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V. H. PAVLECKA ET AL

2,274,091

BUCKING TOOL

Filed April 23, 1938

2 Sheets-Sheet 1

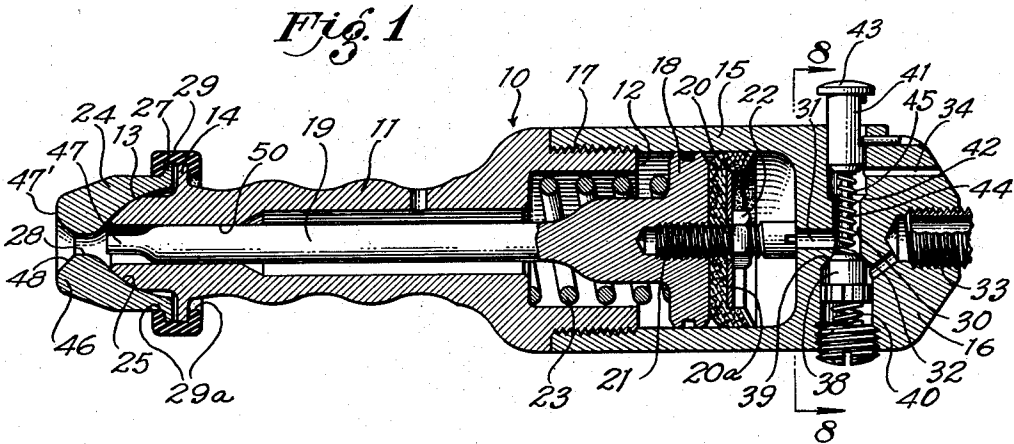
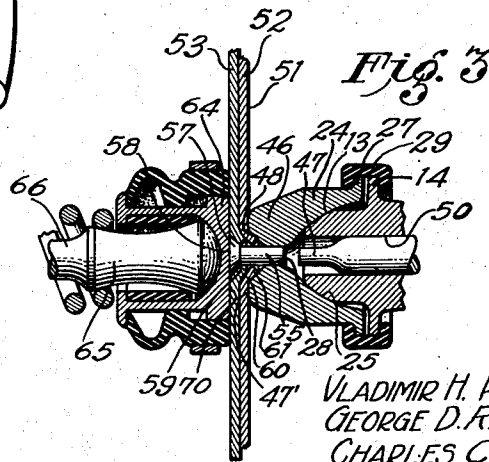
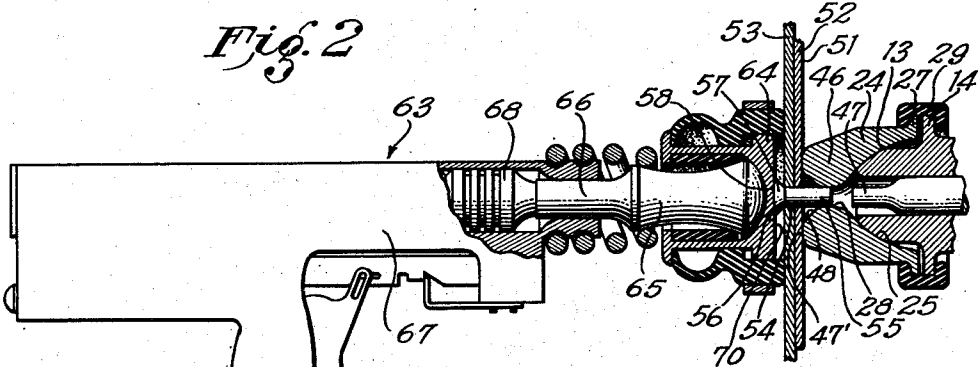


