May 23, 1944. J. A. DISSE 2,349,341

RIVETING DEVICE

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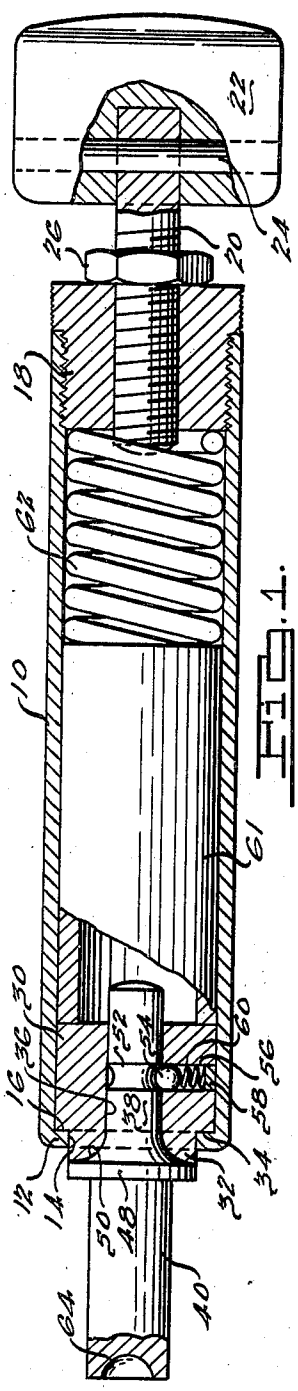


Fig. 1.

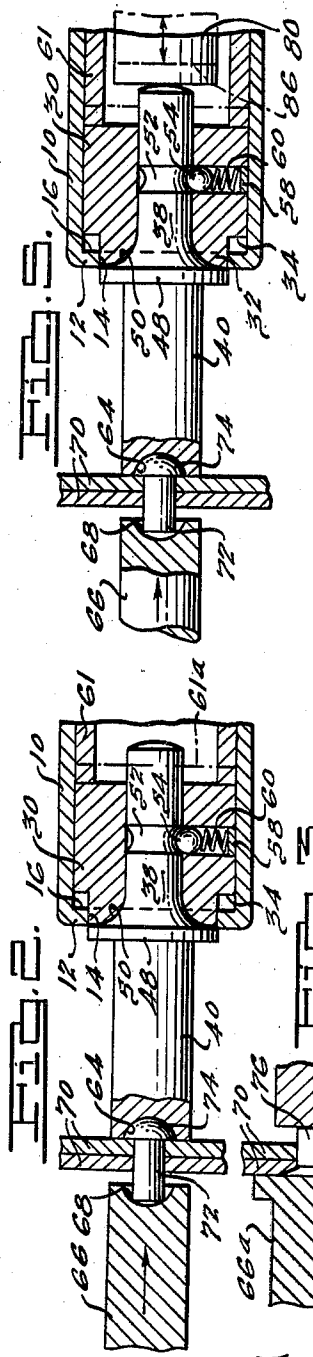


Fig. 5.

Fig. 2.

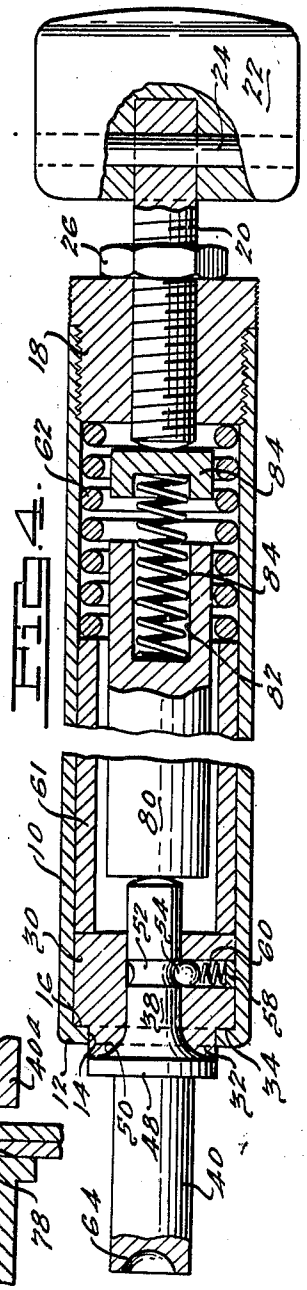


Fig. 4.

