Aug. 2, 1960 J. E. FEUCHT 2,947,519

PERCUSSION DRILL

Filed Sept. 11, 1957 4 Sheets-Sheet 1

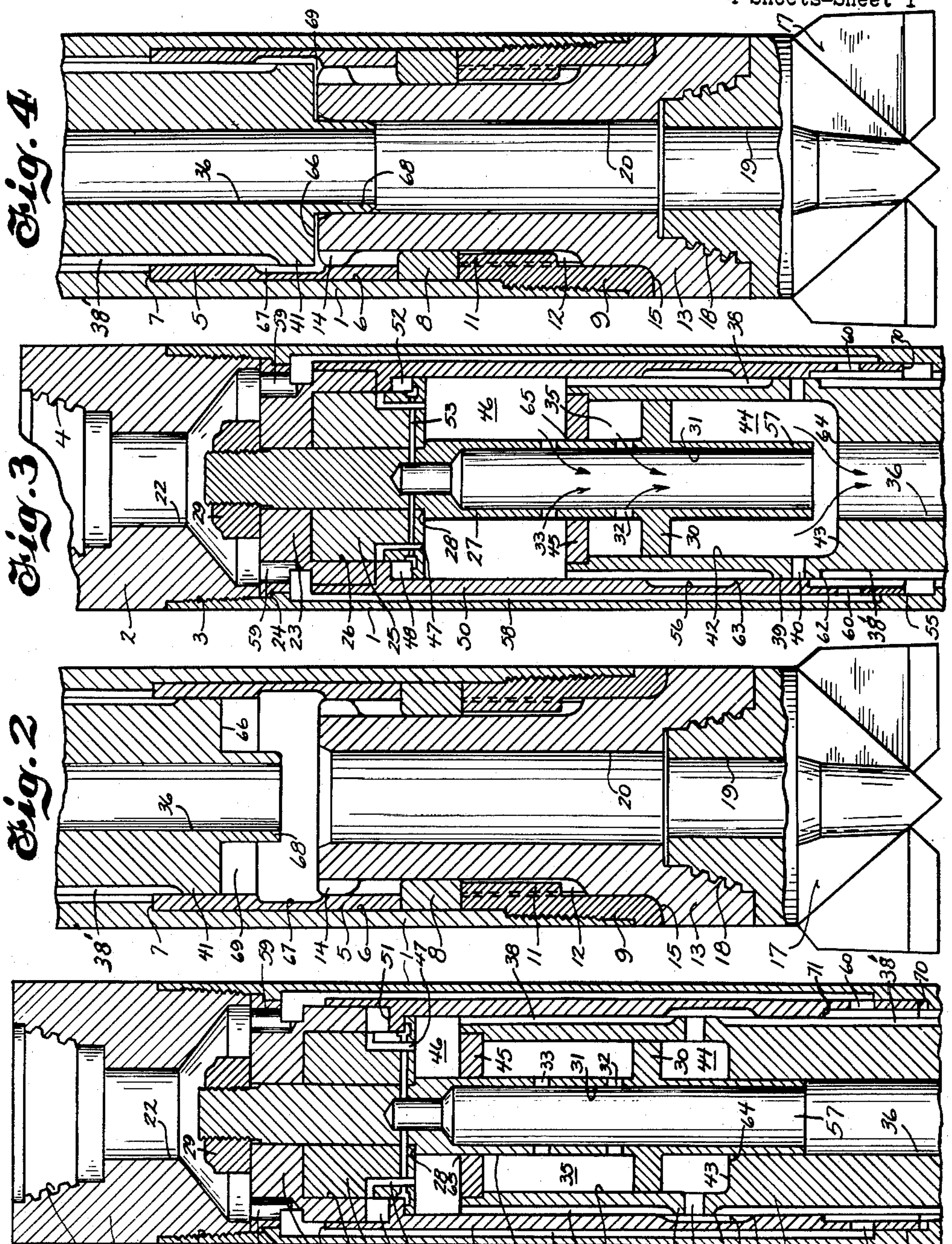

Fig. 4 Fig. 3 Fig. 2 Fig. 1

INVENTOR.
J. E. FEUCHT
BY
