

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FLOTEK INDUSTRIES, INC., TURBECO, INC., and
TELEDRIFT COMPANY,
Petitioner,

v.

NATIONAL OILWELL DHT, L.P.,
Patent Owner.

Case IPR2015-01210
Patent 6,431,294 B1

Before KEN B. BARRETT, SUSAN L. C. MITCHELL, and
JAMES J. MAYBERRY, *Administrative Patent Judges*.

MAYBERRY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

Petitioners, Flotek Industries, Inc., Turbeco, Inc. (d/b/a Spidle Turbeco, d/b/a Galleon Turbeco and d/b/a Cavo Drilling Motors), and Teledrift Company (d/b/a Spidle Turbeco) (collectively “Flotek”), filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1–13, 15, 16, and 18–24 of U.S. Patent No. 6,431,294 B1 (“the ’294 patent”). Patent Owner, National Oilwell DHT, L.P. (“NOV”),¹ filed a Preliminary Response (Paper 10, “Prelim. Resp.”) to the Petition. We instituted trial on all asserted grounds. Paper 11, 39 (“Dec. on Inst.”).

After institution of trial, Patent Owner filed a Patent Owner Response (“PO Resp.”) to the Petition. Paper 19. Petitioner filed a Reply (“Reply”) to Patent Owner’s Response. Paper 23. Petitioner relies on the Declaration testimony of Dr. Douglas E. Smith in support of its Petition (Ex. 1002). Patent Owner relies on the Declaration testimony of Dr. John Edward Akin (Ex. 2005) in support of its Patent Owner Response.

Oral hearing was conducted on July 21, 2016. The record contains a transcript of the hearing. Paper 33 (“Tr.”).

The Board has jurisdiction under 35 U.S.C. § 6(b). This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

Petitioner has shown by a preponderance of the evidence that claims 1–3, 5–7, 9–13, 15, 16, and 18–24 are unpatentable as obvious over U.S. Patent No. 2,738,956 to Bielstein (Ex. 1006, “Bielstein”). Petitioner has also shown by a preponderance of the evidence that claims 1, 5, and 8 are

¹ At the time the Petition was filed, the patent owner of record was Andergauge Ltd. NOV subsequently recorded assignment documents evidencing that it is the current owner. See Exhibit 3002.

unpatentable as obvious over U.S. Patent No. 3,270,822 to Cleary (Ex. 1010, “Cleary”). Petitioner has not shown by a preponderance of the evidence that claim 4 is unpatentable as obvious over Bielstein.

A. Related Proceedings

The parties indicate that the ’294 patent is the subject of litigation in *National Oilwell DHT, L.P. v. Flotek Industries, Inc.*, No. 2:14-CV-01056 (E.D. Tex.) and *National Oilwell DHT, L.P. v. Amega West Services, LLC*, No. 2:14-CV-01020 (E.D. Tex.). Pet. 1; Paper 6, 2.

B. The ’294 Patent

The ’294 patent, entitled “Percussive Tool,” issued August 13, 2002. The claims of the ’294 patent are directed to a percussive drill and method for using the drill. Ex. 1001, 5:15–6:59. Specifically, the claims are directed to a percussive drill that employs a valve that controls the flow of fluid through a fluid transmitting body, where the fluid provides hydraulic pressure to accelerate a mass to provide a percussive force against a drill bit support. *Id.* at 1:27–2:67.

Figure 1, reproduced below, depicts an embodiment of the percussive tool.

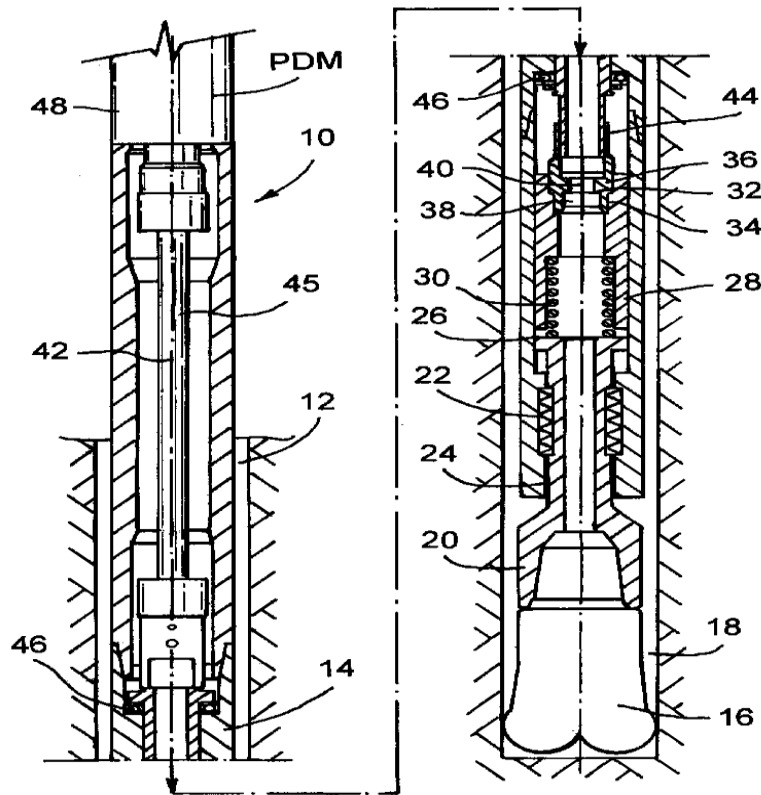


Figure 1 above illustrates percussion drill 10 located in drilled bore 12. Ex. 1001, 3:18–19. Details of the invention are best understood by way of an explanation of how the tool works. In the embodiment of Figure 1, drilling fluid is passed through motor 48, which rotates transmission shaft 45 and drive shaft 44. *Id.* at 3:44–48. Drilling fluid passes through fluid transmitting body 14, including valve 32, ultimately reaching the drill face of drill bit 16, where it lubricates the drill bit and carries cuttings away from the face. *Id.* at 3:20–23. The rotation of drive shaft 44 rotates upper valve plate 36 of rotating valve 32. *Id.* at 3:48–49. Upper valve plate 36 includes slot 40 and, as upper valve plate 36 rotates, it causes slot 40 to align and misalign with slot 38 in stationary valve plate 34, which is fixed relative to mass 28. *Id.* at 3:49–50. By misaligning slots 38, 40, valve 32 restricts the flow of drilling fluid through fluid transmitting

body 14. *Id.* at 3:50–52. This restriction produces a pressure differential across valve 32 and creates an unbalanced force across the top of mass 28, causing mass 28 to move down and compress spring 30—that is, the fluid pressure on the valve plates at the top of mass 28 becomes greater than the fluid pressure below the mass and the compressive force of spring 30. *Id.* at 3:52–54. When mass 28 reaches the end of its downward stroke, it impacts anvil face 26, which is the top surface of the mandrel, or drill bit support 20. *Id.* at 3:55–56. This impact is transmitted through mandrel 20 to the operating face of drill bit 16. Ex. 1001, 3:56–57. As valve plate 36 continues to rotate, slots 38, 40 align, which opens valve 32, reducing the restriction to flow through valve 32 and reducing the pressure differential across valve 32. *Id.* at 3:57–60. This reduction in downward force causes spring 30 to force mass 28 upwards. *Id.* at 3:60–61. Valve plate 36 continues to rotate, and this cycle is repeated. *Id.* at 3:61–62.

