

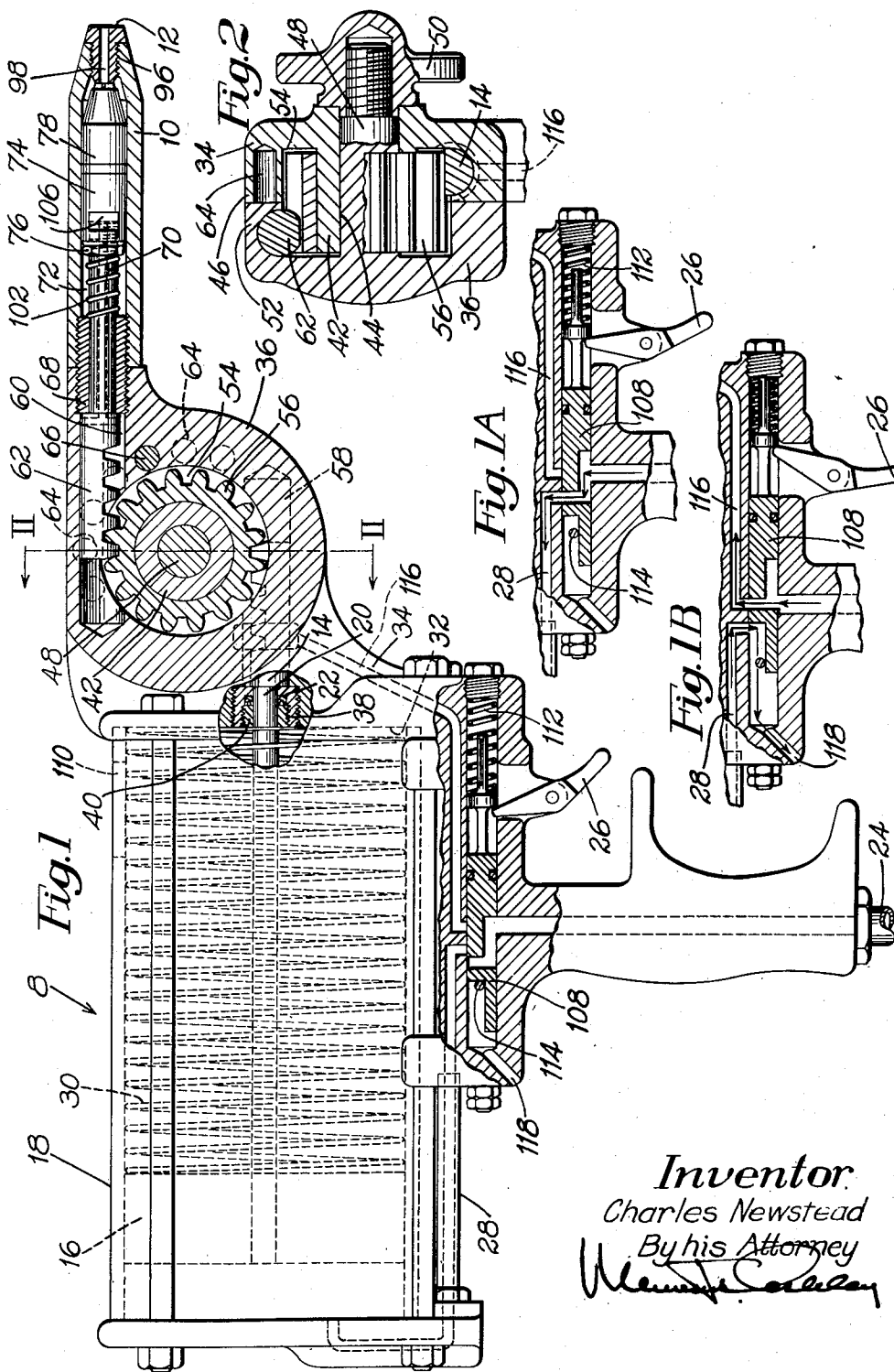
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POWER RIVET SETTING TOOLS HAVING ANGULARLY
ADJUSTABLE NOSEPIECES

