Feb. 16, 1954

C. M. BREHM

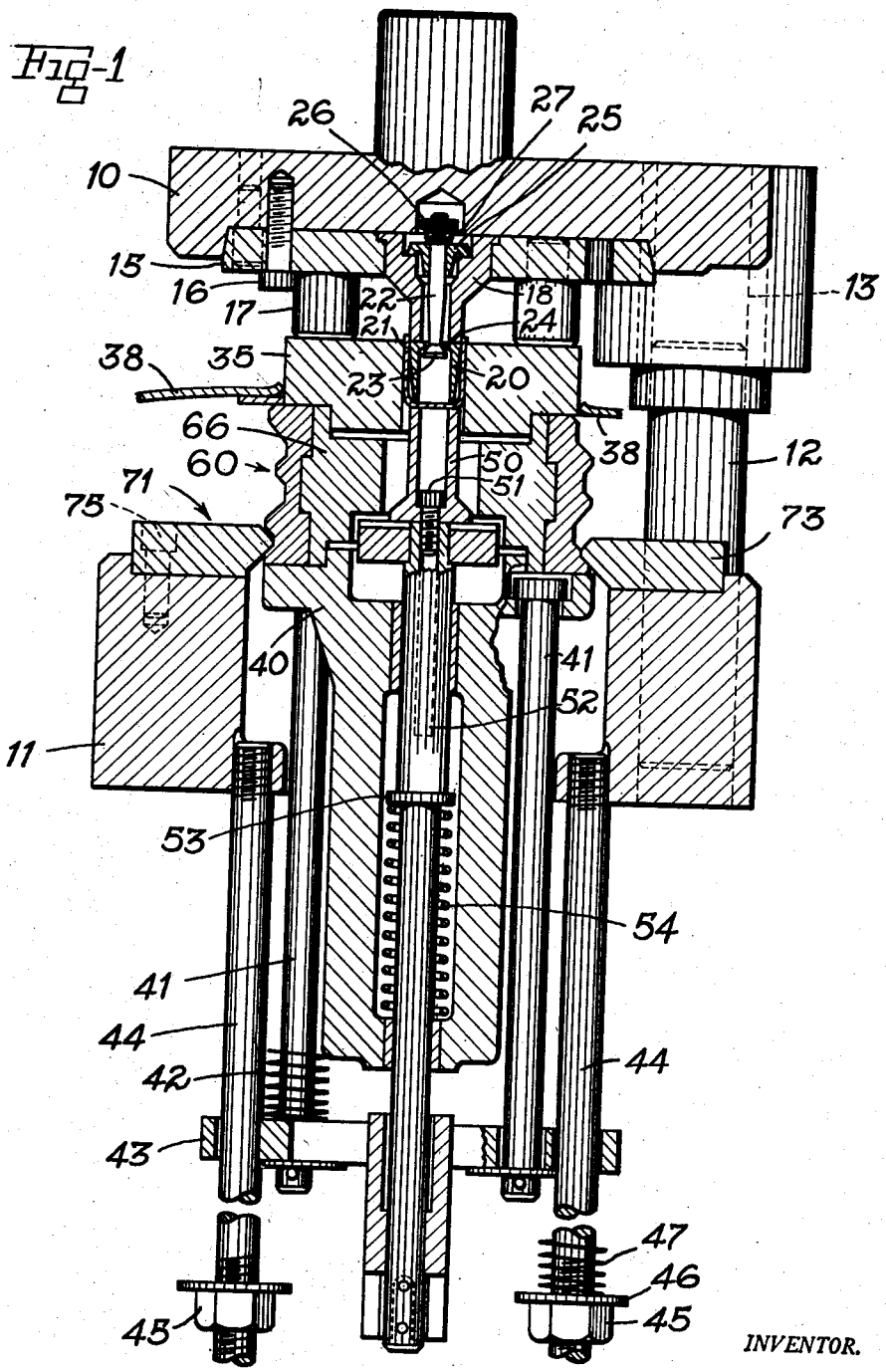
2,669,302

CAM OPERATED TRIMMING DIES

Filed May 8, 1950

2 Sheets-Sheet 1

Fig-1



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2 Sheets-Sheet 2

Fig-2

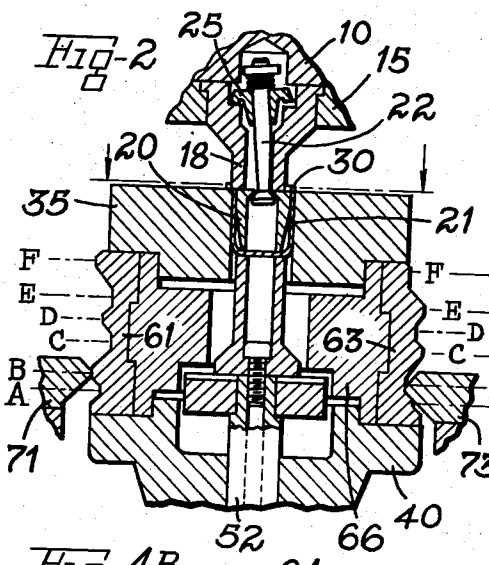


Fig-3

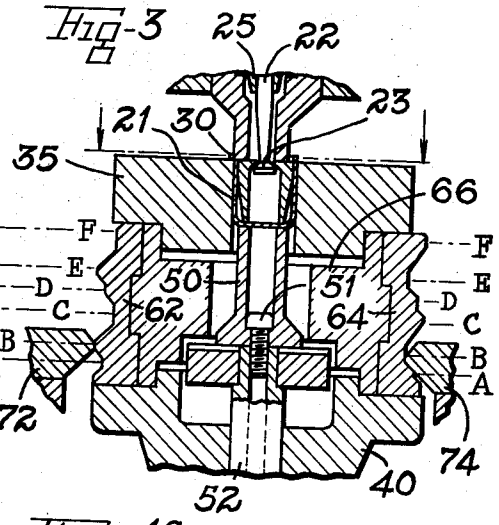


Fig-4B

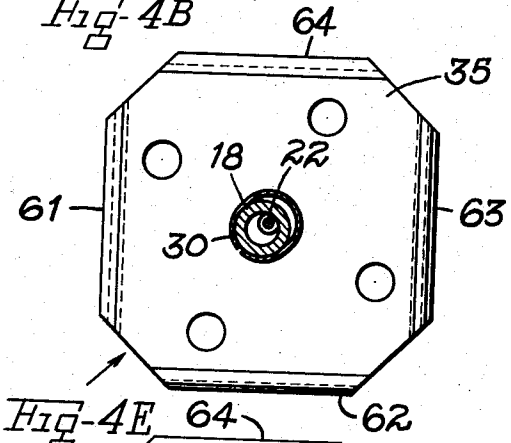


Fig-4C

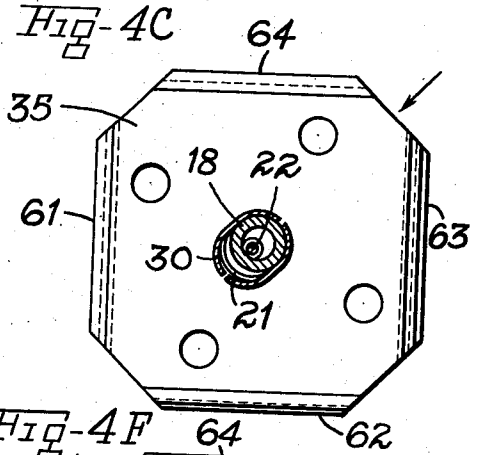


Fig-4E