The embodiments of Figures 2 and 3 of the '294 patent operate in a similar manner. However, in these embodiments, the rotating valve is located above the mass, rather than mounted on the mass, and is configured such that the upper valve plate rotates without a connection to a drive shaft. See Ex. 1001, 4:7–10, 4:25–30, Figs. 2, 3. These embodiments include a nozzle in the central bore of the mass. See *id.* at 4:15–17, 4:27–29. When the ports in the valve plates are aligned, fluid flows through the nozzle, creating a pressure differential, with the pressure above the mass greater than the pressure below the mass. *Id.* at 4:21–24. This pressure differential causes the mass to accelerate downward and strike the anvil. *Id.* When the valve plate rotates to close the valve, flow through the nozzle reduces, which reduces the pressure drop across the mass and causes the spring to return the

mass upward. *See id.* at 4:17–24. As the valve plate continues to rotate, the cycle repeats. Patent Owner describes the embodiments of Figures 2 and 3 as embodiments where the rotating valve is provided separately from the means for creating a fluid pressure force on the mass. *See* PO Resp. 11;² *see also* Tr. 31–32 (explaining that, in the embodiment of Figure 2 of the '294 patent, “the valve is provided separately of the movable mass,” which differs from the embodiment of Figure 1); Ex. 1002 (providing Petitioner’s expert declaring that, for the embodiment of Figure 2, “the rotating valve 64 is separate from ‘a means associated with the mass for creating a fluid pressure force on said mass,’ which is the increased fluid pressure on the upwardly facing area on the top surface of mass 62”).

The embodiment of Figure 3 further includes bypass conduit 104. Ex. 1001, 4:36–38, Fig. 3. A stationary valve plate includes two ports, where the rotating valve plate provides fluid communication with the nozzle in the central bore of the mass when its port is aligned with one of the ports of the stationary plate, and provides fluid communication with the bypass conduit when its port is aligned with the other port of the stationary plate. *Id.* at 4:30–38.

² The Patent Owner Response states that the '294 patent’s Figures 3 and 4 provide embodiments where the rotating valve is provided separately from the means for creating a fluid pressure force on the mass. *See* PO Resp. 11. We read this statement as a typographical error, with the Patent Owner actually meaning Figures 2 and 3. *See id.* at 12 (discussing Figures 2 and 3).

C. Illustrative Claim

Claims 1, 19, 21, and 23 of the challenged claims of the '294 patent are independent. Claims 1 and 19 are illustrative of the claimed invention and are reproduced below.

1. A percussion drill comprising:
 - a fluid transmitting body;
 - a drill bit support coupled to the body;
 - a mass movable relative to the body for impacting on the drill bit support;
 - means associated with the mass for creating a fluid pressure force on said mass;
 - a rotating valve located in the body for controlling flow of fluid through the body to produce a varying fluid pressure force on the mass and induce acceleration of the mass; and
 - a valve motor for driving said valve.

19. A percussive drilling method comprising the steps:
 - providing a drill having
 - a fluid transmitting body,
 - a drill bit support mounted to the body,
 - a mass movable relative to the body for impacting on the drill bit support,
 - a rotating valve in the body for controlling flow of fluid through the body and
 - a valve motor for driving said valve; and
 - passing drilling fluid through the body and the drill bit support via the rotating valve to vary the flow of the fluid through the body and produce a varying fluid pressure force on the mass to induce acceleration of the mass.

Ex. 1001, 5:16–28, 6:16–26.

D. Prior Art References

We instituted *inter partes* review on grounds of unpatentability for claims 1–13, 15, 16, and 18–24 of the '294 patent that rely on the following prior art references.

Bielstein	US 2,738,956	Mar. 20, 1956	Ex. 1006
Cleary	US 3,270,822	Sept. 6, 1966	Ex. 1010

Dec. on Inst. 7, 39.

E. Asserted Grounds of Unpatentability

We instituted *inter partes* review on the following asserted grounds of unpatentability for the challenged claims of the '294 patent.

References	Basis	Claims Challenged
Bielstein	35 U.S.C. § 103(a)	1–7, 9–13, 15, 16, and 18–24
Cleary	35 U.S.C. § 103(a)	1, 5, and 8

Dec. on Inst. 39.

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are given their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *see also* *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–46 (2016) (concluding that 37 C.F.R. § 42.100(b) “represents a reasonable exercise of the rulemaking authority that Congress delegated to the Patent Office”). Under the broadest reasonable construction standard, claim terms are given their ordinary and customary meaning, as would be understood by one of ordinary skill in the

art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). Also, we are careful not to read a particular embodiment appearing in the written description into the claim if the claim language is broader than the embodiment. *See In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993) (“[L]imitations are not to be read into the claims from the specification.”) (citation omitted).

1. Level of Ordinary Skill in the Art

Flotek contends that the level of ordinary skill in the art of the ’294 patent “is a person who has, through formal education or extensive practical experience has the equivalent of a Bachelor’s Degree in Mechanical Engineering *or* 2 to 3 years of experience in the design, use or making of downhole tools.” Pet. 3 (emphasis added); *see also* Ex. 1002 ¶ 10 (providing Flotek’s expert’s, Dr. Smith’s, testimony on the level of ordinary skill in the art corresponding to the ’294 patent).

NOV disputes this proffered level of ordinary skill for the ’294 patent. NOV contends that the level should be “a person who has, through formal education or extensive practical experience, has the equivalent of a Bachelor’s Degree in Mechanical Engineering and 2 to 3 years of experience in the design, use or making of downhole tools.” PO Resp. 4; *see also* Ex. 2005 ¶¶ 18–23 (providing NOV’s expert, Dr. Akin’s, testimony on the level of ordinary skill in the art corresponding to the ’294 patent). That is, NOV contends that both a degree in Mechanical Engineering and practical experience designing, making, or using downhole tools is required. *See id.* NOV bases this contention, in part, on an assertion that the ’294 patent is directed to the field of downhole tools. *See* PO Resp. 5–6.