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Fig. 3

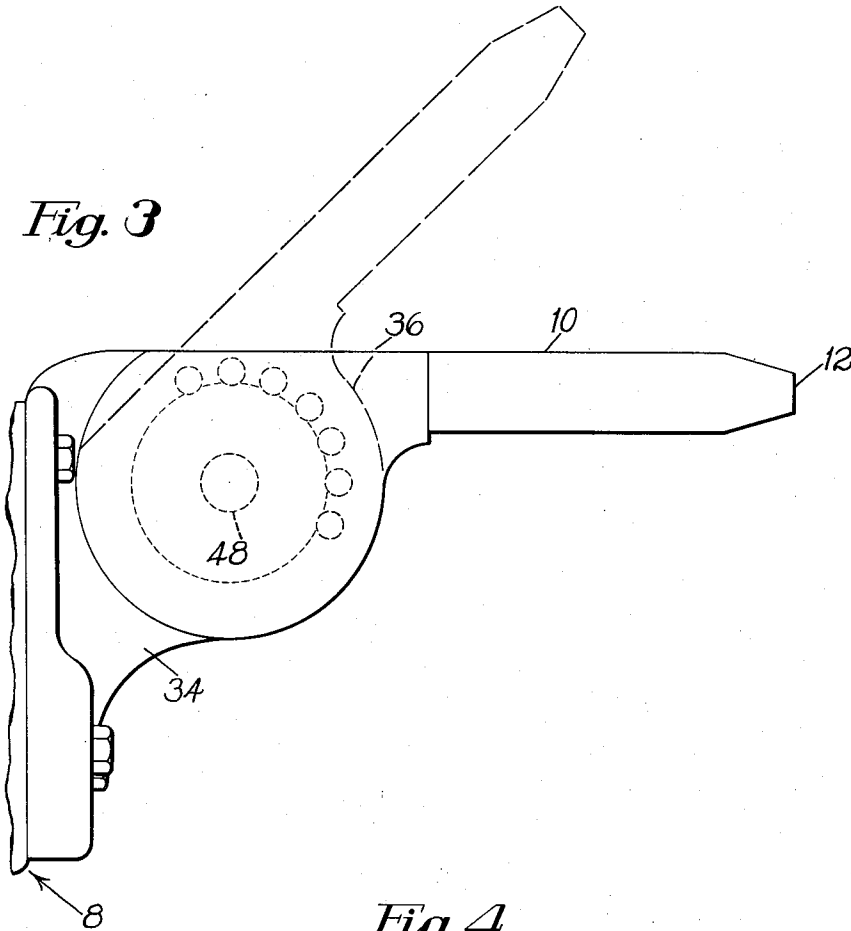
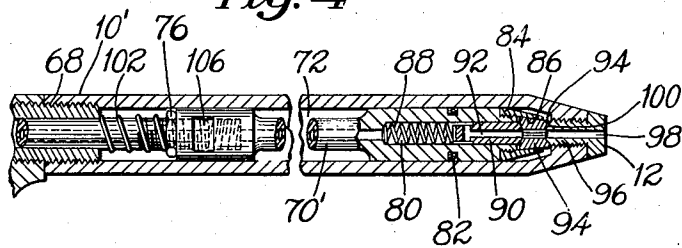


Fig. 4



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POWER RIVET SETTING TOOLS HAVING ANGULARLY ADJUSTABLE NOSEPIECES

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6 Claims. (Cl. 218—47)

