Aug. 15, 1933. F. KORNBRATH 1,922,770

DRAWING DIE

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Fig. 1.

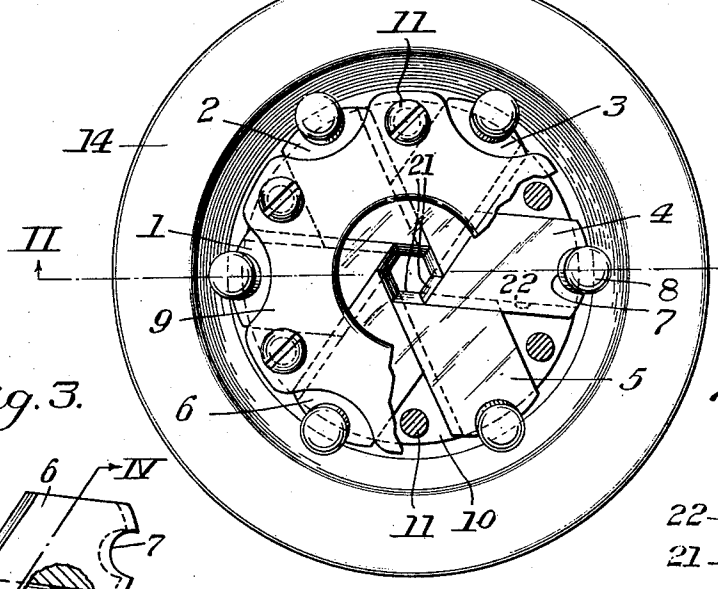


Fig. 3.

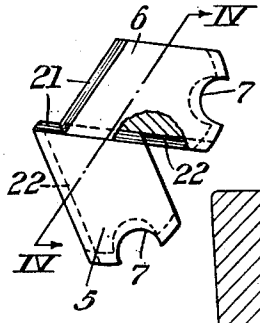


Fig. 4.

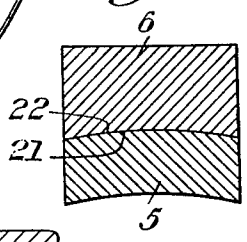
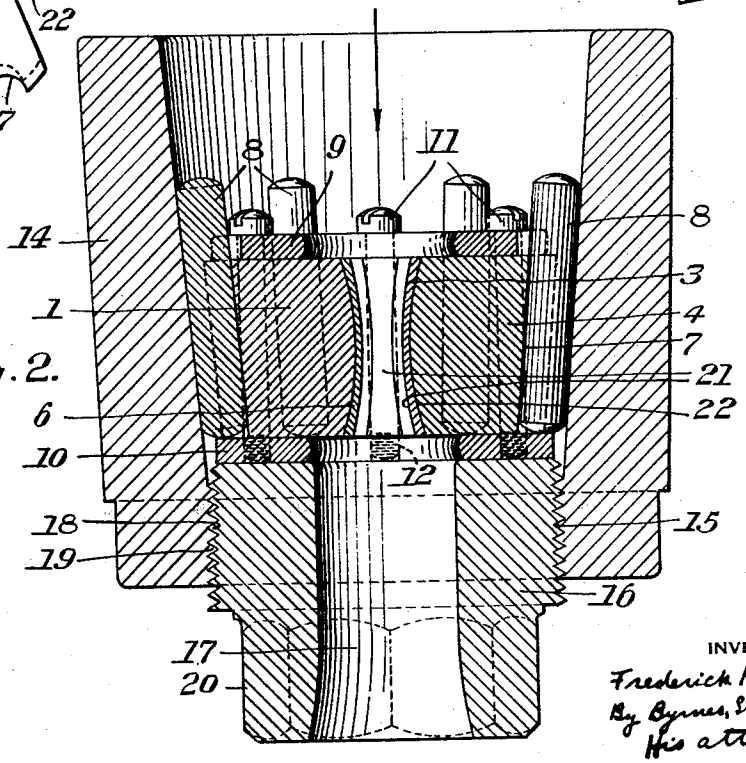


Fig. 2.



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DRAWING DIE

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Fig. 5.