Based on our review of the record, the '294 patent appears to cover a broader field than downhole drilling. The '294 patent expressly states that the field of the invention “relates to percussive tools” and *is not exclusively limited to* a percussive tools for use in drilling operations using drilling fluid—that is, downhole drilling. Ex. 1001, 1:5:8. Indeed, the '294 patent’s description of the prior art encompasses two industries that employ percussive tools that do not employ drilling fluid—the mining and construction industries. *Id.* at 1:9–20. Also, contrary to NOV’s contention, not all of the art cited on the face of the '294 patent is in the field of downhole drilling. See PO Resp. 5–6. For example, U.S. Patent No. 4,478,248 (provided as Ex. 2008) is directed to drilling holes for roof bolts in rock formations in mines. See Ex. 2008 1:15–30; *see also* Ex. 2007 (describing the background of the invention to encompass drilling holes for roof bolts in mines).

NOV also contends that downhole tools are complex, necessitating its asserted higher level of skill. In reply, Flotek states that the devices described in the '294 patent are basic. Reply 23. Flotek further explains that, to the extent that downhole tools are complex, those components that add complexity to the tools are neither claimed nor even disclosed in the '294 patent. *Id.* at 24 (discussing deposition testimony from Dr. Akin admitting that certain complex concepts are not claimed or disclosed in the '294 patent).

Factual indicators of the level of ordinary skill in the art include “the various prior art approaches employed, the types of problems encountered in the art, the rapidity with which innovations are made, the sophistication of the technology involved, and the educational background of those actively

working in the field.” *Jacobson Bros. v. U.S.*, 512 F.2d 1065, 1071 (Ct. Cl. 1975); *see also Orthopedic Equip. Co. v. U.S.*, 702 F.2d 1005, 1011 (Fed. Cir. 1983) (quoting with approval *Jacobson Bros.*). We find that much of the prior art of record discloses similar equipment as that disclosed in the ’294 patent. *See* Exs. 1005, 1006, 1007, 1008, 1009, 1010. Also, we agree with Flotek that the components disclosed and claimed in the ’294 patent are simple. *See* Reply 23. Finally, both Dr. Smith and Dr. Akin indicate that the level of ordinary skill encompasses, at least in part, a person with a Bachelor’s degree in Mechanical Engineering, and based on this indication, we find that the educational background of those actively working in the field is a Bachelor of Mechanical Engineering. Accordingly, we adopt Flotek’s definition of the level of ordinary skill in the art.

2. *“means associated with the mass for creating a fluid pressure force on said mass”*

Independent claims 1 and 21 each recite the claim limitation “means associated with the mass for creating a fluid pressure force on said mass.” Ex. 1001, 5:21–22, 6:36–37. As both Flotek and NOV agree, this claim limitation invokes the requirements of 35 U.S.C. § 112, paragraph 6.³ *See* Pet. 4; Prelim. Resp. 9. Accordingly, we construe this limitation by determining what the claimed function is and identifying the structure disclosed in the specification that corresponds to the means for performing

³ Paragraph 6 of 35 U.S.C. § 112 was replaced with newly designated § 112(f) when § 4(c) of the America Invents Act (AIA), Pub.L. No. 112–29, took effect on September 16, 2012. Because the application resulting in the ’294 patent was filed before that date, we refer to the pre-AIA version of § 112.

that function. *See Kemco Sales, Inc. v. Control Papers Co.*, 208 F.3d 1352, 1360 (Fed. Cir. 2000); *see also In re Donaldson Co.*, 16 F.3d 1189, 1193 (Fed. Cir. 1994) (“[P]aragraph six applies regardless of the context in which the interpretation of means-plus-function language arises, i.e., whether as part of a patentability determination in the PTO or as part of a validity or infringement determination in a court.”).

Both parties agree that the recited function for this claim element is “creating a fluid pressure force on said mass.” *See* Pet. 4; Prelim. Resp. 10. Flotek contends that the structures “are those surface areas disclosed in the ’294 patent associated with the mass . . . that are subjected to fluid pressure,” “includ[ing] the upward facing surfaces and downward facing surfaces of the mass.” Pet. 4 (citing Ex. 1002 ¶¶ 31–35 (Declaration of Dr. Douglas E. Smith); Exhibit 1001, Figs. 1–3, 3:44–61, 4:15–23, 4:38–46). As Flotek explains, with respect to the embodiment of Figure 1 of the ’294 patent, rotating valve 32 causes a restriction in the flow pathway and the resulting increase in fluid pressure creates a force that is exerted downward on the valve plate of valve 32 and the upward facing areas of mass 28. Pet. 5. Flotek further explains that the downward facing areas of mass 28 are subjected to a reduced fluid pressure, resulting in a net force exerted downward on the mass 28. *Id.* For the embodiments of Figures 2 and 3 of the ’294 patent, Flotek identifies the upward facing surfaces and downward facing surfaces of the mass as corresponding structure, and explains the role of the rotating valve and nozzle in affecting the fluid pressure on these surfaces. *Id.* at 5–6.

NOV agrees with Flotek’s identified structure “provided that it’s understood that that would include in Figure 1 [of the ’294 patent] the

surfaces where the pressure is generated, which is the valve surface on which the pressure is created.” Tr. 47; *see also* PO Resp. 10–11 (“With respect to the ‘means associated with the mass for creating a fluid pressure force on said mass,’ this Response addresses the patentability of the pertinent claims under the construction of that limitation proposed by Flotek’s as addressed in the Decision [on Institution].”). Flotek recognizes that, in the embodiment of Figure 1 of the ’294 patent, the upward facing surface of the valve is a structure corresponding to the claimed means. *See, e.g.*, Pet. 4–5 (defining the associated structure as “those surface areas . . . associated with the mass – whether integral or provided separately from the mass – that are subjected to fluid pressure” and identifying valve plate 36 as one such structure).

As the parties do not dispute the construction of this term and we find Flotek’s proposed construction proper in light of the record, we adopt Flotek’s construction.

3. “*valve motor*”

For the purposes of the Decision on Institution, we gave the term “valve motor” its ordinary and customary meaning—“a device that imparts motion to the valve.” *See, e.g.*, WEBSTER’S 3D NEW INT’L DICTIONARY 1475 (2002) (defining “motor” as “one that imparts motion: a source of mechanical power”) (provided as Ex. 3001). Neither party offers, expressly, an alternative construction for “valve motor,” and based on the record

developed during trial, we discern no reason to adjust the meaning. *See* PO Resp. 26; Reply 5.⁴

4. “slot,” “spline,” and “rotating valve”

Although these terms were addressed in our Decision on Institution, they are no longer in controversy in this proceeding, and accordingly, we do not offer explicit constructions for these terms here. *See Vivid Techs., Inc. v. Am. Sci. & Eng’g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (construing *explicitly* only those claim terms in controversy and only to the extent necessary to resolve the controversy). In the Patent Owner Response, NOV addresses the patentability of the instituted claims applying the constructions in our Decision on Institution. *See* PO Resp. 10–11.