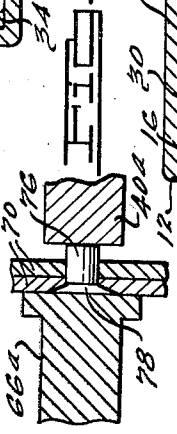


Fig. 3.

INVENTOR
Josef A. Disse.

BY
Harness, Dickey & Pierce.
ATTORNEYS.

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RIVETING DEVICE

Josef A Dissé, Detroit, Mich.

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4 Claims. (Cl. 78—53.5)

This invention relates to riveting devices and particularly to so-called bucking bar structures, the principal object being the provision of a new and improved bucking bar.

Objects of the invention include the provision of a bucking bar which will greatly relieve the operator, commonly known as the bucker, from the impact delivered to the rivet by the riveting hammer or other device; the provision of a bucking bar in which the reaction to the force of the riveting hammer is absorbed by an inertia member which is spring pressed by the bucker against the rivet; the provision of a bucking bar structure in which the force applied against the rivet by the bucker is transmitted through a spring element to an inertia member the inertia of which resists movement of the rivet under the force of the riveting hammer, such force thus being cushioned in its reaction against the bucker through the spring element; and the provision of a bucking bar having the above described characteristics that is simple in construction, easily manipulated and economical to build.

Further objects of the invention include the provision of a bucking bar structure so constructed and arranged as to react to the force of the blow by the riveting hammer upon the rivet being operated upon to apply one or more blows to the rivet in opposition to each blow applied thereto by the riveting hammer during the riveting operation; the provision of a bucking bar structure including one or more spring pressed inertia members movable in response to a blow upon the rivet by the riveting hammer against the force of spring means and caused by the force thus stored in such spring means to strike the anvil or equivalent member of the bucking bar and thus urge the rivet by a hammer blow or blows in a direction opposite to that which it is urged by the force of the riveting hammer; the provision of a bucking bar including an inertia member associated with the anvil thereof and a plurality of inertia members each independently spring pressed toward the anvil thereof and each movable in response to the blow of the riveting hammer upon the work out of contact with the anvil and returned into contact with the anvil by the energy stored in its associated spring to apply a hammer blow thereto in opposition to the force applied by the riveting hammer; the provision of a structure as above described in which means are provided for adjusting the pressure of the spring acting upon at least one of the inertia members; the provision of a structure as above described in which such adjusting means for the spring pressure comprises a support for the handle or head of the bucking bar; and the provision of a structure as above described that is simple in construction, efficient in operation, and economical to build.

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 suitable embodiments of the present invention and in which like numerals refer to like parts throughout the several different views,

Fig. 1 is a partially broken, partially sectioned side elevational view of one form of bucking bar constructed in accordance with the present invention, the section being taken axially thereof; and the bar being shown in its at rest position;

Fig. 2 is a fragmentary view of the operative end of the bar shown in Fig. 1 illustrating the same applied to a piece of work and illustrating the position of the inertia member thereof under such conditions, a fragment of a cooperating riveting hammer or other riveting device being shown in cooperative relation therewith;

Fig. 3 is a fragmentary view similar to that shown in Fig. 2 but illustrating a construction in which the riveting hammer acts upon the head of the rivet instead of upon the shank thereof as in the previous views;

Fig. 4 is a view similar to Fig. 1 but illustrating a modified form of construction in which a secondary inertia member is incorporated in the bucking bar; and,

Fig. 5 is a fragmentary view, similar to that shown in Fig. 2 but with the bar shown in Fig. 4, illustrating the same in operative position with respect to a piece of work and a riveting hammer or the like.