Lieber & Lieber
ATTORNEYS

Aug. 2, 1960 J. E. FEUCHT 2,947,519

PERCUSSION DRILL

Filed Sept. 11, 1957 4 Sheets-Sheet 2

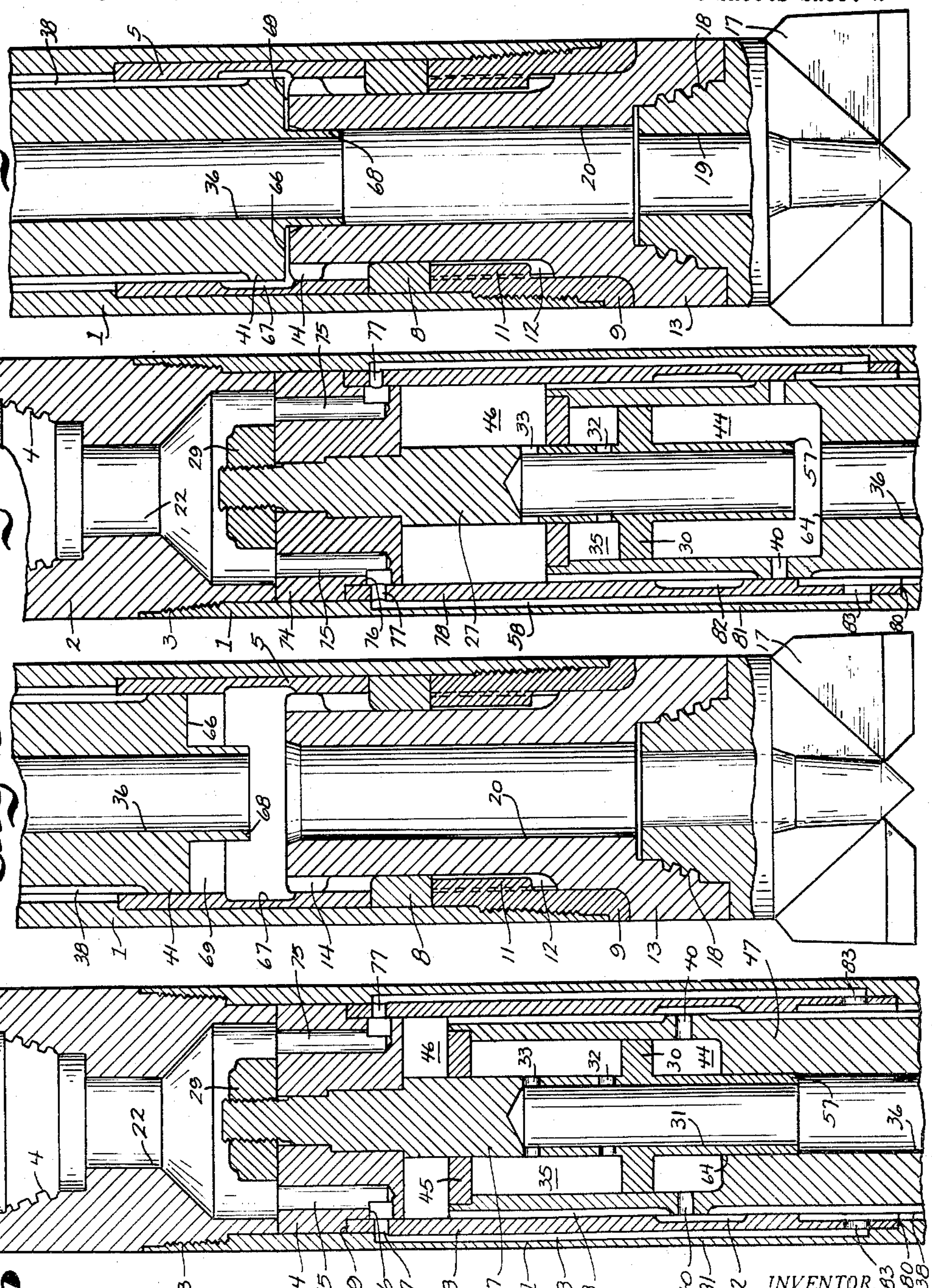

Fig. 8

Fig. 7

Fig. 6

Fig. 5

INVENTOR.

