

Dec. 8, 1942.

T. A. O'LEARY

2,304,704

SCREW

Filed Dec. 4, 1939

2 Sheets-Sheet 1

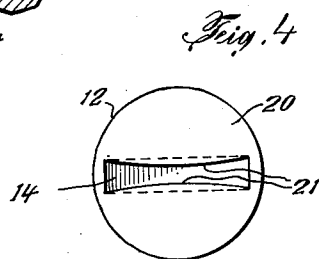
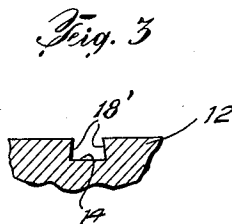
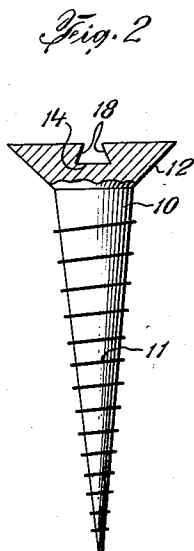
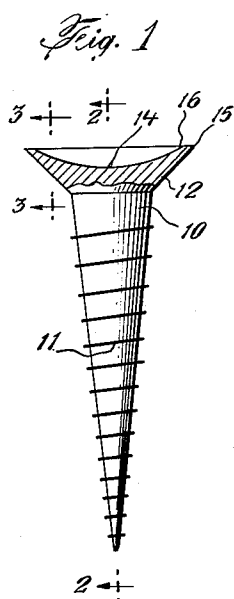


Fig. 5

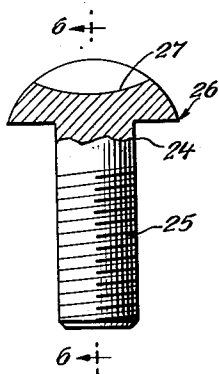
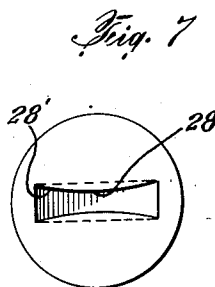
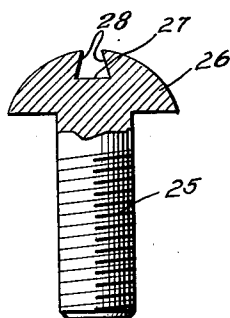


Fig. 6



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Dec. 8, 1942.