The present invention relates to bucking bars for riveting operations and while it has been particularly designed for use in those situations where the bucking bar is required to be pressed against the work by a workman, who is commonly known as the bucker, it may also find application in so-called riveting machines or yoke type riveters wherein the riveting machine or hammer is permanently connected with the anvil which bucks the rivets. For the purpose of simplicity in description the present inven-

tion will be described in its relation to the manually supported type of bucking bar and its application to the other types will be made apparent to those skilled in the art therefrom without further mention.

Conventional types of manually held bucking bars for riveting operations usually consists of a relatively heavy bar of metal, usually steel, which the workman or bucker holds against one end of the rivet while the riveting device, usually an air hammer, operates against the opposite end of the rivet. While the mass of such bars does, of course, absorb a considerable amount of the blow of the riveting device or hammer in bucking a rivet, nevertheless because of the inflexible connection between the bucking bar and the workman a considerable amount of the force of the blow of the hammer or riveting device is absorbed by the workman and becomes very tiring for that reason.

One of the principal objects of the present invention is the provision of a construction in which the force of the blow of the riveting device or hammer upon the bucking bar is cushioned in its transmission to the bucker so as to greatly relieve him of the tiring effects to which he is subjected as above described with the ordinary type of bucking bar. This is accomplished by mounting the anvil or the heading die of the bucking bar, depending upon whether the riveting hammer is operating against the head or the shank of the rivet, in an inertia member comprising a mass of metal and which is spring pressed by the bucker against the rivet being operated upon. The inertia member thus primarily absorbs the force of the riveting device or hammer and the force which reacts upon the bucker is transmitted to him through a spring element which thus cushions the blow upon the bucker and greatly relieves him of the strains which he would otherwise be subjected to from the blow of the riveting device or hammer.

It is another principal object of the present invention to provide a bucking bar construction in which the force of the blow of the riveting hammer or device reacts upon one or more additional inertia members in the bucking bar to displace it or them against spring means, such displacement storing up energy in such spring means to return such inertia member or members against the heading die or anvil of the bucking bar with a hammer blow or blows whereby to supplement the striking force of the riveting device or air hammer to produce an additional force tending to head the rivet being worked upon. The second inertia member or members not only supplement the action of the first-mentioned inertia member in absorbing the blow of the air hammer on the rivet but supplements the effect of the riveting device or air hammer in heading over the rivet. Thus it not only aids in relieving the bucker of the strain of the riveting operation as compared to conventional constructions but actually increases the speed of operation of the heading of the rivet.

Referring now to the accompanying drawing and particularly to Fig. 1 which shows a bucking bar equipped with a first inertia member and one secondary inertia member only, it will be noted that the device consists of a cylindrical and preferably metallic tube 10 one end of which is radially inwardly flanged as at 12, preferably by turning the metal at such end inwardly, to provide a bore 14 which is restricted in diameter as compared to the interior diameter of the tube 10, and a radial shoulder 16. The opposite end of the tube 10 is closed by a plug 18 screw threaded thereinto and which in turn threadably and centrally receives a stud 20 the other end of which carries a head 22 which may be suitably secured thereto in any suitable manner such, for instance, as by means of a pin 24 which passes through the head 22 and diametrically through the associated end of the stud 20. The head 22 is preferably shaped to fit the palm of the bucker's hand and is preferably of a greater dimension vertically as viewed in Fig. 1 than in a direction perpendicular to the plane of the drawing so as to more comfortably fit the palm of the hand. A lock nut 26 is preferably provided on the stud 20 for cooperation with the end of the plug 18 so as to enable the head 22 to be locked in suitably spaced relation with respect to the plug 18, preferably by a distance permitting the workman to engage his fingers around the inner face of the head 22.

