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Cooley et al.

[11] **3,881,554**

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[54] **MECHANICALLY ACTUATED HAMMER AND BIT ASSEMBLY THEREFOR**

[76] Inventors: **William C. Cooley**, 5400 Pooks Hill Rd., Bethesda, Md. 20014; **Franklin L. Beck**, 3040 39th St., N.W., Washington, D.C. 20016

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[52] **U.S. Cl.** **173/13**; 91/276; 173/119; 173/127; 173/139; 173/162

[51] **Int. Cl.** **B25d 9/04**

[58] **Field of Search** ..... 173/13, 119, 127, 139, 173/162; 91/4 R, 5, 276; 92/23, 140; 404/133; 299/69, 70; 74/18.2, 379 R

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Primary Examiner—Frank L. Abbott
Assistant Examiner—William F. Pate, III
Attorney, Agent, or Firm—Edwin E. Greigg

[57] **ABSTRACT**

A percussion bit assembly for use with a mechanically actuated hammer, and of a mechanically actuated hammer including the above-mentioned percussion bit assembly and an exemplary actuator. The percussion bit assembly is constructed to include a percussion bit and a plurality of toroidal springs mounted to provide lateral reactive forces in response to lateral movement of the percussion bit. A brake structure is also included which directly engages the percussion bit.

22 Claims, 3 Drawing Figures

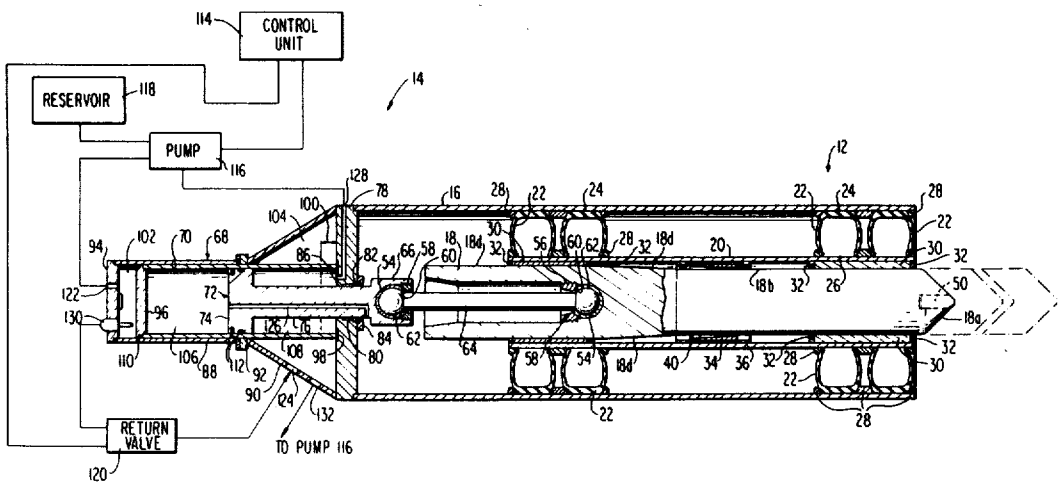
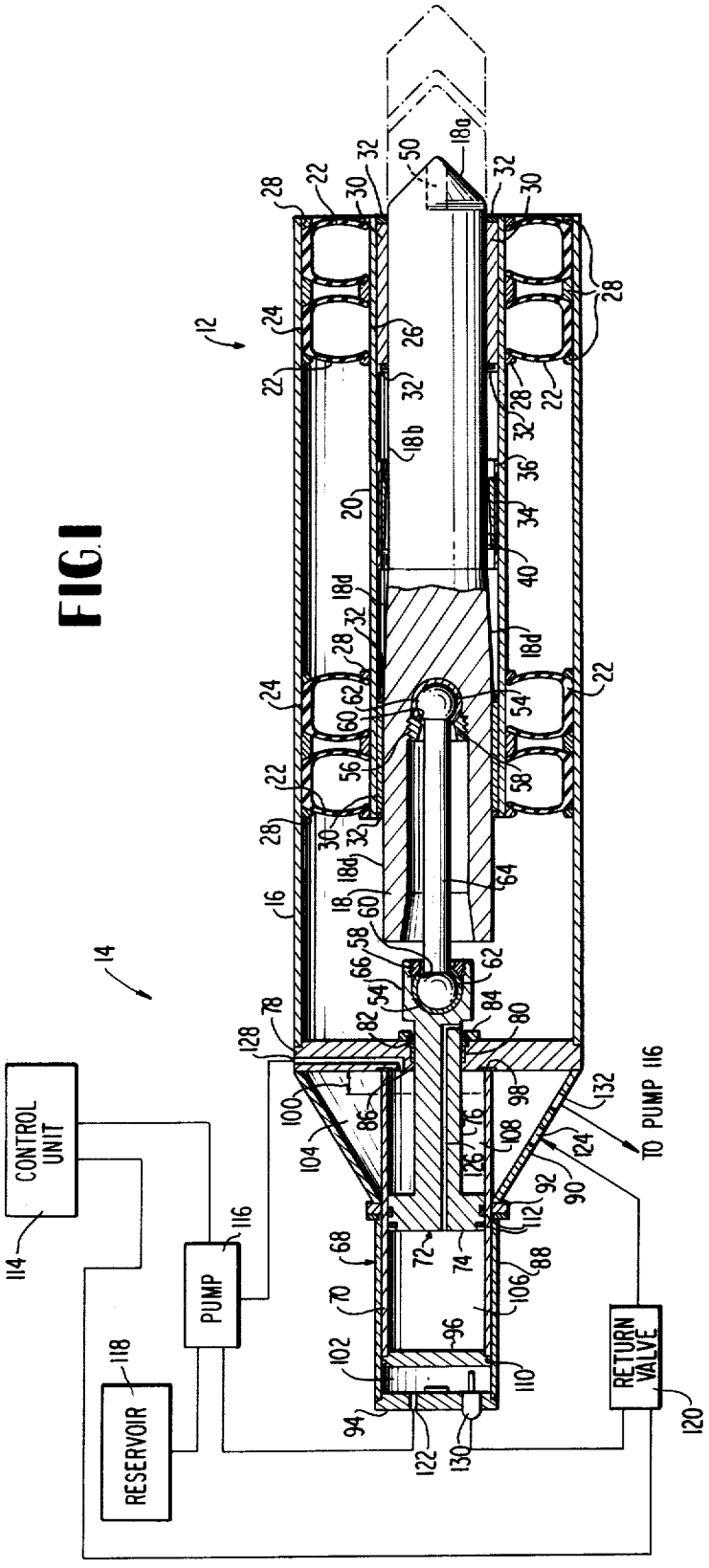


