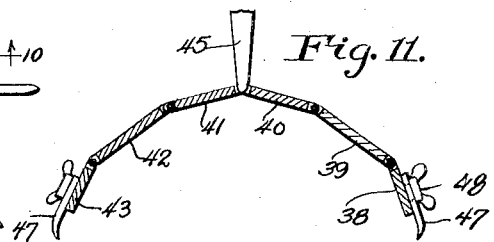


Fig. 11.



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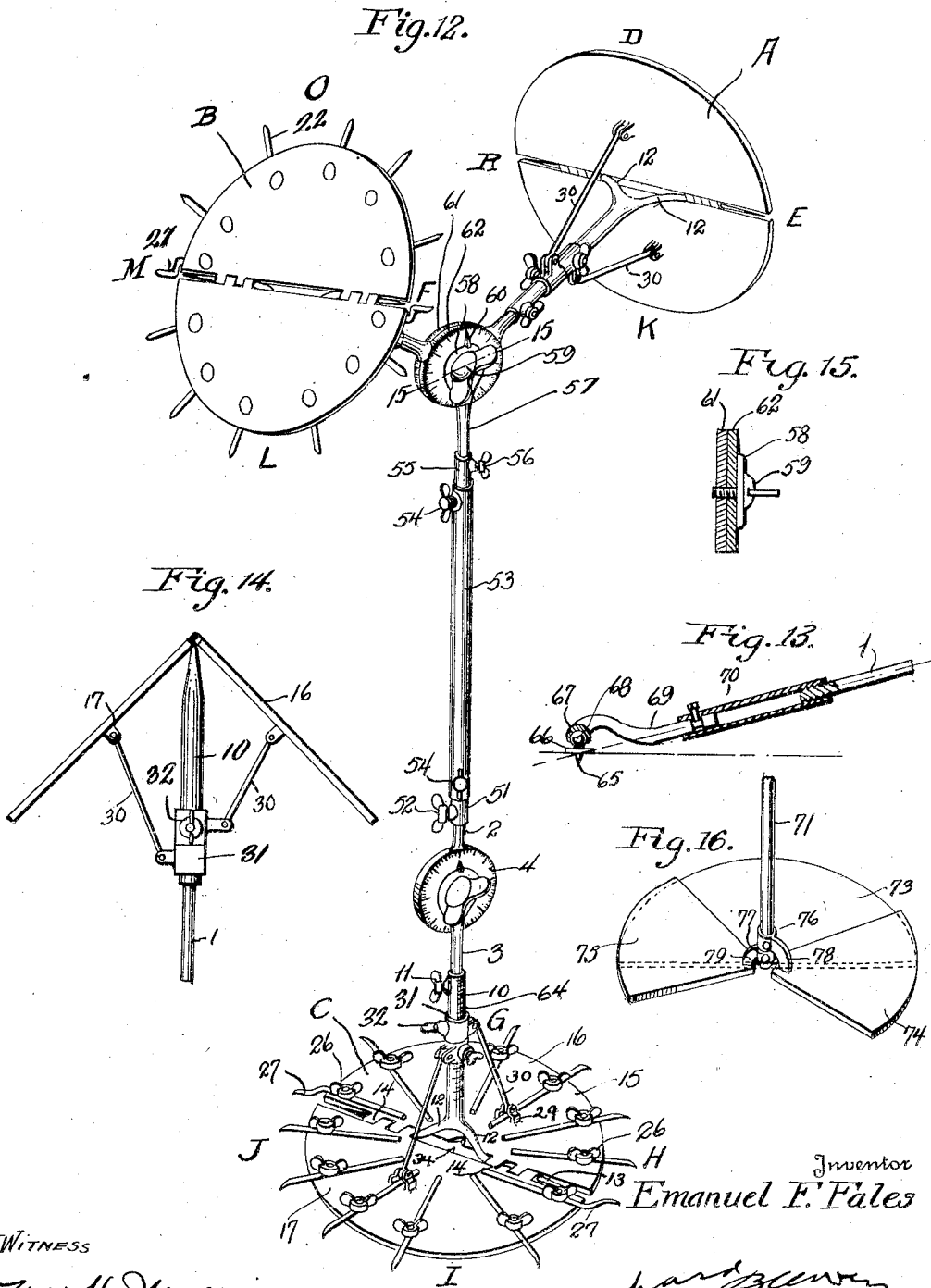
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SHEET METAL DRAFTING INSTRUMENT