Slidably received within the tube 10 is a first or primary member 30 provided with a concentric end portion 32 of reduced diameter which slidably projects through the bore 14 and which forms with the main body portion of the inertia member 30 a radial shoulder 34 complementary to the shoulder 16 of the tube 10. The inertia member 30 is provided with a central bore 36 within which the shank 38 of a heading die or anvil member 40 is relatively loosely received. Such heading dies or anvils 40 are conventionally provided with an annular radial flange such as 48 joined to the shank 38 by a flared portion such as 50 and the bore 36 is preferably flared to conform therewith. Also, as indicated, the reduced diameter end 32 of the inertia member 30 is preferably of a diameter approximately equal to the diameter of the flange 48. Although not necessary it is preferable that some means be provided for preventing inadvertent disengagement of the heading die or anvil member 40 from the inertia member 30 and for this purpose the particular means shown in accordance with the present invention comprises a circumferential groove 52 in the shank 38 which is engaged by a ball 54 reciprocable in a radial hole 56 in the inertia member 30. The outer end of the hole 56 is closed by a plug 58 and the hole contains a coil spring 60 which constantly urges the ball 54 inwardly into engagement with the groove 52. As will be appreciated the engagement between the ball 54 and the groove 52 provides a releasable connection which resiliently maintains the heading die or anvil member 40 from inadvertent disengagement with the inertia member 30.

A second or supplementary inertia member 61, shown in the form of a cylindrical tube, is also axially slidably received in the tube 10 with its lefthand end, as viewed in the drawing, normally in engagement with the primary inertia member 30. Loosely received within the tube 10 and maintained under compression between the outer end of the second inertia member 61 and the inner end of the plug 18 is a relatively heavy coil spring 62 which constantly acts through the second inertia member 61 to urge the shoulder 34 of the inertia member 30 against the shoulder 16 of the tube 10.

There are two general modes of riveting now in use. In one of these the bucking bar is placed against the head of the rivet and the riveting device or hammer is provided with a heading die which operates against the shank of the rivet to

upset it. In such case the operative end of the bucking bar constitutes an anvil and is conventionally provided with a depression in the end thereof shaped to fit the head of the rivet. The depression 64, illustrated in the end of the member 40 in all figures of the drawing except Fig. 3 is provided for receiving the head of the rivet and in such case is, strictly speaking, an anvil. In the other procedure the riveting device or air hammer operates against the head of the rivet and the bucking bar operates against the shank of the rivet and in such case, which is illustrated in Fig. 3, the member equivalent to the member 40 and there shown as at 40*a* in reality constitutes a heading die. The element of the riveting device or air hammer which directly contacts the rivet and which is illustrated in Figs. 2 and 5 at 66 will be formed to upset a head from the shank of the rivet of the desired shape. In Figs. 2 to 5 it is assumed that it is desired to have a semi-spherical head upset from the shank of the rivet and in such case the member 66 is provided with a semi-spherical depression 68 therein to effect such results. In Fig. 3 it is assumed that the rivet is a flared head rivet the outer surface of which is adapted to be flush with the surface of the work and in such case the operative end of the riveting device or air hammer illustrated at 66*a* is illustrated as having a slightly enlarged flat face end for engagement with the head of the rivet. Also in Fig. 3 it is assumed that the shank of the rivet may be upset into a cylindrical head and in such case the member 40*a* is simply provided with a flat operative end face which will act to effect this result.

The work which is to be riveted together is illustrated in Figs. 2, 3 and 5 as comprising a pair of sheets 70 and in Figs. 2 and 5 the rivet is illustrated as having a cylindrical shank 72 and a semi-spherical head 74, and in Fig. 3 the rivet is illustrated as having a cylindrical shank 76 and a flared head 78, thus agreeing with the above explanation.