Fig. 2



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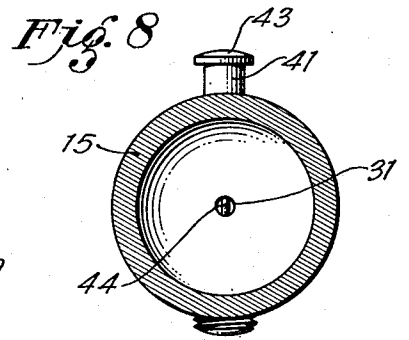
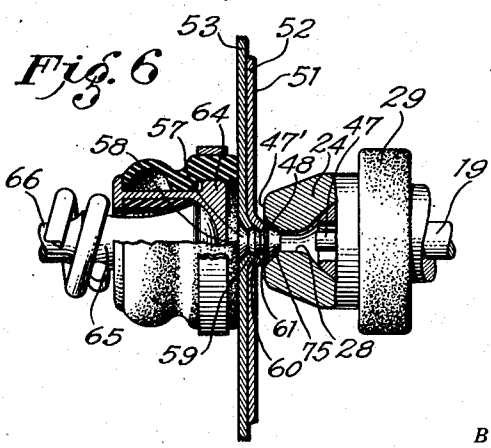
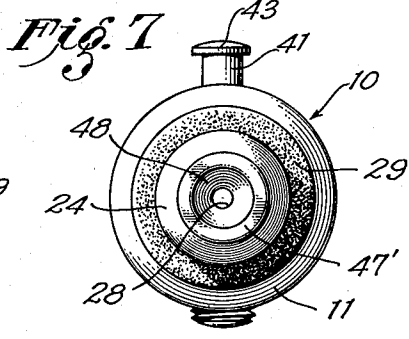
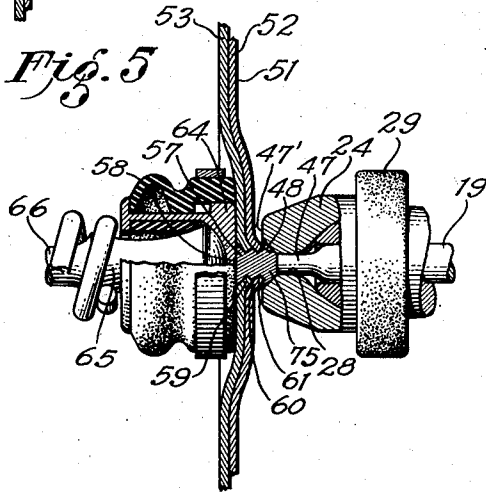
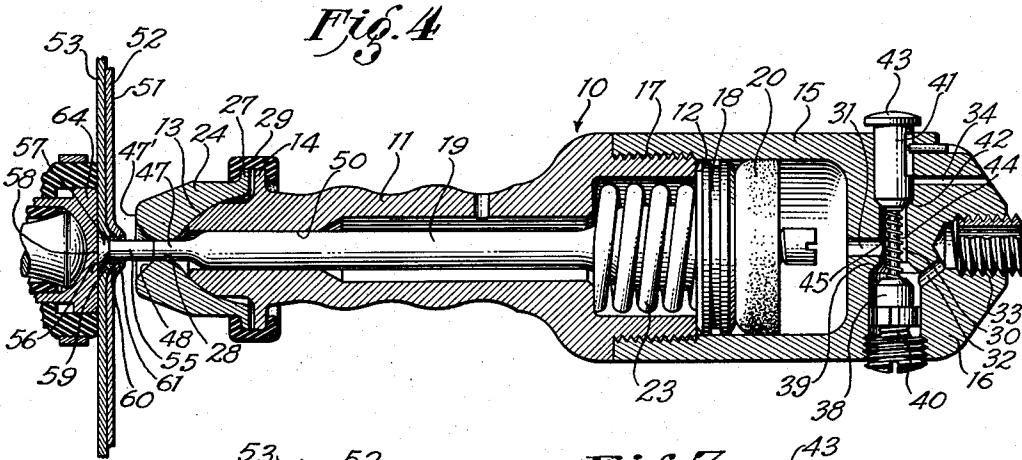
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# UNITED STATES PATENT OFFICE

2,274,091

## BUCKING TOOL

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Application April 23, 1938, Serial No. 203,946

12 Claims. (Cl. 78—46)

Our invention relates to the art of forming riveted joints between relatively thin and resilient metal sheets, and relates in particular to a simple and efficient means to be used in the forming of flush riveted joints.