This invention relates to power operated rivet setting tools of the type employed to set rivet assemblies, wherein a flanged rivet barrel, after having been inserted through one or more work pieces to be fastened, is axially compressed and set by distortion forces produced by the drawing of the headed end of a mandril either completely through the hollow barrel of the rivet or into forceful abutting engagement with the unflanged end of the rivet barrel. In either case, the head of the mandril is slightly larger in diameter than the bore diameter of the hollow barrel so that, when the flanged end is "bucked" or held stationary with respect to the work piece being fastened together, and when the mandril head is pulled from the front of the work piece in the direction of the flanged end, the larger size of the mandril head causes that portion of the opposite end of the barrel which protrudes beyond the rear or blind side of the work, to be collapsed in accordion fashion until the work pieces are drawn tightly together. In some instances, the mandrils are designed to break upon the application thereto of a sufficient tensile strain to effect a tight setting of the rivet barrels. However, in other instances, it may be desirable to provide a mandril having tensile strength sufficient to permit the enlarged mandril head to be completely drawn through the rivet barrel, thereby to enlarge the bore of the barrel and simultaneously to divide the outer walls of the barrel, causing them to become firmly interlocked with the work pieces. The techniques that may be most advantageously employed for any given rivet setting requirement are well known to those skilled in the art of blind riveting. However, although many rivets and rivet setting tools have been developed, by the use of which, blind rivets may be set into work pieces having only one side exposed and accessible for the riveting operation, it frequently happens that the location in the exposed side where the rivet is to be set is such as to preclude the use of tools which require considerable unobstructed space directly in front of the flanged end of the rivet barrel. Accordingly, many special attachments have been developed as accessories to riveting tools, thereby to permit their use for setting rivets which are located in corners, around corners or otherwise adversely located. While such attachments are interchangeable, and permit the nosepiece or mandril gripping portion of the setting tool to be either offset or angularly disposed with respect to the longitudinal line, or axis, of the main body of the tool, and thus enable otherwise inaccessible rivets to be set, numerous interchangeable nosepiece attachments must be maintained at hand and frequently interchanged in accordance with each change in rivet setting conditions. In addition to the cost involved in maintaining an adequate supply of such attachments, much unproductive operator time is wasted in the substituting of one attachment for another.

Accordingly, one of the objects of the present invention is to provide a portable power operated blind riveting tool which requires no extra attachments to enable

the angle of the nosepiece to be varied with respect to the body portion of the tool.

Another object is to provide an inexpensive and sturdily constructed tool which may be quickly adjusted to vary the angular relationship between the axis of the nosepiece and the body portion of the tool. This provision is not only necessary to render rivet setting locations accessible, but also, due to the inclination of the outer surface of some work pieces away from either the horizontal or vertical plane, less operator fatigue will be produced if the main body portion, by which the tool is manually supported and presented to the work, may be readily shifted angularly with respect to the work or to the axis of the mandril stem to be engaged and pulled by the tool.

Accordingly, the invention to be hereinafter claimed relates particularly to an angularly adjustable nosepiece so constructed and arranged as to permit the axis of the nosepiece to be pivotally shifted and disposed at varying angles with respect to the axis of the body of the tool.

One of the several features of the invention is the provision, in a blind rivet setting tool having a body portion and abutment means mounted thereon for engaging a rivet to be set, of additional means whereby the angular relationship of the body of the tool and the abutment means can be adjusted in accordance with optimum working conditions, and whereby the abutment means can be locked in adjusted relationship.

The above and other objects and features of the invention will appear from the following detailed description of the preferred embodiment thereof illustrated in the accompanying drawings, and will be pointed out in the claims.

In the drawings:

Fig. 1 is a side elevation of a blind riveting tool, showing one embodiment of the invention, with some of the parts in section and others broken away illustrating the inoperative phase, the nosepiece being in its horizontal or straight forward position;

Fig. 1A is a sectional detail of the manually movable control parts of Fig. 1, but showing said parts in their operative rivet setting position;

Fig. 1B is a view similar to that of Fig. 1A, but showing the control parts in their position for ejecting a broken mandril stem from the nosepiece;

Fig. 2 is a view in section, taken along the line II—II of Fig. 1;

Fig. 3 is a side elevation of the nosepiece, illustrating the manner in which it may be inclined or angularly adjusted away from the horizontal position of Fig. 1; and

Fig. 4 is a sectional view showing a nosepiece of different length from that shown in Figs. 1 and 3.