In the operation of the device illustrated in Figs. 1 and 2 the bucking bar is placed against the rivet with the head 74 of the rivet received in the complementary recess 64 of the anvil member 40 and the workman or bucker then exerts force against the head 22 axially of the bucking bar and rivet sufficiently to move the shoulder 34 of the inertia member 30 away from the shoulder 16 of the tube 10, as illustrated in Fig. 2, thus placing the spring 62 under a compression in addition to its initial compression. The riveting device or air hammer is then set in operation to cause the end 66 thereof to be driven by repeated blows against the free end of the shank of the rivet as illustrated in Fig. 2 to cause the same to be upset. As the hammer-like blows from the riveting device or air hammer are delivered through the member 66 against the free end of the shank 72 of the rivet and these blows are transmitted through the anvil member 40 to the inertia members 30 and 61, the inertia members being pressed by the force of the spring 62 towards their operative position are nevertheless capable of a limited amount of retractive movement under the force of the blow within the tube 10 without causing an equivalent movement of the head 22 and consequently the hand and arm of the workman. Nevertheless the force of the spring 62 urges the inertia members 30 and 61 and, therefore, the anvil member 40 in a direction tending to maintain the head 74 of the rivet 72 in contact with the cooperating sheet 70. Thus the necessary resistance is applied to the rivet being headed to effect the heading thereof and yet the force of the riveting blows upon the workman or bucker is materially reduced and the strain to which he would otherwise be subjected correspondingly reduced.

In addition to the yielding of the spring 62 under the force of the rivet hammer blows to relieve the workman from material absorption of such blows on the rivet, the inertia member 61 has an additional and highly important function as follows. The relative masses of the inertia members 30 and 61 are such, and the latter particularly with relation to the weight or force of the spring 62, that each time the riveting hammer or device strikes the rivet the force of the blow transmitted to the inertia member 61 causes it to move inwardly against the force of the spring 62 away from contact with the inertia member 30, as, for instance, to a position such as indicated by the dotted line 61*a* in Fig. 2. This action further compresses the spring 62 and following which the force of the spring 62 drives the inertia member 61 back into contact with the inertia member 30 thereby to apply a hammer-like blow to the inertia member 30 which is transmitted through the anvil or heading member 40 against the rivet in opposition to the force of the hammer or other riveting device thereon, and thus imparts an additional heading over blow to the rivet each time a blow is struck on the rivet by the air hammer or other riveting device. This supplementary blow through relative movement between the inertia members 30 and 61 is of a material force and materially aids in the speed with which the riveting operation on a rivet may be completed and, as previously explained, at the same time this feature of the construction materially reduces the reaction to the blow on the rivet by the riveting hammer or other device which must be absorbed by the bucker or workman supporting the bucking tool, thus to reduce the fatiguing effects of the same on the workman.

It will be appreciated, of course, that the mass of the inertia members 30 and 61 or the weight of the spring 62, or both, may desirably be varied in accordance with the size of the rivet being driven and the material from which the rivet is made. In other words, it will be appreciated that the larger the rivet the greater the desirable mass particularly of the inertia member 30. If the weight of the spring 62 is increased, then the mass of the inertia member 61 must also be increased. On the other hand, it will also be appreciated that there is a practical limit to the mass of the inertia members 30 and 61, particularly in connection with manually operated types of bucking bars for workmen's muscles may become fatigued from supporting a heavy weight as well as from resisting the blows from the riveting hammer or device. Actual experience indicates, however, that particularly for the size of rivets employed in aircraft construction the inertia members 30 and 61 may be of sufficiently low mass as not to subject the workman to any unusual fatigue in supporting the bucking bar of the present invention and materially reduces the fatiguing effects of the action of the riveting hammer upon him.

It will be appreciated that the above described construction may be modified so that the inertia member 61 or its equivalent would not be interposed between the inertia member 30 and the spring 62, but would be separate therefrom and

provided with an individual spring allowing it to function in the same manner as above described. In such case the spring 62 would be lengthened so as to be compressed between the inertia member 30 and the spring 62 would be lengthened so as to be compressed between the inertia member 30 and the closure plug 18. Or, the inertia member 61 may be retained in the position shown and a third inertia member disposed as thus described and provided in addition thereto. This last form of construction is shown by way of illustration of these suggestions in Figs. 4 and 5.

