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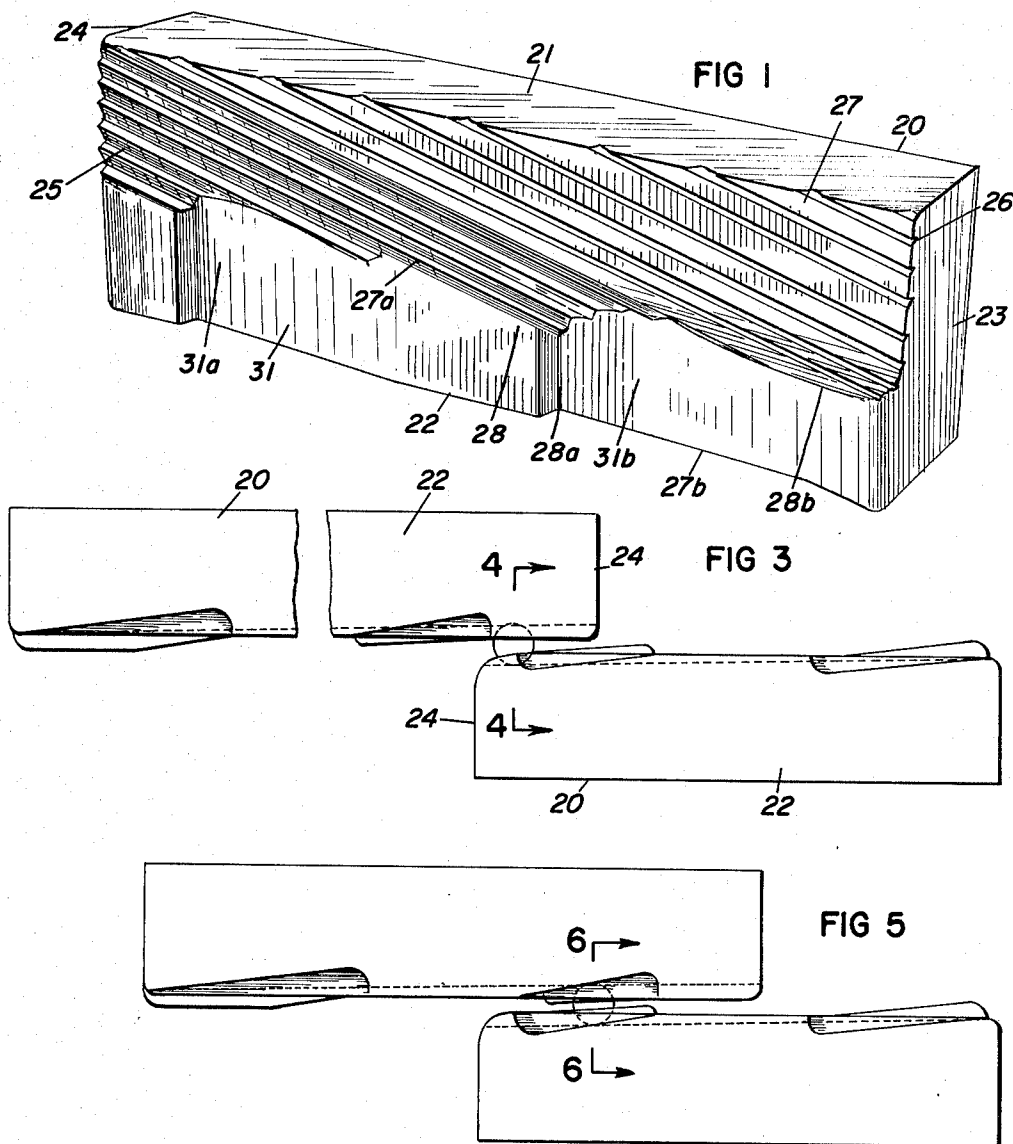
TEIJI SATO