B. Overview of the Prior Art

We instituted trial for grounds involving two prior art references—Bielstein and Cleary.

a. Overview of Bielstein

Bielstein, entitled “Rotary Percussion Drilling Device,” “is directed to a drilling device in which a well [is] drilled in an earth formation by rotating a drill bit while simultaneously causing jars or vibrations on a drill bit.” Ex. 1006, 1:19–22.

⁴ Although NOV does not dispute this construction expressly, underlying its arguments as to the patentability of certain claims over Bielstein is how the claim limitation “a valve motor for driving [the rotating] valve” should be interpreted. We address these arguments *infra*, in our analysis of the patentability of claims 1–7, 9–13, 15, 16, and 18–24 over Bielstein.

Figure 1 of Bielstein, reproduced below, illustrates an embodiment of its invention.

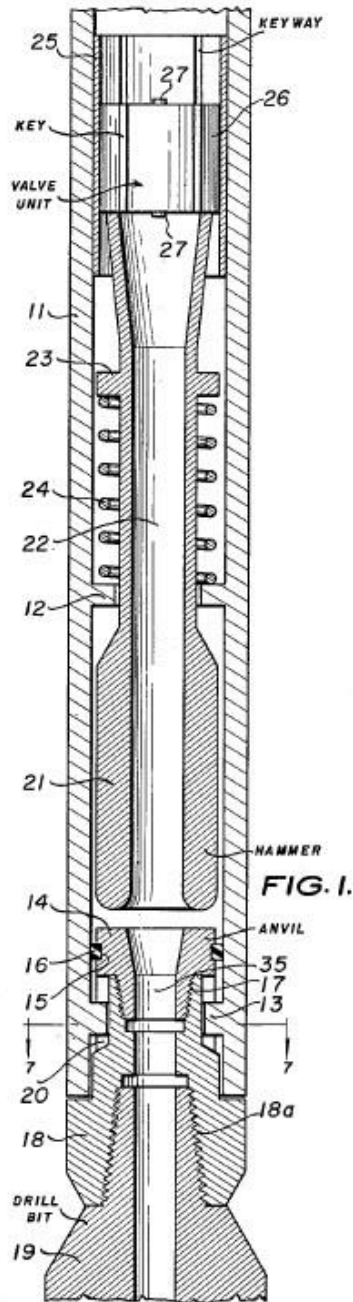


Figure 1 provides a sectional view of Bielstein's drilling device. Within tubular member 11, valve piston 26 is attached to the top of hammer 21, which includes central passageway 22. Ex. 1006, 2:25-34. The valve

piston includes rotating valve element 28 that provides ports for the passage of drilling fluid. *Id.* at 2:34–36. Hydraulic forces cause the valve piston and hammer to move downward, where the hammer strikes anvil 14. *Id.* at 3:23–29. The anvil is attached to drill bit 19 through drilling sub 18. *Id.* at 2:18–23. After the hammer strikes the anvil, hydraulic forces are reduced and the hammer is returned upward by spring 24. *Id.* at 3:38–40.

Bielstein's Figures 2, 3, and 4, reproduced below, depict details of valve piston 26.

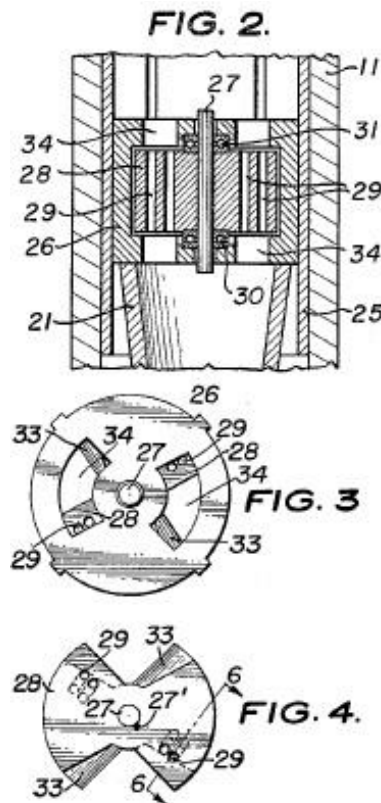


Figure 2 depicts an enlarged view of the valve within piston 26; Figure 3 depicts a top view of the valve unit within piston 26; and Figure 4 presents a top view of rotatable valve element 28. Rotatable valve element 28 includes slanted areas 33 that, when impacted by fluid flowing through tubular member 11 into piston 26, cause the rotatable valve element to

section of a size similar to keyway 59, is pulled through the keyway, causing the vane to rotate, which rotates shaft 54 and valve element 52. *Id.* at 3:67–4:7. Other aspects of this embodiment are the same as the embodiment of Bielstein’s Figure 1, including its general operation, where valve element 52 rotates to open and close ports 65 in the valve piston. *Id.* at 3:46–4:24.

Bielstein’s Figures 10 and 11, reproduced below, provide additional details of valve piston 50.

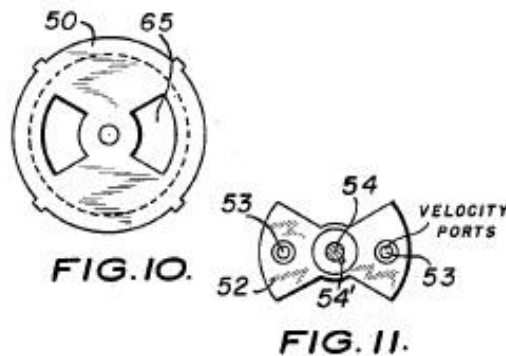
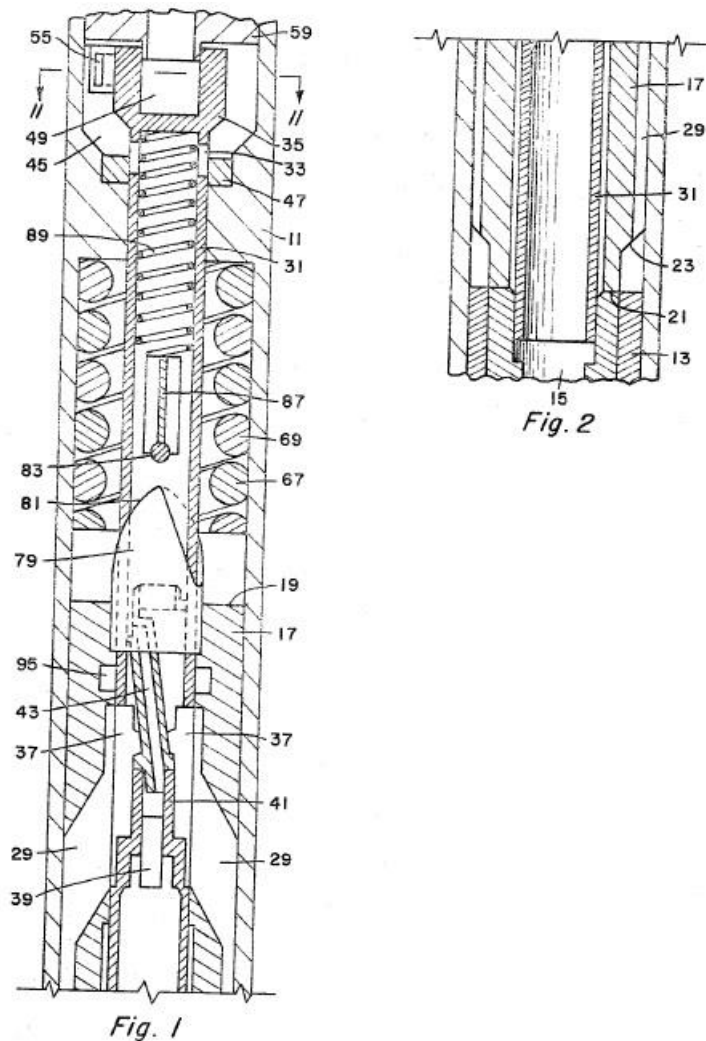


