June 19, 1945. T. M. LAHR 2,378,562

DIE

Filed Oct. 12, 1943

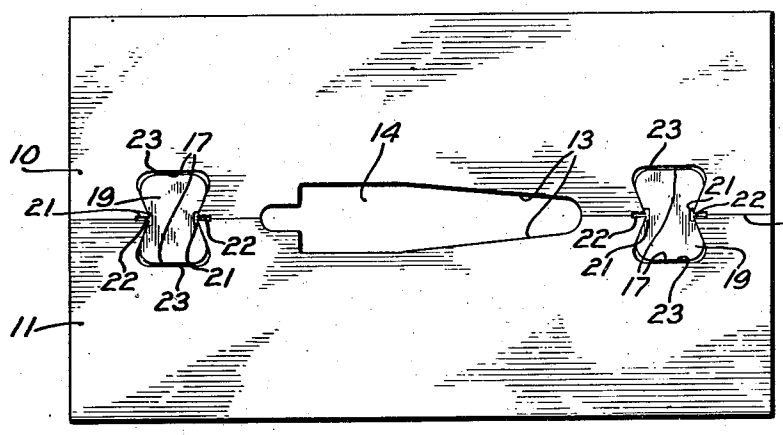


FIG. 1

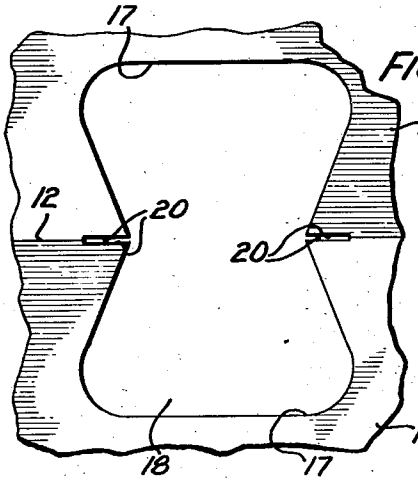


FIG. 3

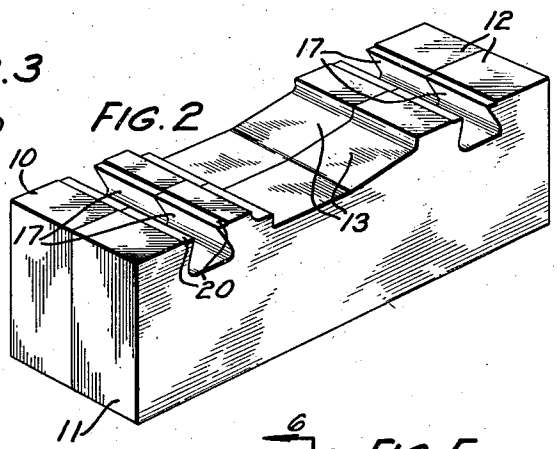


FIG. 2

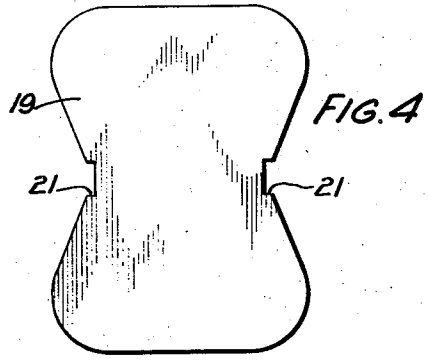


FIG. 4

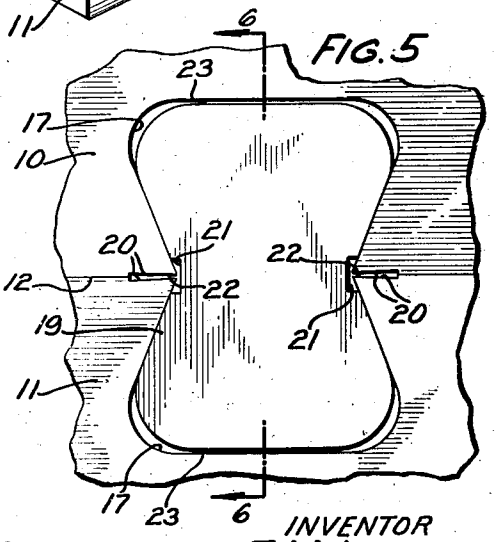


FIG. 5

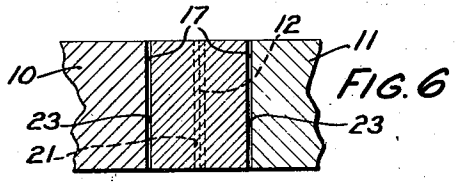


FIG. 6

INVENTOR
T. M. LAHR
BY Harry C. Dufft
ATTORNEY

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Thomas M. Lahr, Berwyn, Ill., assignor to Western Electric Company, Incorporated, New York, N. Y. a corporation of New York

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6 Claims. (Cl. 164—118)

This invention relates to dies and more particularly to a composite die for material punching operations.

An object of the invention is the provision of a simple and practicable composite die for material punching operations which is capable of a maximum period of serviceability.