3,217,530

DIE BLOCKS FOR THREAD ROLLING MACHINES

Filed Jan. 2, 1963

3 Sheets-Sheet 1



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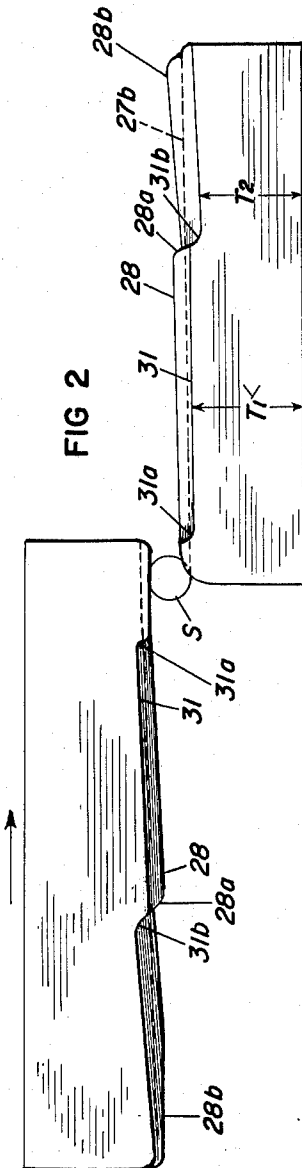
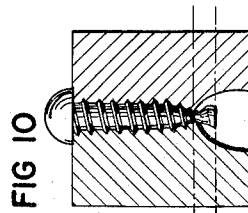
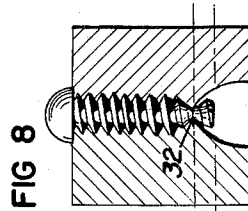
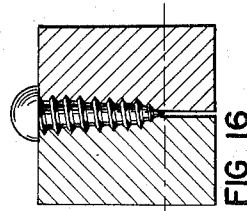
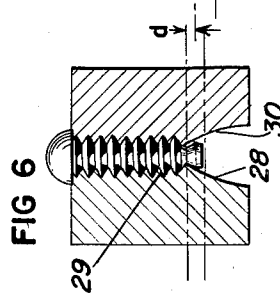
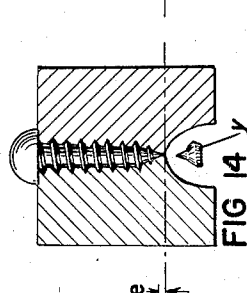
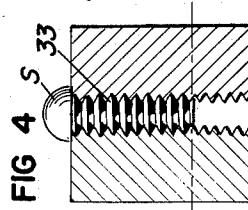
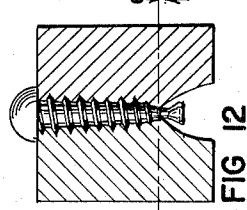
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DIE BLOCKS FOR THREAD ROLLING MACHINES

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3 Sheets-Sheet 2



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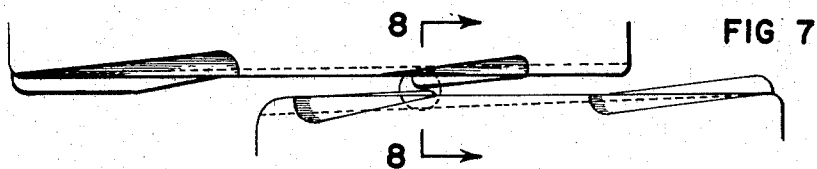
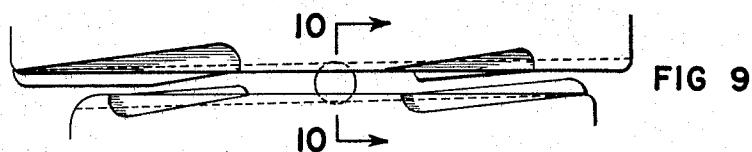
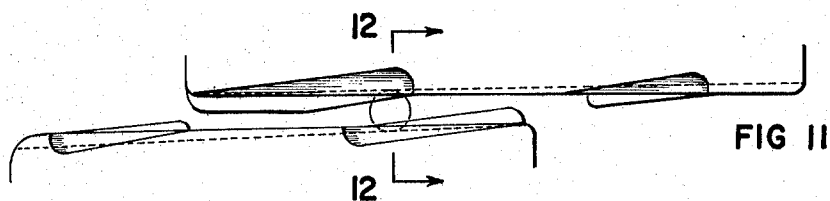
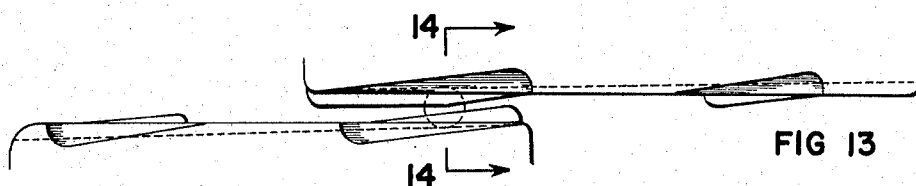
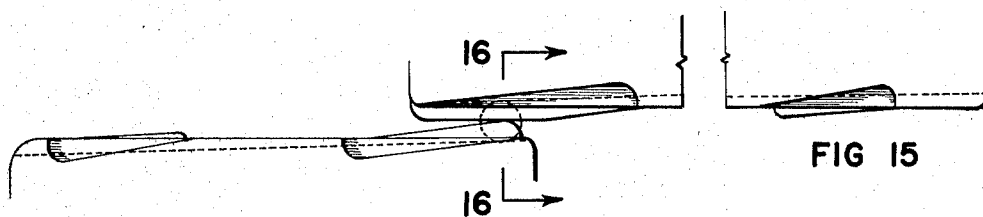
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DIE BLOCKS FOR THREAD ROLLING MACHINES