FIG.1



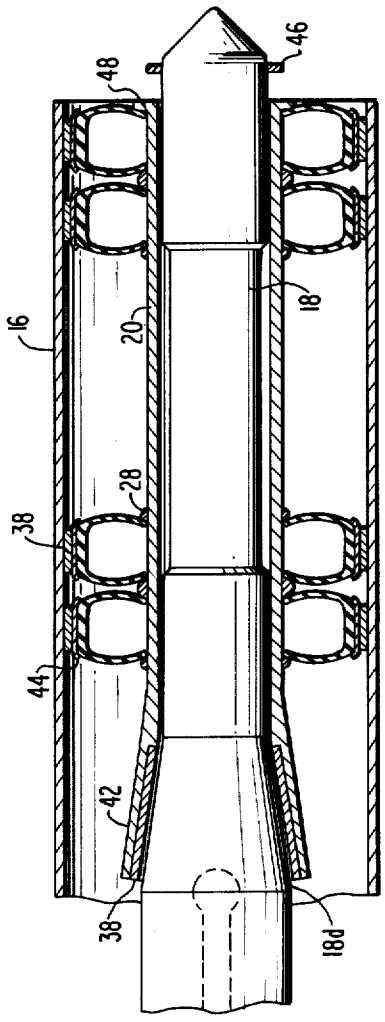


FIG.2

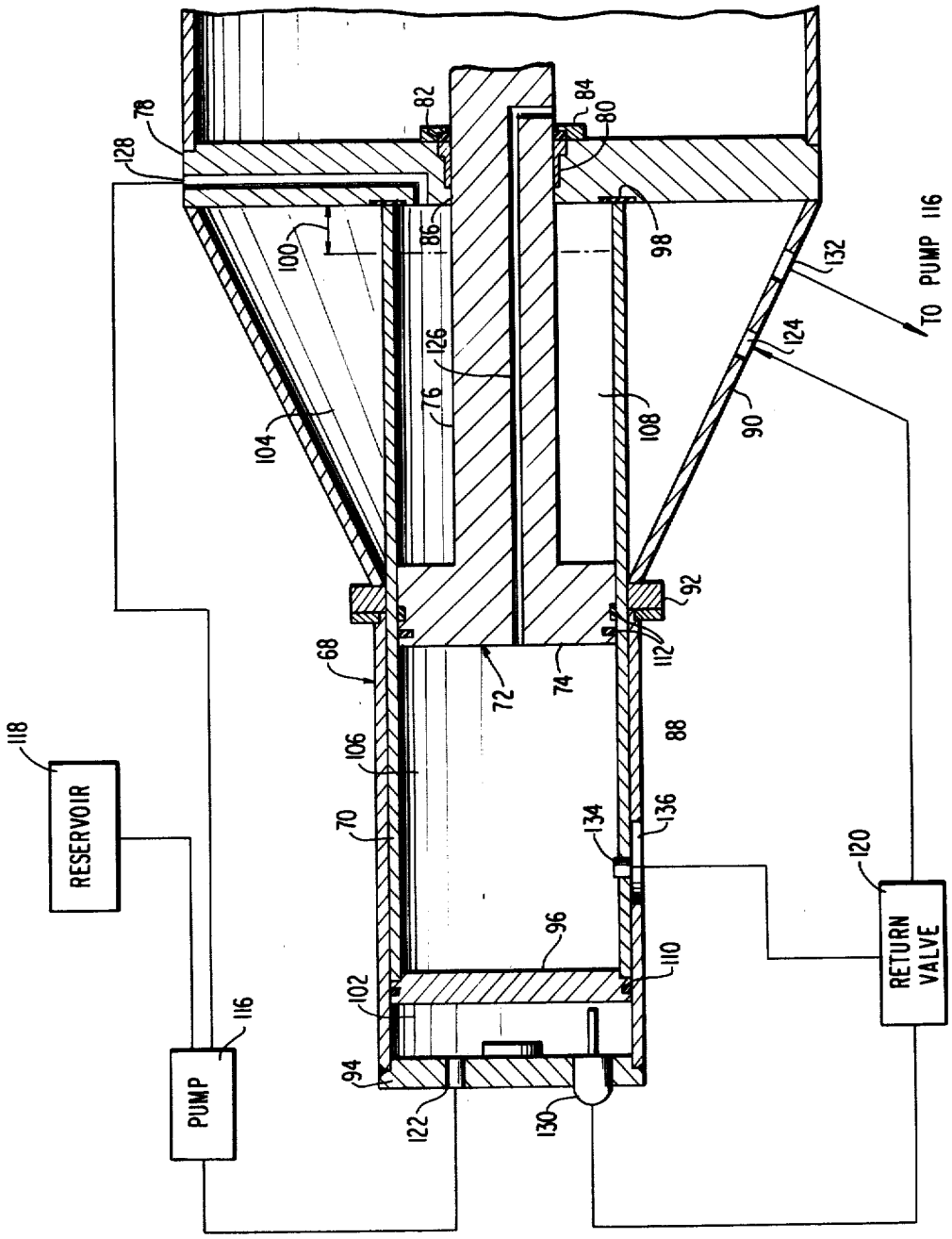

RESERVOIR
PUMP
RETURN VALVE
TO PUMP 116
78
128
82
84
80
86
98
100
132
126
124
76
108
104
90
92
68
112
72
74
88
106
70
134
136
120
96
110
102
94
122
130
116
118

FIG. 3

MECHANICALLY ACTUATED HAMMER AND BIT ASSEMBLY THEREFOR

CROSS REFERENCE TO RELATED APPLICATION

The present application discloses subject matter common to applicant's concurrently filed copending application Ser. No. 363,878 entitled "Hydraulically Powered Actuator."

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of mechanically actuated hammers, and more particularly to a unique mechanically actuated hammer and to a percussion bit assembly for use with a mechanically actuated hammer.

2. Description of the Prior Art

Hammers known heretofore, which are used, for example, for tunneling, mining, quarrying and general demolition work, have been found unsatisfactory because they are unable to deliver a blow energy output in excess of approximately 3,000 FT-LBS. Hammers of higher energy are generally subject to mechanical damage or are inefficient and unreliable in operation.

One known device of high energy is disclosed, for example, in U.S. Pat. No. 3,605,916, issued on Sept. 20, 1971 to B. V. Voitsekhovsky et al. The device disclosed in this patent is limited in efficiency, inter alia, by the fact that liquid is throttled through narrow radial ports which causes the moving ram element of the actuator to be subjected to excessive liquid drag.

Also worthy of note in the field of percussive-type hammers, that is, hammers in which the primary moving ram element directly accelerates a bit which, in turn, strikes a work surface, are certain energy limiting factors, such as for example, the strength and resilience of the mechanical structure.

The large hammer developed by B. V. Voitsekhovsky et al is capable of a blow energy of 70,000 ft. lbs. However, in addition to the disadvantage pointed out above, it is expensive, quite complicated in construction, and subject to wear and gas leakage from the compressed gas springs which support the bit laterally.

