

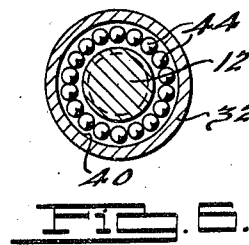
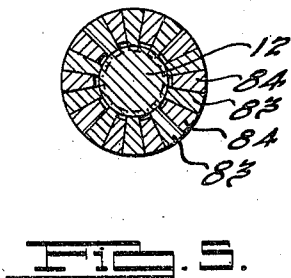
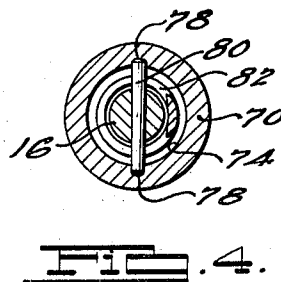
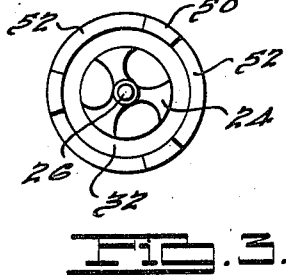
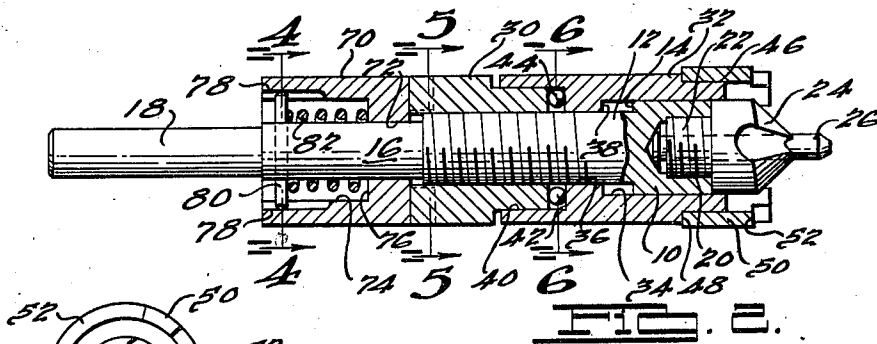
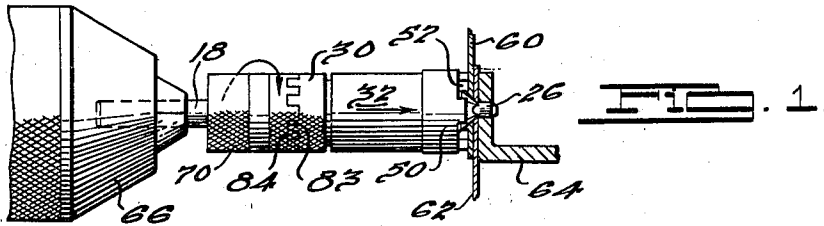
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S. A. COGSDILL

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ADJUSTABLE COUNTERSINK STRUCTURE

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INVENTOR

Stuart A. Cogsdill.

BY

Harnes, Dickey & Pierce

ATTORNEYS.

UNITED STATES PATENT OFFICE

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ADJUSTABLE COUNTERSINK STRUCTURE

Stuart A. Cogsdill, Detroit, Mich., assignor to
Cogsdill Twist Drill Co., Detroit, Mich., a corporation of Michigan

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3 Claims. (CL 77-55)

This invention relates to countersinks and particularly to that type thereof embodying means adjustably associated therewith for limiting the depth to which the countersink may be projected into a piece of work, the principal object being the provision of a construction of the type described having an improved form of adjustable depth determining means associated therewith.

Objects of the invention include the provision of a countersink having associated therewith means by which the penetration of the countersink into a piece of work may be accurately controlled, and including a pair of relatively adjustable parts manually operable without the use of tools and positively locking the parts in their adjusted positions; the provision of a structure as above described in which the adjusting means includes a pair of relatively rotatable and relatively axially slidable parts provided with axially inter-engageable teeth and recesses; the provision of a device of the type described in which the inter-engaging teeth and recesses are provided with cooperating surfaces arranged in planes parallel to the axis of the countersink whereby to positively guard against inadvertent displacement of the relative position of the adjusted parts; and the provision of a construction as above described in which one of the parts is threadably associated with the shank of the countersink or countersink holder and the other of the adjustable parts is non-rotatably but axially slidably mounted on such shank and is constantly spring pressed in one direction with respect thereto.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawing, and then claimed, having the above and other objects in view.