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3 Sheets-Sheet 3



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3,217,530

DIE BLOCKS FOR THREAD ROLLING MACHINES

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4 Claims. (Cl. 72-469)

The present invention relates to a pair of matched die blocks which are movable relative to each other in a thread rolling machine for rolling threads on self-tapping screws or wood screws. More particularly, the invention relates to the configuration of the working faces of said die blocks which enables the screws which are rolled between the die blocks of a pair to be threaded, pointed and finished progressively during the course of a single relative movement of the blocks of a pair.

A comprehensive survey of the prior art by one familiar with thread rolling problems and the difficulties in making dies for rolling threads would reveal prior patents evidencing the numerous efforts which have been made along various lines, to simultaneously thread and gimlet point screws. However, for reasons which are not important to the present discussion, prior art dies have failed to live up to expectations and have therefore not been endorsed by the art and have not come into widespread adoption and use.

It is an object of the present invention to provide a pair of improved die blocks which not only will roll and finish threads while simultaneously pointing self-tapping screws and wood screws, but which will also be possible to make economically by conventional manufacturing methods and which will also be usable in conventional reciprocating thread rolling machines.

Another object of the present invention is to provide a specially designed working face on a screw threading die which is reliable and which will produce perfect screw threads without the difficulties which are frequently encountered with conventional thread rolling dies, and which has accurately milled grooves which act on the shank of a screw blank with sufficient precision and certainty that the desired threading and pointing action is satisfactorily carried out.

A still further object of the present invention is to provide die blocks which will finish the threads and the points of the screws perfectly so that no further manufacturing steps or operations need be performed on them, and particularly which will produce screws having sharp pointed ends which are free from burrs and which do not have the slight cavity or recess which is often present in the pointed ends of such screws.

It should be pointed out that during the development of die blocks of the present invention it was found that conventional thread rolling dies can be converted to dies according to the present invention by forming a recess in the die block and placing in said recess an insert having a shape according to the present invention to thereby convert the conventional die block into a die block according to the present invention.

It is to be understood that while for any particular pair of die blocks, the dimensions of the various parts of the surface are critical, the important feature of the invention generally is the shape and proportions of the surfaces of the die, and that by maintaining these factors and varying the dimensions, blocks can be made for rolling various sizes of screws.

Each die block of the pair of die blocks of the present invention is a rectangular metal block having a flat back face, flat side faces, transverse end faces, as is common in such die blocks, and a working face having a particular shape. The working face has a plurality of obliquely

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extending thread forming grooves and ribs, as is usual in such thread forming die blocks, and in addition has a ridge gradually rising out of the working face of the die block beginning at a point spaced a short distance from one end of the die block and extending obliquely toward one edge of the die block and then substantially parallel to the said one edge, with the thread forming grooves and ribs extending up the face of the ridge facing the other edge of the die block.

A preferred embodiment of the invention will now be described in the following specification with reference to the accompanying drawing, in which:

FIG. 1 is a perspective view of one die block of a pair of die blocks according to the present invention;

FIG. 2 is a plan view of two blocks of a pair of blocks according to the present invention at the starting position for rolling a headed screw blank between them;

FIGS. 3, 5, 7, 9, 11, 13 and 15 are schematic plan views similar to FIG. 2 with the blocks in successive positions during their relative motion while threading, pointing and finishing a screw; and

FIGS. 4, 6, 8, 10, 12, 14 and 16 are sectional views taken along respective section lines 4-4, of FIG. 3, 6-6 of FIG. 5, 8-8 of FIG. 7, 10-10 of FIG. 9, 12-12 of FIG. 11, 14-14 of FIG. 13, and 16-16 of FIG. 15.

