May 20, 1958 T. J. O'CONNOR ET AL 2,835,474

DRILL ATTACHMENT

Filed May 5, 1955

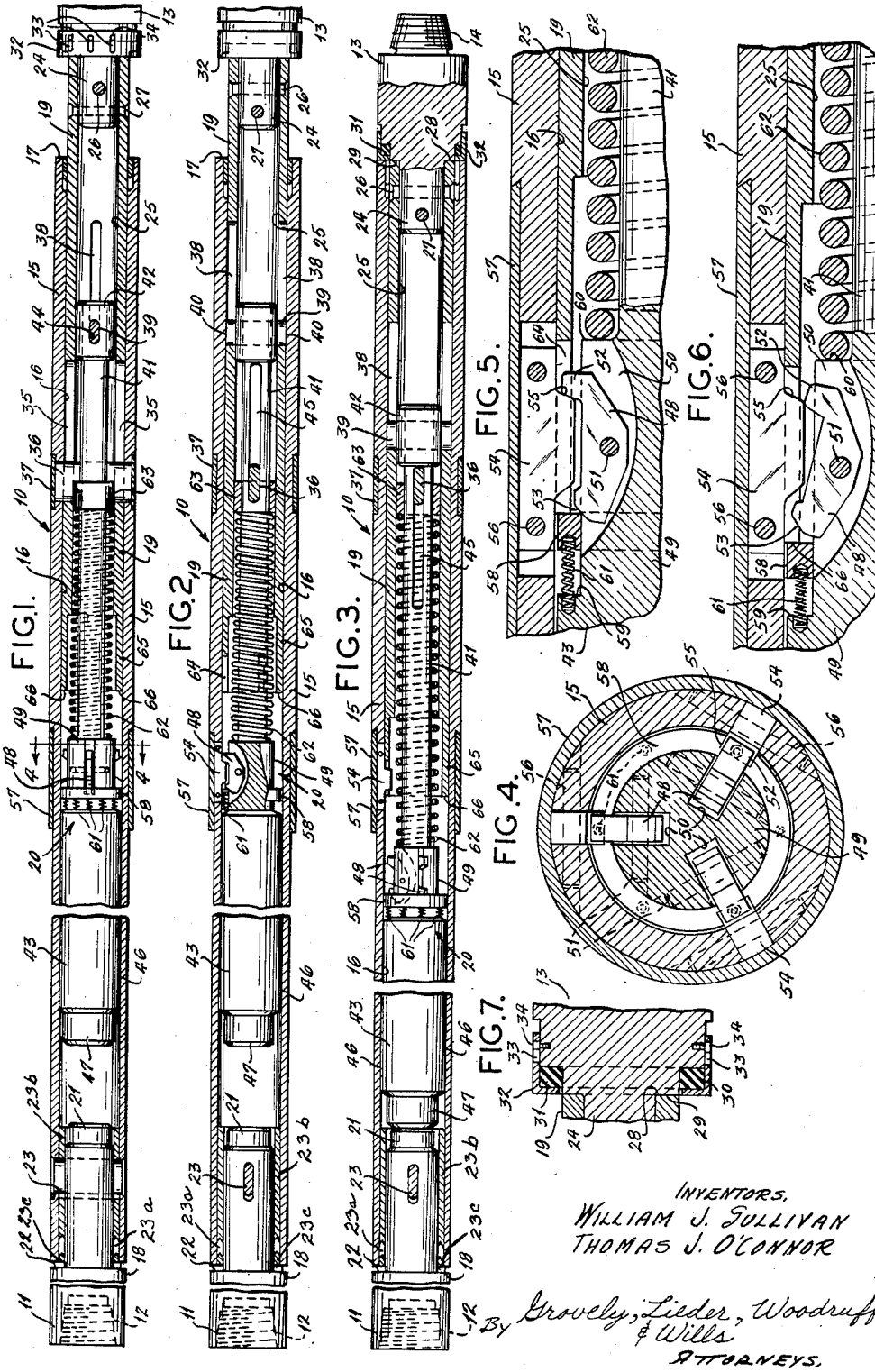


FIG. 1.