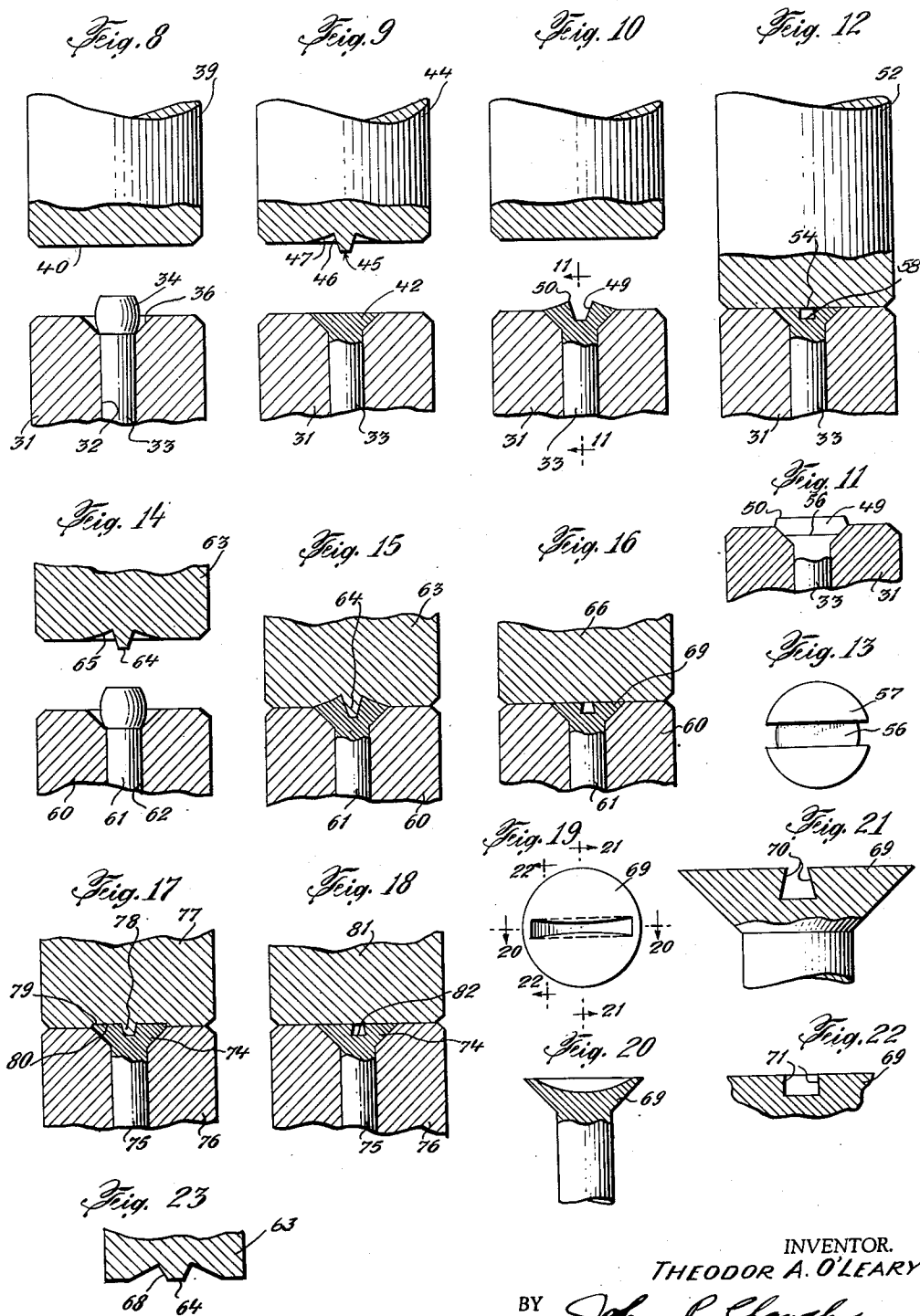
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2,304,704

SCREW

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,304,704

SCREW

Theodor A. O'Leary, New York, N. Y., assignor of
forty-eight and one-third per cent to Winslow
Foster, New York, N. Y.

Application December 4, 1939, Serial No. 307,504

9 Claims. (Cl. 85-45)

This invention relates to new and useful improvements in screws adapted to be driven into wood, metal or other materials and relates more particularly to an improved type of slot in the head of a screw, such screw being adapted to be driven by a special type of driver. The present application constitutes a continuation-in-part of my co-pending application Serial No. 75,611, Screws and the method of making same (since issued as Patent No. 2,182,092, December 5, 1939), such latter application having been a division of my earlier application Serial No. 61,931, Screws and driver means therefor.

It is well known that considerable difficulty is always experienced in retaining the bit portion of a screw driver in the screw slot during the driving operation. Various expedients have been devised to provide some positive connection between the bit of the driver and the head of the screw which will prevent lateral displacement of the former relative to the latter and will also prevent the bit from jumping out of the slot, particularly in cases wherein the screw is cutting the hole in the first instance. Most of the efforts to solve the problem have been unsatisfactory for the reason that no cooperating structures were devised to maintain a proper balance of rigidity and flexibility between the driving and driven elements.

Screws have been provided with special slots which are dove-tailed in transverse section, the screw driver having flanges on either side of the bit which engage the sides of the dove-tailed or undercut slot. In the case of flat headed screws, however, which are adapted to be counter-sunk flush with the surface of the member in which the screw is driven, it is impossible to remove the bit of such screw driver after the screw has been driven home.