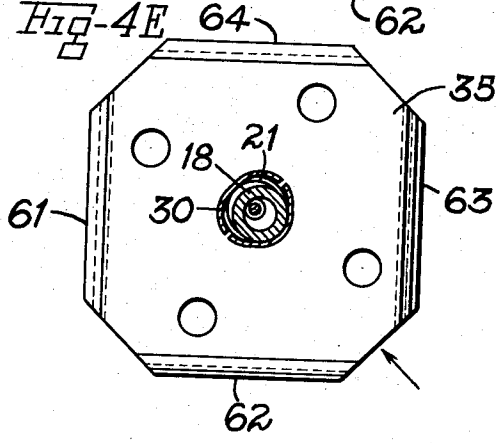
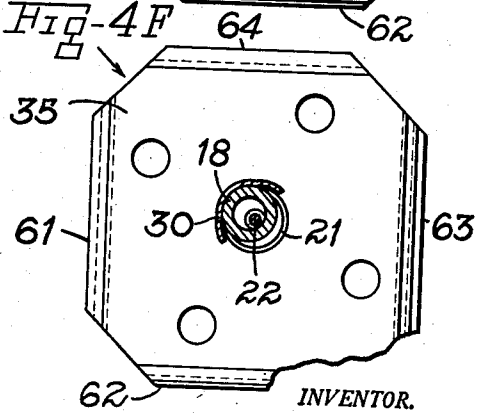


Fig-4F



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CAM OPERATED TRIMMING DIES

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Application May 8, 1950, Serial No. 160,655

2 Claims. (Cl. 164—47)

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This invention relates to trimming dies and more particularly to a trimming die capable of handling heavy work.