In the accompanying drawing which illustrates a suitable embodiment of the present invention and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a fragmentary side elevational view illustrating a countersink constructed in accordance with the present invention operatively gripped by the chuck of a suitable turning device and positioned in operative relation with respect to a piece of work;

Fig. 2 is an enlarged sectional view taken axially through the countersink shown in Fig. 1;

Fig. 3 is an end view of the countersink shown in Fig. 2 taken from the righthand end thereof; and,

Figs. 4, 5 and 6 are transverse sectional views taken, respectively, on the lines 4-4, 5-5 and 6-6 of Fig. 2.

While the present invention is applicable for use in connection with the countersinking of a hole or opening in any kind or type of workpiece where it is desired to limit the depth of the countersunk opening, it is particularly adaptable for the countersinking of holes in airplane structures designed to receive flush type rivets therein. Accordingly, the description of the present invention will be limited to its application to the latter use, and its application to other types or pieces of work will be readily apparent to those skilled in the art thereby.

Modern airplanes and particularly those employed for military purposes, require all rivets that are exposed to the flow of air over any part of the airplane structure be of the flush head type, and with the outer face of the rivet as close as possible to the plane of the surrounding surface. This requires the workpiece to be countersunk around the margins of the hole adapted to receive the rivet to an exacting depth for otherwise the exposed surface of the rivet would either project above or below the surrounding surface of the workpiece which would set up an undesirable drag or resistance to the flow of air thereover. Accordingly, it has been conventional practice to provide the countersink with a surrounding sleeve one end of which is adapted to engage the work and serve as a stop to limit the penetration of the countersink into the work. This sleeve is conventionally made adjustable axially of the countersink so as to enable the depth to which the countersink may machine the work to be adjusted to take care of adjustment of the countersink with respect thereto to accommodate rivets of different sizes, to initially adjust the sleeve with respect to the countersink when a new countersink is first employed, and for other reasons.

In the past the conventional method of locking the adjustable sleeve in its adjusted position axially of the countersink has comprised a pair of members threaded upon or relative to the countersink, one of which is adapted to bind upon another in the manner of a lock nut to lock the parts in their adjusted position. This method of adjusting conventional sleeves and locking them in place in devices of the type under discussion has not only been open to the objection of occasionally slipping in operation and permitting disruption of the adjustment, which in itself is a serious matter unless immediately discov-

ered, but it is also such that it has been recognized as the most desirable and safest practice to send such countersinks to the tool room and to permit experts there to adjust and lock the devices in their adjusted positions, thus entailing a considerable amount of time and expense.

The present invention obviates these disadvantages of conventional constructions not only in eliminating possibility of disruption of the adjustment thereof in service, but also is of such type as to permit the ordinary workman to easily and quickly make the desired adjustment thereto without the use of tools and without danger of the adjustment later becoming inadvertently displaced.

In connection with the present invention, it will be understood that the countersink proper may, if desired, be of the conventional combined countersink and drill combination or may be of the conventional straight countersink type shown, and also that it may be of an integral one-piece construction or may be of the type shown including a shank portion and a separately formed tool bit or end portion threaded or otherwise suitably secured therein. It will be understood in the following description and claims that the term "countersink" is to be interpreted to mean either a countersink alone or a countersink and center drill combination, and also to include a structure where the countersink proper is constructed more or less as a tool bit and secured to a shank portion, as well as where it is formed integrally with such shank portion.

In the case illustrated in the drawing, and now referring particularly to Fig. 2, the countersink shown includes a shank or shank member all portions of which are of circular conformation and including a head portion 10 integrally and concentrically joined to one end of a body portion 12 of lesser diameter so as to form a shoulder 14 between them, the portion 12 at its opposite end being integrally and concentrically joined to a smaller portion 16 which in turn is integrally and concentrically joined to a still smaller portion 18 adapted to be gripped by the chuck of a drill or other turning device employed for the purpose of driving the same. The head 10 is provided with a central threaded bore 20 in which the shank 22 of the tool bit or countersink proper 24 is threadably received and through which it receives its driving movement. In the particular case shown the tool bit 24 is provided with a pilot 26 conventionally shown in the form of a pin extending through the length of the bit 24 and terminating in a head at the inner end of the shank 22. The structure thus far described is similar to a conventional countersink having a removable cutting end portion or bit, and while it may be used for countersinking purposes in the form thus described, it would not include any means for predetermining the depth of the countersunk opening to be formed thereby.

In order to predetermine the depth to which the bit 24 may countersink an opening, the shank portion 12 is externally threaded and receives thereon a nut member 30 the outer end of which is preferably reduced in diameter as indicated. A sleeve 32 surrounds the shank between the nut 30 and the operative end of the shank and includes one portion having a bore 34 of a diameter to be relatively closely but slidably and rotatably mounted on the head portion 10 of the shank, a second portion having a bore 36 of a size to be relatively closely but rotatably and slidably received on the portion 12 of the

shank and forming a radial shoulder 38 between it and the bore 34, and a third portion having a bore 40 of a diameter to be relatively closely but rotatably and slidably received upon the reduced forward end portion of the nut 30 and forming a shoulder 42 between it and the bore 36. Between the shoulder 42 and the opposed end of the nut 30 a circular series of ball bearings 44 are located as best indicated in Figs. 2 and 6. The nut 30 and the sleeve 32 are both preferably hardened so that the surfaces upon which the balls 44 roll offer a minimum amount of resistance to such rolling. A conventional cage, not shown, may be provided for the balls 44 if desired.