It is one of the principal objects of the present invention to provide a screw having a slot of particular formation, adapted to be driven with a specially formed driver, such slot having a lower wall which is concavely curved through substantially its entire length, such slot preferably terminating at each end thereof just short of the periphery of the screw head in the case of the flat headed screw. The opposed side walls of the slot are not vertical nor parallel with each other, as in the case of the conventional screw slot, but rather are inwardly inclined at their central portions and progressively become more nearly vertical and parallel with each other as they approach their terminals.

It will also be appreciated that in view of the

curved lower wall of the slot these side walls become progressively shorter vertically as they approach such terminals. Thus it will be apparent that the opposed upper edges of the slot are slightly convexly curved throughout all or substantially the greater portion of their length.

This screw, with its undercut or dove-tail slot, is adapted to be driven by a driver preferably having some degree of curvature along the lower edge of the bit portion, such bit portion having opposed flanged walls adapted to be received in the undercut screw slot from the side thereof. When so positioned therein, longitudinal displacement of the bit relative to the slot is prevented and if means are carried on the bit for yieldingly or otherwise engaging the head of the screw head, lateral displacement of the bit during the driving operation is prevented as well. A particularly effective driver for driving the screw of such character and comprising a split bit structure, the bit portions entering and leaving the slot from each end thereof, is described in a co-pending application.

The precise curvature of the lower wall of the slot, as well as its length relative to the diameter of the screw head, is a matter of choice. Likewise, the particular curvature of the side walls of the slot can be varied within limits without departing from the spirit of the invention.

This slot may be formed in a variety of ways, although the method described in my co-pending application Serial No. 75,611, which includes the steps of forming a slot with substantially parallel walls and then upsetting the head by a suitable die to cause the central portions of such side walls to converge, is the most preferable.

Another object of the present invention is the provision of another improved method for forming such slots, as well as for forming conventional slots in screw heads. For countless years a slot has been formed in the head of a screw by cutting the slot in the otherwise finished head by means of a circular milling cutter. This method is relatively expensive and production is distinctly limited because of the well defined limitations on the speed of this cutting element. In other words, a considerable number of slot cutters are required to cut the slots in screws produced by a single head forming and thread cutting machine.

My co-pending application Ser. No. 75,611 related to a method of forming a special type of undercut or dovetail slot in a screw head by an upsetting process. Essentially, this method comprised the steps of placing the wire in a supporting die, striking the head portion to partially

form or "cone-up" the head, then striking the head portion with a combined head forming and slot forming die which formed the transverse slot, the die being so shaped as to leave a slight excess of material in the central portion of the head. The final operation was to strike the head, while still supported in the same die, with an upsetting die which, in the case of a flat head screw, was substantially flat. The final die completed the head and slot forming process by causing the excess metal in the central portion to flow inwardly, thus causing the side walls of the slot, adjacent to the central portions thereof, to move inwardly at their upper ends. The result was a slot having inwardly converging side walls at the center thereof, the wall portions adjacent to the terminals thereof being substantially vertical and parallel with each other.

The present improved method of forming a slot in a screw head by upsetting means differs in certain essential respects from that described in my earlier application and may be employed for forming a slot of the type just described or for forming a conventional screw slot.

Struck-in screw slots have been previously unsatisfactory in the past for the reason that such slot was not a true rectangle or square in transverse section for the reason that if the slot forming die were so shaped as to form such a slot, it could not be removed. In other words, if the opposed walls of such a die were parallel the flowing metal would travel in such a fashion as to effectively weld the die in the slot. Conversely, if the die were given a more nearly V-shaped formation, the slot was unsatisfactory because the driver would not remain therein during the driving operation, and, more particularly, the opposed upper edges of the slot were not square or sharp but were rounded, thereby making the screw unfit for ordinary use.