Referring to the drawings, and particularly to Figs. 1 and 2, the illustrated tool comprises a body portion 8, a tubular nosepiece 10, one end of which constitutes an abutment means 12, and means for adjusting the disposition of the abutment means relative to the body portion of the tool, i. e., by adjustment of the angular relationship between the said nosepiece and the body portion. The body portion 8 may be variously constructed so that, by pneumatic, hydraulic, electromotive or other means, force may be applied to a driving rack member 14 to cause it either to be projected outward from, or to be drawn inward toward, the forward end of the body portion 8. Although the design of the mechanism for actuating the rack member 14 (hereinafter referred to as the first rack member), does not constitute a part of the present invention, for the sake of illustration it may be comprised of a pneumatic piston 16 mounted within a piston chamber 18 and having a piston rod 20 projecting outward through a packing gland 22 for actuating the rack 14. In the herein illustrated embodiment, pneumatic pressure is employed as an actuating

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force and the compressed air, supplied to the tool by an air hose 24, is metered through a valve mechanism by a manual trigger control 26. When the trigger 26 is tripped (Fig. 1A), compressed air is admitted, through a conduit 28, to the rear face of the piston 16, whereupon the piston 16, the rod 20, and the rack 14 are driven toward the right (as viewed in Fig. 1), while at the same time a helical spring 30, having sufficient force to return the piston and associated parts to the left when the air pressure is released, is compressed by movement of the piston 16 toward a vertical face 32 which abuts against the forward end of the body portion 8.

A fixed housing 34 is attached to the body portion 8, and a movable housing 36, mounted on the fixed housing, is capable of adjustment relative thereto. The nosepiece 10 is mounted rigidly on the movable housing. The means for adjusting the angular relationship between the housings 34 and 36 and certain parts, to be described hereinafter, mounted in or on these housings. The body portion 8 constitutes portable pneumatically operated means for causing longitudinal motion of the rack member 14.

Referring to Fig. 1, in which movement of the piston rod 20 toward the right is referred to as forward movement, the rack member 14 projects from the body portion through the face 32 and through a rack member retaining nut 38. The gland 22, secured in the nut 38 by a gland retaining nut 40, forms an air seal between the piston chamber 18 and mechanism mounted in and on the housing 34. The housing 34 also comprises a transverse sleeve 42, projecting on the left-hand side of the housing (as viewed in Fig. 2). This sleeve has an axial bore 44 therein. Spaced radially from and concentric with the sleeve 42, and, on the same side of the housing as it, is a circular flange 46 of lesser depth. The movable housing 36 is mounted on the housing 34 by means of a transverse spindle 48, which, passing through the bore 44 in the sleeve 42, is secured therein by a knurled cap nut 50. The housing 36 also comprises a circular flange 52, concentric with the spindle 48, which abuts against the flange 46 of the housing 34. The sleeve 42 of the fixed housing 34 also abuts against the movable housing 36 and thus, when the two housings are mounted together, an annular space 54 is formed between the sleeve 42 and the two abutting circular flanges 46 and 52. A gear 56 is mounted on the sleeve 42 in this space 54. A bore 58 in the housing 34 allows the rack member 14, projecting from the tool body 8, to pass into engagement with the underside of the gear 56 (as viewed in Fig. 1). A similar bore 60 in the housing 36 allows a second rack member 62 also to engage the gear. There is a plane perpendicular to the axis of rotation of the gear 56 which divides the gear into left-hand and right-hand portions: the two bores 58 and 60 are offset on either side of this plane so that the first rack member 14 engages the right-hand underside portion of the gear, and the second rack member 62 engages the left-hand portion of the gear.