It would therefore be desirable to have a hammer which effectively overcomes the problem of liquid drag, is relatively inexpensive, less complicated in construction and reliable even in those situations where lateral skidding occurs and which possesses a capability of delivering greater than 3,000 FT-LBS of energy per blow. In conjunction with this goal it would also be desirable to have a hammer which includes an efficient and effective braking system which affords protection to the hammer in the event that the bit fails to strike its target, or strikes a target which permits free entry.

OBJECTS AND SUMMARY OF THE INVENTION

It is, therefore, a general object of the present invention to overcome the stated disadvantages of the known prior art.

It is a more specific object of the present invention to provide a percussion bit assembly which is simple in construction, reliable in operation and inexpensive to fabricate.

It is another object of the present invention to provide a percussion bit assembly for use with a unique mechanical impulse-type actuator.

It is still another object of the present invention to produce a percussion bit assembly for use with any of the known actuators comprising the present state of the art.

It is yet another object of the present invention to provide a percussion bit assembly which includes a compressed gas spring system capable of exerting both lateral and axial reactive forces.

It is still another object of the present invention to provide a percussion bit assembly which utilizes inexpensive and available components, such as rubber tires, for use as a component part of a spring system capable of exerting both lateral and axial reactive forces.

It is yet another object of the present invention to provide a percussion bit assembly which includes a brake system which is directly applied against the percussion bit to thereby safely and reliably brake the percussion bit in the event that the bit fails to strike its intended target.

It is a related object of the present invention to provide a mechanically actuated hammer in which high output energies are achieved by a unique structure for liquid escape.

It is another related object of the present invention to provide a mechanically actuated hammer including a mechanical impulse actuator with a displaceable cylinder which serves as a working cylinder in conjunction with a piston assembly.