It is accordingly one of the objects of the present invention to provide a method of striking a slot in the head of the screw either as part of the head forming operation or as a separate step after the head has been formed, the method also including a novel step for straightening up the side walls of the slot to make them conform to the slot formed by a milling cutter or to cause the central portions thereof to converge inwardly, as in the case of my improved screw previously described, which is adapted to be driven with a special driver.

In the preferred method of carrying out my invention, one of the steps is to strike the blank, which may or may not, as desired, be previously partially formed or coned-up, with a combined head forming and slot forming die. It is clearly within the scope of my invention, however, to first form the head by upsetting or otherwise, and then to strike in the slot. The die for so forming the slot has opposed walls which are shaped as to form an initial slot with non-parallel walls, the opposed walls at their lower ends being closer together than at their upper ends. This die also leaves excess material preferably along the entire length of the slot and when the head is struck the final blow, these non-parallel walls are in effect straightened up to a point wherein they are substantially parallel with each other. The upper edges of such walls likewise being relatively sharp and not rounded.

In the drawings:

Fig. 1 is a central vertical section taken

through a flat headed screw formed in accordance with the present invention;

Fig. 2 is a similar section taken on line 2-2 of Fig. 1;

Fig. 3 is a vertical section taken on line 3-3 of Fig. 1;

Fig. 4 is a top plan view of the flat headed screw;

Fig. 5 is a central vertical section taken through a round headed screw constructed in accordance with the present invention;

Fig. 6 is a central vertical section taken on line 6-6 of Fig. 5;

Fig. 7 is a top plan view of such screw;

Fig. 8 illustrates the cooperating dies used to form a flat headed screw from a previously coned-up blank;

Fig. 9 illustrates the die supporting the formed head and the die employed for striking in the slot;

Fig. 10 shows the lower die supporting the formed slotted head and the finishing die prior to the striking of the head;

Fig. 11 is a vertical section taken on line 11-11 of Fig. 10 through the screw blank and supporting die;

Fig. 12 shows the die at the finish of the blow and the finished, slotted head;

Fig. 13 is a top plan view of the finished screw;

Fig. 14 shows a lower or stationary die similar to that shown in Fig. 8, such die supporting a previously coned-up blank and further shows a movable die which is adapted to both form the head and strike in the slot;

Fig. 15 shows the upper die having been moved into engagement with the stationary die and having formed the head and slot;

Fig. 16 shows the finished slotted head after the same has been struck with the final die;

Fig. 17 shows a modified form of operation wherein the relation of the initial die is such as to leave excess material over the entire upper surface of the head when the slot is struck in;

Fig. 18 shows the completely formed head after it has been struck with the final die;

Fig. 19 is a top plan view of the finished screw with the central dovetail portion;

Fig. 20 is a section on line 20-20 of Fig. 19;

Fig. 21 is a section taken on line 21-21 of Fig. 19;

Fig. 22 is a section taken on line 22-22 of Fig. 19;

Fig. 23 is a broken section taken through upper die 63 (Fig. 15) but taken at one side of the center thereof.

The screw comprising the present invention includes a conventional tapered shank portion 10 provided with conventional threads 11, a head portion 12 being formed at the upper end of the screw which in Figs. 1 to 4, inclusive, is a flat head. The screw head is formed with a transverse recess comprising a lower wall 14 which is concavely curved throughout its length, such slot terminating at each end thereof at a point 16 which is just short of the periphery 15 of the screw as illustrated at 16. This lower wall 14 is of substantially the same width throughout its length and in the central portion of the slot the opposed side walls 18 converge inwardly as illustrated in Fig. 2, thus forming a dovetail portion to receive the flanged bit previously mentioned. As these side walls approach their terminals, they become progressively more nearly parallel to each other, as indicated at 18' in Fig. 3. The upper surface 20 of the head 12 is

thus formed with opposed, convexly curved edges 21 of such screw slot.