FIG. 2.

FIG. 3.

FIG. 5.

FIG. 6.

FIG. 4.

FIG. 7.

INVENTORS.
WILLIAM J. SULLIVAN
THOMAS J. O'CONNOR

By Grovely, Lieder, Woodruff & Wills
ATTORNEYS.

United States Patent Office 2,835,474 Patented May 20, 1958

2,835,474

DRILL ATTACHMENT

Thomas J. O'Connor, Kansas City, and William J. Sullivan, Normandy, Mo., assignors to Unexcelled Die & Supply Co., St. Louis, Mo., a corporation of Missouri

Application May 5, 1955, Serial No. 506,236

7 Claims. (Cl. 255—37)

This invention relates to drilling devices generally, and more particularly to an improvement in drill attachments for use with churn drilling apparatus.

In the past many drill attachments for churn drilling apparatus have been provided for delivering a percussive stroke to a drill bit in addition to the gravity stroke thereof, but none of them has been entirely satisfactory. Drill attachments of this type are generally referred to as "double action" or "double blow" drill attachments in that two blows are delivered to a drill bit instead of only one whereby the drilling efficiency is greatly improved. However, the prior art devices ordinarily have employed triggers for locking a casing having a bit anvil secured thereto and a relatively slidable spring-biased hammer in "cocked" position in which the hammer is spaced from the anvil and the spring is compressed. These triggers were moved out of locking engagement between the casing and the hammer by other slidable means in the casing which positively, forcefully and frictionally contacted and unlocked the triggers so that the spring moved the hammer against the anvil. Of course, the force of the slidable means on the triggers resulted in extreme wear of the parts whereby the life of the drill attachment was relatively short. Furthermore, cushion means for preventing high impact forces between the relatively slidable parts has not been provided in these prior art devices.

The principal object of this invention is to provide a greatly improved double blow drill attachment in which the extreme wear of parts is obviated thereby increasing the usable life of the drill attachment.

Another object is to provide a double blow drill attachment having novel power restraining means for releasably spacing a spring-biased hammer from an anvil, the power restraining means being releasable with a minimum of frictional force being exerted thereon to initiate the percussive stroke of the hammer against the anvil.

A more specific object is to provide a double blow drill attachment in which a spring-driven hammer is locked in a casing by a pivoted trigger that is maintained in hammer locking position by a yieldable plunger acting in opposition to the hammer driving spring, and projection means slidable toward the plunger and being offset from the trigger for by-passing the trigger to depress the plunger so that the hammer may move relative to the anvil. Still further, another object is to pivotally mount a trigger so that a minimum frictional wear on the trigger takes place when the hammer is moved relative to the anvil.

Still another object of the present invention is to provide novel cushion means for a double blow drill attachment whereby impact forces between the parts will be dissipated without deformation or wear of the parts.

A still further object is to provide an improved drill attachment capable of producing a percussive stroke of great force in addition to the gravity stroke whereby drilling efficency is greatly increased.

These and other objects and advantages will become apparent hereinafter.

The invention is embodied in a drill attachment including a casing and a spring driven hammer within the casing, spaced dogs releasably locking the hammer to the casing and a plunger maintaining the dogs in locking condition whereby the spring is compressed, and a sleeve slidable in the casing for moving the plunger out of engagement with the dogs permitting the spring to drive the hammer with striking force against an anvil secured to the casing. The invention is further embodied in a cushion which absorbs shock forces between the casing and the slidable sleeve.