While the sleeve 32 itself may be made of sufficient length to partially shroud the bit 24 and engage a piece of work and limit the penetration of the bit 24 thereinto, particularly where the workpiece is of relatively soft metal as will usually be the case in aircraft the sleeve 22 is preferably provided with an end portion for contact with the work constructed of some material that will not score the work when it comes in contact therewith. For this reason the end of the sleeve 32 is reduced in diameter as at 46, forming a shoulder 48, and received in the reduced portion 46 and against the shoulder 48 is a sleeve 50 of a desirable material which may be fiber, hard rubber, plastic, or any of the softer metals as may be found suitable for the purpose. Preferably the outer end of the sleeve 46 is notched out or cut-away as at 52 so as to provide for the escape of chips from the end of the sleeve 50 during a countersinking operation.

It will be appreciated that in practice the nut 30 is threaded along the portion 12 of the shank to a position in which the forward end of the sleeve 50, when the balls 44 are gripped between the shoulder 42 and the forward end of the nut 30, will lie in a plane perpendicular to the axis of the shank at a position along the axis of the bit 24 corresponding with the outer edge of the desired countersunk opening to be formed thereby. Accordingly, and now referring to Fig. 1, let it be assumed, as a matter of illustration, that it is desired to rivet a pair of sheets such as the sheets 60 and 62 and which may comprise a portion of the covering of an airplane wing, to a frame part such as 64 which may constitute, for instance, a rib of an airplane wing. Assuming that the countersink has been mounted in the chuck 66 of a suitable electric drill and that the sheets 60 and 62 are disposed as indicated with respect to the member 64 and that a hole has been drilled through the assembly at a point at which it is desired to insert a rivet and of a diameter substantially equal to or slightly greater than the diameter of the pilot 26 of the counterbore which pilot is of substantially the size of the body of the desired rivet. The pilot 26 is inserted into such hole and the electric drill pressed inwardly to bring the bit 24 into cutting relation with respect to the work and is pressed inwardly until the operative end of the sleeve 50 contacts the outer surface of the outer sheet 60 and limits further penetration of the bit 24 into the work. It will be appreciated that as soon as the end of the sleeve 50 contacts the surface of the work, friction between it and the work will prevent further rotation of the sleeve 32, the balls 44 insuring that the very slightest resistance to rotation of the sleeve 32 will stop the rotation thereof and thus minimize any scoring tendencies of the sleeve 52 on the work.

Cooperation of the shoulder 14 on the shank and shoulder 38 on the sleeve 32 will prevent the sleeve 32 from being removed forwardly over the operative end of the structure, and as long as the nut 30 is threaded on the shank portion 12 cooperation of the shoulder 42 with the forward end of the nut 30 through the balls 44 will prevent removal of the sleeve 32 in a rearward direction. It will also be understood that except when the nut 30 is threaded to the full extent of its movement to the right as viewed in Fig. 2, the sleeve 32 will have a certain amount of axial movement relative to the shank which in itself is not undesirable.

It will be appreciated that in order to hold any adjustment of the limiting position of the sleeves 32 and 50 with respect to the operative end of the counterbore, some means must be provided for locking the nut 30 in its adjusted position along the shank portion 12. As previously mentioned conventional practice in devices of this general character has heretofore been to provide a second nut also threaded upon the threaded portion of the counterbore shank, or at least a second threaded member cooperating with the threaded adjusting member of the structure, arranged to be threaded into jammed relation with respect to the nut in the same general manner as an ordinary lock nut. To obviate the previously described disadvantages of such type of adjustment locking means, the present invention provides the following mechanism.