It is a principal object of this invention to save time and energy in flush riveting and to provide a tool which does not require alternate repositioning between the rivet head seating and rivet shank upsetting operations.

Although the invention may be employed in the forming of various types of riveted joints, with different types of rivets, we have for the purpose of simplicity limited this disclosure to what we believe to be the preferred practice of the invention wherein a plurality of resilient metal sheets are flush riveted together by use of rivets disposed with their head surfaces coplanar with the surface of the outer sheet, and with the heads of such rivets occupying depressions, referred to as "dimples" formed by bending inwardly the annular portions of the sheets surrounding the holes through which the rivet shanks are passed.

It is an object of the present invention to attain a commercially feasible sequence of operations wherein the sheets are perforated in matched relation, portions of the sheets circumferentially adjacent to the perforations are impact-dimpled into accurately nested relation to each other and to the back face of the rivet head, and the shanks of the rivets are then upset by impact into sealing relation with the edges of the perforations and also into sealing relation to the dimpled portion of the top or front sheet. In the practice of the invention the rivets are quickly applied without causing buckling of the sheets, with the outer head surfaces of the rivets in co-planar alignment with the outer surface of the top sheet, and with the rivet bodies effectively filling and sealing the openings in which they are contained.

It is an object of the invention to provide a bucking tool having a head which is positioned against the back of a sheet assembly to serve in the rivet head seating or dimpling operation, and which has a member movable into cooperative position for the rivet shank upsetting operation, without the necessity for repositioning the head. The customary practice of applying rivets in flush riveted joints, wherein the rivet heads are received in dimple-type recesses, has required a bucking tool to buck the sheets during the impacting of the rivet head into nested relation to the sheets, and another bucking tool

for application to the rivet shank during the upsetting of the rivet shank by impacting the head. Our invention provides a simple tool to replace these two previously employed bucking tools. Accordingly, an object of the invention is to provide a convertible bucking tool adapted to the operation of seating the rivet head and also to the operation of upsetting the rivet shank.

It is a further object to provide pneumatically operable means for converting the bucking tool from a condition in which it is adapted to the operation of seating the rivet head into condition adapted to the operation of upsetting the rivet shank.

A further object is to provide a bucking tool, having means for automatically producing alignment of the head of a rivet with the outer sheet of an assembly of sheets, while the seating operation is being performed.

It is a further object of the invention to provide a method of applying a rivet to aligned openings through superimposed sheets, wherein the rivet is impacted forwardly so that the head thereof will impact-dimple the circumferentially adjacent edges of the sheets; the head is then pressurally or forcibly held in place in the dimple thus formed during the placing of a shank bucking member and the head end of the rivet is then impacted so as to upset the shank by driving the same against the bucking member.

Further objects and advantages of the invention will be brought out in the following part of the specification.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a partly sectioned view of a preferred embodiment of the bucking tool forming a part of the present invention.

Fig. 2 is a partly sectioned elevational view showing an impacting means in opposed relation to the head of the bucking tool in preparation for the seating of the rivet in aligned openings in superimposed plates.

Fig. 3 is a fragmentary sectional view showing the second operation of riveting the plates, wherein the rivet is impacted so as to form a dimple in the plates to receive its head.

Fig. 4 is a partly sectioned view showing the bucking tool converted to a state wherein it may buck the shank of the rivet.

Fig. 5 shows the fourth operation of riveting in accordance with our present invention wherein impact is applied to the driving head to drive the rivet and the flexible sheets toward the

bucking member, thereby expanding the shank of the rivet.

Fig. 6 is a view similar to Fig. 5 showing the parts after they have returned to normal position.

Fig. 7 is a view looking toward the head of the bucking tool.

Fig. 8 is a section taken on a plane represented by the line 8-8 of Fig. 1.