The invention also consists in the parts and in the arrangements and combinations of parts hereinafter described and claimed. In the accompanying drawings which form a part of this specification and wherein like numerals refer to like parts wherever they occur:

Fig. 1 is a longitudinal sectional view of the drill attachment showing the spring driven hammer locked to the casing prior to the percussive stroke,

Fig. 2 is a longitudinal view taken substantially 90° from the view shown in Fig. 1,

Fig. 3 is a view similar to Fig. 2 showing the relative position of the parts of the drill attachment following the percussive stroke,

Fig. 4 is a greatly enlarged cross-sectional view taken substantially along line 4—4 of Fig. 1,

Fig. 5 is an enlarged fragmentary sectional view showing the trigger arrangement of Fig. 2 in greater detail,

Fig. 6 is a view similar to Fig. 5, but showing the plunger depressed and the trigger being pivoted by the spring, and

Fig. 7 is an enlarged fragmentary sectional view of the cushion retainer.

Referring to the drawings in detail, the invention is embodied in a drill attachment **10** adapted to be operatively connected between a drill bit or cutting tool (not shown) and a drill rod or shank (not shown) in a churn drilling apparatus. One end of the drill attachment **10** is provided with a bit coupler **11** having a threaded socket or opening **12** or the like for attaching the drill bit thereto, and the other end of the drill attachment **10** is provided with a shank coupler **13** having a threaded projection **14** or the like for attaching the drill shank thereto.

The drill attachment **10** comprises a cylindrical or tubular casing **15** having an inner wall **16** and open upper and lower ends **17** and **18**, a sleeve **19** positioned adjacent to the end **17** of the casing **15** for limited sliding movement relative thereto, a hammer assembly **20** positioned intermediate the ends **17** and **18** of the casing **15** for limited sliding movement therein, and a knocker or anvil **21** in the end **18** of the casing **15** in position to be contacted by the hammer assembly during operation of the device as will appear hereinafter. The cylindrical anvil **21** may be integrally formed with the bit coupler **11** and a radial abutment **22** is provided therebetween, the anvil **21** being concentrically positioned in the casing **15** and a key **23** or the like passed through the anvil into the casing wall to prevent relative rotation therebetween. However, the anvil **21** is not rigidly secured to the casing **15** by the key **23**, but limited axial movement is permitted between the bit coupler **11** and the casing **15**.

Inasmuch as water and other fluids are frequently found in drill holes, suitable annular packing material **23***a* is provided between the anvil **21** and the casing **15** to prevent the fluids from passing into the interior of the casing **15**. The packing material **23***a* is held in fixed position with the casing **15** by a sleeve **23***b* secured on the key **23** and a packing nut **23***c* threadedly received in the end **18** of the casing **15**.

The sleeve **19** is rigidly secured to the shank coupler **13** by means of a cylindrical stud **24**, which may be

formed integral with the shank coupler and project into the bore 25 of the sleeve 19. Pins 26 and 27 may be provided to secure the stud 24 to the sleeve 19, the pin 26 being transversely positioned relative to the pin 27. As shown best in Fig. 7, the sleeve 19 has an end 28 fixedly positioned on a cooperating annular seat 29 formed on the shank coupler adjacent to the stud 24, the seat 29 forming a first step having an outer wall conterminous with the outer surface of the sleeve 19. A second step or seat 30 is formed on the body of the coupler adjacent to the first step, and a resilient annular pad or cushion 31 is positioned thereon. The cushion 31 is encased by a flanged collar or cushion retainer 32 having an outer diameter equal to that of the casing 15 and shank coupler 13, the collar 32 being provided with longitudinal slots 33 in which bolts 34 or the like are secured to the coupler 13. It is now apparent that the collar 32 can move axially relative to the coupler 13 except as restricted by the resilient cushion 31 or the abutment of the bolts 34 on the ends of the longitudinal slots 33.

The sleeve 19 is provided with a pair of lower longitudinal slots 35 in opposed diametral relationship in which a sleeve guide key 36 is positioned, the key 36 being secured in the walls of the casing 15 and enclosed by a circumferential collar or split cover ring 37. A pair of upper longitudinal slots 38 formed in the sleeve 19 are axially spaced from the slots 35 and positioned on a diametral plane extending transversely of the plane on which the lower slots 35 are positioned. A hammer guide key 39 extends through the slots 38 and has ends 40 slidably engaged on the inner wall 16 of the casing 15. The keys 36 and 39 co-act in guiding the sleeve 19 and the hammer assembly 20 during the operation so that no rotational movement relative to the casing 15 takes place, as will become apparent hereinafter.