J. E. FEUCHT

BY

Lieber & Lieber

ATTORNEYS

Aug. 2, 1960 J. E. FEUCHT 2,947,519

PERCUSSION DRILL

Filed Sept. 11, 1957 4 Sheets-Sheet 3

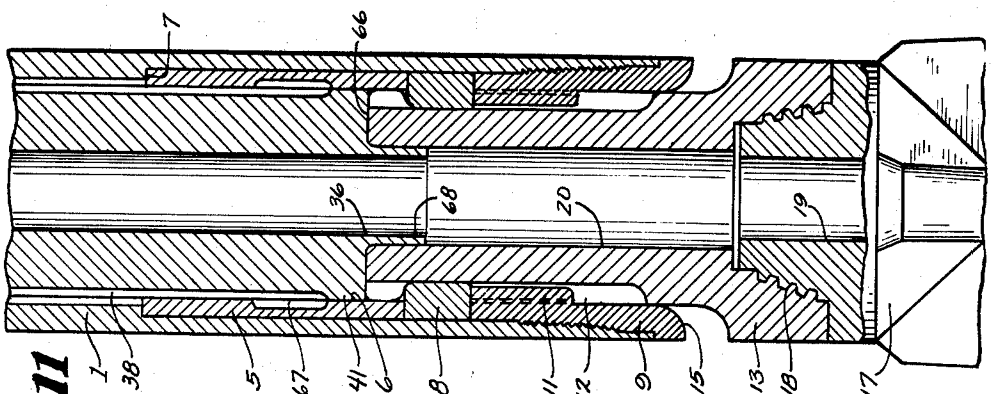

Fig. 11

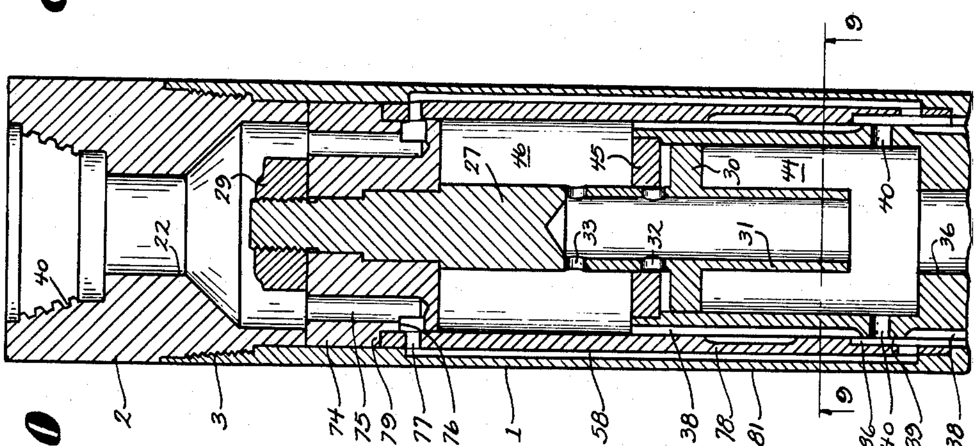

Fig. 10

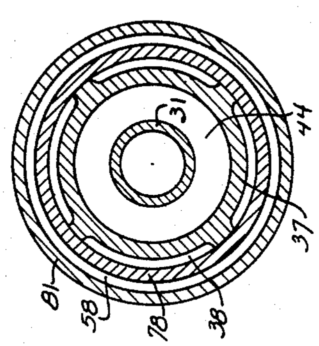

Fig. 9

INVENTOR.