As seen in FIG. 1 one of the die blocks of the pair of die blocks according to the present invention is a rectangular metal block having a flat back face 20, flat side faces 21 and 22, transverse end faces 23 and 24, and a working face 25. A large portion of the working face 25 is provided with a plurality of uniformly spaced diagonal or obliquely angled lengthwise extending grooves 26 and intervening ribs 27. These ribs and grooves are gradually changed in width and depth from the end 24 to the end 23, that is from the end at which the screw is initially acted on by the die block to the end at which the finished screw leaves the die block, so as to start the threads gradually and gradually shape them to the finished form desired.

Running along the block in the direction of its length starting from a point spaced a short distance from the initially acting end 24 and toward the finishing end 23 is a ridge 28 of gradually increasing height which on the side toward the upper flat face 21 has a profile 29 gradually changing from a slight curve as shown in FIG. 6 to a more pronounced curve corresponding to the curvature of the pointed portion of the screw to be threaded, as seen in FIG. 10. The profile 30 of the side of the ridge 28 toward the lower flat side 22 drops off sharply into a recess 31 which runs along the lower portion of the working face 25 from a point spaced a short distance from the initially acting end 24 of the die block. The height of the pointed apex 32 of the ridge 28 gradually increases until it approaches the finishing end of the block, see FIG. 14, at which point it stops rising and becomes substantially level. As will be clear from a comparison of FIGS. 6 and 8, the ridge 28 not only extends in the direction of the length of the die block in the portion where it starts to rise, but it also extends obliquely, along one of the ribs 27, specifically along rib 27a, obliquely of the block. A first portion of recess 31 is cut back into the ribbed working face 25 to the rib 27a at 31a, so that the side of the rib 27a forms the lower profile 30 of the ridge 27 at this point, and the apex 32 of the ridge is formed by the top of the rib 27a. It will also be seen that the upper profile of the ridge has ribs and grooves thereon, but these are of reduced size, as seen in FIG. 8.

The oblique portion of the ridge 28 terminates in a first portion 28a substantially midway of the length of the die block, and at this point a second portion of the recess 31 is cut back into the working face 25 of the die block at 31b, the second portion of the recess cutting through the ridge 28 and being slightly deeper than recess 31a. This

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gives the illusion, as seen in FIG. 2, that the ridge drops abruptly, but in reality what is seen is a rib 27b, see FIG. 1, spaced several ribs away from the ridge portion 28a, which rib is rising as it extends up the side of the ridge 28. The edge of the second recess portion 31b also extends obliquely substantially parallel to the ribs 27, and as seen in FIG. 2, the ribs 27 along the edge are progressively higher until they reach the peak of the ridge 28 at a second portion 28b near the finishing end of the die block. From this point to the finishing end, the ridge 28 is of uniform height and extends substantially parallel to the lower face 22 of the die block, as seen most clearly in FIG. 2, and as will be clear from the cross sections 14 and 16.

The other die block of each pair is identical to the die block described above, and when the pair of die blocks is placed in a machine for moving the die blocks in opposite directions relative to each other, such as a conventional thread rolling machine, the two die blocks will have initial positions as shown in FIG. 2 with the initially acting ends 24 opposed to each other. A headed screw blank S is placed between the die blocks, and they are moved in opposite directions relative to each other. This is usually accomplished by holding one of the die blocks, the lower block in FIGS. 2-16, in a fixed position and moving the upper block along the lower block.

When the die blocks have been moved to the position shown in FIG. 3, the screw blank has had the threads 33 started, but the overall shape of the shank of the screw is still substantially cylindrical, as seen in FIG. 4, since the first part of the working face 25 is, with the exception of the grooves 26 and ribs 27, substantially flat. When the die blocks have been moved further to the position shown in FIG. 5, however, the shape of the shank of the screw has started to change. At this point, the ridges 28 on the working faces of the die blocks have started to rise out of the working faces 25, and since the blocks are a pair, these ribs will extend toward each other and squeeze the shank of the screw blank S between them as shown in FIG. 6. Since the upper face 29 of each ridge curves gradually upwardly, the profile of the screw shank will be correspondingly rounded. It is also to be noted that the grooves 26 and the ribs 27 have deepened the threads somewhat.

At this point on the working face of the die blocks, the ridges 28 are not only rising out of the working face, but are angling obliquely downwardly. As a result, when the blocks reach the positions shown in FIG. 7, the apexes 32 of the ridges 28 have not only pushed deeper into the shank of the screw blank, but they have elongated the lower end of the blank by drawing it downwardly a distance d , as shown between FIGS. 6 and 8. By this action, the pointed end of the screw is drawn and also rolled to produce a hard pointed end without producing cracks or rolling over the ends of the blank to leave a slight cavity or recess in the end of the screw which is a common defect in rolled screws.