Our present invention includes a bucking tool 10. Although this tool may be converted from one state to another in a number of ways, we have preferred to disclose only a simple pneumatically convertible embodiment thereof, which includes a barrel 11, having a peripheral abutment 12 at its rear end and a semi-spherical nose 13 at its front end, there being a radially projecting collar 14 adjacent the nose 13. A cylinder 15 having a head 16 is joined to the barrel 11 by use of a threaded joint 17. A piston 18 provided with a conventional cup washer 20 is disposed within the cylinder 15 and has a forwardly projecting stem or piston rod 19 extending substantially through the barrel 11. The cup washer 20 is held in place on the piston 18 by use of a washer 20a and a nut 22, threaded on a screw 21, which screw 21 threads into the piston 18 and may be adjusted longitudinally so as to act as an adjustable stop to limit the rearward movement of the piston 18. A spring 23 is placed so as to urge the piston 18 toward the head 16, or toward retracted position, the forward movement of the piston 18 being limited by the abutment 12.

On the forward end of the barrel 11 there is a bucking head 24 having a concave seat 25 for cooperative engagement with the nose 13, this head 24 having an aperture 28, a collar 27, and being secured to the barrel 11 in swivelling relation by a resilient ring or sleeve 29 provided with inwardly projecting flanges 29a which project inwardly on opposite sides of the collars 14 and 27. This sleeve 29 normally holds the head 24 in a position wherein its aperture 28 will be aligned with the bore 50 of the barrel 11.

The cylinder head 16 has a valve chamber 30 which communicates with the interior of the cylinder 15 through a passage 31. The chamber 30 has an inlet port 32 which communicates at 33 with a source of fluid pressure, and the chamber 30 likewise has an outlet port 34 leading to the exterior of the head 16. An inlet valve 38 is disposed so as to engage a valve seat 39 positioned between the inlet port 32 and the chamber 30, this valve 38 being urged toward closing relation to the seat 39 by means of a spring 40. An exhaust valve member 41 is disposed so as to seat at 42 in response to inward pressure applied to a button 43 formed on the outer end thereof. When the exhaust valve member 41 is forced inwardly against the pressure of a retracting spring 45 the exhaust valve 41 engages the seat 42 and prevents escape of fluid through the exhaust port 34 and a stem 44 which projects inwardly therefrom engages the valve 38 and lifts the same from the seat, allowing fluid under pressure to enter the chamber 30 and pass through the opening 31 into the cylinder 15 to move the piston 18 forwardly. When pressure is released from the exhaust valve member 41, the inlet valve 38 is seated and fluid from the cylinder 15 may pass to the atmosphere through the exhaust port 34.

The piston rod 19 has a rivet shank bucking member or portion 47 formed on its front end,

which is disposed to the rear of the aperture 28 in the bucking head 24 when the piston is in retracted position, as shown in Fig. 1. When pressure fluid is admitted to the cylinder 15, so as to move the piston 18 into a position against the stop 12, the shank bucking member 47 will rest within the aperture 28, as shown in Fig. 4. If the piston rod 19 is moved forward when the head 24 is not in alignment with the barrel 11, the shank bucking member 47 will swivel the head 24 about the nose 13 to a position wherein the aperture 28 will be aligned with the bucking member 47, whereupon the member 47 may move within the aperture 28 to the position thereof shown in Fig. 4. The forward end of the head 24 may be referred to as an anvil 46 which has an annular face 47' surrounding a recess 48, or countersink, coaxial to the aperture 28 and lying in a plane perpendicular to the axis of the opening 28.