These and other objects are accomplished according to the present invention by the provision of a percussion bit assembly which includes a housing, a guide means for axially guiding the percussion bit during its axial displacement, spring means mounted between the guide means and the housing which are capable of exerting lateral reactive forces in response to the lateral displacements of the percussion bit, and brake means mounted to directly engage the percussion bit in order to decelerate the axial movement of the percussion bit and thereby limit the stroke of the actuator.

Moreover, there is provided a mechanically actuated hammer including the percussion bit assembly set forth above and any known actuator, or a mechanical impulse-type actuator which includes a piston assembly, which produces a reciprocating output, and a cylinder within which the piston assembly is reciprocated, and which is itself displaceably mounted in order to provide a large passage for liquid escape during firing of the piston assembly.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view in cross section illustrating a hammer according to the present invention which includes a percussion bit assembly having novel spring and brake means, and a novel mechanical impulse actuator.

FIG. 2 is a schematic view in cross section illustrating an alternative embodiment of the braking system according to the invention.

FIG. 3 is a schematic view in cross section illustrating the novel mechanical impulse actuator according to the present invention including specifics of an alternate embodiment of an associated control circuit for the actuator.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to a more detailed consideration of the

present invention as illustrated in the exemplary embodiments of FIGS. 1–3, there is shown a mechanically actuated hammer **10** comprising a percussion bit assembly **12** and a hydraulic actuator assembly **14.**

It should be understood at the outset that the percussion bit assembly **12,** although illustrated in combination with a particular hydraulic actuator assembly **14,** can be combined with other and different actuator assemblies known in the art and still achieve its intended objects.

The percussion bit assembly **12** is constructed to include an outer generally cylindrical housing **16** which can be connected in any conventional manner, for example, by welding, to the actuator assembly **14.** Within the outer housing **16** there is provided a percussion bit **18** along with supporting structure for supporting the percussion bit **18** to the housing **16,** and flexible or articulated connecting structure for connecting the percussion bit **18** to the reciprocating output of the actuator assembly **14.**

The supporting structure comprises a generally cylindrical guide tube **20** within which the percussion bit **18** is axially and rotationally displaceable. The guide tube **20** is, in turn, mounted to the housing **16** by a spring system preferably formed of a plurality of flexible toroidal members **22,** such as, for example, conventional pneumatic tires utilized on vehicles. Preferably two sets of toroidal members **22** are provided as shown in FIG. **1.** However, it should be understood that any desired number of these members or sets of members can be employed. The toroidal members **22** forming the spring system, which can be pressurized in any known manner, are mounted between the guide tube **20** and the outer housing **16** in such a way that they are capable of exerting both axial and lateral reactive forces on the guide tube **20** in response to axial and lateral displacements of the guide tube **20** caused by impact motions of the percussion bit **18.** To achieve this result, the individual toroidal members are mounted in facing recesses **24** and **26.** These recesses are formed by spaced annular members in the form of rings **28.** A first portion of the rings **28** form with the outer surface of the guide tube **20** a plurality of first recesses, while the second portion of the rings **28** forms with the inner surface of the housing **16** a plurality of second recesses. Between respective facing recesses, the individual toroidal members are mounted. The rings **28** may be formed integrally with the housing **16** and the guide tube **20,** or they may be formed separately and connected to the housing **16** and guide tube **20** in a conventional manner.

The radial extent of the rings **28** is sufficient to establish a sufficient reactive surface area with the toroidal member being mounted. It should also be noted that the spacing between adjacent rings **28** between which the open ends of the toroidal members **22** are mounted, that is, the bead ends in the case of pneumatic tires, are sufficiently spaced in the axial direction of movement of the percussion bit **18** to ensure an adequate seal for retaining the pressurized medium within the toroidal members from escaping under load. It can be seen that as a result of the spring system according to the present invention, an effective and yet inexpensive means is provided for controlling both lateral and undesirable axial excursions of the guide tube **20** after impact of the percussion bit **18,** while limiting the magnitude of maximum force applied to the structure **16,** and protecting the actuator **14** from damage.

The spring system is capable of exerting higher reactive loads than any of the known systems by reason of the fact that the reactive surface areas are annular. There is, therefore, a greater reactive surface area available according to the spring system of the present invention. By increasing the number of toroidal springs and/or increasing their internal pressure, the lateral spring force can be increased as desired.