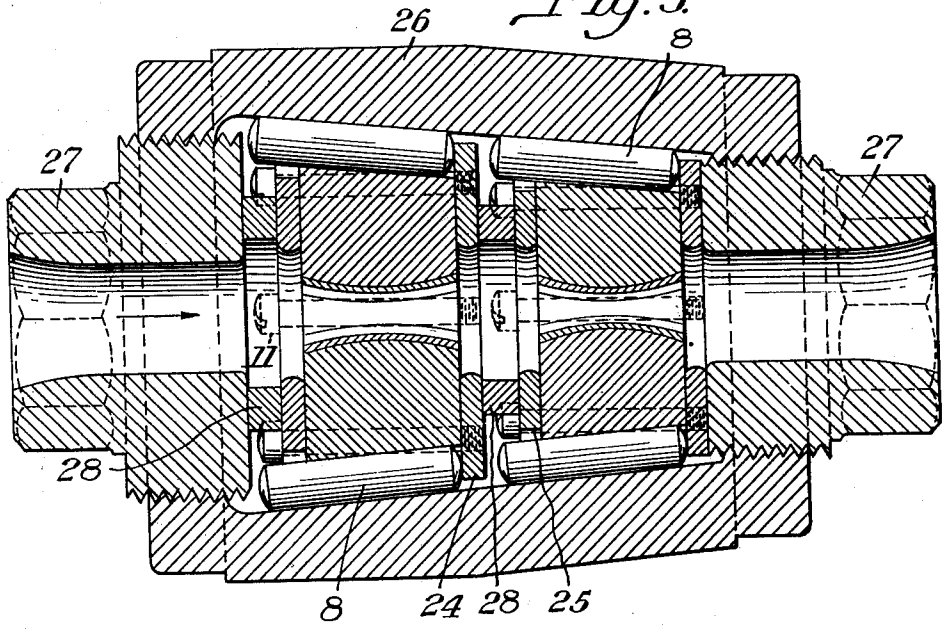


Fig. 6.

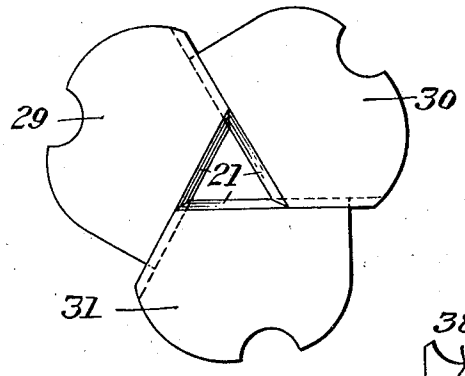


Fig. 7.

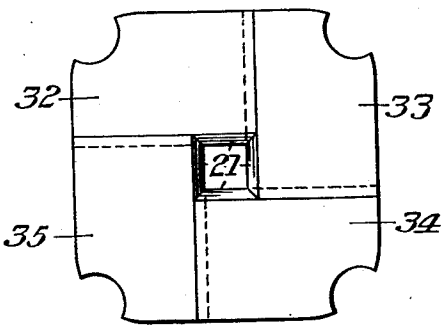
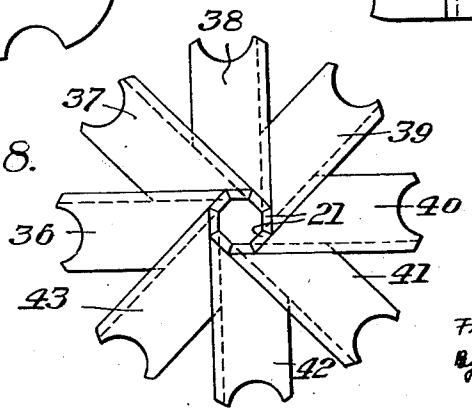


Fig. 8.



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Patented Aug. 15, 1933 1,922,770

UNITED STATES PATENT OFFICE

1,922,770

DRAWING DIE

Frederick Kornbrath, Hartford, Conn., assignor to Union Drawn Steel Company, Beaver Falls, Pa., a Corporation of Pennsylvania

Application March 16, 1929. Serial No. 347,608

7 Claims. (Cl. 205—25)

My invention relates to dies, and particularly to drawing dies.

In drawing metal shapes and particularly rods, difficulty has heretofore been experienced in drawing rods having a shape other than that of a cylinder. For many purposes, it is desirable to draw rods having various other cross sectional shapes such as squares, diagonals, hexagons, octagons and the like.

Where a single die is relied upon to draw a particular size and shape, it is necessary to provide an excessively large number of dies where several shapes are being drawn, and particularly where the same shapes are drawn with different dimensions. The number of such dies required is so large that many mills limit the number of shapes drawn to a few styles and sizes.

Attempts have been made to provide sectional dies which could only be adjusted by swaging the die in a tapering holder or by utilizing swaging wedges. Such dies have not been adjustable over any considerable number of sizes.

