

UNITED STATES PATENT OFFICE

2,128,761

IMPACT WRENCH

Floyd H. Thomas, Milan, Pa., assignor to Ingersoll-Rand Company, Jersey City, N. J., a corporation of New Jersey

Application July 3, 1937, Serial No. 151,958

5 Claims. (Cl. 192—54)

The present invention relates to an impact wrench of the rotary type. It relates more particularly to the type of device wherein a tool is rotated until the tool encounters a resistance torque set up by the work sufficient to prevent further rotation. When this occurs the device is adapted to deliver a series of hammering blows to the tool to overcome the resistance torque. In order that the work may receive a series of hammering impacts when the torsional force of the tool is insufficient to perform the work, a compression or tension member must act on the hammer delivering the impact. If springs are employed they will have to be replaced frequently due to breakage and wear with the consequent delay of the use of the tool.

It is, therefore, an object of the invention to provide a simplified structure in which there are no tension or compression members to replace. Another object is to provide an impact wrench in which no mechanical springs are employed.

A still further object is to provide a rugged structure of simple construction which will withstand the rough usage to which devices of this character are subjected.

These and other objects will be apparent from the following disclosure of which the drawing is a part.

In the drawing similar reference numerals refer to similar parts.

Figure 1 is a transverse view in section of a device embodying the principles of the present invention,

Figure 2 is a similar view of a modified device constructed in accordance with the principles of the present invention,

Figure 3 is a sectional view taken along line 3—3 of Figure 1, and

Figure 4 is a sectional elevation along line 4—4 of Figure 3.

Referring more particularly to the drawing, the impact wrench designated generally by the reference numeral 1, comprises a casing 3 secured by suitable means as the bolts 5 to the prime mover or motor 7. The motor 7, the details of which are not illustrated, is of the reversible type which may be selectively operated in either direction. An extension of the shaft 9 of the motor projects into the casing 3 and has an enlarged head 11 provided with a recess formed by the flange 13 on the head. Surrounding the head 11 is a cup-shaped hammer member 15.

At the lower end of the casing 3 is an opening in which is positioned an anvil 17 comprising

a cylindrical body portion 19 capable of rotation in the bearing 21 within the opening in the casing 3. On the upper portion of the anvil 17 is a flange 23 which bears against and rotates on a shoulder of the bearing 21. The lower portion of the anvil has a shank 25 to which a tool or wrench 27 may be secured. The wrench, for example, may be used to rotate the nut 29 on the bolt 31, but is by no means limited to such usage.

The hammer 15 is employed to transmit the rotation of the motor 7 to the anvil 17. The lower portion of the hammer is provided with clutch teeth 33 which are adapted to engage with similar clutch teeth 35 on the upper surface of the flange portion of the anvil. The rotation of the hammer is guided by a rod 37 which protrudes from the hammer into a recess 39 provided in the anvil 17. The rod 37 is coaxially aligned with the shaft 9 of the motor and the axis of rotation of the shank 25 thereby serving to guide the rotation of the hammer.

A driving connection is provided between the head 11 on the shaft 9 and the hammer 15 into which it extends.

The head 11 which is securely connected to the shaft 9 has a free running fit within the hammer. In order that the head may drive the hammer a driving connection must be made between them. In the present instant this connection consists of roller cams 43 rotatably mounted on studs which are in turn secured by threads to the wall of the hammer. These rollers are normally in contact with the flange 13 of the head which has formed thereon inclined surfaces or notches 44.

In the form of invention here illustrated there are three rollers provided and a corresponding number of notches. The depth of the notches exceeds the depth of the clutch teeth 33 and 35 and each notch is formed by two inclined surfaces inclined in opposite directions, but converging, and meet at their lowermost part to form a curved surface corresponding to the surface of the rollers.

When the head 11 is rotated with respect to the hammer 15, the cams 43 roll on the inclined surfaces of the notches as the hammer is raised with respect to the head. In order to maintain the rollers in constant engagement with the notch surfaces, some means of holding the hammer in its anvil engaging position must be supplied. With the present structure this means consists of a fluid under pressure, such as compressed air, which is introduced into a chamber 45 formed by the head 11 and the inside surface of the bottom wall of the hammer. Since there

is a clearance space between the head 11 and the hammer 15, a sealing member, such as the packing ring 49, is provided on the side wall of the head 11 to prevent communication between the chamber 45 and the chamber 47 formed between the motor 7, the head 11, and the casing 3. It will be noted that a passage 51 extends through the shaft 9 and head 11 and communicates with the chamber 45. This passage 51 permits admission and maintenance of a fluid such as air under compression in the chamber 45. The air pressure acts on the surface 53 and causes the hammer to act as a piston, consequently forcing the hammer constantly towards the anvil. Since there can be no escape of the compressed fluid from the chamber 45 through the clearance space between the head 11 and the hammer 15, air pressure will be maintained in the chamber 45.

In Figure 2 a slightly different construction has been shown. The shaft 9 does not have a head 11 integrally attached thereto. In this form of construction the head 11 is formed separately and has a tapered bore 55 which surrounds and fits over a tapered portion 57 on the shaft 9. The head 11 is secured to the shaft to prevent relative rotation therebetween by a key 59. The head 11 is secured to the shaft 9 against relative longitudinal movement by the nut 61 co-acting with threads on the end of the shaft.

Instead of providing a packing member 49 between the hammer and the head, two packing members 65 are provided on the outer surface of the hammer wall in order to prevent fluid leakage through the clearance space between the outer surface of the hammer wall and the inner surface of the casing wall.