The hammer assembly 20 comprises a cylindrical rod or shaft 41, which is concentrically positioned in the center of the casing 15 and has a guide plug 42 secured to its upper end and a hammer 43 secured to its lower end. The guide plug 42 is slidably positioned in the bore 25 of the sleeve 19 and has an opening 44 for receiving the key 39, which extends between the upper longitudinal slots 38 in the sleeve 19. The cylindrical rod 41 is also provided with a longitudinal aperture 45 adjacent to the guide plug 42, which aperture corresponds in size to the lower slots 35 in the sleeve 19 and registers therewith so that the sleeve guide-key 36 passes through the aperture 45 and guided but limited relative movement between the sleeve 19 and the hammer assembly 20 is provided. The hammer 43 has an outer surface 46 in sliding contact with the inner surface 16 of the casing 15, and a hammer head 47 is formed on the lower end of the hammer 43 in concentric spaced relation with the inner wall 16. The hammer head 47 and the anvil 21 may be constructed of an extremely hard material to prevent their deformation when the drill attachment 10 is in operation.

As shown best in Figs. 4, 5 and 6, a novel triggering arrangement is provided for locking the hammer assembly 20 to the casing 15 during the upward movement of the drill attachment 10 and for maintaining them in fixed relation until after the gravity stroke of the bit has been completed, the triggering arrangement thereafter being cammed from locking engagement whereby the percussive stroke will be delivered to the bit, as will be described more fully hereinafter. The triggering arrangement comprises a plurality of dogs or triggers 48, which are pivotally mounted on a circular base or block 49 formed between the cylindrical rod 41 and the hammer 43. The base 49 has spaced radially-extending grooves 50 in its outer periphery and the dogs 48 are positioned therein. Each of the dogs 48 is pivotally mounted in one of the grooves 50 on a pin 51, the dogs 48 having radial outwardly-extending detents 52 at their upper ends and diagonal outwardly-extending abutment surfaces 53 on their lower ends. The casing 15 is provided with a plurality of spaced catch plates 54 having radial shoulders 55 formed on their upper ends, the plates 54 being rigidly secured to the casing 15 by pins 56 and enclosed by an outer sleeve or cover ring 57. The hammer assembly 20 is locked to the casing 15 by the engagement of the detents 52 of the dogs 48 on the shoulders 55 of the catch plates 54, and an annular plunger 58 or the like is provided to maintain this locked condition until after the gravity stroke of the drill bit has been completed.

Still referring to Figs. 5 and 6, the circular base 49 has an outside diameter that is smaller than that of the hammer 43 so that a radial shoulder 59 is formed therebetween, the outside diameter of the base 49 being larger than the diameter of the cylindrical rod 41 so that another radial shoulder 60 is formed therebetween. The annular plunger 58 is positioned about the outer periphery of the base 49 and in sliding contact therewith, and a plurality of springs 61 are provided to normally maintain the plunger 58 and the radial shoulder 59 in spaced relation. It is now apperent that when the plunger 58 is spaced from the shoulder 59 by the springs 61, it will contact the abutment surfaces 53 of the dogs 48 thereby pivoting the detents 52 into position to engage the shoulders 55 of the catch plates 54 when the drill attachment 10 is lifted.

A heavy pressure helical spring 62 comprises the force producting means for driving the hammer assembly 20 downwardly so that the hammer head 47 strikes the anvil 21. The spring 62 is positioned about or circumscribes the cylindrical rod 41, one of the spring ends being seated on the radial shoulder 60 of the base 49 and the other end being positioned against a spring retainer 63 (Figs. 1, 2 and 3). The spring retainer 63 is a collar having longitudinally extending diametrally opposed notches received on the sleeve guide key 36 and maintained thereagainst by the spring 62 so that no movement of the spring retainer 63 relative to the casing 15 can take place. The spring 62 is fully compressed between the radial shoulder 60 and the retainer 63 when the drill attachment 10 has been raised and the hammer assembly 20 is locked to the casing 15.