In thus modifying the first described construction not only are all of the advantages thus far described realized but an additional advantage in increasing the effectiveness of the riveting device or hammer in heading over the rivet is also realized. This additional effectiveness results from the employment of such third, or second supplementing inertia member resisting the movement of the anvil or heading die of the bucking bar under the force of the blows of the riveting device or air hammer. As above suggested, this third inertia member is similar to the first one in that it is normally spring pressed against the anvil or heading die of the bucking bar, and like the second inertia member is capable of moving out of contact with the first inertia member, or the anvil or heading die which is functionally equivalent to it as far as the operation of the third inertia member is concerned as will be appreciated from the following description, each time the latter receives a blow from the riveting device or air hammer. In thus moving away from the anvil or heading die it compresses its corresponding spring and, therefore, stores up energy in the same, which energy returns it into contact with the anvil or heading die with a hammer-like blow which in itself imparts a supplementary blow to the anvil or heading die of the bucking bar tending to further upset the rivet in the same general manner as the inertia member 61 as above described. The construction thus provides means for producing a further heading blow on the rivet for each blow delivered thereto by the riveting device and thus has the effect of causing the rivet to be headed over in a still quicker manner than by the use of a conventional bucking bar or by a bucking bar of the type illustrated in Figs. 1 and 2. It also provides an additional inertia mass spring pressed toward the work to further relieve the operator or bucker from the tiring effects of the blows from the riveting device or air hammer.

Referring now to Figs. 4 and 5 it will be seen that the device there shown is identical to that shown in the previous views with the exception of the additional parts added. These additional parts comprise a third inertia member 80 in the form of a cylindrical metallic bar relatively loosely and, therefore, slidably received within the second inertia member 61. Its righthand end as viewed in Fig. 4 is provided with a central blind bore 82 within which is partially housed a coil spring 84 of less weight than the spring 62. The opposite end of the coil spring 84 is received in the recessed end of a cap or guide member 86 which abuts the inner end of the stud 20. The spring 84 is normally compressed between the blind end of the bore 82 and the cap member 84 and, therefore, constantly urges the third inertia member 80 to the left, as viewed in the drawing. It may be thus pressed against the inertia member 30 or directly against the end of the shank 38 of the anvil member 40, the latter condition being preferable and being shown by way of illustration. By loosening the lock nut 26 and turning the head 22 the initial compressive force of the spring 84 may be varied as will be readily appreciated and this is of particular advantage in adjusting the device for optimum operating conditions of the third inertia member 80 and particularly in adapting the bar for driving of rivets of different sizes.

In operation with the modified bucker bar shown in Figs. 4 and 5 the same mode of operation is carried out as previously described in connection with the forms shown in Figs. 1 and 2, that is, the workman or bucker presses against the head 22 to cause the inertia members 30 and 61 to be retracted in the tube 10 against the force of the spring 62 so as to space the shoulder 16 of the tube 10 and the shoulder 34 of the inertia member 30 from one another as illustrated in Fig. 5. At the same time it will be appreciated that the spring 84 is also compressed beyond its normal condition. With the bucking bar in such relation the riveting device or air hammer is operated to cause the anvil member or heading die 66 or 66a thereof to strike against the rivet 72 or 76. Under such conditions when the blow from the riveting device is transmitted through the rivet to the anvil or heading die member 40 or 40a the movement of the latter in reacting to the force of such blow is transmitted to the third inertia member 80 and the inertia thus imparted to such third inertia member 80 is sufficient to cause its operative end to move away from the cooperating end of the shank 38 against the force of the spring 84, as for instance to a point such as indicated by the dotted line 86 in Fig. 5, upon which not only the initial compressive force of the spring 84 but that added by the further compression thereof due to the movement of the third inertia member 80 forcefully returns the third inertia member 80 into contact with the end of the shank 38 with a hammer-like blow which blow is transmitted through the anvil member or heading die 40 to the rivet being operated upon to thus provide an additional blow tending to upset the rivet. This movement of the third inertia member 80, in the same general manner as the second member 61 above described, thus furnishing an additional upsetting blow on the rivet will, of course, occur each time a blow is struck against the rivet by the riveting device or air hammer and, of course, where the force of the blow of the latter is sufficient to effect the above described separating movement between the secondary inertia member 80 and the shank 38 of the anvil or heading die member the same as in the case of the inertia member 61. The relation of the parts and the weight of the spring 84 are, of course, so proportioned that such movement of the secondary inertia members 61 and 80 will occur during normal operation of the riveting device employed as the prime motive force in the driving of the rivet.