The invention relates to trimming dies for the trimming of a blank similar to that in applicant's earlier patent No. 2,347,808, issued May 2, 1944. In the earlier constructon trimming dies are provided which may be utilized in a typical press or the like and which provide for receiving a blank therebetween the peripheral edge of which is to be trimmed. A series of cam members are provided and so arranged that as the dies move in translation under the action of the press, transverse movements of one die relative to the other are produced in a definite pattern and sequence such that the desired trimming of the periphery of the blank is obtained.

Since the trimming movements of the dies are produced by cooperative engagement of cam members, it is important that the forces on the cam members be so limited as not to exceed the permissible bearing loads for the cam surfaces employed. Usually the length of these cam members is limited, at least for practical reasons, and the weight and thickness of the blank which can be trimmed are therefore necessarily so restricted that with cams of the maximum size, the bearing loads will not exceed proper values.

In accordance with the present invention a construction of trimming dies is provided in which with no increase in the size of the cam members, substantially increased forces are made available for the trimming movements of the dies, and thus with cams of the same size, work of substantially increased weight and thickness can be properly handled, and the capacity of any particular set of dies thereby correspondingly increased. This is accomplished in accordance with the present invention by so arranging the cam surfaces that instead of the transverse movements of the dies being produced by cooperative engagement of one fixed member with a corresponding movable motion producing member, there is simultaneous engagement between a plurality of such motion producing members arranged in angular relation to each other. Thus for example where the die arrangement employs four cams or motion producing members arranged around the periphery of the dies and at substantially right angles to each other, the mechanism provides for simultaneous engagement of a pair of such members with the corresponding fixed cams, thereby producing a combined or resultant force and motion of the movable die which corresponds to the vectorial addition or resultant of the individual components

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produced by the separate cam members. With any adjacent pair of cams so working simultaneously, the motion will occur in a direction at 45° to each of the right angularly related surfaces, the force developed along this 45° line of motion will have a value corresponding to approximately the $\sqrt{2}$ times that developed by either cam alone.

As the movements of the dies in translation continue, a different pair of motion producing members is brought into use, and this results in producing a movement of the die in translation in a different direction. Such different direction will again be at an angle of 45° to both of the cams which produce the motion, and it will be obvious that by so continuing, and with each successive pair of adjacent cams being used progressively to cause movement of the die transversely, a complete series of transverse die movements will be obtained, the line of which is always at the resultant angle of 45° to the cam members producing the movement, and with the full series of transverse movements thus being accomplished. The blank of course will be properly indexed in the dies initially so that the angular transverse trimming movements will correlate in proper sequence with the blank structure.

In this way with no increase in the size of the cam members, die movements are developed which require a considerably greater force than would be possible where the movement was produced by one cam alone, and thus dies of the same size can be used for trimming blanks of larger size or heavier gage material, or resulting in longer life and generally making the dies better adapted for heavy duty work.

It is accordingly the principal object of the invention to provide a construction of trimming dies which is economical as to size and space and which is adapted for heavy work, and for developing greater forces than would be possible with the ordinary die construction.

It is also an object of the invention to provide a die construction for the trimming of blanks in which a plurality of cam members are utilized simultaneously to cause die movements in a direction and with a force corresponding to the vectorial resultant of the individual components.

Other objects and advantages will be apparent from the following description and the accompanying drawing, and the appended claims.

In the drawing—

Fig. 1 is a vertical sectional view through the trimming dies in accordance with the present in-

vention in operative position in a typical press;

Fig. 2 is a sectional view through the dies and one pair of oppositely located motion producing cam members;

Fig. 3 is a view similar to Fig. 2 in the plane at right angles thereto; and

Figs. 4B, 4C, 4E and 4F are a series of views looking down upon the movable die and showing the cam members which are associated therewith, with arrows indicating the resultant direction of transverse movement of the die under the action of the adjacent pair of cams in each of the several positions throughout the course of the trimming operation.