Surrounding the shank portion 16 of the counterbore is a sleeve member 70 having a bore portion 72 which relatively closely but axially slidably receives the shank portion 16 therein, and also having an enlarged bore portion 74 therein forming a shoulder 76 between it and the bore 72. The bore 74 at diametrically opposite points therein is provided with axially parallel grooves or slots 78, and a pin 80 extends diametrically through the shank portion 16 in fixed relation thereto and is of such length that its ends are slidably received within the grooves 78. A coil spring 82 surrounds the shank portion 16 within the bore 74 and is maintained under axial compression between the pin 80 and the shoulder 76, thus serving to constantly urge the sleeve 70 to the right as viewed in Fig. 2 against the rear end of the nut 30. The rear end of the nut 30 and the forward end of the sleeve 70 are machined to provide rearwardly projecting lugs or teeth 83 and forwardly projecting lugs or teeth 84, respectively, these lugs or teeth being of such size and so spaced as to adapt them for reception of each other in the same manner as in a dog clutch and serving, when engaged with one another, to positively lock the sleeve 70 and nut 30 together against relative rotation with respect to each other. The pin 80 being held against relative rotation with respect to the shank portion 16, it will be appreciated that when the teeth 83 and 84 are in operative engagement with respect to each other the nut 30 is positively locked against relative rotation on the shank of the device. It will also be appreciated that whenever it is desired to rotate the nut 30 in order to adjust the position of the end of the sleeve 52 with respect to the bit 24, a workman may grasp the sleeve 70 and pull it to the left as viewed in Fig. 2 against the force of the spring 82 until the teeth 84 are disengaged from the teeth 83, upon which the nut 30 may be rotated with the fingers to the desired extent and then, upon release of pressure on the sleeve 70, the spring 82 will project it back

to the right to bring the teeth 83 and 84 again into engagement with each other to again lock the nut 30 against relative rotation with respect to the shank. Because of the character of the teeth 83 and 84, that is because their engaging side faces lie in planes parallel to the axis of the shank, it will be appreciated that it is impossible to turn the nut 30 with respect to the sleeve 70 by any turning force less than that required to shear the pin 80, and in view of the fact that the sleeve 70 is spring pressed into operative engagement with the nut 30 no ordinary handling of the device can possibly disrupt the adjusted position of the nut 30 on the shank. At the same time the ease with which the sleeve 70 may be retracted to permit adjustment of the nut 30 will be readily appreciated by those skilled in the art, the adjustment thus being made so simple and the lock thereof so positive that adjustment may be made by the ordinary workman without requiring the device to be sent back to the tool room each time an adjustment is required.

Formal changes may be made in the specific embodiment of the invention described without departing from the spirit or substance of the broad invention, the scope of which is commensurate with the appended claims.

What is claimed is:

1. In a device of the character described, in combination, a countersink including a shank portion and a bit portion, a nut threadably mounted on said shank portion, a sleeve surrounding said shank portion in rotatable and relatively axially movable relation with respect thereto and extending into shrouding relation with respect to said bit portion, said nut cooperating with said sleeve for limiting axial movement of the latter in one direction, a second sleeve non-rotatably but axially slidably mounted on said shank portion in cooperative relation with respect to said nut, spring means constantly urging said second sleeve axially towards said nut, and cooperating interengageable teeth formed on said second mentioned sleeve and said nut, respectively, for locking said nut against rotation relative to said shank portion, said second mentioned sleeve being axially retractable against the force of said spring means to disengage said teeth whereby to permit relative rotation of said nut on said shank portion.

2. In a device of the character described, in combination, a countersink including a shank and a bit, said shank including portions of different diameters forming a radially directed annular shoulder thereon, a sleeve surrounding said shank in rotatable and axially movable relation with respect thereto and extending into partly shrouding relation with respect to said bit portion, an internal radially directed annular shoulder on said sleeve cooperating with the first mentioned shoulder to limit movement of said sleeve axially in one direction with respect to said shank portion, a nut threaded on said shank in cooperative relation with respect to said sleeve for limiting movement of said sleeve in a direction opposite to the first mentioned direction of movement, a second sleeve non-rotatably but axially slidably mounted on said shank in cooperative relation with respect to said nut, spring means constantly urging said second sleeve towards said nut, and cooperating interengageable teeth formed on the cooperating surfaces of said sec-

ond sleeve and nut for releasably locking said nut against relative rotation on said shank.

3. In a device of the character described, in combination, a countersink including a shank and a bit, said shank including portions of different diameters forming between them a radial annular shoulder, a sleeve surrounding said shank and extending into partially shrouding relation with respect to said bit, an internal annular shoulder on said sleeve cooperable with the first mentioned shoulder to limit movement of said sleeve axially in one direction along said shank, a second shoulder on said sleeve facing in the opposite axial direction to the first mentioned shoulder, a nut threaded on said shank and pro-

vided with an annular shoulder, rolling anti-friction elements interposed between the last mentioned pair of shoulders, a second sleeve mounted on said shank, means restraining said second sleeve against relative rotation on said shank without preventing axial movement of said second sleeve thereon, spring means constantly urging said second sleeve into cooperative relation with respect to said nut, and interengageable locking means formed on said second sleeve and nut, respectively, whereby during engagement thereof said nut is restrained from relative rotation on said shank.

STUART A. COGSDILL.