Figure 10 depicts a top view of valve piston 50. Ex. 1006, 2:7–8. Figure 11 depicts a top view of rotatable valve element 52. *Id.* at 2:9–10. Rotatable valve element 52 is located within valve piston 50. *See id.* at Fig. 8. When rotatable valve element 52 is oriented such that its “wings” block ports 65, the flow of drilling fluid is restricted through valve piston 50. *See id.* at 3:46–61. The drilling fluid exerts hydraulic pressure on the top surface of valve piston 50 (that is, the surface depicted in Figure 10) and on the portion of rotatable element 52 that covers ports 65, which forces valve piston 50 and hammer 21 downward towards anvil 14. *See id.*

b. Overview of Cleary

Cleary, entitled “Percussive Unit for Earth Drilling,” “is concerned with fluid-actuated percussive units for earth borehole drilling.” Ex. 1010, 1:12–14.

Figures 1 and 2 of Cleary, reproduced below, illustrate an embodiment of its invention.



“Figures 1 and 2 are elevational, fragmented, partial cross-sectional views showing the internal construction of one embodiment of the percussive mechanism described” in Cleary. Ex. 1010, 2:34–36. “[T]he basic components of the percussive unit are a ported rotating valve for

supplying power fluid to and removing power fluid from the ends of the hammer, a reciprocating hammer with upper and lower passages, a cam and follower, and a rebound spring above the hammer.” *Id.* at 8:22–27.

Specifically, the embodiment of Cleary’s Figures 1 and 2 includes hammer 17 within a fluid transmitting tubular housing 11 that delivers percussive blows to a drill bit through anvil 13. *Id.* at 3:57–72. The hammer includes upper surfaces 19, lower surfaces 21, and central bore 25. *Id.* at 3:72–4:3. The central bore is in fluid communication with hammer passage 27, which is in fluid communication with the upper surfaces of the hammer, and hammer passage 29, which is in fluid communication with the lower surfaces of the hammer. *Id.* at 4:3–20. Rotatable tubular valve 31 extends longitudinally through the central bore, with an open end at its bottom and inlets 33 at its upper end. Ex. 1010, 4:34–38. The valve includes inlet ports 37 and exhaust ports 39. *Id.* at 4:58–72. The rotation of the valve is driven by rotary drive means 35 positioned near the top of housing 11 and valve 31. *Id.* at 4:41–44.

In operation:

[A]t time zero, the hammer rests on anvil 13, inlet ports 37 are just opening to lower hammer passages 29 and exhaust ports 39 are just opening to upper hammer passages 27. Power fluid enters rotary drive means 35 . . . causing the rotary drive means to rotate tubular valve 31. Power fluid passes downward in passageway 45 through inlet openings 33 and into the inlet section of tubular valve 31. Power fluid inlet ports 37 communicate with lower or second hammer passages 29 which in turn communicate with the underside surfaces of the hammer. The power fluid pressure acting on the underside surfaces of the hammer causes the hammer to accelerate upward in its up or return stroke. At the same time, power fluid above the hammer is exhausted through upper first hammer passages 27, power

fluid exhaust ports 39 and the exhaust section of tubular valve 31 where the exhausted fluid is conducted through anvil passage 15 to the drill bit.

Hammer 17 accelerates upward causing single-acting cam surface 81 to rise to a point where the cam surface could contact cam follower 83. Whether or not cam follower 83 contacts cam surface 81 will depend on the angular or rotative position of tubular valve 31. If the valve is rotating either too fast or too slow relative to the position of the hammer, single-acting surface 81 will contact the cam follower causing the follower to follow the cam surface thereby coordinating the axial motion and position of the hammer with the angular or circumferential rotative position of inlet ports 37 and exhaust ports 39 in the tubular valve.

Hammer 17 continues to accelerate upward in its upstroke as long as power fluid passes from inlet ports 37 to second hammer passages 29 and the underside of the hammer. At the desired moment of upward hammer travel and valve rotation, power fluid inlet ports 37 rotate out of communication with second hammer passages 29 cutting off the flow of power fluid to the underside of the hammer.

...

When power fluid inlet ports 37 rotate out of communication with the second hammer passages, the hammer continues to travel upward decelerating and compressing springs 67 and 69 until the upward energy of the hammer is absorbed by these springs and the drill string.

...

Before the hammer reaches its upward peak, tubular valve 31 rotates far enough for power fluid inlet ports 37 to communicate with upper or first hammer passages 27. High pressure power fluid passes upward via passages 27 to exert its pressure on the upside surfaces of the hammer. This pressure causes some deceleration of the hammer and, once the hammer reaches its peak upward travel, causes the hammer to accelerate downward.

...

[A]t the same instant as power fluid inlet ports 37 rotate into communication with first hammer passages 27, power fluid exhaust ports 39 rotate into communication with lower or second hammer passages 29. This allows fluid beneath the hammer to exhaust through second hammer passages 29 and power fluid exhaust ports 39 and into anvil bore 15.

The hammer accelerates downward until it leaves springs 67 and 69. After leaving these springs . . . the hammer accelerates downward until it impacts the anvil. The cycle then repeats itself.

Ex. 1010, 8:28–9:56.

1. *Claims 1–7, 9–13, 15, 16, and 18–24 in view of Bielstein*

Flotek contends that claims 1–7, 9–13, 15, 16, and 18–24 would have been obvious to one of ordinary skill in the art based on Bielstein. Pet. 11.