J. E. FEUCHT

BY

Lieber & Lieber

ATTORNEYS

Aug. 2, 1960 J. E. FEUCHT 2,947,519

PERCUSSION DRILL

Filed Sept. 11, 1957 4 Sheets-Sheet 4

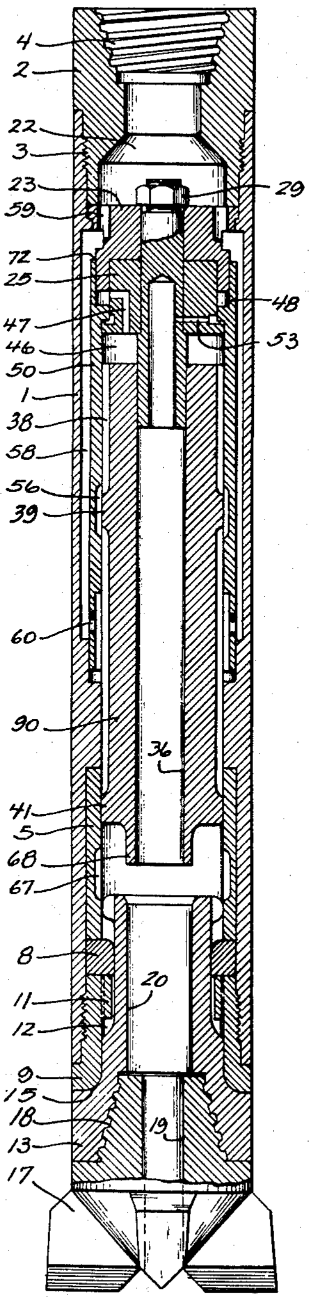

Fig. 12

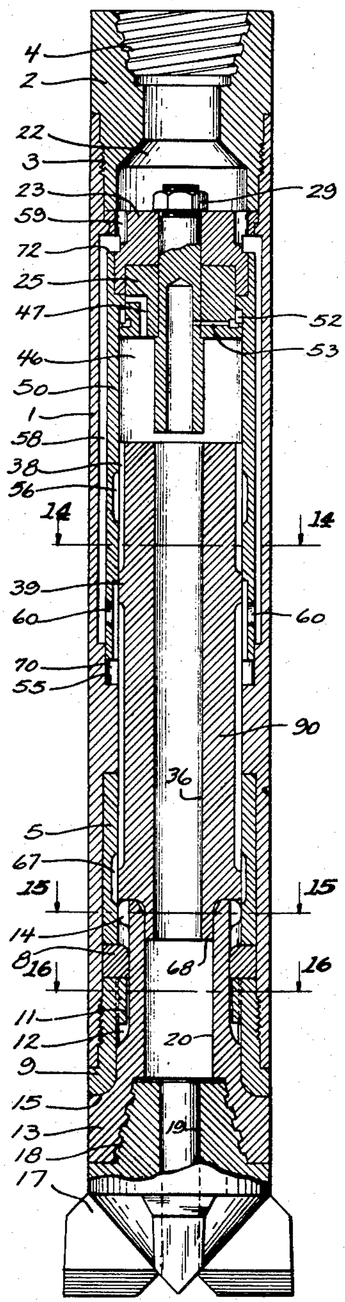

Fig. 13

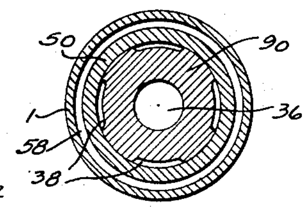

Fig. 14

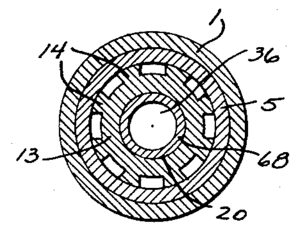

Fig. 15

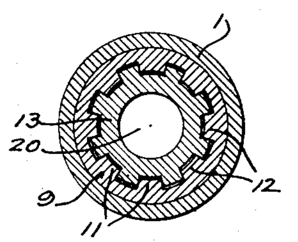

Fig. 16

INVENTOR.
J. E. FEUCHT

BY

Lieber & Lieber
ATTORNEYS

United States Patent Office

2,947,519

Patented Aug. 2, 1960

2,947,519

PERCUSSION DRILL

Jacob E. Feucht, Garfield Heights, Ohio, assignor to Westinghouse Air Brake Company, Wilmerding, Pa., a corporation of Pennsylvania

Filed Sept. 11, 1957, Ser. No. 683,408

9 Claims. (Cl. 255—4.4)

This invention relates to a fluid actuated impact tool which finds particular utility in earth drilling.

Drill tools of this general type usually include an elongated cylinder which forms the outer casing of the drill. A piston is reciprocally mounted within the casing and forms the hammer which is actuated by fluid, such as compressed air. An anvil is also mounted in the casing for slight reciprocatory movement and has a cutting bit at its outer end while its inner end is adapted to be struck by the hammer. Drills of the type to which this invention pertains are known as down-the-hole drills. They are lowered into the hole being formed in a drill string which is suitably attached to the upper end of the casing and through which the compressed air is introduced into the drill. The compressed air passes through suitable valving in the drill to alternately force the hammer against the anvil with a sharp impact and then return the hammer to the starting position. The compressed air is discharged from the drill through apertures in the bit which causes the drillings to be blown out of the hole.

Various devices have heretofore been proposed which have rather complicated valving mechanism designed to regulate the flow of fluid through the drill in order to utilize the pressure fluid to apply a power stroke to the hammer, and then return the hammer to the starting position before the fluid is permitted to escape to clean out the drillings. The use of complicated valves not only increases the number of relatively moving parts subject to misalignment and wear, but also adds to the cost of the drill and increases the over all size, particularly the diameter, of the drill.

According to the present invention, a down-hole, fluid pressure actuated, impact drill is provided which utilizes a porting sleeve between the piston hammer and cylinder casing, resulting in a particularly compact drill that is economical to manufacture, highly versatile as to the operations it can perform and very efficient in performing its intended functions.

Different types of impact blows are desirable in tools of this type. For example, some drills should deliver a hard, long stroke while in others a faster, lighter impact is desirable.

By means of this invention drills have been provided which are capable of being made from substantially the same tools and using a considerable number of common parts, the drills, however, having different operating characteristics.

Another aspect of the invention provides that the novel porting sleeve of the drill is slidable so as to increase the length of piston travel during which the compressed air is effective on the piston in delivering the power stroke. Similarly, the length of return travel of the piston during which the pressure fluid acts to return the piston, is also increased.

With the particular porting sleeve arrangement of this invention, a source of compressed air is always located closely to either end of the piston for instantaneously

moving the latter in either direction as the ports are opened.

Another aspect of the invention provides that when the drill is raised slightly from its cutting position, the entire source of compressed air will automatically be directed out through the bits to blow the drillings from the hole and will be ineffective to return the hammer to the starting position. No separate or manual adjustments are required to effect this blowout position.

These and other objects and advantages of the invention will appear hereinafter as this disclosure progresses, reference being had to the accompanying drawings in which:

Figures 1 and 2 are longitudinal cross-sectional views of a drill made in accordance with this invention, the devices of these figures being one drill; the device of Figure 2 simply being being a continuation of the Figure 1 device. The drill is shown here with its parts in position at the start of a power stroke;

Figures 3 and 4 are views similar to Figures 1 and 2 but show the parts at the striking point or where the hammer engages the anvil;

Figures 5 and 6 are views similar to Figures 1 and 2 but show a modification thereof wherein the porting sleeve is of the fixed type;

Figures 7 and 8 are views of the device shown in Figures 5 and 6, but in the striking position;

Figure 9 is a transverse cross section taken on line **9—9** of Figure 10;

Figures 10 and 11 are views similar to Figures 5–8 and show the device thereof, but the drill is in the blowing position;

Figure 12 is a longitudinal sectional view of another modification of the drill;

Figure 13 is a view of the device of Figure 12 but in the striking position; and

Figures 14, 15 and 16 are transverse cross-sectional views taken on lines **14—14**, **15—15** and **16—16** respectively in Figure 13.