Mounted to the inside surface of the guide tube **20** in the vicinity of its two extremities are guide bushings **30.** The guide bushings **30** are retained in position, according to the preferred embodiment illustrated in FIG. **1,** by end rings **32.** Of course, the guide bushings **30** could alternatively be made integral with the guide tube **20,** or retained in position by means other than the end rings **32.**

According to one preferred embodiment of the present invention, there is provided a brake system for braking the percussion bit **18** if it exceeds a predetermined axial displacement. The brake system illustrated in FIG. **1** includes a brake shoe support tube **34** which is mounted to the inner surface of the guide tube **20** approximately midway between the two guide bushings **30.** The brake shoe support tube **34** is mounted to the guide tube in any conventional manner, as for example, by bolts **36.** Extending from the inner surface of the brake shoe support tube **34** is a brake shoe **38.** The brake shoe **38** is mounted to the brake shoe support tube **34** in any conventional manner. It should also be noted that the support tube **34** can be formed of segmented members, and that the brake shoe **38** can also be a single annular member or a plurality of segmented members. In addition, it should also be noted that the location of the brake system **34–38** between the guide bushings **30** is arbitrary, depending upon the desired stroke limitations of the percussion bit **18.**

The percussion bit **18** includes a portion **18d** having a tapered surface which engages a correspondingly tapered surface **40** of the brake shoe **38** after a predetermined axial displacement of the percussion bit **18.** This engagement gives rise to a braking force applied directly to the percussion bit **18** in association with concurrently applied axial reactive forces in the spring system. This reactive loading effects a deceleration of the axial movement of the percussion bit which thereby limits the stroke of the actuator.

Like the spring system, the brake system is also quite reliable and inexpensive. Heretofore, so far as applicants are aware, braking systems which effect axial deceleration of the percussion bit assembly or the equivalents of such a braking system, are usually located in the actuator assembly **14.** These systems are much more complex and more difficult to service than the system according to the present invention.

An alternative braking system is illustrated in FIG. **2.** According to this embodiment, the guide tube **20** is mounted to be axially displaceable with the percussion bit **19** after a predetermined axial displacement of the bit **18.** Preferably, according to this embodiment, brake shoes **38** are mounted both to the guide tube **20** and the outer surface of the individual toroidal members **22.** The guide tube **20** includes a tapered portion **42** at one end thereof, to the inner surface of which a brake shoe **38** is secured in a conventional manner. In this case the brake shoe **38** of the guide tube **20** has a conical inter-

nal surface which is engaged by the tapered portion **18***d* of the percussion bit **18** near the end of its motion.

The individual toroidal members **22** are mounted to the outer surface of the guide tube **20** by the annular rings **28.** Support rings **44** are fastened to the closed ends of the toroidal members **22** in a conventional manner. To the rings **44** there are mounted brake shoes **38** which directly engage the inner surface of the outer housing **16.** In the event that the percussion bit **18** is displaced in the axial direction beyond a predetermined distance, the tapered surface portion **18***d* is brought into engagement with the brake shoe **38** which, in turn, causes the guide tube **20** to be displaced in the axial direction with the percussion bit **18.** This causes the brake shoes **38** mounted to the support rings **44** to generate frictional force axially on the inner surface of the outer housing **16.** The frictional engagement of the brake shoes **38** with the inner surface of the outer housing **16** effects deceleration of the percussion bit **18,** which thereby limits the stroke of the actuator.

To return the guide tube **20** to its initial position, the percussion bit **18** is provided with a ring **46** formed near its tip end. The ring **46** engages the flange **48** formed at one end of the guide tube **20** and retracts the guide tube **20** during cocking of the percussion bit **18** by the actuator. It should also be noted that each brake shoe **38,** according to the embodiment illustrated in FIG. **2,** may be formed as a continuous annular shoe or as a plurality of segmented shoes.

Returning to FIG. **1,** it can be seen that the percussion bit **18** is formed as an elongated generally cylindrical shaft member having a work-engaging conical tip portion **18***a* which leads to a cylindrical portion **18***b*. The cylindrical portion **18***b*, in turn, is connected to a cylindrical portion **18***c* by the tapered portion **18***d*. The tip of the conical portion **18***a* may be provided with an insert **50** of hardened material, such as sintered tungsten carbide or alloyed steel.

To connect the percussion bit **18** to the actuator so that the bit **18** will be capable of independent rotation and lateral movement relative to the actuator, at least one ball-and-socket joint is provided. The ball may be formed at the free end of the actuated element of the actuator, while the socket is formed in the percussion bit **18.** The joint may be recessed in a preferred manner as illustrated in FIG. **1** in order to secure a more desirable degree of stability in operation for the percussion bit **18.** In the preferred manner, the joint is located at the center of rotation of the percussion bit and guide tube system, associated with a center of lateral percussion located at the tip of the percussion bit.

The socket is preferably formed at the closed end of a central bore **52** formed in the portion **18***d* of the bit **18.** The inner surface forming the bore **52** preferably terminates in a concave surface **54.** Immediately above the surface **54** the bore **52** is provided with threads **56** for securing a socket ring **58.** The socket ring **58** is provided with a curved surface **60** which forms a conformable continuation of the surface **54** when the ring **58** is fully engaged within the bore **52** so that the surfaces **54** and **60** are contiguous. Preferably, the surfaces **54** and **60** are lined with a shock-absorbing material **62.**

As a preferred alternative to connecting the percussion bit **18** directly to the actuator, there is provided according to the present invention, an articulated link **64** which serves along with the percussion bit **18** and the actuator to form at each of its ends a ball-and-socket joint. At its actuator end, the articulated link **64** is joined within the socket formed in an adapter block **66,** made integral with or connected to the reciprocated actuated element of the actuator. Preferably, the articulated link is utilized with a recessed socket in the percussion bit **18.**