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WITNESS

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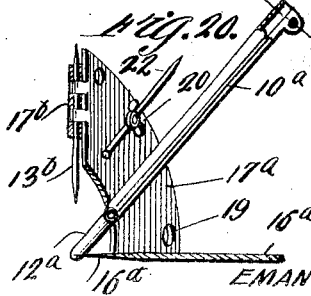
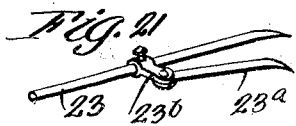
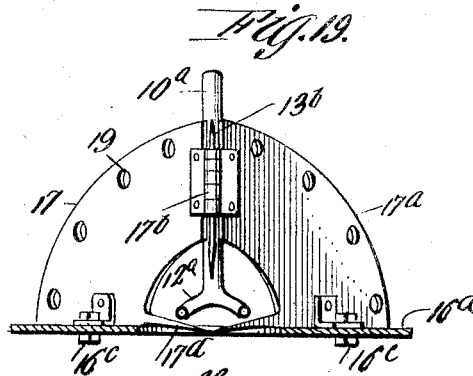
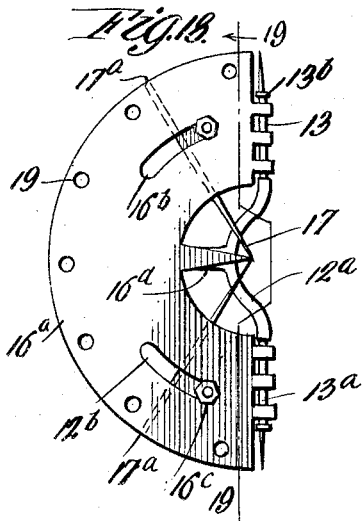
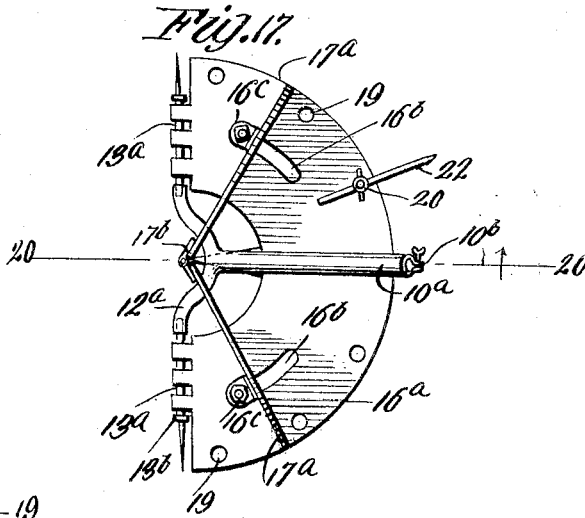
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SHEET METAL DRAFTING INSTRUMENT

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WITNESSES

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# UNITED STATES PATENT OFFICE.

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SHEET-METAL DRAFTING INSTRUMENT.

Application filed December 10, 1919, Serial No. 343,783. Renewed December 27, 1923.

*To all whom it may concern:*

Be it known that I, EMANUEL F. FALES, a citizen of the United States, residing at Wilmington, in the county of New Hanover and State of North Carolina, have invented certain new and useful Improvements in Sheet-Metal Drafting Instruments, of which the following is a specification.

This invention relates to drafting instruments and more particularly to an improved device adapted for marking sheet metal whereby proper guide lines may be indicated on the metal for the purpose of guiding the worker whereby the metal may be properly cut without waste.

In the art of sheet metal working, it is necessary for the workman to either first provide himself with a properly cut pattern, or to lay out, by means of the various rules known in the art, an exact or proximate pattern of the work on the sheet metal. It is often necessary to secure the services of a sheet metal draftsman in order that the lay out of the work will be exact and in order that the pattern will be accurate so that the finished product will meet the required dimensions. It is the purpose of the present invention, therefore, to provide a means for marking the work accurately by merely first setting the instrument in the proper manner, by rules which can be readily learned by the ordinary workman.

The invention contemplates the provision of an instrument which will overcome many of the difficulties encountered by sheet metal workers who are required to form irregularly shaped products such as are found in the piping and fittings of ventilating systems.

Figure 1 is a perspective view of one form of the instrument constructed in accordance with my invention.

Figure 2 is a central longitudinal section through the instrument in the position shown in Fig. 1.

Figure 3 is a plan view of one of the disks included in the instrument.

Figure 4 is a perspective view of one of the marking elements.

Figure 5 is an enlarged detail section taken through one of the hinges which join the halves of the disk together.

Figure 6 is a detail section showing the manner of fastening the marking elements in position.

Figure 7 is a detail perspective view of the central portion of one of the disks.

Figure 8 is a transverse detail section showing the manner of holding one of the marking elements in position.

Figure 9 is a plan view of a modified form of disk.

Figure 10 is a section taken on the line 10—10 of Fig. 9.

Figure 11 is a view similar to Fig. 10 showing the modified form of disk in curved position.

Figure 12 is a perspective view of a modified form of the invention, illustrating an additional marking disk mounted in position.