Similar parts in the various figures will be designated with like numerals. Referring more particularly to Figures 1 to 4, the outer casing **1** forms a cylinder which is of one piece construction and extends for the substantially entire length of the tool. At the upper end of the casing a plug **2** is threadably engaged at at **3** and has an internal threaded portion **4** to which the drill string (not shown) is attachable. At the lower end of the cylinder **1** a forward sleeve **5** is inserted in the bore **6** of the cylinder and bears against a shoulder **7** at its upper end. A stop ring **8** is also inserted in bore **6** and bears against the lower end of forward sleeve **5**. A locking collar **9** is threadably engaged in the lower end of the cylinder and has an upper end which bears tightly against the stop ring **8** to rigidly hold it against axial displacement. The locking collar **9** also has an internal splined portion **11** which registers with a complementary external splined portion **12** of the anvil **13** which is axially slidable within the cylinder within limits. These limits are defined in a downward direction by another spline-shaped portion **14** of the anvil which is adapted to bear against the stop ring **8** as shown in Figure 11. The limit of travel of the anvil in the upper direction is established by the anvil contacting the bottom rounded edge **15** of the locking collar **9**, as shown in Figures 2, 4, 6, 8, 12, and 13. A drill bit **17** is threadably engaged on the lower end of the anvil as at **18** and has a bore **19** extending therethrough which communicates with bore **20** of the anvil.

The drills shown in Figures 1–4, 12 and 13 are of the type which utilize the sliding sleeve feature of the invention while the drills of Figures 5–8, 10 and 11 utilize a fixed sleeve embodiment. In addition the drills shown in Figures 1–11 use a piston having a dual effective area while the drill shown in Figures 12 and 13 use a piston having a single effective area. Various combinations of these features may be incorporated as required, for example, the single effective area piston (Figures 12, 13) could be used with a fixed sleeve arrangement (Figures 5–8). The difference in structure between the various devices is small and some of the parts require only slight modification to provide the other type. Thus common toolage may be used for many of the parts, and many are completely interchangeable.

Referring to the drills shown in Figures 1–4, a funnel-shaped fluid inlet port **22** extends axially through plug **2**. A block **23** is axially secured within the cylinder **1** by the plug **2** which holds it against shoulder **24** of the cylinder. Another block **25** is secured within the bore **26** of block **23** by the shaft **27** which extends through blocks **23** and **25** and holds them axially in place between the shaft shoulder **28** and the nut **29**.

The shaft **27** includes an integrally formed flange **30** and a center bore **31**. Cross ports **32**, **33** connect the bore **31** with the annular space **35** so as to always vent space **35** to atmosphere through the center bore **36** of the piston, as will appear more fully.

A dual effective area piston or hammer **37** is used in which there is provided an increased amount of effective area to which the piston is exposed during its power stroke. The piston has four circumferentially spaced axial grooves **38** which are interrupted by the annular flange **39** on the periphery of the piston. These grooves form distributing passages. A series of radial ports **40** extend through flange **39**. The lower end of the piston also has an annular flange **41** which forms a sliding seal fit with the internal diameter of collar **5**.

The terms "piston," "hammer" or "pistonhammer" will be used synonymously throughout this specification.

The dual area piston has a large central bore **42** which terminates at its front end in a wall **43** which forms a secondary effective area of the piston. The bore **42** forms a sliding seal fit with flange **30** to define a secondary pressure chamber **44** to which pressure fluid is admitted through ports **40**. The primary effective area of the piston is formed by the ring **45** which is press fitted into fixed engagement with the rear end of the piston and which is slidable on shaft **27**. Thus a primary pressure chamber **46** is formed to which pressure fluid is admitted through the distributing passage **38**. Fluid pressure then enters ports **47** which are in communication with the annular space **48**.

A sleeve **50** is provided between the cylinder and the piston and in the embodiment of the invention shown in Figures 1–4, 12 and 13 is adapted for slight axial sliding movement within the cylinder between the positions shown in Figures 1–2 and 3–4. The rear end of the sleeve **50** forms a sliding fit with the block **23** and block **25** and with which it defines the chamber **48**. The fluid pressure that is admitted to chamber **48** via ports **47** acts on surface **51** of the sleeve to urge the latter in the forward or power delivering stroke simultaneously with the forward power stroke of the piston. When the sleeve is in the position shown in Figure 3, a chamber **52** is formed between the sleeve and block **25**, and this chamber is always open to the atmosphere via ports **53**.

The forward end of the sleeve **50** forms a sliding seal fit with the counterbore **55** of the cylinder. The sleeve has an annular groove **56** formed on its internal diameter.

The central bore **36** extending through the hammer is adapted to receive the lower end **57** of shaft **27** and is adapted to form a sliding seal therewith as shown in Figure 1. The end **57** thus acts as a valve element as will appear hereinafter.

An annular space **58** is formed on the internal surface of cylinder **1** and receives fluid pressure from the inlet port **22** via the circumferentially spaced ports **59**. Thus the annular space **58** forms an inlet passage.