The shaft passage 51 which communicates with chamber 45 is provided with a lateral passage 63 communicating with the chamber 47 above the hammer and head. It is thus apparent that the chambers 45 and 47 are in constant communication, and both are supplied with a fluid under pressure during the operation of the device.

The operation of the device will now be described: Assuming that the motor 7 is a compressed air motor it will be seen that when compressed air is supplied to the motor to cause the shaft 9 to rotate, air will also be supplied through the passage 49 to the chamber 43 in Figure 1. The pressure of the air will force the hammer against the anvil and, as the shaft 9 rotates, the clutch teeth 33 on the hammer will engage the clutch teeth 35 on the anvil and rotate the anvil, thereby turning the tool.

As long as the resistance torque set up by the nut 29 is insufficient to overcome the torque of the prime mover the nut 29 will be turned on the bolt 21. However, as soon as the resistance torque set up by the nut is sufficient to prevent further rotation of the anvil 17, the clutch teeth will tend to separate. These clutch teeth are so designed that the clutch teeth on the hammer will move up on the surface of the clutch teeth of the anvil as the driving member continues to rotate to thereby separate the hammer and anvil against the force of the compressed air in the chamber 43. As the shaft 9 continues to turn it tends to rotate the head with respect to the hammer as long as the clutch teeth are in engagement. Some relative rotation is permitted by the rollers 43 moving along the surface of the notches on the flange 13 and as soon as the rollers have risen on the inclined surfaces to a point where the clutch teeth are out of engagement, the hammer clutch teeth will rotate with respect to the anvil clutch

teeth until the teeth are again in a position which will permit re-engagement of the teeth. When this occurs the compressive force of the air will then press the hammer into contact with anvil and the rollers will come to rest at the bottom of the notches. As the hammer is brought into contact with the anvil, the hammer will strike the anvil clutch teeth with a blow due to the fact that the rollers on the hammer urged by the compressed air will roll forward and toward the bottom of the notches. Thus the hammer will be rotated by the driving head and by the compressed air which will cause the hammer to strike the anvil with a hammering blow when the anvil and hammer re-engage.

The device shown in Figure 2 will operate in the same manner as that shown in Figure 1. The only difference between the two structures is that the pressure exerted by the compressed air in Figure 2 is greater than that exerted in Figure 1, the reason for this being, of course, that the air pressure exerts its influence on the upper edges of the wall of the hammer as well as in the inner bottom surface. Consequently, the air pressure will be acting upon a piston of the external diameter of the hammer instead of on a piston of the internal diameter of the hammer.

I claim:—

1. In a tool of the character described, a rotary driving head, an anvil, a hammer member having a recess to receive the driving head and to thus form a pressure fluid chamber therebetween, engageable clutch members on the hammer member and anvil, means to introduce a pressure fluid in said chamber to normally maintain the clutch members in engagement and thereby maintain the hammer member slidably interlocked with the anvil, rollers on the hammer, and roller follower surfaces on the head coacting with the rollers to convert the pressure exerted by the pressure fluid into rotation of the hammer relative to the driving head.

2. In a rotary impact tool of the character described comprising a casing, a rotary driving member in the casing, an anvil in the casing, a hammer member in the casing having a recess to receive the driving member and to thus form a pressure fluid chamber therebetween and coacting with the driving member and casing to define a second pressure fluid chamber between the respective walls thereof, clutch means on the anvil and hammer member, means to introduce a pressure fluid in both said chambers to normally maintain the clutch means in engagement and thereby maintain the hammer member slidably interlocking with the anvil, rollers on one member, and roller follower surfaces on the other member coacting with the rollers to convert the pressure exerted by the pressure fluid into rotation of the hammer member relative to the driving head.

3. In a tool of the character described a rotary driving head member, an anvil, a hammer member having a recess to receive the driving head member and to thus form a pressure fluid chamber therebetween, clutch means on said members, means to introduce a pressure fluid in said chamber to normally maintain the clutch means in engagement and thereby maintain the hammer slidably interlocked with the anvil, means to vent said chamber of pressure fluid when the clutch means are disengaged, and means including rollers on one member and roller follower surfaces on the other member to convert the pressure

exerted by the pressure fluid into rotation of the hammer relative to the driving head.

4. In a tool of the character described comprising a casing, a rotary driving head member in the casing, an anvil extending into the casing, a hammer member in the casing having a recess to receive the head member and thus form a pressure fluid chamber therebetween and coacting with the casing and head member to form a second pressure fluid chamber between the walls thereof, clutch means on said members, means to introduce a pressure fluid into both of said chambers to normally maintain the clutch means in engagement and thereby maintain the hammer member slidably interlocked with the anvil, said means serving to conduct pressure fluid from the first said chamber to the second said chamber when the clutch means are disengaged, rollers on the hammer member and roller follower sur-

faces on the head member coacting with the rollers to convert pressure exerted by the pressure fluid in said chambers into rotation of the hammer relative to the driving head.

5. In a tool of the character described comprising a casing, a rotary driving head member in the casing, an anvil in the casing, a hammer member in the casing, cooperating clutch means on the hammer member and anvil, piston means on the hammer member, means to introduce fluid pressure into the casing to act on the piston means to normally maintain the clutch means in engagement and thereby maintain the hammer member slidably interlocked with the anvil, and means including rollers on one member and coacting roller follower surfaces on the other to rotate the hammer member with respect to the driving member.

FLOYD H. THOMAS.