The screw shown in Figs. 5, 6 and 7 is a round headed machine screw with a shank 24 having a threaded portion 25, the round head being indicated at 26. This screw is likewise provided with a transverse slot defined by a lower, concavely curved wall 27 and opposed side walls 28 which converge inwardly in their central portions, as shown in Fig. 6, and also tend to assume a more nearly vertical or parallel position as they approach their terminals, as indicated at 28' in Fig. 7.

Whereas a flat headed screw and a round head screw have been chosen for illustration of the present invention, it will be nevertheless appreciated that this type of slot may be made in any other type of screw, such as one with a flister head, button head, or otherwise. It will further be appreciated that the invention may be applied to a screw of any size and also to a wood screw of the type shown in Figs. 1 to 4 of a machine screw of the type shown in Figs. 5 to 7, or to any other type of screw adapted to either cut its own threads or to be driven into a previously threaded aperture.

The hereindescribed method of forming a slot in the head of a screw may be adopted for forming conventional slots of the type which has been used since time immemorial or it may be employed for making slots of the special type disclosed in this and in my earlier application.

Figs. 8 to 13, inclusive, illustrate the method as applied to a conventional screw and in carrying out the method a substantially cylindrical stationary die 31 having a central aperture 32 therein receives a screw blank 33, which is formed with a previously coned-up head portion 34. The precise shape of this coned-up portion is dependent upon the shape and size of the head to be subsequently formed, as will be appreciated by those skilled in the art. The coning-up step is not essential in carrying out the present method, although it is desirable since it is a simple operation and reduces the wear on the heading punch or die. The aperture 32 is formed at its upper end with a tapered portion 36 corresponding to the shape of the lower surface of the screw head to be formed. The movable die 39 in the case of the flat headed screw has a flat lower surface 40 which forms the flat head portion 42, shown in Fig. 9. The movable die 44 is formed as shown in Fig. 9 and includes a male portion 45, having non-parallel side walls 46 and a recessed portion 47. After this die has struck the head portion 42, it forms the slot 49 shown in Fig. 10, the upper edges 50 of the slot throughout their length at this stage of the operation being raised slightly above the upper surface of the stationary die 31.

This head portion is now struck with a die 52 which has a flat lower surface similar to the die 39, and such die causes the opposed side walls of the slot to become straightened, as indicated at 54 in Fig. 12. The lower wall 56 of this slot throughout the operation is flat, as shown in Fig. 11, and the extent to which the upper edge 50 of the side walls of the slot prior to the final blow is moved, is dependent upon the shape and size of the screw head to be formed. The head 57 of the finished screw shown in Fig. 13 is thus similar to a conventional screw head having the usual transverse slot 58. If the lower edges of the slot are slightly rounded as a result of the formation of male portion 45, this final blow also

causes the edges to become square as shown in Fig. 12.

Substantially the same method of forming the slot is shown in Figs. 14 to 16, although the slot in this instance is of the type disclosed in Figs. 19 to 22, namely, the dovetail slot of the special type disclosed herein and the initial slot as well as the head are both formed in one operation. In this instance the stationary die 60 likewise receives the coned-up blank 61 in a central aperture 62. The movable die 63 is formed with a male portion 64 and recessed portions 65, but in this instance the shape of the movable die is so formed that when the final die 66, which in this instance is flat, strikes the head portion the central portions of the walls are caused to converge and the terminal portions are caused to be straightened. In other words, the die 63 is specially formed for each type of screw slot to be formed. In my earlier application relative to the method of making such a screw, I left excess material only in the central portion of the head prior to the final blow. In accordance with the present invention, however, there is no limitation as to where this excess material is to be left and it may be formed over the entire head of the screw. It will accordingly be apparent that the male portion 64 of die 63 is not of the same cross sectional formation throughout its length. For illustrative purposes, it may be stated that this male portion in its center is of the shape shown in Fig. 15 but as it approaches its terminals it becomes more shallow as shown in Fig. 23 and the opposed walls 68 at this portion are more angular relative to each other. Accordingly, when this die strikes the head portion the slot so formed has walls which are more nearly parallel with each other at the center than at the ends. Thus when the head 69 is struck with the final die, such as die 66 in the case of the flat headed screw, these central portions converge inwardly, as shown at 70 in Fig. 21, and the terminal portions which are more shallow are merely straightened to assume a more nearly parallel position as shown at 71 in Fig. 22.