The operation is as follows when pressure fluid is admitted through the inlet port **22** to the inlet passage **58**. The fluid then flows through the radial holes **60** in the sleeve and into the distributing passages **38** between the sleeve and piston. It then flows into the secondary chamber **44** via ports **40** and also into the primary chamber **46**. From chamber **46** it also flows into the sleeve actuating chambers **48** via ports **47**.

The pressure fluid then acts on the secondary surface **43** and primary surface **45** to drive the hammer **37** downwardly in the power stroke direction. At the same time the pressure fluid acts on surface **51** of the sleeve to drive the latter also in the downward direction.

The fluid pressure is thus effective to drive the hammer until the valve edge **62** of the hammer engages the valve edge **63** of the sleeve, thus cutting off the pressure supply to the chambers. The trapped air pressure in the chambers **44** and **46** expands and continues to drive the hammer in its power stroke until (Figure 3) the edge **64** of the hammer bore slides off the valve element **57** of the shaft **27** and the valve edge **65** of the rear end of the piston passes exhaust ports **33**. Pressure fluid will then exhaust as indicated by the arrows in Figure 3.

Immediately upon the pressure being released from chambers **44** and **46**, the stem or valve element **68** at the lower end of the hammer has entered the bore **20** of the anvil. Pressure fluid will flow from the inlet passage **58** via port **60** and splined distributing passages **38'** and annular groove **67** in the forward sleeve **5** to the return pressure chamber **69** and act on the lower end surface **66** of the hammer to instantaneously return the hammer to the starting position. The pressure fluid will be effective to action the hammer during the return stroke until the annular flange **41** on the lower end of the hammer passes the annular groove **67** at which time the pressure supply will be cut off to surface **66**. The trapped air pressure continues to act on surface **66** as it expands and therefore continues to urge the hammer upwardly in the return direction until the hammer valve stem **68** emerges from the bore **20**.

The sleeve **50** is also returned to the starting position by pressure fluid acting on its lower edges **70**, **71** which are greater in area than its upper edge **72**. With the sleeve now in the upper or rearward position, the valving edge **62** (Figure 3) of the hammer will take a longer rearward stroke before admitting air past the valving edge **63** of the sleeve and then to the chambers **44** and **46**.

With this sliding sleeve arrangement, therefore, the pressure fluid acts on the piston for a greater length of piston travel in either direction than would be obtainable with a fixed sleeve. The result is a compact drill with a particularly heavy impact stroke of realtively long duration and a quick and positive return stroke which is also of long power delivering duration. Furthermore, the double effective area of the hammer greatly increases the impact force available.

The modifications shown in Figures 5–11 are generally similar in operation to that described above, but they utilize a sleeve that is fixed against axial movement. This type of construction also results in a diametrically compact design because it utilizes the space between the hammer and cylinder for a porting sleeve. Here, too, the compressed air is carried in storage adjacent each end of the hammer. With this design, however, the timing of compressed air to the upper and lower ends of the drill is not controlled quite so easily, and this design finds more utility where a lighter type impact is desirable.

In the devices of Figures 5–11, it will be noted there is no sleeve actuating chamber **48**, and block **74** replaces blocks **23**, **25** of the Figure 1 device. Axial passages **75** and annular groove **76** place the inlet port **22** in fluid communication with the inlet passage **58** via the radial ports **77** in the fixed sleeve **78**. The sleeve **78** is fixed against axial movement by bearing at its upper end against the shoulder 79 on block 74 and at its lower end by bearing against shoulder 80 of the casing 81. The sleeve 78 has an internal annular groove 82 intermediate its length and also has a series of radial ports 83 at its lower end which place space 58 in communication with distributing passages 38 of the hammer piston. The operation of the drill of these figures is generally the same as those of Figures 1–4, 12 and 13 except there is no movement of the sleeve. Fluid enters chambers 44 and 46 via distributing passages 38 and ports 40 and moves the hammer downwardly until ports 40 are closed by sealing against the internal diameter of the sleeve and after they have passed annular groove 82. Upon reaching the end of its downward stroke, as shown in Figure 8, fluid is admitted to the front effective area 66 of the piston and after hammer valve element 68 has entered bore 20 of the anvil. Fluid pressure then acts on the lower end of the hammer until valve element 68 leaves the bore 20, causing the lower end to open to atmosphere.

The blowing position shown in Figures 10 and 11 is used when it is desired to pass all of the compressed air directly through the drill and without operating the drill, for the purpose of blowing the hole completely free of drillings. This is done periodically and is accomplished as follows.

To position the various parts as shown in Figures 10, 11, it is only necessary to pull the drill slightly upwardly off the bottom of the hole. The piston and anvil then drop downwardly by gravity and the flange 41 (Figure 11) of the piston seals against the internal diametrical surface 6 of the forward sleeve 5. Fluid pressure then cannot reach the lower effective area 66 of the piston hammer to return it upwardly.