The resistance of the secondary inertia member 80 to movement and its connection to the head 22 through the spring 84 serves, of course, to supplement the same action as the inertia members 30 and 61 in relieving the operator or bucker from absorbing the full force of the blow of the riveting device or air hammer on the rivet during the riveting operation, and, therefore, supplements the action of the inertia member 30 in

relieving the operator or bucker from the tiring effects of the riveting operation.

Having thus described my invention what I claim by Letters Patent is:

1. In a rivet bucking device, in combination, a housing, an inertia member reciprocable in said housing and having a bore therethrough, spring means urging said inertia member in one direction of movement in said housing, means limiting movement of said inertia member under the influence of said spring in said housing, a rivet engaging member received in and projecting through said bore in said inertia member, a second inertia member reciprocable in said housing, and spring means constantly urging said second inertia member into contact with the end of said rivet engaging means projecting through said first-mentioned inertia member.

2. In a rivet bucking device, in combination, a housing, an inertia member reciprocable in said housing and having a bore therethrough, a second inertia member reciprocable in said housing and normally abutting the first-mentioned inertia member, spring means urging said inertia members in one direction of movement in said housing, means limiting movement of said inertia members under the influence of said spring in said housing, a rivet engaging member received in and projecting through said bore of said first-mentioned inertia member, a third inertia member reciprocable in said housing, spring means constantly urging said third inertia member into contact with the end of said rivet engaging means projecting through said first-mentioned inertia member, a movable abutment for the second-mentioned spring means, and screw means cooperating with said housing for adjusting the position of said abutment.

3. A rivet bucking device comprising, in combination, a tube having an inwardly flanged end, an inertia member reciprocable within said tube and engageable with said inwardly flanged end to limit movement thereof in one direction in said tube, said inertia member having a bore therein for reception of a rivet engaging member, a rivet engaging member received in and projecting through said bore, a second inertia member reciprocable in said tube and normally abutting the first-mentioned inertia member, a closure for the opposite end of said tube, a coil spring within said tube maintained under compression between said closure means and said second inertia member, a third inertia member reciprocably received within said tube, a second spring within said housing cooperating with said third inertia member to constantly urge the same in the same direction of movement in said housing that the first-mentioned spring urges the first two mentioned inertia members and into contact with the inwardly projecting end of said rivet engaging member independently of the first two mentioned inertia members, an abutment for said second spring, screw means threaded through said closure member and engaging said abutment member whereby to enable the force of compression of said second spring to be varied, and a manually graspable head carried on said screw means exteriorly of said housing.

4. A rivet bucking device comprising, in combination, a housing, a rivet engaging member guided for reciprocable movement in one end of said housing, a pair of inertia members independently reciprocable in said housing axially thereof, a spring constantly urging one of said inertia members toward said rivet engaging member, another spring constantly urging the other of said inertia members toward said rivet engaging member, said inertia members independently cooperating with said rivet engaging member whereby the force of movement of each thereof under the force of its respective spring is transmitted to said rivet engaging member independently of the other.

JOSEF A. DISSĚ.