March 8, 1949. F. H. THOMAS 2,463,656

ROTARY IMPACT TOOL

Filed Jan. 7, 1944 2 Sheets-Sheet 1

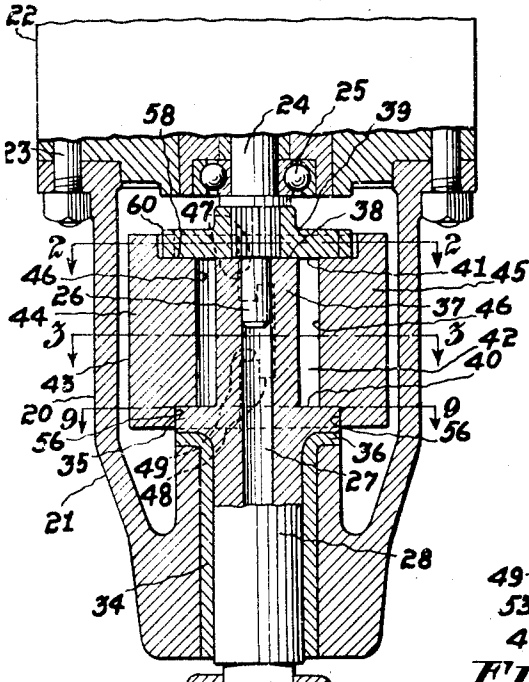


FIG.-1.

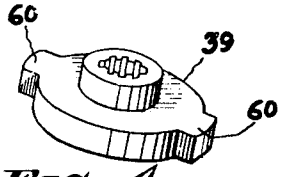


FIG.-4.

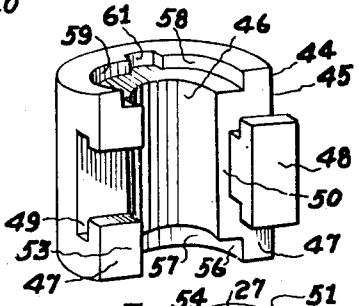


FIG.-5.

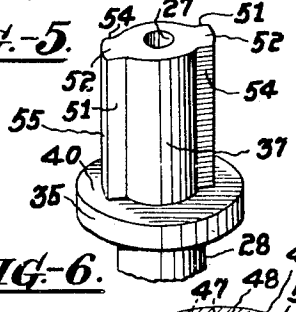


FIG.-6.

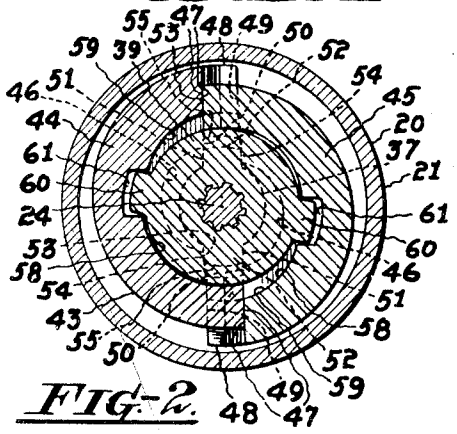


FIG.-2.

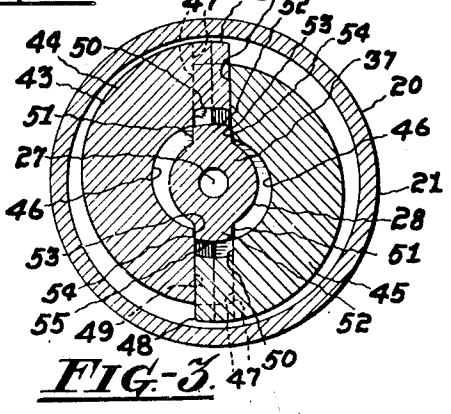


FIG.-3.

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ROTARY IMPACT TOOL

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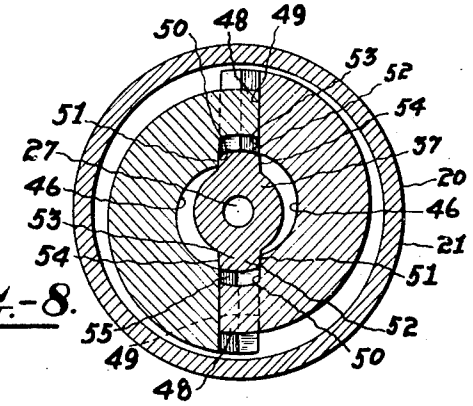


FIG.-8.

