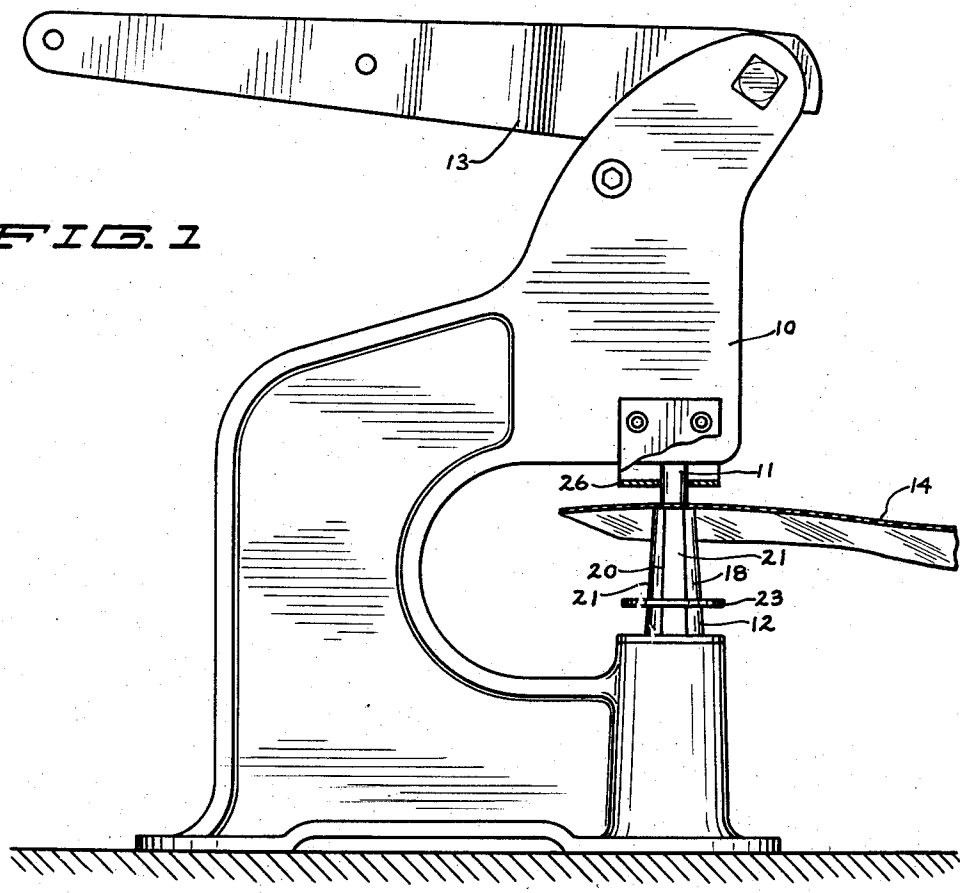
July 7, 1959 J. D. THOMPSON 2,893,489

PUNCH AND DIE

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FIG. 1



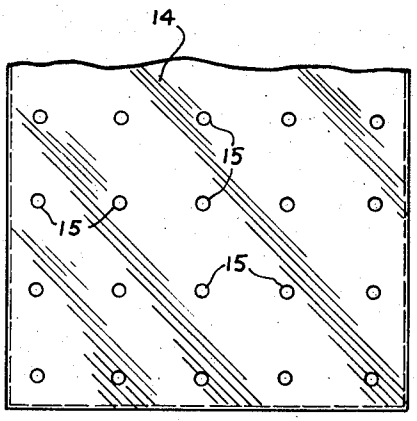


FIG. 2

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PUNCH AND DIE

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FIG. 3

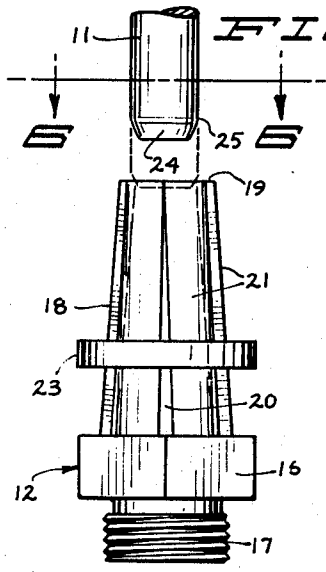
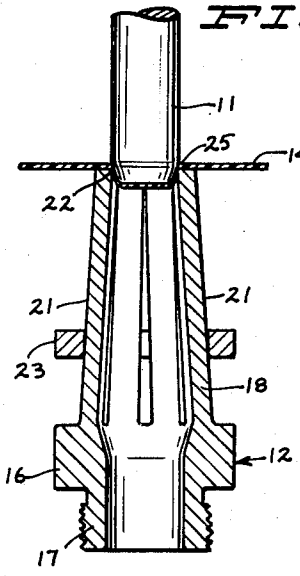