Figure 13 is a detail view of a pointer element which may be employed in operating the instrument.

Figure 14 is a detail view illustrating the positions which the sections 16 and 17 of the disk 15 may assume when certain configurations are to be marked on the sheet metal, the marking elements in this view being removed.

Figure 15 is a detail section taken through the connecting disk approximately on the line 15—15 of Fig. 12.

Figure 16 is a perspective view of a modified form of marking disk.

Figure 17 is a top plan view of a further modification.

Figure 18 is a view of the modification shown in Fig. 17, inverted.

Figure 19 is a section on the line 19—19 of Fig. 18, looking in the direction of the arrows.

Figure 20 is a vertical section on the line 20—20 of Fig. 17, looking in the direction of the arrows.

Figure 21 is a modified form of marker.

Figure 22 is a sectional detail on the line 22—22 of Fig. 20.

Corresponding and like parts are referred to in the following description and indicated in the several views of the drawing by like reference characters.

Referring to the drawings, wherein is illustrated the preferred form of my invention, in which like numerals of reference indicate like or corresponding parts throughout the several views, the shank of the instrument is composed of two rods 2 and 3. The end of the rod 2 is provided with a disk 4 which has one surface provided with

graduations indicated at 5 which represent degrees and fractions of degrees of a complete circle. The adjacent end of the rod 3 is provided with a circular plate 6 which is equipped with a pointer 7 having its terminal disposed in a position to indicate the graduations 5. The plate 4 is provided with a screw threaded aperture and the plate 6 has an opening through which the screw threaded shank of a thumb nut 8 may be extended. Thus the two plates 4 and 6 may be tightened together for holding the rods 2 and 3 at any angle with respect to each other. The opposite end of the rod 3 is threadedly engaged with a removable extension rod 9 as shown to advantage in Figs. 1 and 2, and this extension projects into a sleeve member 10 which is adapted to receive the greater portion of the rod 3 and the extension 9 when the two members 3 and 9 are thrust inwardly into the sleeve thus permitting longitudinal adjustment of the shank. A set screw 11 carried by one end of the sleeve is adapted to lock or hold the parts in adjusted position. The sleeve 10 is provided with oppositely extending arms 12 which have reduced portions 13 in alinement with each other, these reduced portions forming pintles for the hinges 14. A disk 15 comprises the substantially semi-circular portions 16 and 17 having their proximate edges hingedly connected by means of the hinges 14 which are arranged so that they will be flush with the opposite surfaces of the disk. It is to be observed that the pintles 13 project outwardly toward the edge of the disk at diametrically opposite points and these projected portions of the pintles are sharpened to provide the pointers 18, the purpose of which will presently appear. While the disk 15 is formed in separate sections 16 and 17 which are really independent parts, the disk will be hereinafter referred to as the circular member comprising the semi-circular sections 16 and 17. The rod 2 forming the opposite portion of the shank is also provided with a sleeve 10 which is constructed in the same manner as above described, and which includes the arms 12 supporting the opposite disk 15. The disks at the opposite ends of the shank, therefore, are of the same construction so that a detail description of one will suffice. Each disk is provided, near its edge, with a plurality of circumferentially spaced openings 19 shown in detail in Figs. 6 and 8. The openings are countersunk and receive the screws 20 the heads of which are received in the countersunk portions of the openings so that the heads will lie flush with one surface of the disk. Each bolt or screw 20 is provided with an elongated opening 21. The opening 21 in each bolt 20 receives a marker 22 which is adapted to extend radially from the edge of the disk.

There may be as many markers as desired according to the number of holes provided in the disk and each marker comprises an elongated rod of any desired length having opposite flat surfaces 23 and 24 and a pointed end 25. Mounted upon each bolt or screw 20 is a thumb nut or a wing nut 26 and, as shown in Fig. 8, these nuts will serve to securely maintain the marker element 22 in position when the nuts are tightened. The nuts clamp the marker elements against the surface of the disk and the points of the markers may be adjusted toward or away from the edge of the disk so that the points may be disposed in the desired position. Inasmuch as the meeting edges of the sections 16 and 17, will prevent the disposing of an opening 19 at the exact transverse center of the disk, the openings adjacent these points are offset as shown in Fig. 1, and the markers 22 provided at these points have offset pointed ends as indicated at 27 so that the pointed ends of the markers will be in properly spaced relation and the spots indicated by the markers when the instrument is used, will be equally spaced apart.

Each section of the disk 15 is provided, adjacent its central portion with the ears or lugs 29 which connect with an actuating rod 30 which has its opposite end joined to a sliding sleeve 31 on the member 10. The sleeve 31 is provided with spaced apart ears for connecting the rod 30 to the sleeve and the latter is equipped with a set screw 32 whereby the slidable sleeve 31 may be fixed in position on the sleeve member 10. Both of the sleeves 31 are independently movable on the sleeve member 10.