From this point to the position of the die blocks shown in FIG. 9, the ridges 28 rise relatively little, and the point of the screw is sharpened only slightly more than it was in the position of FIGS. 7 and 8. Further, the grooves 26 and ribs 27 on the upwardly sloping side 29 of the ridges 28 are less pronounced so that the threads on the shank are not very pronounced in the position as shown in FIG. 9.

As the die blocks are moved further, however, the screw is rolled over the point at which the recesses 31b are cut back into the working faces 25 of the die blocks, and as seen in FIGS. 11 and 12, the height of the die face is reduced and the highest point of the die is farther away from the lower edge of the blocks than the point just preceding the recess 31b and the points farther along the block by a distance e , see FIGS. 12 and 14. Thereafter, the working face of the block along the edge of the recess 31b rises and runs obliquely downwardly to the point at which the ridge 28 is highest and where the opposed apexes 32 will approach each other and cut the surplus material y from the

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pointed end of the screw and form a sharp point on the screw. Thereafter, as the blocks move through the position as shown in FIG. 15, the threads are finished as seen in FIG. 16.

It will thus be seen that by the appropriate shaping of the working faces of the die blocks the screws which are threaded by being rolled between the blocks have accurately rolled threads and the points thereof are perfectly finished without cracks or recesses therein. Because of the simplicity of the method, screws can be mass produced with only a single threading and finishing operation, and yet an excellent finished screw will be formed.

It is thought that the invention and its advantages will be understood from the foregoing description and it is apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing its material advantages, the form hereinbefore described and illustrated in the drawings being merely a preferred embodiment thereof.

What is claimed is:

1. A pair of die blocks for rolling screw threads in and pointing and finishing a headed screw blank, each die block having a working face with a plurality of obliquely extending thread forming grooves and ribs, and a ridge gradually rising out of the working face of said die block beginning at a point spaced a short distance in from one end of said die block and extending obliquely toward one edge of said die block and then substantially parallel to said one edge of said die block, said thread forming grooves and ribs extending up the face of the ridge facing the other edge of said die block, and said die block having a recess therein extending back into the working face thereof from said edge beginning at a point spaced from said one end of said die block, the ungrooved face of said ridge extending into said recess.

2. A pair of die blocks for rolling screw threads in and pointing and finishing a headed screw blank, each die block having a working face with a plurality of obliquely extending thread forming grooves and ribs, and a ridge gradually rising out of the working face of said die block beginning at a point spaced a short distance in from one end of said die block and extending obliquely toward one edge of said die block and substantially parallel to said grooves and ribs and then substantially parallel to said one edge of said die block, said thread forming grooves and ribs extending up the face of the ridge facing the other edge of said die block, the said lastmentioned face of the ridge having a slightly curved profile in the lower part of said ridge and the profile gradually becoming more pronouncedly curved as the height of the ridge approaches a maximum, and said die block having a recess therein extending back into the working face thereof from said one edge beginning at a point spaced from said one end of said die block, the ungrooved face of said ridge extending into said recess.

3. A pair of die blocks for rolling screw threads in and pointing and finishing a headed screw blank, each die block having a working face with a plurality of obliquely extending thread forming grooves and ribs, and ridge gradually rising out of the working face of said die block beginning at a point spaced a short distance in from one end of said die block and extending obliquely toward one edge of said die block and substantially parallel to said grooves and ribs and then substantially parallel to said one edge of said die block, said thread forming grooves and ribs extending up the face of the ridge facing the other edge of said die block, the said lastmentioned face of the ridge having a slightly curved profile in the lower part of said ridge and the profile gradually becoming more pronouncedly curved as the height of the ridge approaches a maximum, said die block having a recess extending back into the working face thereof from said one edge and said recess having a first portion extending into the grooved and ribbed portion of the working face at a point spaced a short distance from one end of the die block and having the edge of the recess

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running parallel to said ribs and grooves, the said ridge having the unribbed and ungrooved side thereof falling sharply off into said first portion of said recess, and said recess having a second portion extending into the grooved and ribbed portion of the working face through said ridge at a point near the middle of said die block and having the edge of the recess running parallel to said ribs and grooves, the rib extending along the edge of said second portion of said recess falling sharply off into said second portion of said recess.

4. A pair of die blocks as claimed in claim 3 in which the second portion of the recess in each die block is deeper than the first portion of the recess.

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