Section 103(a) forbids issuance of a patent when “the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains.”

KSR Int’l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when available, secondary considerations, such as commercial success, long felt but unsolved needs, and failure of others. *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). We analyze these factual determinations below.⁵

⁵ We address the level of ordinary skill in the art *supra*, in Section II.A.1.

a. Claim 1

As noted above, independent claim 1 is directed to a percussion drill, including “a fluid transmitting body; a drill bit support coupled to the body; [and] a mass movable relative to the body for impacting on the drill bit support.” See Ex. 1001, 5:16–21. Flotek contends that Bielstein discloses the quoted subject matter. Specifically, Flotek contends that Bielstein discloses a percussion drill where fluid is transmitted within tubular member 11, through ports in valve piston 26 (in the embodiment of Figure 1) or valve piston 50 (in the embodiment of Figure 8) and eventually to drill bit 19. Pet. 12–14. Flotek further contends that Bielstein discloses a drill bit support coupled to the fluid transmitting body—sub 18 and anvil 14 attached to drill bit 19. *Id.* at 14, 15. Flotek also identifies Bielstein’s hammer 21 as a mass that moves relative to tubular member 11 to impact the drill bit support at anvil 14. *Id.* NOV does not contest Flotek’s application of Bielstein to these claim elements. See PO Resp. 11–32 (arguing the patentability of claims over Bielstein and not arguing that Bielstein fails to disclose the recited rotating valve). We are satisfied, based on our review of the trial record, that Flotek has adequately demonstrated that Bielstein discloses the above-quoted elements, and we adopt Flotek’s reasoning and support as our own.

Claim 1 also recites a “means associated with the mass for creating a fluid pressure force on said mass,” which invokes the requirements of 35 U.S.C. § 112, paragraph 6. In order for a prior art element to meet a section 112, paragraph 6, means-plus-function limitation, the prior art element must either be the same as the disclosed structure or be a section

112, paragraph 6, equivalent. *In re Donaldson Co.*, 16 F.3d 1189, 1195 (Fed. Cir. 1994). Two structures may be “equivalent” for purposes of section 112, paragraph 6, if they perform the identical function, in substantially the same way, with substantially the same result. *See Kemco Sales, Inc. v. Control Papers Co.*, 208 F.3d 1352, 1364 (Fed. Cir. 2000).

Flotek contends that Bielstein discloses the recited means. Pet. 15–16. Flotek identifies the structure disclosed in the ’294 patent for performing the recited “creating” function as “those surface areas disclosed in the ’294 patent associated with the mass – whether integral or provided separately from the mass – that are subjected to fluid pressure.” *Id.* at 4. We find that such surface areas include the horizontal surfaces of the mass and the upper facing surface of the upper plate of rotating valve 32. Flotek contends that, in the embodiment of Bielstein’s Figure 8, a downward hydraulic force is exerted on piston 50, which is attached to hammer 21, caused by a restriction in the flow of drilling fluid in ports 65 when valve element 52 closes the ports. *Id.* at 15–16. That is, the structures that correspond to the recited means that is disclosed in Bielstein include the upper-facing surfaces of piston 50 and the upper-facing surfaces of valve element 52. *See, e.g.*, Pet. 23 (indicating that the top surface of piston 50 corresponds to the recited means); Ex. 2004, 34 (containing the deposition testimony of Flotek’s expert and providing the following exchange: “Q. And so is it correct that you believe both Elements 50 and 52 of Figure 8 of Bielstein 956 are part of the ‘means associated with the mass for creating a fluid pressure force on said mass’? A. Yes, they are each -- each qualifies for that.”).

NOV agrees with Flotek's position. See PO Resp. 14; Tr. 50 ("And I think in terms of the operation of Bielstein, there's really no question about [which structures correspond to the means]."). We are satisfied, based on our review of the trial record, that Flotek has shown by a preponderance of the evidence that Bielstein discloses the recited means for creating a fluid pressure force or an equivalent thereof—we find that the upper-facing surfaces of piston 50 and the upper-facing surfaces of valve element 52 are the same structures as the structure disclosed in the '294 patent.

As for the limitation requiring "a rotating valve located in the body for controlling flow of fluid through the body to produce a varying fluid pressure force on the mass and induce acceleration of the mass," Flotek alleges that, as to the embodiment of Bielstein's Figure 8, valve piston 50, with its rotatable valve element 52, satisfies this claim element. Pet. 16–17. As Flotek explains, the valve piston, which is within tubular member 11, includes ports 65, and valve element 52 rotates to open or close flow through the valve. *Id.* at 17. In this way, the valve controls the flow of drilling fluid through tubular member 11 by varying the flow of fluid to produce a varying fluid pressure on the hammer to cause the hammer to strike the anvil. *Id.* at 17–19. That is, Bielstein discloses a valve located in the body of a drill that is capable of controlling the flow of fluid through the body to produce a varying fluid pressure force on a mass and induce acceleration of the mass through the rotation of one or more valve components. NOV does not dispute this contention. See PO Resp. 11–32 (arguing the patentability of claims over Bielstein and not arguing that Bielstein fails to disclose the recited rotating valve). We are satisfied, based on our review of the trial record, that Flotek has shown by a preponderance of the evidence that

Bielstein discloses the recited rotating valve and we adopt this reasoning and support as our own.

With respect to the claim element requiring “a valve motor for driving said valve,” Flotek alleges that, as to the embodiment of Bielstein’s Figure 8, this claim element is satisfied by helical vane 57 and plate 58. Pet. 19–20.⁶ As Flotek explains, “[h]elical vane 57 with synchronizing plate 58 under the reciprocating motion provided by hammer 21 forms an oscillatory valve motor that drives rotatable valve element 52.” *Id.* at 20. That is, as hammer 21 moves down, it pulls helical vane 57 through plate 58, which causes helical vane 57 and shaft 54 to rotate. *See* Ex. 1006, 3:48–61. Shaft 54, in turn, causes rotatable valve element 52 to rotate within piston 50. *See id.* As valve element 52 rotates within piston 50, it controls the flow of drilling fluid through ports 65. *See id.*

NOV disputes Flotek’s position. NOV contends that independent claim 1 requires both a rotating valve and a valve motor for driving the rotating valve. PO Resp. 24. That is, that claim 1 “explicitly recite[s] the rotating valve and the valve motor as separate elements.” *Id.* NOV further notes that the Specification for the ’294 patent discloses embodiments with the rotating valve and valve motor as separate components. *Id.* at 24–26 (comparing the embodiments of Figures 1 and 2 of the ’294 patent). NOV argues that “[i]n context of the claim language ‘a valve motor driving a valve,’ one of skill in the art would understand that the valve motor is a

⁶ Flotek further contends that one of ordinary skill in the art would have understood that the embodiment of Bielstein’s Figure 1 could be modified to include helical vane 57 to drive the rotatable valve element. Pet. 20–21. We need not address this position, because we find that Figure 8 of Bielstein satisfies “a valve motor for driving said valve.”

component that imparts motion to the valve, and that the valve motor and the valve are different components.” *Id.* at 26–27. NOV further argues that this understanding is consistent with its expert, Dr. Akin’s, understanding of how the term motor would be understood in the field of downhole drilling. *Id.* at 27. At oral argument, NOV made clear how the term “valve motor for driving [the rotating] valve” should be construed:

JUDGE BARRETT: So are you asking us to construe the claims [with respect to the valve motor recitation of claim 1] as limited to the disclosure in the spec?