Since the central portion of each disk 15 is open as provided by the separated edges of the sections 16 and 17, it will be an easy matter for the user to determine the center of the disk when the instrument is in use, and in order that this may be accurately determined, I have provided a centering point 34 as shown in detail in Fig. 7. One of the sections of the disk is provided at the center of its straight edge with the pointer member 34 which projects toward a notch or recess 35 provided at the same point in the corresponding section 16. The point of the member 34 terminates at the exact center of the disk 15 so that the user of the implement in endeavoring to place the implement in position on a piece of work, may strike a center point, and then place the implement in position so that the member 34 indicates the center point, thus being assured that the disk 15 will be centrally located with respect to the point which has been struck on the work.

Fig. 3 illustrates the manner in which the marker elements 22 may be adjusted to have the points indicate geometrical figures of different shapes. Obviously the marker

element may be of any desired length and a supply of these marker elements may be kept on hand in order that the instrument may be supplied with marker elements of the proper length.

In Figs. 9, 10 and 11 of the drawings, I have illustrated a slightly modified form of disk, which comprises a plurality of sections 38, 39, 40, 41, 42 and 43 all of which are hingedly connected together as indicated at 44 and which are so shaped as to form a perfectly circular disk when the sections are disposed in a plane as shown in Fig. 9. The meeting edges of the sections 40 and 41, have their hinges provided with the pintles formed by the arms 45 which are equivalent to the arms 12 in the above described form, so that this form of disk may be attached to the members 12 if desired.

With reference to the pointer 60, it is desired to set forth that the disk 58 is an integral part of the auxiliary rod 57 and the shank of the thumb screw provides an axle for disks 61 and 62, either of which may rotate independently upon the thumb screw to vary the angle of either disc A or B. The graduations of the disc 62 will provide means for cooperation with the pointer 60 for accurately determining the angle at which the disc B is set, and the edges of the two discs 61 and 62 may be provided with corresponding graduations whereby the former may be set from the latter. This disk is also provided with a plurality of equally spaced openings near its edge through which bolts are extended whereby the marker elements 47 may be secured in position by the fastening members 48 which may be thumb screws or wing nuts as desired. In order that the disk may be formed into an arcuate shape as illustrated in Fig. 11, the sections are thus hinged together and it will be obvious that the user of the implement may move the various sections so that the pointer elements will be disposed in a position similar to that illustrated in Fig. 11. In order that the sections may be held in this position while the instrument is in use, the pintles 49 may be provided with jam nuts 50 for tightening the hinged portions of the sections together in order that the desired rigidity may be secured. Obviously any other form of tightening means may be employed to maintain the sections in the desired rigid positions.

Fig. 12 illustrates the manner of assembling the various parts for providing a use of the implement when more complicated patterns are to be marked or cut. To one of the rod sections of the shank, preferably the rod section 2, is attached a sliding sleeve 51 which may be adjusted and held in position by a set screw 52. Telescopically mounted upon the sleeve 51 is the tubular extension 53 which has a set screw 54 at each end. At the

end opposite the tubular sleeve 51, is another sleeve 55 also provided with a screw 56 and this sleeve receives one end of the auxiliary rod 57 which is similar in construction to the rod 3 in the above described form, and has the disk member 58 provided with an opening through which the screw threaded shank of the set screw 59 is extended. The disk 58 is also provided with a pointer 60.

The disk and the adjacent interconnecting parts including the sleeve portion 10 and the connecting or operating rods 30 may be termed heads for the implement and it will be obvious by virtue of the construction set forth that two, three or four heads may be provided with the form shown and described in Fig. 12. To accomplish this purpose, therefore, a pair of the disk members 61 and 62 are assembled together on the shank of the set screw 59, these disk members being exactly the same as the disk member 4 in the above described form. By pivotally moving the disk members on the shank of the set screw 59, the two adjacent heads indicated generally at A and B, may be disposed at any desired angle with respect to each other. While the disk A is shown in the present instance without the marker elements it is thought advisable to point out that the implement may be provided with or without the marker points. That is, if it is found that the disk is of the desired circumference, the edge of the disk may be employed to make the necessary markings on the work, and if desired different sizes of disks may be employed in this connection although it will be found more practical and convenient to provide the disk with the adjustable markers as above referred to. I do not desire to limit myself, however, to the provision of markers on the disk, and consequently have illustrated the plain disk indicated at A with the marker elements removed therefrom. By means of the structure shown in Fig. 12, the shank may be longitudinally adjusted to any desired length and obviously other tubular members, similar to the tubular member 53 may be inserted in position in order that the shank of the implement may be extended for considerable length if desired. Also the angular position of the heads A and B with respect to each other, and with respect to the center line of the shank may be changed as desired by simply loosening and tightening the set screw 59. The angular positions of the heads may be determined by observing the graduations on the disks 61 and 62 with respect to the pointer element 60 on the stationary disk 58.