The flange 46 is provided with a series of index holes 64 whose centers are on a circle concentric with the spindle 48, and spaced from each other by the angle between adjacent teeth of the gear 56. The abutting flange 52 is provided with an indexing and locking pin 66 (Fig. 1), which will fit into any of the holes 64.

In the operation of the tool, the fixed housing 34 and movable housing 36 are fastened together, the nut 50 being tightened, the pin 66, being engaged in one of the holes 64, locking the housings 34 and 36 against relative movement, and the rack members 14 and 62 both engaging the gear 56. Thus, by loosening the nut 50 so that the housing 36 can be withdrawn from the housing 34 until the rack member 62 is disengaged from the gear 56 and the pin 66 disengaged from its hole 64, the housing 36 can be rotated by means of its spindle

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48 which fits in the sleeve 42 to any angle corresponding to a coincidence of the pin 66 with a hole 64 and then moved toward the fixed housing 34 to position both the pin 66 in the required hole 64 and the rack member 62 in engagement with the gear 56. The nut 50 is then retightened. This mechanism is thus so arranged that the angular relationship between the two rack members 14 and 62 can be altered, and the members locked in altered angular relationship, while both the extent of movement of the member 62 consequent on a given movement of the member 14, and the manner in which this movement of the member 62 is effected, remain unaltered.

The tubular nosepiece 10 comprises the abutment means 12 at its forward end, and is mounted on the housing 36 by a screwed sleeve 68. A shaft 70, forming an extension of the member 62, is mounted for longitudinal movement along the axis of the nosepiece 10: an annular space 72 is formed between the nosepiece and the shaft. It will be realized that as the first rack member 14 is restricted to longitudinal movement in the body portion 8, and the second rack member 62 to longitudinal movement along the axis of the nosepiece 10, adjustment of the angular relationship between the nosepiece and the tool body is equivalent to adjustment of the angular relationship between one rack member and the other rack member.

At its forward end the shaft 70 is threaded into a mandril engaging unit 74 and secured thereto by a locknut 76. The unit 74 comprises a cylindrical block 78 mounted for longitudinal movement along the axis of the nosepiece 10, which block has a longitudinal concentric bore 80 (Fig. 4) open at its forward end, and a gland 82 arranged to prevent passage of air between the outside of the block 78 and the nosepiece. A centrally bored screw cap 84 with a frusto-conical internal surface 86 is mounted on the forward end of the block 78. A spring 88, abutting against the closed end of the bore 80, urges a hollow piston 90, having a bore 92, forward against two collets 94, which have frusto-conical forward surfaces abutting against the surface 86. A member 96, which is screwed into the forward portion of the nose piece 10, has a hole 98 drilled on the axis of the nosepiece. The forward face of this member 96 constitutes the abutment means 12. The member 96 also comprises a rearwardly projecting conical ring 100. In the position of the unit 74 (shown in Figs. 1 and 4), the ring 100 contacts the collets 94 and holds them apart so that, when it is required to use the tool in blind riveting, the stem of a blind riveting assembly may be simply inserted therebetween. On rearward movement of the unit 74, the stem of an assembly having been so inserted, the collets 94 close on the stem and it is pulled rearwardly as required. A compression spring 102 surrounding the shaft 70 abuts against the sleeve 68 and against the locknut 76. When adjustment is being made of the angular relationship between the nose piece and the body portion of the tool, the rack member 62 is disengaged from the gear 56. The spring 102 insures that the unit 74 is urged forward in the nosepiece 10 and maintained in the position of Fig. 1 relative to the nose piece while the rack member is so disengaged.