MR. McAUGHAN: No, Your Honor. For example, the disclosure in the specification requires a positive displacement motor. As I mentioned earlier, any motor that provides an independent motive force to drive the rotational valve to control the fluid flow we believe would be within the scope of the claims.

Tr. 42.

NOV argues that, in the embodiment of Bielstein’s Figure 8, which Flotek relies on for disclosing helical vane 57 and plate 58 as the recited valve motor, it is piston 50, which is part of the rotating valve, that drives the rotation of rotating element 52 and helical vane 57 merely reacts to the movement of the piston. PO Resp. 29; *see also id.* at 30 (“[M]ovement of the rotational member 52 originates from fluid pressure force against the valve (e.g., rotational member 52), rather than the helical vane 57.”). That is, the motive force for rotating the valve is not independent from the valve.

To further support its position, NOV notes that Flotek’s expert characterizes vane 57 and plate 58 as a cam and follower, which creates relative motion between the two components separate from what drives the motion. PO Resp. 30. NOV contends that it is “interesting” that Dr. Smith

finds that Bielstein's cam-and-follower arrangement is a valve motor yet Cleary's cam-and-follower arrangement is not. *Id.* at 31.

At oral hearing, NOV argued, when attempting to distinguish Bielstein's vane 57 and plate 58 from the valve motor of claim 1, that claim 1's rotating valve is "a valve that's driven by the motor to control the flow of fluid through the body." Tr. 32. NOV characterizes the relationship of the motor to the valve in claim 1 as one where "the valve motor provides a driving motive force that then rotates the [valve] to control the fluid and varying the fluid pressure force on the mass," that is, "it's the fluid pressure that is a function of the valve motor driving the valve." *Id.* at 33. In contrast, NOV contends that Bielstein's configuration is not one where "you have a motor independently driving the rotation of the valve to control the fluid, but rather it's one where the fluid pressure is causing forces that drive the rotation of the valve." *Id.* at 34. NOV argues that, in Bielstein's configuration, without a change in fluid pressure on piston 50, the mass will not move up and down to drive the valve to cause a change in the fluid pressure—"[t]here's no independent motive force that causes the rotation of the valve." *Id.* at 35.

Flotek replies that Bielstein's valve motor—helical vane 57 (and shaft 54) and plate 58—are separate components from valve piston 50 and rotatable element 52. Reply 6–7. Flotek further states that, similar to the positive displacement motor of the embodiment of Figure 1 of the '294 patent, fluid pressure imparts the motive force for the motor just like Bielstein's vane 57. Reply 9. Flotek notes that NOV's expert testified that if one removed either vane 57 or plate 58 from Bielstein's configuration, that valve element 52 would not rotate. *Id.* at 10. Flotek also emphasizes that

the '294 patent does not limit the valve motor to the valve motor disclosed in the patent—a positive displacement motor. Reply 11.

We find, based on the record evidence, that Bielstein's helical vane 57, including shaft 54, and plate 58 correspond to the recited "valve motor for driving [the rotating] valve" as required by claim 1. Helical vane 57 and plate 58 drive the rotation of rotating element 52, which causes rotating element 52 to come in and out of alignment with ports 65 to control the flow of fluid through the fluid transmitting body to produce a varying fluid pressure force on the mass. Helical vane 57 is driven by the up and down motion of the mass, which is driven down by an increase in fluid pressure on piston 50 and driven up by spring 24.

We agree with Flotek that helical vane 57, including shaft 54, and plate 58 are separate components from valve piston 50 and rotating element 52. *See* Reply 6–7; *see also* PO Resp. 26–27 (arguing that the valve motor and valve must be separate components). Although their functions may be interconnected, helical vane 57 and plate 58 are separate, physical components from piston 50 and rotating element 52. Accordingly, even under NOV's interpretation of claim 1 to require the recited rotating valve to be a separate component from the recited valve motor, Bielstein discloses such a configuration.

Further, we do not agree with NOV's interpretation that the valve motor of claim 1 requires an independent motive force to drive the rotation of the valve—that is, a force that is divorced from the valve itself. Nothing in the language of the claims requires the valve motor to be driven by a motive force that is independent of the valve. Further, we find nothing in the Specification or prosecution history of the '294 patent, nor does NOV

identify any particular language, that would require us to read claim 1 to require a valve motor that is powered with a motive force that is independent of any action of the valve. NOV does identify that, in the disclosed embodiments of the '294 patent, the motive force for the valve motor is independent of the operation of the valve at least part of the time, but of course, "limitations are not to be read into the claims from the specification." *In re Van Geuns*, 988 F.2d 1181, 1184 (Fed. Cir. 1993).⁷

Instead, claim 1 merely requires a valve motor that drives the rotation of rotating valve such that the valve controls the flow of fluid through the fluid-transmitting body to vary the fluid pressure force on a mass and induce the mass to accelerate. *See* Ex. 1001, 5:16–28. Bielstein's helical vane 57, including shaft 54, and plate 58 do just that. As Bielstein's helical vane 57 is pulled through plate 58, shaft 54 rotates to rotate element 52. By rotating element 52, the flow of fluid through the fluid-transmitting bodies varies, which varies the fluid pressure force on a mass and induces the mass to accelerate. By varying this flow, Bielstein's valve controls (increases or decreases) this varying flow. The fact that Bielstein's helical vane 57 takes advantage of the reciprocating motion of the mass as its motive force, which is caused by the rotating valve, does not change the fact that Bielstein's helical vane 57, including shaft 54, and plate 58 is a device that imparts motion to the valve.

Further, NOV's argument regarding Dr. Smith's alleged inconsistency concerning whether a cam and follower is a valve motor is inapposite. Cleary discloses an additional structure that satisfies the valve motor claim

⁷ We note that helical vane 57 is driven, at least half the time, by spring 24, which would be an independent motive force.

limitation (rotary drive means 35, *see infra*)—the fact that Dr. Smith did not find that Cleary’s single cam and follower corresponds to a valve motor, and instead relied on Cleary’s additional structure is immaterial to whether Bielstein’s vane 57 and plate 58 constitutes the recited valve motor of claim 1.