In Fig. 14 I have illustrated one of the positions in which the hinged sections of the disk may be disposed if desired. In some forms of patterns it will be necessary to move the sections of the disks to be dis-

posed at an angle with respect to each other, and when this is desired, the movable sleeves 31 are longitudinally adjusted on the sleeve member 10 and the sections of the disk  
5 moved to the desired angle and in order that this may be accurately determined without the use of a protractor or the like, the sleeve 10 is provided with graduations 64 indicating degrees and fractions of degrees  
10 so that the exact angular positions of the sections of the disk can be accurately determined, as shown in Fig. 12.

The form of device illustrated in Figure 12 may be used to advantage in laying out  
15 patterns for three way trunks, which are usually adapted to fit openings in the corner of a room. In the present adjustment shown in Figure 12, the adjustable points of the disc C are disposed to form a circle, while  
20 the adjustable points 22 of the disc B and the adjustable points which may be provided upon the disc A, are set to form ellipses. These adjustments are made so that two trunks of the fitting will be elliptical and the other circular at their open  
25 ends. Now, to lay out the pattern, the device illustrated in Figure 12 is arranged upon the sheet of metal similar to the device illustrated in Figures 1 and 2, so that  
30 the stem 53 will be arranged horizontally and will provide means for rolling the device in different directions. The device is arranged upon the metal so that the points G, R and M of the three discs touch the  
35 metal. A line from G to R on the metal will represent the seam and the starting point for the pattern. The stem 53 is then rocked so that the disc C is elevated and the discs B and A rock or roll until points O and D thereon touch the metal. The stem  
40 is then moved to its original position, after which it is rolled to the left of the figure in its own course until points I, E and F touch the metal. After this, the stem is tilted  
45 upwardly until the points O and D again touch the metal after which the device is rolled upon the discs A and C until the points G and B touch the metal. This operation brings the device back to the  
50 starting point and completes the flat pattern which when formed up will fit openings corresponding to those at the ends of the three way trunk.

Only one of the disks may be employed at  
55 certain times during the use of the implement and in order that a point may be established from which the disk may be swung, I have provided a means whereby one end of the shank of the implement may be properly  
60 disposed in position for permitting the disk to swing. In Fig. 13, I have illustrated one manner of laying off a pattern for a cone and inasmuch as the longitudinal center line of the shank must coincide exactly  
65 with the point on the surface of the material

at which the implement swings, it will be noted that I have indicated the center line and the point at which they intersect. The pivot point 65 carries a stationary disk 66  
70 which has mounted thereon a movable disk 67, the two disks being provided with a ball and socket joint 68 whereby free movement will be permitted. The disks are held in  
75 assembled relation in any desired manner and the movable disk is equipped with an arm 69 suitably curved and provided with a recess 70 to receive one end of a shank 1 whereby the longitudinal center line of the  
80 shank 1 will intersect the point on the surface of the material to which the pointer element 65 extends, so that when the material is marked out and properly cut, a conical shape will be provided.

To lay out a pattern for a cone or pyramid, the adjustable marking points on the  
85 disc associated with the shank 1 shown in Figure 13 are adjusted to fit a polygonal, circular or any other shaped base. The disc is then adjusted along the stem so that the distance between the former and the point  
90 65 represents the height of the cone or pyramid. The point 65 is then placed upon the sheet of metal and retained in position while the disc and stem are rotated about the point through a complete circle. The points  
95 marked by the adjustable marker are then connected so that the pattern may be cut out and formed into a cone or pyramid.

As above set forth, the implement is especially designed for marking out sheet  
100 metal work, and the form shown in Fig. 1 may be the form generally used, inasmuch as this form of the implement may be employed for marking out the simple patterns. Assuming that a sheet metal tubular member is  
105 to be formed, having a circular opening at one end and an elliptical opening at the other and the circular opening is to be in a plane at an angle with respect to the central axis of the pipe, the implement will be set in the  
110 manner shown in Fig. 1. The elliptical opening is formed by arranging the markers in the manner shown at the lower portion of Fig. 1 or in the manner indicated in Fig. 3 of the drawings. The major and minor diameters of the ellipse are first obtained and the pointers set accordingly. The opposite  
115 disk is then tilted at the angle desired at the opposite end of the pipe and the markers on this disk set to indicate a circle of the desired diameter. Then, by taking the implement and rolling it like an axle and a pair of  
120 wheels over the surface of the material, the points will indicate dots on the material and the user may draw lines through the dots to provide guide lines whereby the material may be readily cut. If desired, the pointer elements may be inked and they may also serve to indicate the properly spaced  
125 rivet holes when the material is to be riveted  
130



together. This example illustrates one of the uses of the instrument and it will be readily appreciated that the more complicated patterns may be easily formed by disposing the various parts in various angular positions one of which is indicated in Fig. 12 of the drawing.