The sleeve 19 has a plurality of axially-extending slots 64 in its lower end providing spaced projections 65 having end surfaces 66 thereon, the slots 64 being aligned with the dogs 48 so that after the gravity stroke the sleeve 19 will continue to slide downwardly relative to the locked casing 15 and hammer assembly 20 until the slots 64 have received the dogs 48 therein. Inasmuch as the projections 65 are out of the plane of the dogs 48, or are offset circumferentially relative thereto the projections will by-pass the dogs 48 and the end surfaces 66 will contact the plunger 58. The plunger 58 is thus depressed to permit the pressure spring 62 to cam or pivot the detents 52 from engagement with the catch plates 54 whereby the percussive stroke is initiated. Having now described the invention in detail, the operation of the drill attachment 10 will now be described to more fully point out the coaction of the parts thereof.

Assuming that the drill attachment 10 has just completed a drilling operation and that the parts thereof are relatively positioned as shown in Fig. 3, the drill attachment 10 will be raised a predetermined distance by the drill rig preparatory to dropping the entire assembly to effect another drilling operation. On the upward stroke, the weight of the casing 15, together with the bit coupler 11 and drill bit provides a gravity load which is transmitted through the sleeve guide key 36 and the spring retainer 63 to overcome the force of the spring 62 when the sleeve 19 and hammer assembly 20 are raised relative to the casing 15. The upward force exerted by the drill rig is transmitted through the shank coupler 13 and sleeve 19 to the hammer guide key 39, which is positioned in the guide plug 42 of the hammer

assembly 20. The sleeve 19 and hammer assembly 20 are thereby raised relative to the casing 15 until the dogs 48 are pivoted into locking engagement with the catch plates 54. Furthermore, the upward force of the springs 61 position the plunger 58 against the abutment surfaces 53 of each of the dogs 48 so that the detents 52 are maintained in locked relation with the plates 54, the hammer assembly 20 thus being locked relative to the casing 15. It is apparent that as the hammer assembly 20 is raised relative to the casing 15, the hammer 43 is moved into spaced relation with the anvil 21 and the pressure spring 62 is compressed between the radial shoulder 60 of the base 49 and the spring retainer 63.

Simultaneously with the locking action just described, the lower longitudinal slots 35 of the sleeve and the longitudinal opening 45 in the cylindrical rod 41 have passed upwardly on the sleeve guide key 36, which is now in abutting relation with the lower edges of the slots 35. Further lifting action by the drill rig will carry the entire drill attachment 10 with it until the predetermined distance for dropping the drill attachment has been traversed. This lifting or raising action "cocks" the drill attachment (Figs. 1 and 2) and the parts are conditioned to effect a percussive stroke following the gravity stroke when the drill attachment is dropped, as will now be described.

When the drill attachment 10 is dropped, the entire assembly will fall at an accelerated rate of speed until the drill bit strikes the object to be drilled, this initial impact being called the gravity blow or stroke. As the gravity stroke is delivered, the sleeve 19 continues to move downwardly relative to the casing 15, the upper and lower longitudinal slots 38 and 35 sliding on the guide keys 39 and 36, respectively. The projections 65 on the lower end of the sleeve 19 by-pass the dogs 48 and the end surfaces 66 contact with the plunger 58 whereby the plunger 58 is depressed. It is now apparent that the arrangement of keys and slots in the relatively movable parts of the drill attachment 10 prevent any relative rotational movement therebetween so that proper alignment of the slots 64 in the sleeve 19 with the dogs 48 is maintained at all times.