In accordance with the above object, in one embodiment of the invention there is provided a die comprising two parts which are clamped together with accurately ground edge faces thereof, which are abutted together in the finished die, in alignment. As thus arranged, symmetrical halves of a die aperture and wedge-shaped clamping apertures, having outwardly extending clearance recesses at the junctures of the opposite inclined faces of the clamping apertures, each extending in a common direction across the two aligned faces, are milled in the faces of the die parts. After hardening the surfaces of the recesses and then finishing the same by stoning operations, the die parts are unclamped, properly positioned, and double wedge-shaped clamping keys, suitably dimensioned relative to the dimensions of the clamping apertures and slightly under-cut at the junctures of the tapered faces at opposite sides thereof for clearance purposes, are pressed into the apertures. The keys, due to their being double wedge-shaped, serve to firmly draw and hold the die parts together at their abutting faces.

Other objects and advantages of this invention will more fully appear from the following detailed description, taken in conjunction with the accompanying drawing, in which

Fig. 1 is a plan view of a die embodying the features of the invention;

Fig. 2 is a perspective view of the two parts of the die shown in Fig. 1 at the completion of the milling operations in their abutting faces to form the symmetrical halves of the die and clamping apertures;

Fig. 3 is an enlarged fragmentary view of the die parts shown in Fig. 1 before being keyed and clamped together;

Fig. 4 is an enlarged plan view of one of the clamping keys shown in Fig. 1 before its insertion in its clamping apertures;

Fig. 5 is a view similar to Fig. 3 after the insertion of a clamping key; and

Fig. 6 is a fragmentary vertical sectional view taken on the line 6—6 of Fig. 5.

Referring to the drawing, and particularly to Fig. 1, a composite die is illustrated comprising, in the present embodiment of the invention, two parts 10 and 11, which may be similar in all particulars and composed of a suitable metal for the purpose intended, such as metal punching operations. The parts 10 and 11 are ground to accurately mate along longitudinal edge faces 12 and each is provided with symmetrically aligned recesses 13, which form a die aperture 14, and symmetrically aligned wedge-shaped recesses 17 at each end of the die aperture, which form key-receiving or clamping apertures 18 for the reception of double-ended wedge-shaped keys 19 of a suitable metal, such as hardened steel with a high tensile strength, the recesses in each case extending in a common direction completely across the faces 12 and thus through the entire thickness of the die (Fig. 6). In forming the die recesses 13, allowance is made in the dimensions thereof to provide sufficient additional material for finishing and grinding operations, upon the surfaces thereof, after the hardening thereof.

As shown in the enlarged detailed view (Fig. 3) of one of the clamping apertures 18, before the insertion of a clamping key 19, the abutting faces 12 of the die parts 10 and 11 are each slightly recessed, as indicated at 20, at the junctures of the inclined faces at opposite sides of the wedge-shaped recesses 17, which provides a clearance between the abutting faces at these points, the recesses extending outwardly for a short distance therefrom. The purpose of the clearances formed by the recesses 20 will be made apparent hereinafter.

Referring now to Fig. 4, which shows an enlarged view of one of the clamping keys 19 before being inserted in the clamping aperture 14, the key is formed at the junctures of the inclined faces at opposite sides thereof with slight undercuts or recesses 21, which provide clearances at each side of the junctures to facilitate the placing of the keys in the apertures 18. By this arrangement, suitable space is provided for receiving the free outer ends of the recessed portions of the die parts 10 and 11 as they are drawn toward each other and which are slightly longitudinally displaced into the recesses 20 when the key 19 is assembled with the die parts. The clamping keys 19 are formed to predetermined accurate dimensions relative to accurate dimensions of the clamping apertures 18 so that the desired clamping action is effected when the keys are inserted in the apertures. Thus, the inclined faces of the apertures and the keys are identical as to angle and position when aligned and the longitudinal dimension of the apertures is predeterminedly slightly greater than the corresponding dimen-

sions of the keys. The preferred angle of the inclined key and key apertures' faces is 20°.

In assembling the die parts 10 and 11, they are abutted along their recessed mating faces 12 with their clamping recesses aligned, as shown in enlarged detail in Fig. 3. Thereafter, the keys 19 are aligned with the apertures 18 and, while flooded with a suitable oil and with the parts under normal room temperature, the keys are pressed into clamping position (Figs. 1 and 5) by suitable means. Another method of placing the keys 19 in clamping position in the parts 10 and 11 comprises heating the keys to a suitable temperature to expand them and then pressing them by suitable means into the apertures 18 of the parts 10 and 11, which are of room temperature. Upon the keys 19 cooling, the parts 10 and 11 will be firmly drawn and held together. After the placing of the keys 19 in the apertures 18 by either method, the parts 10 and 11 and the keys 19 appear as shown in enlarged detail in Figs. 5 and 6.