The percussion bit assembly **12** thus described is adaptable for use with any actuator known in the art in addition to the actuator shown and described hereinafter according to the present invention. It can be seen that the percussion bit assembly **12** is relatively inexpensive to fabricate primarily in view of the fact that conventional pneumatic tires can be utilized as part of the spring system. Moreover, the percussion bit assembly **12** is significantly improved from the standpoint of the impact energy which can be safely delivered by the percussion bit **18.** Even if the percussion bit **18** strikes an uneven surface and is caused to pivot as a result the spring system will withstand the imposed lateral loads and prevent damage to the hammer. Likewise, if the percussion bit **18** fails to strike the intended working surface or if it strikes the working surface of an object which does not offer the expected resistance, that is, it permits relatively free entry, the hammer is protected by the braking system and spring system; the brake system transmitting an axial loading to the spring system which is, in turn, reacted over a large reactive area.

It should be noted that the brake system is optional, that is, if the percussion bit assembly **12** is intended for use with an actuator which already has a shock-absorbing system, then the brake system can be dispensed with.

Turning now to the actuator assembly **14** to which the percussion bit assembly **12** is operatively connected, there is included a housing member **68** within which a working cylinder **70** is displaceably mounted. Mounted within the working cylinder **70** for reciprocating movement is a piston assembly **72,** which comprises the actuated element referred to above. The piston assembly **72** includes a piston **74** and a piston rod **76** which extends through a transverse end plate **78** of the housing member **68.** The housing member **68** is connected to the transverse end plate **78** in any conventional manner, such as, for example, by welding. The piston rod **76** extends through a bore **80** formed centrally within the end plate **78.** Preferably, the bore **80** is lined with a bushing **82** which is retained within the bore **80** by an externally fastened retaining ring **84.** At the opposite end of the bore **80** adjacent to the bushing **82** there is provided a fluid seal **86.** The external end of the piston rod **76** can either form the ball of a ball-and-socket joint, as described above, or it can terminate in an adapter block **66** for receiving one end of the articulated link **64.** In this way, the reciprocating output of the actuator is transmitted to the percussion bit **18** of the percussion bit assembly **12.**

The housing member **68** is preferably formed to include an upper portion **88** and a lower portion **90.** The two portions may be joined together by, for example, a plurality of circumferentially arranged bolted joints **92.** Alternatively, the lower portion **90** may be formed integrally with the upper portion **88** if so desired. The free end of the upper portion **88** is closed by a transverse head plate **94.**

The working cylinder **70** is closed at one end by a transverse end plate **96** and retained opened at its opposite end. The open end of the working cylinder **70**

engages a face seal **98** located within the inner transverse surface of the end plate **78**. The free end of the working cylinder **70**, when displaced within the housing member **68** away from the face seal **98**, defines an annular passage **100**. The importance of the passage **100** will be described hereinafter.

The assembled members of the actuator described above form a number of working chambers, which, for convenience, will be identified as the first, second, third and fourth working chambers. The first working chamber **102** is defined by the upper portion **88** of the housing member **68**, the transverse head plate **94** and the transverse end plate **96**. The second working chamber **104** is defined by the lower portion **90** of the housing member **68** and the working cylinder **70**. The third working chamber **106** is defined by the working cylinder **70**, the transverse end plate **96** and the piston **74**. Finally, the fourth working chamber **108** is defined by the working cylinder **70**, the piston **74**, the piston rod **76** and the transverse end plate **78**. As can be seen, the annular passage **100** provides access between the second and fourth working chambers **104** and **108**.

The transverse end plate **96**, as well as the piston **74**, is provided with appropriate seals **110** and **112**, respectively, to ensure a sufficient pressure seal between the first and second working chambers **102** and **104**, and between the third and fourth working chambers **106** and **108**.

To provide a high energy reciprocating output through the piston rod **76**, it is desirable according to the present invention to provide rapid escape of the piston cocking liquid during piston firing. To accomplish this purpose, it is proposed, according to the present invention, to provide a large annular passage in the form of the passage **100**. With such a design it is possible to minimize the power wasted in forcing liquid from the path of piston during firing. It is only necessary to displace the working cylinder **70** from the face seal **98** at an appropriate time in the cycle of operation of the piston assembly **12**.

To accomplish this purpose, the following control circuit is employed. A control unit **114** sequentially controls the operation of a pump **116** and a return valve **120**. The pump **116** is connected to the first, second and fourth working chambers **102**, **104** and **108**, and to a reservoir **118**. Ports **122**, **128** and **132** in the transverse head plate **94**, in the end plate **78**, and in the lower portion **90** of the housing member **68**, respectively, are provided for this purpose. Finally, the return valve **120** is connected between the first working chamber **102** and the second working chamber **104**. Ports **130** and **124** in the transverse head plate **94** and the lower portion **90** of the housing member **68** are provided for this purpose. According to the present invention, the third working chamber **106** is initially supplied with a closed volume of compressed gas through a conventional gas fill port **126** provided in the piston assembly **72**. Also, according to the present invention, the working chamber **104** serves as a liquid sump.