In Fig. 16 I have illustrated a slightly modified form of disk, the same comprising a circular member formed of segmental sections 73, 74 and 75. Section 73 is substantially semi-circular in formation and the sections 74 and 75 are quarter circular in formation. The standard 71 is rigidly attached to the semi-circular section 73 and each of the quarter circular sections 74 and 75 are provided with arms 78 and 79. These arms are attached to the collars 76 and 77 respectively on the shank 71 so that the sections 74 and 75 are permitted to turn on the shank. The quarter circular sections are also disposed in a plane whereby they may swing over the surface of the semi-circular section 73 as shown, so that sections may be overlapped to form a partially circular disk having an open space which may be adjusted to any desired width. To maintain the parts in their proper relative positions after being set, set screws are provided in the collars 76 and 77 whereby the collars may be rigidly secured to the shank. This form of disk will be found to be of valuable utility in marking patterns for forming three-way fittings, and the disk may be provided with the marking elements if desired, or the edge of the disk may be employed for the marking of the material.

I have found from my experience with the implement that the use of four heads instead of three as indicated in Fig. 12 is possible, although not exactly practical for the reason that the pattern shaped with the use of four heads is not as economical or as easily assembled as when a less number of marking heads are employed and the pattern divided into a greater number of independent sections to be riveted together. However, the use of three heads as shown in Fig. 12 is especially advantageous as it permits the workman to quickly lay off patterns of unusual form and design which would otherwise require careful calculating and drafting well known in this art. The use of "short rules" and "jump rules" commonly employed by ordinary workmen in laying out sheet metal patterns will be practically eliminated by the use of the present instrument and a great saving in material and time will be accomplished. Any workman unfamiliar with technical sheet metal drafting and calculating can readily acquire skill in the using of the present instrument so that the patterns of any desired form may be quickly laid off and marked so that they can be accurately cut.

In the modification shown in Fig. 17 and the detail views thereof, the device is designed more particularly for outlining constructions embodying 3 or more branches whereby pipes may radiate from a common point. For a cluster embodying three branches the adjustable plates will be set one third the distance, whereas for clusters embodying four branches the adjustable plates will be set one fourth the distance. The main or primary plate is indicated at 16<sup>a</sup> and the adjustable plates or sections at 17<sup>a</sup>. The main plate or section 16<sup>a</sup> is of semi-circular form whereas the adjustable plates or sections 17<sup>a</sup> are one fourth of a circle each. The main plate 16<sup>a</sup> is formed with arcuate slots 16<sup>b</sup> which receive the fastenings 16<sup>c</sup> by means of which the plates 17<sup>a</sup> are adjustably connected to the plate 16<sup>a</sup>. The plates 17<sup>a</sup> are hingedly connected as indicated at 17<sup>b</sup>, the hinge pin 13<sup>b</sup> being detachable and pointed so as to be used as a centering element or marker as desired. The plates 17<sup>a</sup> are adapted to be arranged at right angles to the plate 16<sup>a</sup> and hingedly connected to the plate 16<sup>a</sup> in substantially the same manner as indicated in Figs. 1 and 12. The several plates are provided with hinge knuckles which are adapted to receive pintles 13<sup>a</sup> which are detachable thereby admitting of the plates 17<sup>a</sup> being disengaged from the plate 16<sup>a</sup> when the device is adapted for outlining a multiple cluster of three or more branches. It is to be understood that the several plates will be provided near their outer edges with openings 19 which are adapted to receive markers 22 which are adjustably connected to the plates by fastenings 20 in substantially the manner herein indicated.

The sleeve 10<sup>a</sup> has the extremities of its arms 12<sup>a</sup> formed with threaded openings or slits to receive the threaded ends of the hinge pins 13<sup>a</sup>. These hinge pins have their outer ends pointed and formed with polygonal portions 13<sup>b</sup>, for the reception of a suitable socket wrench whereby the hinge pins may be screwed into or unscrewed from the extremity of the arms 12<sup>a</sup>. The several plates are formed with pointers which enable them to be accurately positioned. The plate 16<sup>a</sup> is formed with a centrally disposed pointer 16<sup>d</sup> whereas the plates 17<sup>a</sup> are formed with pointers 17<sup>d</sup>. The extremities of the pointers 16<sup>d</sup> and 17<sup>d</sup> are disposed at a common center as indicated most clearly in Figs. 17, and 18 thereby insuring their correct positioning. The sleeve 10<sup>a</sup> is formed at its extremity with an integral clamp 10<sup>b</sup> whereby it may be secured to the supporting or carrying rod.