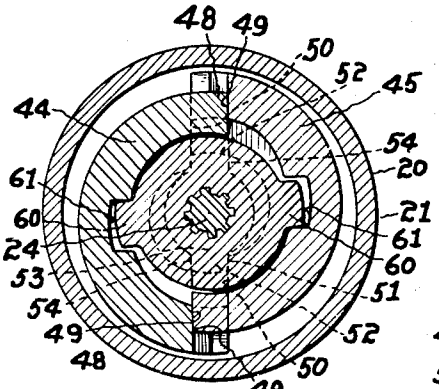


FIG.-7.

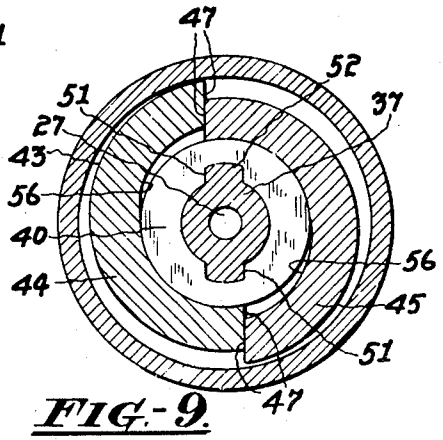


FIG.-9.

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2,463,656

ROTARY IMPACT TOOL

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Application January 7, 1944, Serial No. 517,393

10 Claims. (Cl. 192—30.5)

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This invention relates to impact tools, and more particularly to impact tools of the rotary type.

One object of the invention is to assure a driving force commensurate with the immediate requirements of the work.

Another object is to subject the work to a series of impacts whenever the torsional force of the tool proves ineffective for performing the work.

Another object is to simplify the construction of tools of this character and to assure a rugged tool comprising only a minimum number of parts which will be well able to withstand the rough usage to which tools of this character are usually subjected.

Other objects will be in part obvious and in part pointed out hereinafter.

In the drawings accompanying this specification and in which similar reference numerals refer to similar parts,

Figure 1 is an elevation, partly in section, of a tool constructed in accordance with the practice of the invention,

Figures 2 and 3 are transverse views taken through Figure 1 on the lines 2—2 and 3—3, respectively, and showing the impact elements of the tool in certain positions which they may assume in operation,

Figures 4, 5 and 6 are perspective views of details of the invention,

Figures 7 and 8 are views similar to Figures 2 and 3, respectively, showing the impact elements in other positions which they may assume in practice, said Figures 7 and 8 being taken on the lines 2—2 and 3—3, respectively, in Figure 1, and

Figure 9 is a transverse view taken through Figure 1 on the line 9—9.

Referring more particularly to the drawings, the impact tool, designated in its entirety by 20, comprises a casing 21 that is connected to a motor 22 by bolts 23.

The details of construction of the motor are omitted and only a front end portion of its casing is shown, but it is to be understood that the motor is intended to be of the constant speed, reversible type for selective operation in opposite hand directions. Its shaft 24, supported by a bearing 25, projects into the casing 21 and has a reduced stem 26 that extends rotatively into an axial bore 27 of a spindle 28 rotatable in the casing 21.

The forward end or shank 29 of the spindle 28 carries a tool 30, as for example a wrench shown as engaging a nut 31 for rotating it on a bolt 32 seated in a work piece 33.

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The spindle 28 is journaled in a bushing 34 in the forward end of the casing and has a cylindrical flange 35 that bears against a flange 36 at the inner end of the bushing 34 for supporting the weight of the spindle. The portion of the spindle 28 lying rearwardly of the flange 35 constitutes an anvil 37 and its end surface 38 abuts the forward end of a circular plate 39 that is in splined engagement with the motor shaft 24 immediately rearwardly of the stem 26.

The opposed surfaces 40 and 41 of the flange 35 and the plate 39, respectively, define a guideway 42 for an impact element 43 that forms a driving connection between the motor shaft 24 and the spindle 28 for normally rotating the spindle and to strike intermittent blows against the anvil 37 whenever an increased force is required to complete the work.

In the form illustrated, the impact element 43 consists of two members 44 and 45. The members 44 and 45 are identical with each other. They have registering axial, partly-cylindrical recesses 46 to receive the anvil 37. Exteriorly, the members 44 and 45 are also of partly-cylindrical shape and in the assembled positions of said members in the guideway 42 their opposed surfaces 47, located on the opposite sides of the recesses 46, are flatted and in slidable engagement with each other and are held in position for such engagement by suitable means on the members interlockingly engaging each other. Such means may, as shown, consist of a T-shaped wing 48 on a surface 47 of one member extending into a correspondingly shaped slot 49 in the opposed surface of the other member.

As a preferred arrangement each member is provided with one T-shaped portion 48 and one T-slot 49. However, if desired, a portion 48 may be formed on each of the surfaces 47 of one member and the slots 49 may be formed in both surfaces 47 of the other member.