FIG. 4



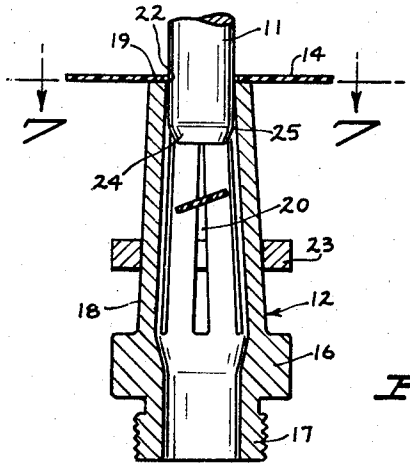


FIG. 5

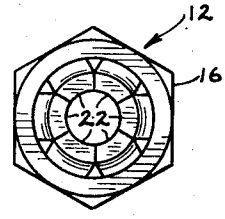


FIG. 6

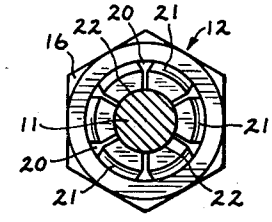


FIG. 7

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United States Patent Office 2,893,489 Patented July 7, 1959

2,893,489

PUNCH AND DIE

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Application November 1, 1957, Serial No. 694,035

2 Claims. (Cl. 164—118)

The invention herein has relation to a punch and die construction which has been devised to be especially useful for the purpose of perforating polyethylene film and other tough, shear-resistant sheet materials.

Sheet materials having perforations therein are commonly in use. They are employed for many purposes, as to produce containers for vegetables, etc. To be suitable for most purposes sheet materials are required to be tough and shear-resistant. By way of example, polyethylene film has qualities which render it sufficiently tough and shear-resistant to be suitable for a variety of uses. Punches and dies heretofore employed to accomplish perforation of sheet materials, such as polyethylene film, having high shear-resistant properties have been expensive to produce and short lived. In practice, sheet material is spread out over a surface and punches and dies for perforating the sheet material are arranged in banks or gangs. Customarily, the punches are constituted as balls which strike hammer blows against the dies. Close and accurate constant alinement is required. Regardless of precautions which may be taken, the punches and dies shortly become out of alinement, damaged and unfit for use.

The purpose of the present invention is to provide an inexpensive, new and improved punch and die construction which will be an improvement over punches and dies for the same general purpose heretofore known and will perform its intended service in efficient and satisfactory manner for an indefinitely long period of time.

In the accompanying drawings forming a part of this specification,

Fig. 1 is an elevational view, partially in section and partially broken away, of a punch and die construction made according to the invention as when applied to use;

Fig. 2 is a plan view of a sheet of material having perforations therein as they might appear when made by the punch and die construction;

Fig. 3 is an enlarged side elevational view, partially broken away, of the punch and die of Fig. 1;

Fig. 4 is a central longitudinal sectional view of the punch and die;

Fig. 5 is a view corresponding with the disclosure of Fig. 4, but showing the punch in a different position;

Fig. 6 in an end elevational view of the die as it would appear from the position of line 6—6 in Fig. 3; and

Fig. 7 is a sectional view, taken as on line 7—7 in Fig. 5.

Referring to the drawings, **10** denotes a machine suitably and conveniently supporting a reciprocatable punch **11** and a stationary die **12** in vertical alinement, and **13** represents generally mechanism for causing the punch to be reciprocated. Desirably, the punch and die construction can be of steel. In practice of the invention, punches and dies such as **11** and **12** can be arranged in banks or gangs to be concurrently operable on sheet material, such as **14**, between the punches and dies and rested on the dies, thus to produce perforations, such as **15**, in the sheet material.

The die **12** is constituted as a body member **16** at an

intermediate portion of said die, an externally threaded supporting member **17** for the die integral with and at a side of the body member, and a hollow frusto-conical element **18** integral with and at a side of said body member opposite the supporting member. The body and supporting members and the hollow frusto-conical element are in alinement longitudinally of the die, and the outer end **19** of said frusto-conical element is in a plane perpendicular thereto. The external thread of the supporting member **17** is to be screwed into a stationary lower member of a machine to incorporate the die. Said die could, however, be suitably and conveniently fixed in a machine, as for adjustment in a horizontal plane, in any ordinary or preferred manner.

The hollow frusto-conical element **18** is constituted as a wall of uniform thickness provided with parallel, circumferentially spaced, longitudinally extending slots, each denoted **20**. As shown, there are six equally spaced slots **20** and each slot extends from the location of the body member **16** to the outer end **19** of said hollow frusto-conical element or wall. Each slot **20** is of divergent configuration in direction inwardly thereof, or toward the body member of the die, and the slots divide the frusto-conical element or wall into a plurality, six as disclosed, of duplicate elongated bars **21** which are part-cylindrical in direction transversely of said frusto-conical element or wall. Desirably, each slot **20** can be of, or approach, zero width at the location of the outer end **19** of the frusto-conical element or wall. The part-cylindrical elongated bars **21** are of uniform width, as well as of uniform thickness, and all longitudinally extending lines of said elongated bars are, geometrically speaking, straight.