MODE OF OPERATION

The actuator assembly **14** operates as follows: After pressurizing the third working chamber **106** through the gas fill port **126** in the piston assembly **72**, pump **116** is actuated and delivers pressurized liquid from the reservoir **118** to the first working chamber **102** through the port **122**. Charging of the first working chamber **102** causes the working cylinder **70** to move in a first direction toward and seat itself against the face seal **98**. Thereafter, the pump **116** is caused to deliver pressurized liquid from the reservoir **118** through the port **128** to the fourth working chamber **108**. Charging of the fourth working chamber **108** results in moving the piston assembly **72** in a second direction (cocking of the piston assembly), which in turn results in further compressing the gas within the third working chamber **106**. After the piston assembly **72** is cocked, the return valve **120** is opened by the control unit **114** permitting a bleed-off from the first working chamber **102** through the port **130** and into the sump **104** through the port **124**. As a result of the bleed-off, the working cylinder **70** is moved in the second direction away from the face seal **98** and defines an annular passage **100** which provides access between the fourth working chamber **108** and the sump **104**. The pressurized gas in the third working chamber **106** then fires the piston assembly **72** (piston assembly moves in the first direction), thereby actuating the percussion bit **18**. Because of the large annular passage **100**, the pressurized liquid within the fourth chamber **108** is provided with a means for rapidly escaping into the sump **104** and from there through the port **132** to the reservoir **118** under the influence of the pump **116**. Thereafter, the first working chamber **102** is once again charged by the pump **116** causing the working cylinder **70** to be seated against the face seal **98**, and the cycle repeated. It should be noted that the working chamber **102** is subsequently charged preferably near the end of the stroke of the piston assembly **72** to effect dampening of the piston stroke.

Because of the principle of a movable working cylinder according to the present invention, it is possible to realize higher energy outputs than has been known heretofore.

Turning now to FIG. **3**, there is illustrated an alternative embodiment of the control circuit for effecting operation of the actuator assembly **14**. According to this embodiment, a control sensor **134** is mounted in the wall of the working cylinder **70** and is connected to the return valve **120**. A slot **136** in the upper portion **88** of the housing member **68** is provided to allow for the movement of the working cylinder **70**. At a predetermined point in the cocking of the piston assembly **72**, the piston **74** coacts with the control sensor **134** to actuate the return valve **120**. Actuation of the return valve **120** causes a bleed-off from the first working chamber **102** with an effect described above. The operation of the pump **116** is similar to that described above. Because of the control sensor **134** it is possible to dispense with the control unit **114** and provide continuous operation of the pump **116** without adversely affecting the high energy output of the actuator assembly **14**.

That which is claimed is:

1. In an assembly for mechanical impulse actuators having actuating means, the assembly comprising:

A. a tubular housing;

B. means for connecting said housing to a desired actuator;

C. a percussion bit;

D. means for connecting said percussion bit to the actuating means of the desired actuator; and

E. means supporting said percussion bit for rotational, lateral and axial displacement relative to said housing, said supporting means including:

a. guide means axially guiding said percussion bit during its axial displacement, said guide means being fabricated as a tubular structue which is arranged concentrically between said housing and said percussion bit;
b. spring means; and
c. means mounting said spring means between said guide means and said housing, said spring means exerting, as a result of said mounting means, both axial and lateral reactive forces in response to the axial and lateral displacements of said percussion bit, with said axial reactive force being exerted through said mounting means.

2. The assembly as defined in claim **1**, wherein said spring means include a plurality of toroidal members forming part of said concentric arrangement, with each of said plurality of toroidal members being spaced from each other in the axial direction of displacement of said percussion bit by said mounting means.

3. The assembly as defined in claim **2**, wherein said mounting means include a plurality of annular members, with a first portion thereof forming with said guide means a plurality of first recesses for said toroidal members and a second portion thereof forming with the housing an equal plurality of second recesses for said toroidal members, said first and second recesses forming corresponding and concentric pairs of recesses in the axial direction of displacement of said percussion bit.

4. The assembly as defined in claim **2**, wherein each of said plurality of toroidal members is a pneumatic tire.

5. The assembly as defined in claim **1**, wherein said means for connecting said percussion bit to the actuating means includes a ball-and-socket joint with said socket being formed in said percussion bit by a concavely curved surface thereof, and a removable ring means having a curved surface which when rendered contiguous with said concavely curved surface forms a conformable continuation thereof.

6. The assembly as defined in claim **5**, wherein said percussion bit includes a bore which penetrates into said percussion bit from one end thereof and in the axial direction of displacement thereof and forms a closed end, said ball-and-socket being formed at said closed end.

7. The assembly as defined in claim **5**, wherein said joint is located at the center of rotation of the assembly of said percussion bit and said supporting means which is associated with the center of percussion at the tip of said percussion bit.

8. The assembly as defined in claim **1**, wherein said means for connecting said percussion bit to the actuating means includes a link element forming a ball-and-socket joint at one end thereof with said percussion bit and having a spherical surface at the other end thereof for forming a ball-and-socket joint with the actuating means, said sockets being formed in the percussion bit and the actuating means, respectively, by a concavely curved surface and removable ring means in each, with each said ring means having a curved surface which, when rendered contiguous with its respective concavely curved surface, forms a conformable continuation thereof.