In Figs. 17 and 18, the head portion 74 of the screw 75, supported in die 76, is struck with die 77 having a male portion 78 and a circular recessed portion 79, thus leaving excess material over the entire area of this head portion as shown at 80. The flat die 81 striking the head causes all of the material in the upper head portion to flow, thus forming slot 82 in the finished head.

Thus, two general means of carrying out the method are illustrated herein, to wit, that illustrated in Figs. 11 and 12 and that illustrated in Figs. 17 and 18. In the former, the excess material is left adjacent to the slot over the full length thereof and in the latter the excess material is left over the entire head of the screw. It will be appreciated that this process may be varied considerably without departing from the spirit of the invention.

The complete mechanism for carrying out the method is not disclosed herein since a two or three blow header is well known in the art and provides means for shifting the dies after they have done their work.

What I claim is:

1. A screw provided with a head having an undercut transverse slot in the upper surface thereof, the slot being curved along its lower surface.
2. A screw provided with a head having a transverse slot in the upper surface thereof, the slot having inwardly converging side edges and being

curved along its lower edge, the opposed terminals of the slot being spaced from the periphery of the head.

3. A screw provided with a head having a transverse slot therein, the lower surface of the slot being curved and being of substantially uniform width, the side walls of the slot converging inwardly.

4. A screw provided with a head having a transverse slot therein, the lower surface of the slot being curved and being of substantially uniform width, the side walls of the slot being inwardly converging, the screw being capable of being driven by a driver provided with a bit portion, the opposed surfaces of which are non-parallel and are of such dimensions as to fit the transverse slot in the head of the screw.

5. A screw formed with a head having a transverse slot therein, such slot being formed with a concavely curved lower wall of substantially uniform width throughout its length, the opposed side walls being so formed as to converge inwardly at the central portion thereof, such walls, as they approach their terminals, becoming progressively more nearly parallel with each other.

6. A screw provided with a head portion having a transverse slot therein defined by a lower wall and opposed side walls, the lower wall being concavely curved and being of substantially the same width throughout its length, the central portions of such side walls converging inwardly to form a dovetail effect, the terminal portions of the opposed walls being substantially parallel with each other.

7. A screw provided with a head portion having

a transverse slot therein defined by a lower wall and opposed side walls, the lower wall being concavely curved and being of substantially the same width throughout its length, the terminal portions of the opposed walls being substantially parallel with each other, the central portions of such side walls converging inwardly to form an undercut portion adapted to receive a screw driver having a flanged bit portion and thus prevent longitudinal displacement of the screw relative to the driver during the driving operation.

8. A screw formed with a head having a transverse slot therein, the opposed upper edges of the slot being convexly curved throughout their length, the lower wall of the slot being of substantially uniform width, and being concavely curved, throughout its length, the opposed side walls of the slot being substantially parallel adjacent to their end sections and inwardly converging midway between their end sections to form a central dovetail section, the opposed wall portions between the central dovetail section and the end sections being formed progressively more nearly parallel to each other.

9. A screw formed with a head having a transverse slot therein, the lower wall of the slot being concavely curved throughout its length and being of substantially uniform width throughout its length, the opposed side walls of the slot converging inwardly at their upper central portions, said side walls becoming progressively more nearly parallel with each other as they approach their terminals and being substantially parallel with each other at their terminal portions.

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