The internal and external surfaces defining the inner and outer circumferences, respectively, of the part-cylindrical elongated bars **21** are in concentric relation, and the outer end portions of the internal surfaces of said part-cylindrical elongated bars are in perpendicular relation to the outer end **19** of the frusto-conical element or wall **18** and provide therewith part-circular severing edges, each represented **22**.

The part-cylindrical elongated bars **21**, provided by the hollow frusto-conical element or wall **18**, will be of structure and thickness to be sufficiently rigid to properly perform their intended service and yet flexible outwardly at their upper end portions in response to forcible insertion of a punch, such as **11**, into the die.

A confining ring or annular element **23** on the external surface of the hollow frusto-conical element or wall **18** is for adjustably altering the tension of the outer end portions of the part-cylindrical elongated bars **21**. Said part-cylindrical elongated bars will be under minimum tension when unconfined. The confining ring or annular element will be moved inwardly along the external surface of the frusto-conical element or wall **18** when tension of the part-cylindrical elongated bars is to be increased, and vice versa. There will be no confinement of the hollow frusto-conical element or wall when the ring or annular element is at its lowermost position. Said ring or annular element need be employed merely to adjust tension. The die is operative without a means for altering tension. In many instances of use, the bars **21** need not be under tension. Clearly, the amount of tension existent at the outer end portions of said part-cylindrical elongated bars can be adjusted to be that which is appropriate in any particular instance merely by sliding of the confining ring or annular element longitudinally of the hollow frusto-conical element or wall.

The punch **11** is constituted as an elongated cylindrical member to be forcibly slid into the outer end portion of the die **12**. A tapered free end portion **24** of the

punch meets the body thereof to provide an annular severing edge **25** in a plane perpendicular to the punch body and complementary to the part-circular severing edges **22** of the part-cylindrical elongated bar **21** of the die. The body of the punch must be somewhat larger than the die opening at the outer end **19** of the frusto-conical element or wall **18** when the part-cylindrical elongated bars **21** are in their natural, unflexed condition and said die is unexpanded. The free end portion of the punch is of reduced diameter to permit its entry into the die even though the punch and die may be somewhat out of longitudinal alinement.

A stripper **26** is for insuring that the punch will be moved clear of the sheet material each time the punch is returned to inoperative position.

In Fig. 3 of the drawings, the punch is disclosed as when in inoperative position, and the die is unexpanded. Also see Fig. 6. In Fig. 4 the punch has entered the die to an extent where the circular severing edge **25** of said punch and the part-circular severing edges **25** of the part-cylindrical elongated bars **21** of the die have cooperated to cut a blank from the sheet material, save for minute thread-like portions possibly occasioned by reason of absence of cutting action at the locations of the slots **20**. In Figs. 5 and 7 the punch has reached its maximum depth in the die and the die has become expanded. The punch has been made to enter the die sufficiently far to insure that thread-like portions, if any, have become disjoined or broken off. In said Fig. 5, the blank is disclosed as when completely removed from the sheet material.

The punch and die construction herein presented possesses advantageous features. There is provision for over-travel with consequent elimination of damaging hammering. Metal to metal contact between punch and die is achieved without binding effect. The flexibility of the part-cylindrical elongated bars of the die permits efficient operation even when the punch and die may be misalined. Punch and die constructions made according to the invention can be inexpensively produced and will be efficiently operable for indefinitely long periods of time.

While the punch and die construction as illustrated and described is for producing circular perforations, it can be employed to produce apertures of various shapes.

What is claimed is:

1. The combination with a female element constituted as a die of rigid material consisting of a supporting member and flexible elongated bars integral with and extending outwardly from said supporting member in adjacent relation to each other, side edges of outer end portions of said elongated bars which are in adjacent relation being tensioned into engaged relation with each other, said outer end portions and outer ends of internal surfaces of the elongated bars together defining a closed punch receiving opening and providing a circumferentially extending severing edge in bounding relation to said opening, of a male element constituted as a punch consisting of a body member to be forcibly inserted into the opening provided by said elongated bars and including a circumferentially extending severing edge complementary to the severing edge of the elongated bars, there being a divergent surface adjacent to and disposed exteriorly of the severing edge of one of said elements and the outer end portions of said elongated bars being capable of flexing away from each other in response to forcible insertion of said punch into said die.

2. The combination as specified in claim 1, and means for adjusting tension upon the outer end portions of said elongated bars.

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