The rapid downward descent of the sleeve 19 relative to the casing 15 is retarded by the contact of the annular flanged collar 32 on the upper end 17 of the casing 15 whereby the resilient cushion 31 will be compressed to absorb the shock forces which would otherwise be exerted between rigid metal parts of the casing 15 and sleeve 19 or shank coupler 13. As the compression of the cushion 31 is completed, the upper edges of the lower longitudinal slots 35 in the sleeve contact the sleeve guide key 36 so that the movement of the sleeve 19 relative to the casing 15 will be finally stopped thereby.

When the plunger 58 is depressed by the projections 65 of the sleeve 19, it is moved axially out of contact with the abutment surfaces 53 of the dogs 48 and the force of the compressed pressure spring 62 on the radial shoulder 60 of the base 49 will cause the dogs 48 to pivot on pins 51 so that the detents 52 will be moved off of the catch plates 54 with a minimum of frictional force being exerted therebetween. The spring exerts a downward force directly on the hammer 43 causing it to slide in the casing 15 against the anvil 21 whereby the percussive blow or stroke is delivered to the drill bit. It is apparent that the force of the gravity blow is determined by the weight of the drill attachment and the height from which it was dropped, and the force of the percussive blow is determined by the weight of the hammer assembly 20 and the tension of the spring 62. Furthermore, the only restriction on the size of the spring 62 is that the casing 15 and drill bit be of sufficient weight to effect the compression thereof.

This invention is intended to cover all changes and modifications of the example of the invention herein chosen for the purposes of the disclosure, which do not constitute departures from the spirit and scope of the invention.

What we claim is:

1. A double blow drill attachment comprising a casing member, a hammer member movable in said casing member, compressible means having a first end mounted on said casing member and a second end on said hammer member, a trigger mounted on one of said hammer and casing members and engageable on the other of said members to hold said compressible means energized, yieldable means for contacting and holding said trigger in engaged position on said other member, a third member movable relative to said casing and hammer members and having a projection adapted to move said yieldable means out of contact with said trigger whereby said compressible means is actuated to move said hammer member relative to said casing member, and an anvil member adapted to be contacted by said hammer member when said compressible means is actuated.

2. A double blow drill attachment comprising a tubular casing, a bit coupler including an anvil mounted on one casing end, a sleeve positioned in the other casing end for limited movement relative thereto, a shank coupler positioned on the sleeve outwardly of the other casing end, a hammer positioned in said casing for axial movement relative to said casing and said sleeve, a spring between said casing and said hammer for biasing said hammer toward said anvil, spaced dogs releasably locking said hammer to said casing, yieldable means for maintaining said dogs in locked position between said hammer and casing, said sleeve being movable into engagement with said yieldable means to move said yieldable means away from said dogs whereby said hammer and casing become unlocked and said spring is actuated to move said hammer into contact with said anvil.

3. A double blow drill attachment comprising a tubular casing, a bit coupler including an anvil mounted on a first casing end; a sleeve slidably positioned in a second casing end; a shank coupler attached to said sleeve outwardly of said second casing end; a hammer assembly positioned in said casing intermediate its ends and having one end in slidable contact with said sleeve and the other end in slidable contact with said casing, a first guide between said hammer assembly and said sleeve for limiting relative reciprocation therebetween, said first guide preventing relative rotation between said hammer assembly and sleeve, a second guide between said hammer assembly and sleeve extending into the walls of said casing thereby limiting reciprocation of said sleeve and hammer assembly relative to said casing, said second guide preventing relative rotation between said hammer assembly, sleeve and casing; a pressure spring axially compressible between said hammer assembly and casing for biasing said hammer assembly toward said anvil; a trigger releasably locking said hammer assembly to said casing with said spring in compressed condition; yieldable means for maintaining said trigger in hammer assembly and casing locking position; said sleeve being slidable into trigger releasing contact with said yieldable means whereby said hammer assembly and casing become unlocked and said pressure spring is actuated to move said hammer assembly toward said anvil.