Figure 21 indicates a modified form of marker which admits of a number of marking points being incorporated in a single marker. In this figure 23 indicates the pri-

mary marker and 23<sup>a</sup> the auxiliary marker. A clamp 23<sup>b</sup> serves to adjustably connect the auxiliary marker to the main marker. In this connection it is observed that there  
 5 may be as many auxiliary markers as desired. This construction admits of the plates being provided with a minimum number of openings 19 and a maximum number of  
 10 markers, it being understood that there may be two or more markers for each of the openings, depending upon the number of auxiliary markers provided for each main  
 marker.

The foregoing description and accom-  
 15 panying drawings have reference to what might be considered to be the approved or preferred form of my invention. I desire it to be understood that I may make such  
 20 changes in the construction, combination and arrangement of parts, materials, dimensions, et cetera, as may prove expedient and fall within the scope of the invention as  
 claimed hereinafter.

Having thus fully described my inven-  
 25 tion what I claim as new and desire to secure by Letters Patent, is:—

1. A drafting implement comprising a shank, a disk mounted on one end thereof, and a pair of disks mounted upon the op-  
 30 posite end of the shank, said pair of disks being adjustable relatively to each other and to the shank.

2. A sheet metal drafting implement comprising a shank, disks mounted upon op-  
 35 posite ends of the shank, the said disks comprising hingedly connected sections, and means carried by the disks to provide markers when the disks are rolled over the  
 sheet metal.

3. A sheet metal drafting implement comprising a shank, comprising pivotally con-  
 40 nected rods, disks mounted on opposite ends of the rod, and means connecting the adjacent ends of the rods to permit relative  
 45 swinging movement, and means to adjust the relative positions of the said disks on the rod.

4. A sheet metal drafting implement comprising a plurality of disks means connecting  
 50 the disks together for simultaneous movement, when the instrument is in use, each disk comprising hingedly connected semi-circular  
 sections, and marking implements circumferentially spaced on the said semi-  
 55 spherical sections.

5. A sheet metal drafting implement comprising substantially circular disks each  
 composed of hingedly connected semi-circular sections, means to maintain the disks  
 60 in relatively fixed position, and marker elements carried by and projecting from the edges of the said disk.

6. A sheet metal drafting implement comprising circular disks formed in sections,  
 65 hingedly connected together and equipped

with radially projecting marker elements, and means to maintain the disks in relatively fixed positions, and at an angle with respect to each other.

7. A sheet metal drafting implement com- 70  
 75 prising a longitudinally adjustable shank, and adjustable heads mounted on the ends of the shank and comprising hingedly connected semi-circular sections adapted for relative angular adjustment, and means to  
 maintain the sections in fixed adjusted po-  
 sitions.

8. A sheet metal drafting implement comprising a shank, sleeve members mounted  
 on opposite ends of the shank, disks sup- 80  
 ported by the sleeve members and including independent sections, each sleeve member having supporting arms forming pintles, the said sections of the disk being provided  
 85 with hinge elements connected to the said pintles whereby independent angular ad-  
 90 justment of the sections of the disk may be permitted, and means mounted on the said sleeves and connected to the sections to maintain the angular positions of the  
 said disk sections.

9. A sheet metal drafting implement comprising circular marking elements longitu-  
 95 dinally spaced apart, an elongated shank connecting the marking elements, and means  
 whereby the said marking elements may be disposed in angular relationship.

10. A sheet metal drafting implement comprising substantially circular disks  
 100 equipped with radially extending markers, an elongated shank composed of sections having their meeting ends pivotally joined together and their opposite ends connected to the said disks whereby the said sections  
 105 of the shank may be swung to angular positions with respect to each other for dis-  
 posing the said disks in angular relation.

11. A sheet metal drafting implement comprising circular disks composed of  
 110 hingedly connected sections, each section provided with radially projecting markers, and means to join the said disks together whereby they may be angularly adjusted  
 115 with respect to each other, and means to permit angular adjustment of the sections  
 in each disk with respect to each other.

12. A sheet metal drafting implement comprising a shank, a marking element carried  
 120 by the shank and including a pair of substantially semi-circular sections hingedly  
 connected together, sliding elements mounted upon the said shank, and means connecting the sliding elements with the said  
 125 semi-circular sections, whereby the said sections may be adjusted with respect to  
 each other by sliding the said members on the said shank.