In Fig. 2 we show the bucking head 24 engaging the rear face 51 of a sheet 52 against which a front sheet 53 lies, these sheets 52 and 53 having cooperating rivet openings 54 therein through which the shank 55 of a rivet 56 projects. This rivet 56 has a head 57 of conical type and is provided with a flat front face 58 which shall lie flush with the front face of the sheet 53 when the riveting operation is completed. In stating that the recess 48 is formed in cooperative relation to the rivet head 58, we mean that the recess 48 has such form that when the rivet 56 is forced into a position, such as shown in Fig. 3, wherein the front face 58 thereof will lie in a plane with the sheet 53, such recess 48 will permit, or assist in, the formation of nested depressions or dimples 59 and 60 in the plates 53 and 52, which dimples will have the cooperative relation, and lie in nested relation, to the rivet head 57, as shown in Fig. 3. The anvil 46 of the head 24 bucks the sheets 52 and 53 during the time the rivet head 57 is being forced inwardly from the position in which it is shown in Fig. 2 to its position of Fig. 3 so as to deflect the metal walls 61 of the sheets 52 and 53 circumferentially disposed around the openings 54 through which the shank 55 of the rivet 56 passes. Accordingly, the anvil 46 may be referred to as the sheet bucking member for the reason that it resists certain movement of the sheets during the time the rivet head is being impacted from its position of Fig. 2 to its position of Fig. 3, such impacting of the head 57 causing some deformation thereof as well as the dimpling of the plates 53 and 52.

In the riveting operation we employ an impacting device 63 which is the subject matter of copending application, Serial No. 206,364, filed May 6, 1938. This impacting device has a drive head 64, carried on the forward end of a shank 65 so as to have a small universal movement thereon. This shank 65 has a stem 66 which extends into a cylindrical chamber 67 having a hammer piston 68 therein.

The riveting operation is carried on as follows. After insertion of a rivet 56 in the opening 54, the driving or impacting head 64 is placed, as shown in Fig. 2, so that the flat front face 70 thereof will be in approximately centralized relation to the rivet head 57. The bucking tool 10 will then be placed so that the shank 55 of the rivet 56 will extend into the opening 28 which is of such diameter that the shank 55 will be held in a position of axial alignment with the opening 28. The axis of the opening 28 will be perpendicular to the face 51 of the sheet 52 when the annular

face 47' of the anvil 46 is pressed against the face 51 and, accordingly, the shank 55 will be held perpendicular to the sheets. The swivelling action of the head 24 on the nose 13 of the bucking tool 10 permits the head 24 to readily assume a position wherein the face 47' will rest firmly against the face 51 and the axis of the opening 28 will be accordingly perpendicular to the face 51, with the result that the shank 55 of the rivet 56 will be positioned perpendicular to the face 51, and likewise, the face 58 of the rivet head 57 will be disposed in a plane parallel to the front face of the sheet 53.

With the parts disposed as described in the preceding paragraph, the impacting device 63 is actuated so as to cause the hammer 68 to strike a forcible blow against the shank 65, the force of which is transmitted through the drive head 64 to the head 57 of the rivet 56, this resulting in the driving or impacting of the head of the rivet to the position in which it is shown in Fig. 3. The operator does not at this time remove the impacting device 63 from the position in which it is shown, but continues to exert pressure to hold the drive head 64 firmly against the plate 53 and the rivet head 57, thereby firmly holding the rivet in position. Then, as shown in Fig. 4, the operator of the bucking tool 10 forces inwardly on the button 43 to actuate the valve mechanism so that fluid pressure, preferably air pressure, is applied to the piston 18 to move the same to a position against the abutment 12 and to move the shank bucking member 47 to advanced or active position within the opening 28 of the head 24, this being done without removing the bucking tool 10 from engagement with the shank 55 of the rivet 56. The shank bucking member 47 will now be in engagement with the end of the rivet shank 55 and the head 24 of the bucking tool 10 will be moved away from the plate 52. The parts are now all in proper position for the upsetting of the rivet shank 55 and the flanging thereof to form a second head 75 on the rivet to complete the riveting operation. It will be remembered that during this conversion of the bucking tool 10 into a position for bucking the rivet shank 55, the drive head 64 of the impacting device 63 has been firmly held in position against the head 57 of the rivet so that to complete the riveting operation it is only necessary to again actuate the impacting device 63 so as to cause the hammer 68 to strike the shank 65 and transmit its force through the drive head 64 to the rivet, this causing the forward movement of the head 64, a momentary deflection of the plates 53 and 52, and the driving of the rivet shank 55 forcibly against the bucking member 47, as illustrated in Fig. 5. This will result in expansion of the shank 55 within the openings 54 of the sheets 53 and 52, and, likewise, the formation of the head 75 on the projecting end of the shank 55, this head 75 being formed in the conical recess 48 and being thereby given a conoidal form. As shown in Fig. 6, the sheets 52 and 53, being resilient, return to normal position when the impacting force applied through the drive head 64 is released, and the cooperating parts assume the positions shown in Fig. 6.