Efforts have been made to form such shapes by the use of rolls set at different angles, each of which defines a surface of the finished rod or strip. The number of rolls which can be mounted in a given space is limited. As the number of rolls required increases with the number of faces formed on the drawn material, it is impossible to mount and operate a sufficient number of rolls in such close proximity as to make possible the shaping of a considerable number of surfaces on a strip of material.

I provide a drawing die in which complementary segments are mounted to provide a die opening. A sufficient number of die faces may be provided to form hexagonal and octagonal shapes. Each die surface constitutes a portion of a die segment. The die segments are arranged radially of the die opening. By moving the die segments outwardly, the size of the opening is increased, with a corresponding increase in the effective length of each die surface.

The die segments are mounted in a cage which in turn is inserted in a support, preferably having a taper. Wedges are interposed between the outer surfaces of the die segments and the support for controlling the size of the opening at the center of the die. The size of the die opening is also controlled by controlling the position of the cage in the support. By positioning the cage at different portions of the tapered surface of the support, the pressure exerted on the die segments as a body of metal is drawn therethrough causes the die segments to separate until stopped by the support.

The accompanying drawings illustrate certain present preferred embodiments of the invention, in which

Figure 1 is a face view, partially in elevation and partially in section, of a drawing die embodying my invention,

Figure 2 is a sectional view thereof taken along the section line II—II of Figure 1,

Figure 3 is a detail view of a pair of adjacent die segments,

Figure 4 is a sectional view thereof taken along the section line IV—IV of Figure 3,

Figure 5 is a longitudinal sectional view of a modified form of a drawing die,

Figures 6, 7 and 8 are detail sections of different assemblies of die segments for forming differently shaped rods.

Referring to Figures 1 to 4, a drawing die comprises a plurality of similar die segments 1, 2, 3, 4, 5 and 6. The segments are each provided with a concave working surface, against which material drawn through the die bears. The outer surface of each segment is tapered and is provided with a notch 7 in which a wedge 8, which may either be a tapered pin or other shaped wedge, is adapted to be seated. It is to be understood, however, that the wedges at the outer surfaces of the segments may be omitted, if desired. The die segments are confined between an outer plate 9 and an inner plate 10, which are connected by screws 11 extending through the outer plate and threaded into openings 12 in the inner plate. The plates 9 and 10, together with the screws 11, constitute a cage for holding the die segments 1 to 6, inclusive.

When the cage is placed in a support 14, which is preferably tapered, the wedges 8 are confined between the outer tapering edges of the segments and the wall of the support so that outward or radial movement of the segments is prevented during the passage of material through the die opening formed between the segments. The discharge end 15 of the support 14 is closed by a plug 16 having an opening 17 formed therein, through which the drawn rod or the like is discharged. The inner plate 10 bears against the inner face of the plug 16. The outer end of the support need not be closed if the direction of the drawn material is such as to urge the cage into engagement with the plug 16.

By varying the effective lengths of the die segments, the size of the opening is varied. This can be done by providing die segments of different

lengths or by making the sizes and shapes of the wedges 8 different. The approximate size of the opening is controlled by the size and shape of the die segments and the wedges. For finer adjustments of the opening, the plug 16 is provided with threads 18 cooperating with threads 19 on the support. The outer end of the plug is provided with a head 20 having flattened faces. By rotating the plug, the position of the cage within the tapered portion of the support is varied.

When the cage is adjusted to any position, the pressure exerted by the rod being drawn through the die forces the die segments out into engagement with the surface of the support or until the wedges prevent further removal. When the correct size of the die opening is obtained, the relative positions of the die segments are maintained by tightening the screws 11 in the cage. The adjustment of the position of the cage by the manipulation of the plug 16 provides a fine adjustment of die sizes.

As the working face of each die segment is convex in a direction parallel to the direction of movement of rod or the like passing through the die, as shown in Figure 2, the surfaces of adjacent die segments are concaved to slide along the convex working surfaces of the adjacent die segments, as shown in Figure 4, where the convex working face 21 of the die segment 5 engages the concave surface 22 of the segment 6. As the die segments are moved inwardly of the support, the size of the die opening is decreased, while as they are moved outwardly the size of the die opening increases.