13. A sheet metal drafting implement including a shank, a sleeve mounted on the  
 130 shank, the said sleeve having diverging

- arms, a disk including semi-circular sections hingedly connected together, pintles formed on the ends of the said diverging arms, the said disks having their hinged sections received over the said pintles whereby relative movement of the said disk sections may be permitted independently of each other, and marker elements carried by the said disks. 5
14. A sheet metal drafting implement including a shank, a sleeve adjustably mounted on the shank, a disk including hingedly connected semi-circular sections, the said sleeve being connected to the said hinged portions of the sections, and means longitudinally adjustable on the sleeve and connected to the said sections whereby independent adjustment of the sections with respect to each other may be made by adjusting the said members on the said sleeve. 10
15. A sheet metal drafting implement including a shank, a sleeve attached to the shank and longitudinally adjustable thereon, diverging arms secured to the sleeves and having their terminals shaped to provide pintles, a disk including semi-circular sections provided with hinge elements adapted to register and receive the said pintles whereby swinging movement of the said sections will be permitted, and means to adjust the said sections with respect to each other by swinging them on the said hinges. 15
16. A sheet metal drafting implement comprising a shank, a sleeve attached to the shank, a disk including hingedly connected semi-circular sections supported by the said sleeves, and adapted for independent swinging movement, sleeves mounted on the said first mentioned sleeve for sliding movement, and connecting rods joining the said slidable sleeves with the said disk sections to permit independent movement of the said disk sections with respect to each other. 20
17. A sheet metal drafting implement comprising a shank, a sleeve attached to the shank, a disk including semi-circular sections provided with openings near its marginal edges, the said sections being hingedly connected together and mounted upon one end of the said sleeve, and marker elements projecting radially from the marginal edges of the said sections. 25
18. A sheet metal drafting implement comprising a plurality of marking heads pivotally connected together and provided with markers disposed in circumferential spaced relation. 30
19. A sheet metal drafting implement comprising a plurality of marker heads each including a disk having radial markers projecting therefrom, a shank for each head, and disks connecting the shanks for pivotal movement with respect to each other, to permit angular adjustment of the heads by pivotally swinging the said shanks. 35
20. A sheet metal drafting implement comprising a plurality of marking heads, each including a disk having shanks attached thereto, pivotal connections for the said shanks, and means to permit longitudinal adjustment of the said shanks whereby the said disks may be adjusted toward and away from each other. 40
21. A sheet metal drafting implement comprising a shank, a marking disk secured to the shank and comprising relatively movable sections. 45
22. A sheet metal drafting implement comprising a shank, a circular disk secured to the shank and equipped with radially projecting marking elements at its marginal edge, the said disk being composed of hingedly connected sections. 50
23. A sheet metal drafting implement comprising a shank, a substantially circular disk mounted on the shank and comprising hingedly connected sections, adapted to be moved out of a level plane to dispose the different sections at angles with respect to each other, and marker elements arranged near the curved edges of the said sections. 55
24. A sheet metal drafting implement comprising a shank, a disk attached to the shank, and comprising substantially semi-circular sections, hingedly connected together, each of the sections being provided with circumferentially spaced openings, fastening elements extending through the openings, and including screws provided with elongated apertures, and marker elements adapted to be extended through the apertures and in contact with one surface of the said disk whereby the said fastening elements may engage the said marker elements to maintain them in firm engagement with the said disks to be held against displacement. 60
25. A sheet metal drafting implement comprising a shank, a disk mounted on one end of the shank and including hingedly connected sections having fastening elements arranged in circumferentially spaced relation around their edges, and marking elements including straight shanks engaged with the fastening elements and adapted to be radially adjusted to vary the position of the ends of the marker elements with respect to the center of the said disk. 65
26. A sheet metal drafting implement comprising a shank, a disk mounted on one end of the shank and including hingedly connected sections having fastening elements arranged in circumferentially spaced relation around their edges, and marking elements including straight shanks engaged with the fastening elements and adapted to 70

be radially adjusted to vary the position of the ends of the marker elements with respect to the center of the said disk, and means to indicate the center of the said disk.

5 27. A sheet metal drafting implement comprising a shank, a marking element connected to one end of the shank and adapted to be rolled over the material being marked, a pivot element, and a universal joint connecting said shank and said pivot element.

10 28. A sheet metal drafting implement comprising a shank, a marking member connected thereto and adapted to be rolled over the material to be marked, and a second marking element connected to the first  
15 named marking element and arranged in a plane intersecting that of the first mentioned marking element.

20 29. A sheet metal drafting implement comprising a shank, a semi-circular plate

movably associated with the shank, and a metal plate adjustably connected to the semi-circular plate and arranged in a plane intersecting the plane of the semi-circular plate.

25 30. A sheet metal drafting implement comprising a shank, a plurality of arms each having an end terminating in a dial, said dials being arranged in contact with one another and pivotally associated with the  
30 shank, and a marking element connected to each of said arms and arranged at right angles thereto.

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

EMANUEL F. FALES.

Witnesses:

IRA G. UPCHURCH,  
J. G. LEA.