Referring to the drawings which illustrate a preferred embodiment of the invention, the die members are shown as being carried by a press including an upper carrying member **10** and a lower or fixed supporting member **11**. Fixed guides **12** carried by member **11** project upwardly through apertures **13** in the carrying member **10** to guide the movement of the upper member as it is closed. Any suitable form of press may be used as desired, that shown being for illustrative purposes only. The carrying member **10** carries a plate **15** which is secured by means of bolts **16** and which in turn is provided with a plurality of pressure pins **17**. The plate also supports the male die member or punch **18** which forms the upper or relatively stationary trimming member, such member being suitably flanged to be received and held in place upon the assembly of plate **15** and member **10**.

A blank clamping member **20** is received internally within the blank **21** and is adapted to hold the blank securely by contact with the inner face of the base thereof during the trimming operation and it also serves as a gage to control the depth of the blank at which the trimming operation occurs. Clamp **20** is supported from the upper trimming member **18** by means of a rod **22** having an enlarged head **23** received within the upper neck **24** of clamp **20** in such manner that it is free to rock in all directions above the clamp while maintaining its engagement therein. Such rocking or swiveling motion is provided for in its support which comprises a sleeve **25** carried on its upper end in a seat in member **18**. The rod carries a nut **26** which retains a spring **27** between the nut and the sleeve **25**, thereby making it possible for the lower end of the rod to move with the blank, the upper end tilting as required within the upper member **18**.

The blank **21** is shown in the form of a cup shaped member of generally circular cross section, the projecting portion **30** of the the edge being the part desired to be trimmed off. While a blank of circular cross section is shown, this is for illustrative purposes only as the invention provides for trimming blanks of any cross section, regular or irregular. The blank is received within a central recess in the lower trimming member **35** corresponding in shape with the section of the blank, which member is seated within and carried by the cam block assembly described below. A chip shield **38** prevents chips from lodging in the cams.

Bearing against the lower side of the cam block assembly is a member **40** which is provided with recesses to receive the flanged heads of elongated rods **41**. Springs **42** are received over rods **41** and are caused to engage against member **40** at one end urging it upwardly into contact with the cam block, the other end of spring **42** engaging against a cross plate **43**

through which the rods **41** freely extend. The cross plate **43** is formed to engage over a second series of rods **44** the upper ends of which are fixed to the frame **11**, with the lower ends carrying nuts **45**, washers **46**, and compression springs **47**. It will thus be seen that the downward movement of the cam block will be resisted by and will result in compression of both sets of springs **42** and **47** the force being transmitted therethrough into frame **11**.

Means are also provided for causing the ejection of the blank following the trimming operation and upon the opening of the press. For this purpose a pedestal **50** engages the underside of the blank, such pedestal being bolted by means of bolt **51** into a rod **52** which in its lower portion is provided with a shoulder **53** against which there operates a compression spring **54**. The rod **52** is guided for vertical movement with respect to the frame member **40**, against which the opposite end of spring **54** bears. Thus upon initial closing movement of the press, the blank member **20** causes the blank to be seated within the recess in the lower trimming member, and as the press begins to close, the blank is pressed into its recess to the extent determined by member **20**, thereby compressing spring **54**. No further relative movement of these parts takes place with respect to the lower trimming member during the trimming operation; however as the press is being released following the trimming operation, spring **54** expands and lifts the trimmed blank out of its position so that it is made readily accessible and the press thus prepared for the reception of a subsequent blank.

Referring now more particularly to the mechanism which provides for the transverse movement of the dies, it will be understood that it is desired to effect such transverse movement of the lower trimming die **35** and of the main portion of the blank which is received therein relative to the upper die member or punch **18**. As the dies move together downwardly in translation, it is further desired to perform a series of transverse movements of the lower die **35**, each of which takes place in a different direction, in order thereby to shift the trimming dies relative to each other and in that way to complete the trimming of the entire periphery of the blank. That is, by the time that the dies have reached the bottom of their downward stroke, the full series of transverse movements of the movable die **35** has been completed with respect to the non-moving die or punch **18**, and the blank has been fully trimmed and the scrap completely separated.

The motion producing members comprise a cam block assembly **60** shown as having four cams designated by reference numerals **61**, **62**, **63** and **64** respectively. These motion producing members are arranged in angular relationship to each other, and in the form shown where there are four such blocks, they extend at right angles to each other around the periphery of the movable cam and die assembly **35** being secured to a cam block **66**.