When the piston is in this position, pressure fluid is admitted past the flange 39 via the annular groove 86 cut in the internal surface of either fixed sleeve 78, or in sliding sleeve 50 of Figures 1–4. In either embodiment, the blowing feature is the same and is provided for by this blowing port 86 which permits fluid to pass fully through said pressure stroke chambers when they are open to exhaust and while the return chamber is closed. More specifically, the fluid enters the secondary chamber 44 via ports 40 and then through the bores 36, 20 and 19 out the end of the bit. Fluid also passes directly through distributing passages 38, primary chamber 46, ports 33 and out through central bores 31, 36, 20 and 19. Thus the entire pressure supply is directed freely through the drill for blowing purposes with the drill inoperative. The hammer and anvil are held in this lowermost position, not only by gravity, but also very positively by the pressure acting on the area 45 which tends to urge the piston downwardly.

The device shown in Figures 12 and 13 uses a piston having only one effective area on which pressure fluid is effective to act in driving the piston in the power stroke direction. This simplified version of the piston has been shown with a sleeve of the sliding type but can also be used with a fixed sleeve. This piston 90 is the same as the dual area piston in regard to external size and configuration and has the annular flange 39, end flange 41 and valve element 68. With this piston construction a less heavy impact will be delivered than that delivered by the dual area type.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent to said end, an anvil slidably and sealingly mounted in the other end of said cylinder and adapted to carry a tool bit, a hammer reciprocatingly mounted within said cylinder, said hammer and anvil each having a bore extending axially therethrough, a valve stem fixedly mounted within said cylinder adjacent said closed end and adapted to receive said hammer bore in fluid sealing relationship so as to define a power stroke pressure chamber at said closed end, said hammer having a valve element adapted to enter into and form a sliding sealing fit with said anvil bore to thereby close said cylinder other end and define a return pressure chamber, a porting sleeve mounted between said hammer and said cylinder, said cylinder and said sleeve defining a fluid inlet passage therebetween which is in fluid communication with said inlet port, said sleeve and said hammer defining fluid distributing passages therebetween which are adapted to be in communication with said chambers, said sleeve having ports which place said inlet passage in communication with said distributing passage intermediate the length of the latter, and valve means between said hammer and sleeve whereby fluid is directed alternatively to each chamber to cause reciprocation of said hammer.

2. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent said end, an anvil sealingly mounted in the other end of said cylinder for limited reciprocatory movement therein, said anvil having a bore extending axially therethrough, said anvil adapted to be rigidly secured to a tool bit, a hammer reciprocatingly mounted within said cylinder and having a bore extending axially therethrough and communicable with said anvil bore, a valve stem fixedly mounted in said cylinder adjacent said closed end and adapted to receive said hammer bore adjacent one end of said hammer in fluid sealing relationship so as to form a power stroke pressure chamber, said hammer having a valve element at its other end which is adapted to form a sliding sealing fit with said anvil bore to thereby form a return pressure chamber between said cylinder, hammer and anvil, a porting sleeve mounted between said hammer and said cylinder, said cylinder and said sleeve defining an axially extending fluid inlet passage in fluid communication with said inlet port, said sleeve and said hammer defining axially extending fluid distributing passages which are adapted to be in communication with said chamber, said sleeve having ports which place said inlet passage in communication with said distributing passage intermediate the length of the latter, and valve means between said hammer and sleeve whereby fluid is directed alternatively to each chamber to cause reciprocation of said hammer.

3. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent said end, an anvil sealingly mounted in the other end of said cylinder for limited reciprocatory movement therein, said anvil having a bore extending axially therethrough, said anvil adapted to be rigidly secured to a tool bit, a hammer reciprocatingly mounted within said cylinder and having a bore extending axially therethrough and communicable with said anvil bore, a valve stem fixedly mounted in said cylinder adjacent said closed end and adapted to receive said hammer bore adjacent one end of said hammer in fluid sealing relationship so as to form a power stroke pressure chamber, said hammer having a valve element at its other end which is adapted to form a sliding sealing fit with said anvil bore to thereby form a return pressure chamber between said cylinder, hammer and anvil, a porting sleeve slidably mounted between said hammer and said cylinder, said cylinder and said sleeve defining an axially extending fluid inlet passage therebetween and in fluid communication with said inlet port, said sleeve and said hammer defining axially extending fluid distributing passages, said sleeve having ports which place said inlet passage in communication with said distributing passage intermediate the length of the latter, said distributing passages adapted to be in fluid communication with said chambers, said

hammer having an annular flange on its periphery, said sleeve having an internal annular groove registerable with said flange to thereby form valve means between said hammer and sleeve through which fluid is directed to said power stroke chamber, and means for sliding said sleeve in the direction of hammer movement whereby said annular flange and groove move axially in registry for a predetermined distance.

4. A device as defined in claim 3, further characterized in that said last named means includes a sleeve actuating chamber in fluid receiving communication with said power stroke chamber.

5. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent said closed end, an anvil sealingly mounted in the other of said cylinder for limited reciprocatory movement therein, said anvil having a bore extending axially therethrough, said anvil adapted to be rigidly secured to a tool bit, a hammer reciprocatingly mounted within said cylinder and having a bore extending axially therethrough and communicable with said anvil bore, a valve stem fixedly mounted in said cylinder adjacent said closed end and adapted to receive said hammer bore adjacent one end of said hammer in fluid sealing relationship so as to form a primary pressure chamber, said hammer having a secondary pressure chamber, said hammer having a valve element at its other end which is adapted to enter into and form a sliding sealing fit with said anvil bore to thereby form a return pressure chamber between said cylinder, hammer and anvil, said secondary chamber vented to atmosphere via said anvil bore when said element is not in said bore, a porting sleeve mounted between said hammer and said cylinder, said cylinder and said sleeve defining an axially extending fluid inlet passage therebetween which is in fluid communication with said inlet port, said sleeve and said hammer defining fluid distributing passages therebetween, said sleeve having ports which place said inlet passage in communiaction with said distributing passage intermediate the length of the latter, said distributing passages adapted to be in fluid communication with said chambers, and valve means between said hammer and sleeve whereby fluid is directed alternatively to said primary and secondary chambers and to said return chamber to cause reciprocation of said hammer.

6. A device as defined in claim 5, further characterized in that a chamber constantly vented to atmosphere is formed in said hammer and between the latter and the valve stem and also between said primary and secondary pressure chambers.

7. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent said end, an anvil sealingly mounted in the other end of said cylinder for limited reciprocatory movement therein, said anvil having a bore extending axially therethrough, said anvil adapted to be rigidly secured to a tool bit, a hammer reciprocatingly mounted within said cylinder and having a bore extending axially therethrough and communicable with said anvil bore, a valve stem fixedly mounted in said cylinder adjacent said closed end and adapted to receive said hammer bore adjacent one end of said hammer in fluid sealing relationship so as to form a power stroke pressure chamber, said hammer having a valve element at its other end which is adapted to form a sliding sealing fit with said anvil bore to thereby form a return pressure chamber between said cylinder, hammer and anvil, a porting sleeve mounted between said hammer and said cylinder, said cylinder and said sleeve defining an axially extending fluid inlet passage therebetween in fluid communication with said inlet port, said sleeve and said hammer defining axially extending fluid distributing passages therebetween, said sleeve having ports which place said inlet passage in communication with said distributing passage intermediate the length of the latter, said distributing passages adapted to be in fluid communication with said chambers, valve means between said hammer and sleeve whereby fluid is directed alternatively to each chamber to cause reciprocation of said hammer, said valve means including a blowing port, said hammer and anvil adapted to drop by gravity to a blowing position in said cylinder when said tool is raised and thereby place said power stroke chamber in communication with the atmosphere via said bores and seal said return pressure chamber and simultaneously place said power stroke chamber in fluid communication with said inlet passage via said blowing port.

8. A fluid actuated impact tool comprising, in combination, a cylinder having a closed end and a pressure fluid inlet port adjacent thereto, an anvil slidably and sealingly mounted in the other end of said cylinder and adapted to carry a tool bit, a hammer reciprocatingly mounted within said cylinder, said hammer and anvil each having a bore extending axially therethrough, a valve stem fixedly mounted within said cylinder adjacent said closed end and adapted to receive said hammer bore in fluid sealing relationship so as to form a primary pressure chamber, said hammer having a secondary pressure chamber, said hammer having a valve element adapted to enter into and form a sliding sealing fit with said anvil bore to thereby form a return pressure chamber, said secondary chamber vented to atmosphere via said anvil bore when said element is not in said bore, a porting sleeve slidably mounted between said hammer and said cylinder, said cylinder and said sleeve defining a fluid inlet passage therebetween and in fluid communication with said inlet port, said sleeve and said hammer defining a fluid distributing passage therebetween which is adapted to be in communication with said chambers, said sleeve having ports which connect said inlet and distributing passages intermediate the length of the latter, said hammer having an annular flange on its periphery, said sleeve having an internal annular groove registerable with said flange to thereby form valve means between said hammer and sleeve through which fluid is directed to said primary and secondary chambers, and means for sliding said sleeve in the direction of hammer movement whereby said annular flange and groove move axially in registry for a predetermined distance.

9. A device as defined in claim 8, further characterized in that said hammer has a second annular peripheral flange cooperable with an annular groove at the forward end of said cylinder forming valve means through which fluid is directed to the end of said hammer.

References Cited in the file of this patent

UNITED STATES PATENTS

1,053,304	Le Gendre	Feb. 18, 1913
1,345,270	Smith	June 29, 1920
1,499,569	Bailly	July 1, 1924
1,692,937	Hulshizer	Nov. 27, 1928
2,333,405	Appton	Nov. 2, 1943
2,661,928	Topenaliar	Dec. 8, 1953
2,665,115	Bassinger	Jan. 5, 1954
2,810,549	Morrison	Oct. 21, 1957
2,851,251	Mori	Sept. 9, 1958