As clearly shown in Fig. 5, the pressing of the keys 19 into the apertures 18 results, due to the cooperating accurately dimensioned and aligned inclined faces of the keys and apertures, in a drawing together of the abutting edge faces 12 of the die parts 10 and 11 with great pressure and a retention of the parts in assembled relation from displacement in all directions in the normal use of the die. This is clearly apparent from the resultant indicated drawing together of the metal of the die parts 10 and 11 adjacent the junctures of the inclined faces of the apertures 18 thereof at the inner ends of the clearance recesses 20, indicated at 22, and indicated clearance 23 between the parallel faces of the key and the adjacent faces of the key aperture at opposite ends of the key. The pressure of the angular faces of the keys 19 on the angular faces of the recesses has a vertical as well as horizontal component, as viewed in Fig. 5. However, at the point where the angular surfaces of the double wedge-shaped keys intersect, there would be only a horizontal component of pressure which would not aid in holding the die sections together, but would be detrimental and the clearance 21 is provided so that the key will not tend to expand the die sections along the line of their mating surfaces. In the drawing, the clearance recesses 20, 21 and 23 have been exaggerated for the sake of clearness.

It will be obvious that, by uniting the sections of a composite die in the manner described above, in which the keys 19 extend throughout the thickness of the die, a maximum period of serviceability is provided since it may be ground down repeatedly for sharpening purposes a maximum number of times without weakening it to such an extent that it is unfit for service.

Although a simple two-part die has been illustrated and described embodying the features of the invention, it is also applicable to dies involving more than two parts and it will be understood that modifications can be made.

What is claimed is:

1. A die comprising two die sections having extended mating surfaces and surfaces between said mating surfaces cooperating to form a die opening, said sections having aligned wedge-shaped apertures, the sides of said apertures forming acute angles with said mating surfaces, and a double wedge-shaped key of substantially greater length than width in the direction of its inclined faces fitting in said apertures to unite said die sections, and a clearance space being provided between the sides of said key and said apertures at the junction of said mating surfaces.

2. A die comprising two die sections having extended mating surfaces and surfaces between said mating surfaces cooperating to form a die opening, said sections having aligned wedge-shaped apertures, the sides of said apertures forming acute angles with said mating surfaces, and a double wedge-shaped key of substantially greater length than width in the direction of its inclined faces fitting in said apertures to unite said die sections, said key and wedge-shaped apertures extending throughout the thicknesses of the die sections, said key being recessed at the junctures of the inclined faces at opposite sides thereof to provide clearances thereat.

3. A composite die for material working operations comprising a plurality of die sections having mating surfaces at separated points and aligned recesses therebetween to form a die aperture, said die sections each having aligned wedge-shaped recesses in the mating surfaces, the inclined faces of each recess being directed towards each other as they approach the mating surfaces, and a double wedge-shaped key having inclined faces similar in angle and position to the inclined faces of said recesses pressed into said aligned wedge-shaped recesses effective to firmly draw and join together under pressure the mating surfaces of the die sections, said key being recessed at the junctures of the inclined faces at opposite sides thereof to provide clearances thereat.

4. A composite die for material working operations comprising a plurality of die sections having mating surfaces at separated points and aligned recesses therebetween to form a die aperture and aligned wedge-shaped recesses at opposite sides of the die aperture recesses, all extending throughout the thicknesses of the die sections, opposite faces of the wedge-shaped recesses being inclined 70° from the mating surfaces of the die sections and directed towards each other as they approach the mating surfaces, said mating surfaces being formed with recesses at the junctures of said inclined recess faces at opposite sides thereof to provide clearances thereat, and a double wedge-shaped key pressed into said aligned wedge-shaped recesses effective to firmly draw and join together under pressure the mating surfaces of the die sections, the recessed portions of the die sections at the junctures of said inclined recess faces being drawn toward each other as said key is pressed into position, opposite sets of faces on said key cooperating with the inclined faces of the wedge-shaped recesses being inclined at the same angle as the inclined faces of the wedge-shaped recesses.

5. A die comprising two die sections having extended mating surfaces and surfaces between said mating surfaces cooperating to form a die opening, said sections having aligned wedge-shaped apertures, and a double wedge-shaped key of substantially greater length than width fitting in said apertures to unite said die sections, the length of said key being slightly less than the length of the aligned wedge-shaped apertures to provide clearances between opposite ends of the key and corresponding ends of the wedge-shaped apertures and of such width that the sloping surfaces of the wedge-shaped key contacts the corresponding surfaces of the die sections.

6. A composite die for material working operations comprising a plurality of die sections having

mating surfaces at separated points and aligned recesses therebetween to form a die aperture and aligned wedge-shaped recesses at opposite sides of the die aperture recesses, all extending throughout the thicknesses of the die sections, the inclined faces of each wedge-shaped recess being directed towards each other as they approach the mating surfaces, said mating surfaces being formed with recesses at the junctures of said inclined recess faces at opposite sides thereof to provide clearances thereat, and a double wedge-shaped key pressed into said aligned wedge-shaped recesses effective to firmly draw and join together under pressure the mating surfaces of the die sections, the recessed portions of the die sections at the junctures of said inclined recess faces being drawn toward each other as said key is pressed into position, opposite sets of faces on said key cooperating with the inclined faces of the wedge-shaped recesses being inclined at the same angle as the inclined faces of the wedge-shaped recesses.

THOMAS M. LAHR.