The T-shaped portions 48 are of less width than the surfaces 47 and the areas of the surfaces 47 between the portions 48 and the recesses 46 constitute impact surfaces 50 for engagement with the side surfaces 51 of wings 52 on diametrically opposite sides of the anvil 37 and extending longitudinally thereof from the flange 35 to the upper or free end of the anvil. Similar areas on the surfaces 47 associated with the T-slots 49 constitute impact surfaces 53 for engagement with the opposite sides 54 of the wings 52.

Being interlocked with each other, the impact members 44 and 45 are capable of slidable movement only with respect to each other. This move-

ment is preferably limited to only such a degree as will enable the impact members to move into positions for disconnecting the surfaces **50**, or **53**, from the sides **51**, or **54**, of the wings **52**, depending upon the direction of rotation of the impact element. In order to enable this movement of the impact members to take place without hindrance from the anvil **37** the recesses **46** are described on a larger radius than the body portion of the anvil **37**. Owing to this arrangement, there will be sufficient clearance between one side edge of a recess **46** and the body of the anvil in a limiting position of an impact member to permit the opposite side edge of the same recess to pass over the outer surface **55** of the adjacent wings **52** to release the impact members **44** and **45** for rotation with respect to the anvil **37**. These outer surfaces **55** are suitably curved to conform substantially to the curvature of the walls of the recess **46**.

Means are provided to prevent the impact element **43** from moving with respect to the anvil **37** in directions other than those described hereinbefore. To this end the impact members are provided in their forward ends with partly circular registering recesses **56** to receive the flange **35**. The recesses **56** are of slightly oblong shape so that when in registry with each other they present a complete recess having a greater diameter in the plane of the contacting surfaces **47** than at right angles thereto.

This arrangement will permit the impact members **44** and **45** to slide the required distance relatively to the flange **35** in order that the impact surfaces of the members **44** and **45** may slide out of engagement with the sides of the wings **52**. The smaller diameter across the recesses **56** is only sufficiently larger than the diameter of the flange **35** to avoid binding engagement between the flange and the impact members at this point.

The curvature of the surfaces **57** of the recesses **56** leading from the surfaces **47** toward the plane of the smaller diameter of the recesses correspond approximately with the curvature of the flange **35** so that when the impact members slide relatively to the anvil in the guideway **42** the curved surfaces of the recesses **56** will roll over the peripheral surface of the flange **35** and the impact element will, in consequence, be prevented from wobbling loosely about the anvil.

The upper ends of the impact members **44** and **45** are guided in the same way by the plate **39**. Each impact member is provided in its upper end with a partly circular recess **58** of substantially the same shape as the recesses **56**, and the curved side surfaces **59** of the recesses **58** cooperate in like manner with the peripheral surface of the plate **39** for preventing uncontrolled lateral movement of the impact element relatively to the anvil.

In addition to its function as a guide for the upper ends of the members **44** and **45** the plate **39** also serves to transmit rotary movement from the motor shaft **24** to the impact element **43** and the spindle **28**. To this end the plate **39** is provided on diametrically opposite sides with radially extending wings **60** that lie in notches **61** located in the upper surfaces of the impact members in the plane of smaller diameter of the recess accommodating the plate **39**. The wings **60** engage the sides of the notches for driving the members **44—45** and are of less width than the notches to permit of free slidable movement of the impact members without hindrance by the said wings.

The operation of the device is as follows: Let it be assumed that it be intended to thread the nut

31 onto the bolt and that these elements are threaded in the right hand direction which requires, therefore, that the motor be rotated in the same direction. During this operation and while the nut **31** is rotating freely upon the bolt the impact members will occupy positions wherein the impact surfaces **50** will seat against the sides **51** of the wings. The anvil **37** and the nut **31** will then rotate with the motor.

The impact surfaces **50** will remain in contact with the sides **51** of the wings **52** as long as the nut **31** turns freely upon the bolt. But when the nut **31** is driven into engagement with the work piece **33** the resistance to turning will, consequently, increase and when such resistance reaches a certain value the plate **39** will slide the impact member **44** outwardly in one direction. The side **51** of the wing **52** will guide the impact member outwardly until the impact surface **50** of the member **44** is out of contact with the side **51**. In a similar manner and at the same time, the plate **39** will slide the impact member **45** outwardly in the opposite direction from that of the member **44**. The side **51** of the wing **52** will guide the impact member **45** outwardly until the impact surface **50** of the member **45** is out of contact with the side **51**. In this way the driving connection between the impact members **44—45** and the anvil will be broken and the anvil will remain momentarily stationary.