9. The assembly as defined in claim **1**, further comprising brake means mounted to directly engage said percussion bit in order to decelerate the axial movement of said percussion bit and thereby limit the stroke of the actuating means.

10. The assembly as defined in claim **9**, wherein said brake means is mounted to the inner surface of said guide means, and wherein said percussion bit is provided with a tapered outer surface portion which engages said brake means after a predetermined axial displacement of said percussion bit.

11. The assembly as defined in claim **1**, wherein said guide means is displaceable in the axial direction of displacement of said percussion bit, said assembly further comprising: brake means mounted to said guide means to directly engage said percussion bit thereby effecting the axial displacement of said guide means in the course of the axial displacement of said guide means in the course of the axial displacement of said percussion bit; and brake means mounted to said spring means to directly engage said housing, both said engagements serving to decelerate the axial movement of said percussion bit and thereby limit the stroke of the actuating means.

12. The assembly as defined in claim **11**, wherein said guide means includes a tapered portion of the inside surface of which said brake means is mounted, and wherein said percussion bit includes a tapered portion which engages said guide means mounted brake means to effect the axial displacement of said guide means.

13. The assembly as defined in claim **11**, wherein said percussion bit includes means for retracting said guide means after its axial displacement.

14. In combination, a percussion bit and link for connecting said percussion bit to the actuating means of a mechanical impulse actuator so that said percussion bit can be axially driven by the actuating means and laterally displaced relative to the actuating means and said link means, the percussion bit comprising:
A. a work engaging tip portion;
B. a brake means engaging portion;
C. an intermediate portion which joins said tip portion and said brake means engaging portion to form thereby a continuous bit; and
D. an actuating ring extending generally radially outwardly from said intermediate portion.

15. A mechanically actuated hammer, comprising in combination:
A. a mechanical impulse actuator having actuating means;
B. a percussion bit assembly including a percussion bit;
C. means connecting said percussion bit assembly to said actuator; and
D. means connecting said percussion bit to said actuating means, said mechanical impulse actuator including:
a. a housing member;
b. a cylinder displaceably mounted within said housing member;
c. a piston assembly forming said actuating means, said piston assembly being mounted to said housing member for reciprocal movement within said cylinder, said piston assembly including a piston and a piston rod, said piston rod being mounted to said housing member to extend outwardly therefrom to thereby serve as the reciprocating output;
d. first means effecting movement of said cylinder relative to said housing member and said piston

assembly in a first direction toward said piston assembly;

e. second means effecting movement of said piston assembly relative to said cylinder and said housing member in a second direction opposite to said first direction; and

f. third means effecting movement of said cylinder and said piston assembly relative to each other and to said housing member, so that said cylinder means moves in said second direction while said piston assembly moves in said first direction said first, second and third means being associated in their respective operations to produce the reciprocating output.

16. A mechanically actuated hammer, comprising in combination:

A. a mechanical impulse actuator having actuating means;

B. percussion bit assembly including a percussion bit;

C. means connecting said percussion bit assembly to said actuator; and

D. means connecting said percussion bit to said actuating means, said percussion bit assembly including:

a. a tubular housing, said housing being connected to said actuator by said means (C);

b. guide means axially guiding said percussion bit, said guide means being fabricated as a tubular structure which is arranged concentrically between said housing and said percussion bit;

c. spring means; and

d. means mounting said spring means between said guide means and said housing, said spring means exerting, as a result of said mounting means, both axial and lateral reactive forces in response to axial and lateral displacements of said percussion bit, with said axial reactive forces being exerted through said mounting means.

17. The mechanically actuated hammer as defined in claim **16,** wherein said housing and said guide means are fabricated as tubular structures which are concentrically arranged with each other and said percussion bit, and wherein said spring means include a plurality of toroidal members forming part of said concentric arrangement, with each of said plurality of toroidal members being spaced from each other in the axial direction of displacement of said percussion bit by said mounting means.

18. The mechanically actuated hammer as defined in claim **17,** wherein each of said plurality of toroidal members is a pneumatic tire.

19. The mechanically actuated hammer as defined in claim **16,** wherein said means (D) comprises link means which forms an articulated joint at its connection with both said actuating means and said percussion bit.

20. The mechanically actuated hammer as defined in claim **16,** wherein said percussion bit assembly further includes brake means mounted to directly engage said percussion bit in order to decelerate the axial movement of said percussion bit and thereby limit the stroke of said actuating means.

21. The mechanically actuated hammer as defined in claim **16,** wherein said mechanical impulse actuator further includes a displaceable cylinder within which said actuating means is reciprocated, and means for effecting displacement of both said cylinder and said actuating means.

22. The mechanically actuated hammer as defined in claim **21,** wherein said mechanical impulse actuator further includes:

a. a housing member within which said cylinder is displaceably mounted, said means (C) connecting said percussion bit assembly to said housing member;

b. first means effecting movement of said cylinder relative to said housing member and said piston assembly;

c. second means effecting movement of said piston assembly relative to said cylinder and said housing member; and

d. third means effecting movement of said cylinder and said piston assembly relative to each other and to said housing member, said first, second and third means being associated in their respective operations to produce a reciprocating movement of said actuating means.

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