The trigger 26, when initially depressed to the position as shown in Fig. 1A, shifts an air control valve 108 toward the right, allowing all the pneumatic pressure, entering the tool through the air hose 24, to enter the conduit 28 and thence into the piston chamber to act upon the piston 16 and drive it toward the right. During this movement of the piston, air in the chamber to the right of the piston 16 is vented to the atmosphere through an exhaust port 110. The control valve 108 is normally biased, by a spring 112, toward the inoperative position of Fig. 1 where its leftward movement is stopped by abutment against a fixed pin 114. In the operation of the illustrated pneumatically actuated tool the trigger is main-

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tained by the operator in the partially depressed position of Fig. 1A until the rivet has been set and the mandril stem has been broken. The broken stem portion may then be ejected from the nosepiece merely by fully depressing the trigger 26 to thereby shift the air control valve 108 to its rightmost position, as illustrated in Fig. 1B. When thus positioned the valve port is shifted out of communication with the conduit 28 and brought into communication with another conduit 116 through which pneumatic pressure is then directed toward the nosepiece. Air passing through the conduit 116 enters the interior of the housing members 34 and 36, flowing through the bore 58, around the annular space 54 into the bore 60 and thence into the nosepiece passages through holes drilled in the shaft 70 (Figs. 1 and 4). Referring to Fig. 1B, it will be seen that, at the same time that the supply of pneumatic pressure is shifted from the conduit 28 to the conduit 116, the conduit 28 is vented, by the valve 108, allowing the air in the chamber to the left of the piston 16 to be expelled by force of the spring 30 through an exhaust port 118, thus allowing the actuating parts of the tool to return to their inoperative positions.

In a convenient mode of operation of the illustrative tool, a stem portion of a blind riveting assembly is inserted into the mandril engaging unit 74 between the collets 94. Referring now to Figs. 1 and 4, initial pressure on the trigger 26, attached to the air control valve mechanism, admits air to the rear face of the piston 16, pushing it forward and thus causing forward motion of the rack member 14. This movement, transmitted through the gear 56, causes rearward movement of the unit 74, and a rivet setting operation takes place, resulting in a broken stem portion of the mandril remaining in the mandril engaging unit 74. The trigger is then fully depressed causing a blast of air to be directed, in the manner above described, against the inner end of the broken mandril to blow the stem portion out from the mandril engaging unit. That this may operate satisfactorily, the construction of the two housings 34 and 36 and of the nosepiece 10 is such that the passageway through which the blast of air passes is airtight. The illustrated tool thus comprises means for adjusting the angular relationship between the body portion of the tool and the nosepiece combined with means in the operation of the tool to transmit a blast of air through the nosepiece thereby to eject a stem portion of a mandril broken off as a result of a rivet setting operation.

The nosepiece 10 can be unscrewed from the sleeve 68 and removed. The unit 74 can then be unscrewed from the rack member 62, and another unit with an extension shaft, to make it of different length, such as 70' of Fig. 4, can be attached in its place. Flats 106 are provided that the unit 74 can be easily removed from the rack member 62, and the locknut 76 holds it fixed in position in the operation of the tool, for it will be realized that once the unit 74 has been correctly positioned with respect to the nosepiece 10, as shown in Fig. 1, it must not be allowed to move relative to the rack member 62. After the unit 74 has been changed for one of a different length 70' (Fig. 4), a nosepiece 10' of appropriate length is screwed into the sleeve 68.

Obviously the present invention is not limited to the illustrated pneumatic means for causing forward rivet setting movement of the first rack member 14. If other means, such as electromotive or electromagnetic means, be employed to move the rack 14 forwardly, the feature of having the broken stem portion of the mandril automatically ejected from the nosepiece by a blast of air may readily be retained without departing from the scope of the present invention: it being understood that, at the completion of the rivet setting movement of the tool, the piston will be forcefully returned rearwardly within the piston chamber by the compression spring 30, thereby creating pneumatic pressure within the rearward portion of the chamber, which pressure, instead of being ex-