Although we have shown and described a simple and practical embodiment of our invention, it will be recognized that various parts or elements thereof may be replaced by other equivalent parts without departing from the spirit of the invention; therefore, the invention is not

limited to the details of the disclosure herein-before made, nor to the whole combination, but also resides in subcombinations and parts. Our invention should therefore be accorded the full scope of the hereto appended claims.

We claim as our invention:

1. In a bucking tool of the character described for use with a rivet, the shank of which projects through an opening in a sheet, the combination of: a body having a head swivelly mounted thereon for universal movement relative to said body, said head having means for engaging said sheet, there being a guide carried by said head to position the shank of said rivet perpendicularly to the plane defined by said sheet; bucking means for said shank movable relative to said body and said head; and means for applying a force and its reaction respectively to said bucking means and said body to produce movement of said bucking means relative to said body and to said head into a position to be engaged by said shank.

2. In a bucking means of the character described for use with a rivet having a head formed so as to be received in a dimple formed in a sheet, and which rivet is placed with its shank projecting from a sheet which is to be riveted, the combination of: a body having a head mounted thereon for universal movement so that said head will automatically assume a position lying flat against said sheet, the front face of said head having a recess formed in cooperative relation to said head of said rivet and an opening extending rearwardly from said recess to receive the shank of said rivet, there being means for positioning said shank in a prescribed relation to said sheet; a shank bucking member movable in said opening; and means operative to apply a force and its reaction respectively to said shank bucking member and said body to move said shank bucking member in said opening to a position where it will be engaged by said shank.

3. In a bucking means of the character described for use with a rivet having a head formed so as to be received in a dimple formed in a sheet, and which rivet is placed with its shank projecting from a sheet which is to be riveted, the combination of: a body having a head provided with a front face to engage said sheet, the front face of said head having a recess formed in cooperative relation to said head of said rivet and an opening extending rearwardly from said recess to receive the shank of said rivet, said body having a wall for positioning said shank in a prescribed relation to said sheet; a shank bucking member movable in said opening; and means operative to apply a force and its reaction respectively to said shank bucking member and said body to move said shank bucking member in said opening to a position where it will be engaged by said shank.

4. In a bucking means of the character described for use with a rivet having a head formed so as to be received in a dimple formed in a sheet, and which rivet is placed with its shank projecting from a sheet which is to be riveted, the combination of: a body having a head mounted thereon for universal movement so that said head will automatically assume a position lying flat against said sheet, the front face of said head having a recess formed in cooperative relation to said head of said rivet and an opening extending rearwardly from said recess to receive the

shank of said rivet, there being means for positioning said shank in a prescribed relation to said sheet; a piston placed and connected to said shank bucking member so that its movement will carry said member to a position in said opening wherein it may be engaged by said rivet shank; and means for applying fluid pressure so that its force will be applied to said piston and its reaction will be applied to said body, whereby said shank bucking member will be moved in said opening to said position.

5. In a bucking tool of the character described for use in opposed relation to a rivet upsetting device, the combination of: a bucking head having an anvil defining a space to receive the shank of a rivet; means for supporting said head in a position against an article from which said shank projects; a bucking member of a size to be received in said space; and means for applying a force and its reaction respectively to said bucking member and said head to produce relative movement thereof whereby said bucking member will be brought into a position in said space for bucking engagement with said shank while said shank is being upset by force applied by said upsetting device.

6. In a bucking tool of the character described for use in opposed relation to a rivet upsetting device, the combination of: a bucking head having an anvil defining a space to receive the shank of a rivet; means for supporting said head in a position against an article from which said shank projects; a bucking member of a size to be received in said space; fluid operated means for applying a force and its reaction respectively to said bucking member and said head to produce relative movement thereof whereby said bucking member will be brought into a position in said space for bucking engagement with said shank while said shank is being upset by force applied by said upsetting device; and means for controlling the delivery of fluid to said fluid operated means.