The impact members will then be free to rotate a partial revolution about the anvil and in doing so the curved surfaces of the recesses **46** will slide across the end surfaces of the wings **52** and the surfaces **57** and **59** will roll over the peripheral surfaces of the flange **35** and the plate **39**. In this way the impact members will be caused to slide in the opposite direction and be suitably guided to bring the surfaces **50** into position for reengagement with the sides **51** of the wings. The impact members will then strike sharply against the surfaces **51** and this force, transmitted through the spindle, will drive the nut **31** firmly into clamping position on the bolt **32**.

This operation of the tool may continue until the desired result has been achieved, that is to say, the motor will continue to rotate and the impact members will be intermittently positioned for striking against the anvil and to disconnect the anvil from the driver for tightening the nut on the bolt or for removing it. In the latter case the motor will, of course, rotate in a reverse direction to cause cooperation between the surfaces **53** and **54** of the impact members and the wings for driving the anvil and for declutching the driver from the anvil.

I claim:

1. A rotary impact tool, comprising a rotary driving member, a driven member, impact members rotatable with the driving member and slidable transversely of the driven member for interlocking engagement and disengagement with the driven member, and means on the driven member to engage the impact members for guiding the impact members to positions for engagement with the driven member and for guiding the impact members out of engagement with the driven member.

2. A rotary impact tool, comprising a rotary driving member, a driven member, an impact member rotatable with the driving member and reciprocable transversely of the members, means on the impact member to interlockingly engage the driven member for rotating the driven member, means on the driven member for guiding

the impact member transversely of the driven member for moving the said impact member out of interlocking engagement with the driven member, and means on the driven member to return the impact member to a position to strike against the driven member.

3. A rotary impact tool, comprising a rotary driving member, a driven member, a pair of impact members rotatable with the driving member and reciprocable transversely thereof, means on the impact members to interlockingly engage the driven member for rotating the driven member, means on the driven member for guiding both impact members simultaneously out of engagement with the driven member, and means on the driven member to return the impact members to positions for reengagement with the driven member.

4. A rotary impact tool, comprising a rotary driving member, a driven member, a pair of impact members rotatable with the driving member and slidable transversely of the driven member, guide means on the impact members slidably interlocked with each other, means on the impact members for interlocking engagement with the driven member, surfaces on the driven member for guiding the impact members out of interlocking engagement with the driven member, and other surfaces on the driven member to guide the impact members into engagement with the driven member.

5. A rotary impact tool, comprising a rotary driving member, a driven member, a pair of impact members rotatable with the driving member and slidable transversely of the driving and driven members, guide means on the impact members slidably interlocked with each other, means on the impact members to interlockingly engage the driven member for rotating said driven member, surfaces on the driven member for guiding the impact members relatively to each other to effect disengagement of the impact members from the driven member, and other surfaces on the driven member to guide the impact members into engagement with the driven member.

6. A rotary impact tool, comprising a rotary driving member, a driven member, means on the members to form a guideway transversely of the members, a pair of impact members rotatable with the driving member and slidable in the guideway, means on the impact members to interlockingly engage the driven member for rotating said driven member, surfaces on the driven member for guiding the impact members in the guideway and relatively to each other to effect disengagement of the impact members from the driven member, and surfaces on the driven member to return the impact members to positions for striking against the driven member.

7. A rotary impact tool, comprising a rotary driving member, a driven member, impact members slidably interlocked with each other and

rotatable with the driving member, wings on the driven member to receive the blows of the impact members, surfaces on the driven member to guide the impact members during sliding movement thereof for effecting disengagement of the impact members from the wings, and surfaces on the impact members and the wings to cooperate with each other to return the impact members to positions for striking against the wings.

8. A rotary impact tool, comprising a rotary driving member, a driven member, impact members slidably interlocked with each other and rotatable with the driving member, means to form a guideway transversely of the driven member for the impact members, means on the driven member to interlockingly engage the impact members to cause the driven member to normally rotate with the driving member and to guide the impact members out of driving engagement with the driven member whenever resistance to rotation of the driven member reaches a certain predetermined force, and surfaces on the driven member to return the impact members to positions for reengagement with the second mentioned means.

9. A rotary impact tool, comprising a rotary driving member, a driven member, impact members rotatable with the driving member and movable with respect to the driven member for engagement and disengagement with the driven member, surfaces on the driven member for guiding the impact members to positions for engaging the driven member, surfaces on the driven member for guiding the impact members out of engagement with the driven member, and means linking the impact members together to cause them to move in planes parallel with each other.

10. A rotary impact tool, comprising a rotary driving member, a driven member, impact members rotatable with the driving member and movable transversely of the driven member for interlocking engagement and disengagement with the driven member, means on the driven member to engage the impact members, surfaces on the driven member for guiding the impact members to positions for engagement with the driven member, surfaces on the driven member for guiding the impact members to move out of engagement with the driven member, and means linking the impact members together to hold them in parallel relation with each other.

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