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hausted to the atmosphere as through the exhaust port 118, may be conveyed by appropriate passageways through the adjustable housing members and thence through the nosepiece in the same manner as above related. Also, nosepieces constructed otherwise than as illustrated in the drawings may be employed without sacrificing the feature of providing means whereby the axis of the nosepiece may be disposed at varying angles in respect to the axis of the body portion of the tool.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A power actuated tool, for setting rivet assemblies by tensioning a mandril portion of an assembly, comprising: mandril engaging means operatively movable in one direction axially of the mandril to grip and tension the mandril; a driving member; power means for operatively moving the driving member in a direction other than in said one direction; and pivotally adjustable motion transmitting means positively coupling the mandril engaging means with said driving member; whereby the angular relationship between the direction of movement of said engaging means in said one direction may be varied relatively to the direction of movement of said driving means.

2. A power actuated tool, for setting rivet assemblies by tensioning a mandril portion of an assembly, comprising: mandril engaging means operatively movable in one direction axially of the mandril to grip and tension the mandril; a driving member; power means for operatively moving the driving member in a direction other than in said one direction; and pivotally adjustable means positively coupling the mandril engaging means with said driving member; said adjustable means including a gear rotatable about a fixed axis and in mesh with a toothed portion of the driving member; a toothed member operatively connected to said mandril engaging means and in mesh with said gear, and pivotally shiftable mounting means for maintaining the toothed member in contact with said gear while permitting said toothed member and mandril engaging means to be pivotally displaced about the axis of said gear.

3. In a portable rivet setting tool, having operatively movable means disposed within a nosepiece for gripping the stem of a rivet setting mandril and having manually controlled power means including a pneumatic piston disposed within the main body portion of the tool and a driving member driven thereby, adjustable means connecting the nosepiece with the body portion and operatively connecting said movable means with the driving member, said adjustable means comprising a gear rotatable about a fixed axis and in mesh with a toothed portion of the driving member, a toothed member operatively connected to said movable gripping means and in mesh with said gear, and shiftable mounting means for maintaining the toothed member in contact with the gear while permitting said toothed member and movable gripping means to be pivotally displaced about the axis of said gear.

4. A portable rivet setting tool, comprising a main body portion adapted to be manually supported; a circular gear mounted for rotation about an axis fixed with respect to said body portion; a power driven driving rack member in mesh with the gear and slidably mounted with respect to said body portion for imparting rotation to the gear; and a second rack member driven by the gear and slidably mounted for operative movement to impart a rivet setting pull to collets attached thereto, said second rack member being mounted so as to be pivotally shiftable to various positions of adjustment about the axis of the gear, whereby the angular relationship between the directions of movement of the racks may be varied while maintaining both racks in mesh with the gear.

5. A portable power tool for gripping and tensioning a rivet setting mandril, comprising a body portion adapted

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to be manually supported; a circular gear rotatably mounted on the body portion; power means associated with the gear for selectively oscillating the gear about its axis of rotation; a nosepiece provided with movable mandril engaging means operatively connected to said gear by a reciprocable toothed rack, said nosepiece being mounted upon said body portion for pivotal movement about the axis of the gear whereby the angular inclination of the nosepiece with respect to the body portion may be varied at will without affecting the operative connection between the gear and the mandril engaging means; and means for locking the nosepiece in the desired angular position of adjustment.

6. A power operated rivet setting tool comprising a pneumatic piston operatively mounted within a piston chamber provided in the main body portion of the tool; a piston rod mounted for reciprocal movement and having a free end in the form of a toothed rack extending from the piston chamber; a circular gear in mesh with said rack and mounted so as to be oscillatable about a

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fixed axis of rotation; a second rack in mesh with the gear and reciprocably slidable within a nosepiece assembly; movable means operatively connected to the second rack within the nosepiece for engaging and tensioning the mandril stem of a rivet; and adjustable mounting means for said nosepiece assembly constructed and arranged so that the second rack and the nosepiece together may be pivotally moved about the fixed axis of said gear to vary the angular relation between the nosepiece and the main body portion of the tool while maintaining the meshed power transmitting relationship between the gear and both racks.

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