7. In a bucking tool of the character described for use in opposed relation to rivet upsetting device, the combination of: a bucking head having an anvil defining a space to receive the shank of a rivet; means for supporting said head in a position against an article from which said shank projects; a bucking member of a size to be received in said space disposed at the rear end of said space; and means for moving said bucking head rearward relative to said rivet and said bucking member whereby said bucking member will then be disposed in said space in a position to buck said shank against the force of said upsetting device.

8. In a bucking means of the character described for use with a rivet having a head formed so as to be received in a dimple formed in a sheet, and which rivet is placed with its shank projecting from a sheet which is to be riveted, the combination of: a body having a head provided with a front face to engage said sheet, the front face of said head having a recess formed in cooperative relation to said head of said rivet and an opening extending rearwardly from said recess to receive the shank of said rivet; a shank bucking member movable in said opening; and means operative to apply a force and its reaction respectively to said shank bucking member and said body to move said shank bucking member in said opening to a position where it will be engaged by said shank.

9. In a bucking means of the character de-

scribed for use with a rivet having a head formed so as to be received in a dimple formed in a sheet, and which rivet is placed with its shank projecting from a sheet which is to be riveted, the combination of: a body having a head mounted thereon for universal movement so that said head will automatically assume a position lying flat against said sheet, the front face of said head having a recess formed in cooperative relation to said head of said rivet and an opening extending rearwardly from said recess to receive the shank of said rivet, a piston placed and connected to said shank bucking member so that its movement will carry said member to a position in said opening where it may be engaged by said rivet shank; means for applying fluid pressure so that its force will be applied to said piston and its reaction will be applied to said body, whereby said shank bucking member will be moved in said opening to said position; and yieldable means to return said piston to the initial position thereof.

10. In a bucking tool of the character described, the combination of: a supporting body having a bucking head at the forward end thereof, said head defining a space to receive the shank of a rivet; a shank bucking member initially disposed rearwardly in said space and being of such size that it may be moved forward in said space to a shank bucking position; and means for holding said shank bucking member in said shank bucking position thereof, said means engaging said shank bucking member and said body so that the reaction to the bucking force applied to said rivet shank by said shank bucking member will be transmitted to said body.

11. In a bucking tool of the character described, the combination of: a hollow body having a forwardly extending tubular neck coaxial with a cylinder which has a rear end wall, the forward end of said neck having a rounded face; a bucking head disposed on the forward end of said neck, said head having a rounded face to cooperate with said rounded face of said neck to form a swivel connection between said head and said neck, and said head having a rivet shank receiving opening in coaxial relation to said neck; a shank bucking member having a part axially movable in said neck whereby it may be moved from a retracted position relative to said shank receiving opening of said head to a shank bucking position in said opening; a piston in said cylinder connected to said shank bucking member; and means for applying fluid pressure to the space between said piston and said rear end wall of said cylinder, whereby said shank bucking member will be moved into said shank bucking position.

12. In a bucking tool of the character described, the combination of: a hollow body having a forwardly extending tubular neck coaxial with a cylinder which has a rear end wall, the forward end of said neck having a rounded face; a bucking head disposed on the forward end of said neck, said head having a rounded face to cooperate with said rounded face of said neck to form a swivel connection between said head and said neck, and said head having a rivet shank receiving opening in coaxial relation to said neck; a shank bucking member having a part axially movable in said neck whereby it may be moved from a retracted position relative to said shank receiving opening of said head to a shank bucking position in said opening; a piston in said cylinder connected to said shank bucking

member; means for applying fluid pressure to the space between said piston and said rear end wall of said cylinder, whereby said shank bucking member will be moved into said shank bucking position; a ring of rubbery material engaging said head and the forward portion of said neck to hold the same in cooperative relation; and a

spring for returning said piston to its initial position in said cylinder after the fluid pressure has been released therefrom.

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