Referring to Figure 5, for shaping a rod in successive stages, a pair of cages 24 and 25 of different sizes are disposed in a tapering support 26. Both ends of the support are preferably closed with plugs 27. Spacing rings 28 are disposed between the cages 24 and 25 and between the cage 24 and the adjacent plug 27. By adjusting the relative positions of the plugs 27 in the support 26, the positions of the cages 24 and 25 are varied in the support.

In the operation of this form of the invention, the die opening in the cage 24 adjacent the entrance of material to the die is larger than the die opening in the cage 25 adjacent the exit end of the support. The detail constructions of the cages 24 and 25 and the die segments mounted therein are similar to those shown in Figures 1 to 4.

Referring to Figure 6, three die segments, 29, 30 and 31 are arranged to define a triangularly shaped die opening. The operation of this form of die is substantially the same as that of the form of die shown in Figures 1 to 4. For providing a die opening of triangular shape, the angle between the working surface and the curved sliding surface of each die segment is greater than a right angle. In the form of the invention shown in Figures 1 to 4, which provides a hexagonally shaped opening, the angle between the same surfaces is less than a right angle.

A die opening of rectangular shape is provided by four die segments, 32, 33, 34 and 35, as illustrated in Figure 7. In this form of the invention, the angle between the working faces and the curved sliding faces of each die segment is substantially a right angle.

In Figure 8, I have illustrated a modification of the invention in which eight die segments, 36, 37, 38, 39, 40, 41, 42 and 43 are arranged to provide an octagonally shaped die opening.

By varying the number of die segments and the angular relation between the working surface and the sliding surface of each die segment, a large number of different shaped openings may be provided. Having once obtained the proper number of working surfaces for any shape, changes in the size of rod or the like being drawn may be made by shifting the die segments in a radial direction relative to the die opening. Accordingly, it is not necessary to provide separate dies for different sizes of rod having the same shape. By controlling the position of the cages supporting the die segments by adjusting the positions of end plugs in die supports, it is possible to secure a much wider range of sizes than is possible where swaging dies or wedges alone are relied upon.

It is to be understood that the word "rod" as herein used includes wire, rods, bars and the like of various shape, either regular or irregular.

While I have shown and described certain present preferred embodiments of my invention, it will be understood that it may be otherwise embodied within the spirit of the invention and the scope of the following claims.

I claim:

1. A drawing device comprising a support having a bore tapering therethrough, successive dies mounted therein, each die comprising a cage having a plurality of segments mounted therein and defining a die opening, and means for spacing the dies relative to each other and the support.

2. A drawing die for forming drawn products of substantially constant cross-section, comprising a cage, a plurality of separate die segments mounted therein and cooperating to define a die opening, a support having a tapered bore adapted to receive the cage with respect to which the die segments are radially positioned, and rotatable means connected with the support and adjustable axially thereof for permitting the movement of the cage to different fixed operative positions therein and maintaining said cage in a fixed position during the operation of the die, said rotatable means and said cage disposed in abutting relation.

3. A drawing die for forming drawn products of substantially constant cross-section, comprising a cage, a plurality of separate die segments mounted therein and cooperating to define a die opening, a tapered support for the cage with respect to which the die segments are radially positioned, and means disposed in abutting relation relative to said cage rotatably cooperating with the support and movable to adjusted positions axially thereof for moving the cage to different fixed operative positions therein.

4. A drawing die for forming drawn products of substantially constant cross-section, comprising a cage, a plurality of separate die segments mounted therein and cooperating to define a die opening, a tapered support for the cage with respect to which the die segments are radially positioned, means rotatably cooperating with the support, said means and the cage disposed in abutting relation whereby upon rotation of said means the cage may be moved axially of the support.

5. A drawing die for forming drawn products of substantially constant cross-section, comprising a cage, a plurality of separate die segments mounted therein and cooperating to define a die opening, a tapered support for the cage with respect to which the die segments are radially positioned, and a nut threaded into the support and disposed in abutting relation with the cage for adjusting the cage axially of the support.

6. A drawing die comprising a cage, a plurality

of separate die segments mounted therein and cooperating to define a die opening, a tapered support for the cage with respect to which the die segments are radially positioned, and a plug threaded into the support and abutting the cage for relatively axially adjusting the cage.

7. A drawing die comprising an internally tapered support, successive dies mounted therein, each die comprising a cage disposed in fixed relation relative to said tapering support, die segments mounted in the cage and operatively opposed to said support in such a manner that pressure is transmitted between the die segments and supports, wedges interposed between at least a part of the die segments and the support whereby said die segments define a fixed die opening and means for spacing the dies relative to each other.

FREDERICK KORNBRATH.