Cooperating with such motion producing means are fixed cam members designated as **71**, **72**, **73** and **74** each of which is fastened upon the frame **11** by means such as bolts **75**. The movable cams **61** to **64** are suitably contoured to form a pattern of rises and valleys as indicated in Figs. 2 and 3, and the arrangement is as follows. Initially before the downward movement in translation begins there is a normal position on all of cams **61** to **64** designated as the A position in

which there is no displacement of the cam and it is in its central or neutral position providing for the placing of the blank in the dies. As the dies move downwardly under the action of the press to the position or level indicated at B, it will be seen by reference to Figs. 2 and 3 that a rise is formed on cams 61 and 62 with a corresponding recess on cams 63 and 64. As a result, fixed cams 71 and 72 both engage the corresponding faces of cams 61 and 62, and motion is thus produced in a direction as indicated by the arrow in Fig. 4B, representing the vectorial addition or resultant of these two components originated and developed at right angles to each other. The transverse movement of the blank with respect to the punch is indicated at the center of Fig. 4B and as shown results in the shearing of one edge of the blank.

Upon further downward movement of the dies in translation to the level marked C it will be evident that a rise is present on both cams 63 and 64 with a corresponding recess being present on the opposite cams 61 and 62. As a result, under the action and engagement of such rises with fixed cams 73 and 74 respectively a resultant movement of the blank in a direction directly opposite to its original travel takes place, as indicated by the arrow in Fig. 4C. This causes the blank to be trimmed along the edge opposite to that first trimmed.

Upon downward travel of the dies to the position or level marked D the blank is brought back to its neutral position in preparation for a transverse movement at right angles to the previous movements. This is accomplished upon the further downward travel of the blank to the position marked E in which position there is a rise on cams 62 and 63 which in cooperation with fixed cams 72 and 73 respectively result in a transverse movement of the movable die in the direction indicated by the arrow in Fig. 4E. This causes the trimming of one of the sides of the blank and the separation of one part of the scrap therefrom.

In the final or lowermost position of the dies as indicated by the level marked F a rise on cams 61 and 64 in cooperation with fixed cams 71 and 74 respectively results in a composite or resultant movement of the blank in the direction indicated by the arrow in 4F, thereby trimming the opposite side of the blank from that trimmed in step 4E. This completes the trimming of the blank and the final separation of the remaining piece of scrap therefrom.

The above sequence of movements is given as typical since it is also clear that different patterns of movement can be arranged by suitable shaping of the several cam surfaces in order to provide movements in a desired direction or sequence of directions for any particular purpose.

It will be evident from the above that each movement of the movable die member occurs in a direction at an angle, approximately 45°, with respect to both of the right angularly related cams for producing such movement. It is also evident that since two cam surfaces are provided and cooperate in producing each such die movement, the component forces developed by each die alone are added vectorially so as to produce a total or resultant force which is the summation

of the two components. In the embodiment shown where the sets of cams work in pairs at right angles to each other, the magnitude of the resultant force is $\sqrt{2}$ times the force developed in either cam alone, thus providing a materially increased available actuating force without necessitating any increase in the size or change in the characteristics of the cam members themselves. The dies are therefore readily adapted for heavy duty work such as in the trimming of blanks of stiffer material or material of heavier gage, or other blanks requiring a greater force than would otherwise be available.

While the form of apparatus herein described constitutes a preferred embodiment of the invention, it is to be understood that the invention is not limited to this precise form of apparatus, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. In combination, a pair of cooperating trimming dies mounted for movement in translation and adapted to receive a blank to be trimmed in response to relative lateral shifting movements therebetween, means for mounting one of said dies in laterally fixed position, a cam block assembly having a plurality of angularly related faces, means for mounting the other said die on said cam block assembly for lateral movement therewith, a cam on each of said faces with a pattern of projections thereon including at least two projections at different levels, one of said projections being at the same level as a projection on one adjacent face and the other said projection being at the same level as the projection on another adjacent face of said cam block assembly, a plurality of fixed cams cooperating respectively with the cams on each of said faces to shift said cam block assembly laterally in different directions at each of said different levels during said translatory movement, said pattern of projections being such that at each of said levels a pair of said fixed cams cooperate with and engage the cams of two adjacent faces of said cam block developing a lateral shift thereof corresponding in direction and amount to the vectorial resultant of the forces developed by said individual cams, each of said fixed cams cooperating with different ones of the other cams on said cam block at said different levels to provide successive lateral shifting movements of said cam block in different directions at different levels under the combined action of a pair of cams at each level.

2. The combination of claim 1 in which the cam block assembly has at least four angularly related faces.

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