4. A double blow drill attachment comprising a tubular casing; a bit coupler including an anvil mounted on a first casing end; a sleeve slidably positioned in a second casing end; a shank coupler attached to said sleeve outwardly of said second casing end; cushion means between said bit coupler and said second casing end; a longitudinal hammer assembly positioned in said casing intermediate its ends and having a guide block at one end and a hammer member at the other end, said guide block being slidably positioned in said sleeve and said hammer member being slidably positioned in said casing adjacent said first end, a first key extending diametrally through said sleeve and guide block and having end surfaces in sliding contact

with the inner wall of said casing, said sleeve having diametrally aligned longitudinal slots through which said first key extends so that limited relative sliding movement is provided between said guide block and said sleeve, a second key extending diametrally through said sleeve and hammer assembly adjacent to said guide block and having end surfaces attached in the walls of said casing, said sleeve and hammer assembly each having longitudinal slots through which said second key extends so that limited relative sliding movement is provided between said sleeve and hammer assembly and said casing, said first and second keys providing substantially rectilinear reciprocation between said casing, sleeve and hammer assembly; a coil pressure spring having one end mounted against said second key and the other end positioned against said hammer assembly; spaced triggers pivotally mounted on said hammer assembly and releasably lockable on said casing for holding said coil pressure spring compressed and said hammer member in spaced relation with said anvil; compressible means for maintaining said triggers in locked condition between said hammer assembly and casing, said sleeve being slidable past said triggers into compressing contact with said compressible means whereby said hammer assembly and casing become unlocked and said hammer member is moved into contact with said anvil by said coil pressure spring.

5. A double blow drill attachment comprising a casing, a bit coupler including an anvil mounted on one end of said casing, a sleeve member reciprocably positioned in the other end of said casing, a shank coupler secured to one end of said sleeve member outwardly of said other end of said casing, a hammer assembly including a hammer member positioned within said casing and axially movable relative to said sleeve member and said casing for engagement with said anvil, first yieldable means between said casing and said hammer assembly for forcibly moving said hammer member into drilling impact with said anvil, spaced detents pivotally mounted on said hammer assembly and releasably locking said hammer assembly to said casing to restrain said first yieldable means and prevent relative movement between said casing and hammer assembly, second yieldable means on said hammer assembly maintaining said detents in engagement with said casing, said sleeve member being slidable into engagement with said second yieldable means to move said second yieldable means away from said detents whereby said first yieldable means are effective to actuate said hammer member into engagement with said anvil.

6. A double blow drill attachment comprising a tubular casing, a bit coupler including an anvil mounted on one casing end, a shank coupler positioned in the other casing end for limited movement relative thereto, a hammer positioned within said casing for limited axial movement relative thereto, compressible means between said casing and said hammer, trigger means releasably locking said hammer to said casing, said trigger means including a plurality of spaced dogs pivotally mounted on said hammer each of which has a projection thereon, said casing having projecting surfaces on the inner periphery thereof adapted to be engaged by said projections on said dogs, yieldable means for maintaining said trigger means in hammer and casing locking position, said yieldable means including an annular plunger yieldably contacting a portion of said dogs remote from the projections thereof, and a sleeve movable in said casing into compressing contact with said yieldable means whereby said hammer and casing become unlocked and said compressible means is actuated.

7. A double blow drill attachment comprising a casing, a bit coupler including an anvil mounted on one end of said casing, a sleeve member reciprocably positioned in the other end of said casing, a shank coupler secured to one end of said sleeve member outwardly of said other end of said casing, a hammer assembly including a hammer member positioned within said casing and axially movable relative to said sleeve member and said casing for engagement with said anvil, a spring between said casing and said hammer assembly for forcibly moving said hammer member into drilling impact with said anvil, spaced detents pivotally mounted on said hammer assembly releasably locking said casing and hammer assembly together with said spring in compressed condition, yieldable means on said hammer assembly maintaining said detents in hammer assembly and casing locking position, said sleeve member being slidable into engagement with said yieldable means to move said yeildable means away from said detents whereby said spring is effective to actuate said hammer member into engagement with said anvil, and resilient cushion means mounted on said shank coupler in position to be compressed between said other end of said casing and said shank coupler when said sleeve member engages said yieldable means.

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