There is no evidence of secondary considerations in the record for us to weigh.

We have considered the record before us, including the Petition, NOV’s opposition, and Flotek’s Reply, as well as the supporting evidence for these papers. We conclude that Flotek has shown by a preponderance of the evidence that claim 1 is obvious over Bielstein.

b. Independent claims 19, 21, and 23

Independent claim 19 recites a method comprising two steps, one step of which is to provide a drill that comprises “a fluid transmitting body, a drill bit support mounted to the body, a mass movable relative to the body for impacting on the drill bit support, a rotating valve in the body for controlling flow of fluid through the body and a valve motor for driving said valve.” Ex. 1001, 6:16–22. This quoted subject matter is similar to the subject matter of claim 1, including requiring a valve motor for driving the rotating valve, except that claim 19 does not require the means-plus-function claim limitation of claim 1. *Compare id.* at 6:16–22, *with id.* at 5:16–27.

Flotek relies on its analysis of how Bielstein discloses the subject matter of claim 1 to support its analysis of the first step of claim 19. *See* Pet. 32–34. Similarly, NOV presents the same argument for the patentability of

claim 19 as it makes for claim 1. *See* PO Resp. 24–32 (arguing independent claims 1 and 19 as a group).

As discussed above in our analysis of Flotek’s assertion that claim 1 is obvious over Bielstein, we find, based on the record evidence, that Flotek’s Petition shows by a preponderance of the evidence that Bielstein discloses each of the claim limitations of the first step in the method of claim 19 by a preponderance of the evidence.

The second step of claim 19 recites “passing drilling fluid through the body and the drill bit support via the rotating valve to vary the flow of the fluid through the body and produce a varying fluid pressure force on the mass to induce acceleration of the mass.” Ex. 1001, 6:22–26. Flotek references its previous analysis of claims 1 and 5 to support Bielstein disclosing this claim step. Pet. 34. Specifically, Flotek identifies valve piston 50 with ports 65 as one portion of the rotating valve, and valve element 52 as the second portion. Pet. 24. Flotek explains that rotatable element 52 rotates between an open position, where ports 65 align with the open area of element 52 (its ports), and a closed position, where valve element 52 mostly covers port 65. *Id.* This varied alignment varies flow through the valve. *Id.* The varied flow also varies the fluid pressure on the mass through piston 50 to induce acceleration of the mass. *Id.* at 16–19. NOV does not dispute Flotek’s position that Bielstein discloses step 2 of the method of claim 19. We agree with Flotek that Bielstein discloses step 2 and adopt this reasoning and support as our own.

Independent claim 21 claims a percussion tool similar to that claimed in independent claim 1, except claim 21 does not recite a valve motor and recites the broader term “valve,” instead of a “rotating valve.” *Compare* Ex.

1001, 6:30–41, *with id.* at 5:16–27. Flotek relies on its analysis of how Bielstein discloses the subject matter of claim 1 to support its analysis of claim 21. *See* Pet. 35–37.

Independent claim 23 claims “[a] method of providing a percussive action in a downhole tool,” and includes the step of providing a tool similar to that claimed in independent claim 1, except claim 23 does not recite the means-plus-function claim limitation of claim 1 and recites the broader term “valve,” instead of a “rotating valve.” *Compare* Ex. 1001, 6:46–52, *with id.* at 5:16–27. Flotek relies on its analysis of how Bielstein discloses the subject matter of claim 1 to support its analysis of the “providing” step of claim 23. *See* Pet. 37–38. Claim 23 further recites the step of “passing drilling fluid through the body and the valve to provide a varying but continuing flow of fluid through the body and producing a varying fluid pressure force on the mass to induce acceleration of the mass.” Ex. 1001, 6:53–56. Flotek references its positions with respect to claims 1, 19, and 21 to support how Bielstein discloses this step. Pet. 39.

NOV does not dispute that Bielstein discloses the subject matter of independent claims 21 and 23. *See* PO Resp. 24–32 (omitting claims 21 and 23 from arguments of the patentability of the independent claims over Bielstein); *see also* Tr. 30 (indicating that NOV concedes that claims 21 and 23 are not patentable over Bielstein).

We have considered the record before us, including the Petition, NOV’s opposition, and Flotek’s Reply, as well as the supporting evidence for these papers. For the reasons that we set forth in determining the patentability of claim 1, we conclude that Flotek has shown by a

preponderance of the evidence that independent claims 19, 21, and 23 are obvious over Bielstein.⁸

c. Claim 4

Claim 4 recites “[a] percussion drill according to claim 1 wherein said rotating valve is provided separately of the means for creating a fluid pressure force on said mass.” Ex. 1001, 5:34–36. Flotek contends that valve piston 50 and rotating element 52 remain separate from themselves. Pet. 24. Specifically, Flotek contends that the upward-facing surface of piston 50 is separate from rotatable element 52 and ports 65, which form the rotating valve. *Id.* Further, Flotek contends that the recited means of claim 4 corresponds to the upward facing surface of piston 50. Pet. 24.

NOV argues that it is clear from Bielstein that valve piston 50 is part of Bielstein’s rotating valve. PO Resp. 15–16. For example, Bielstein’s Figure 10 depicts element 50 and refers to it as a valve housing unit. *Id.* at 16. Further, in Bielstein’s claimed invention, the claims recite “a rotatable valve means comprising a piston.” *Id.*; *see also* Ex. 1006, claims 2 and 3. Still further, NOV argues that Flotek’s expert identified valve piston 50 as part of the rotating valve. PO Resp. 16–19.

Flotek replies that NOV’s position is based on a flawed construction of the term “provided separately of.” Reply 15. Flotek argues that NOV’s position requires the term “provided separately of” to be separated by a

⁸ We note that, although NOV concedes to the unpatentability of claims 21 and 23, our conclusion is based on a complete review of the record and a determination that Flotek has proven, by a preponderance of the evidence, that claims 21 and 23 are unpatentable. *See* 35 U.S.C. §§ 316(e), 318.

distance and not merely separate components. *Id.* Flotek further argues that such a construction is not supported by NOV's own expert. *See id.*

Flotek contends that valve piston 50 includes four separate ports 65—two on the top and two on the bottom and that these ports are the same size. Reply 17. Flotek argues that it follows that Bielstein's rotating valve could be considered rotating element 52 and either the ports above element 52 *or* the ports below element 52. *Id.* at 18. Accordingly, Flotek defines the rotating valve of Bielstein that corresponds to the rotating valve of claim 4 as element 52 and the lower ports 65. *Id.* at 19.

Additionally, in arguing that the upward facing surface of valve piston 50 is provided separately from the rotating valve, Flotek contends that the piston structure of valve piston 50 requires rotating element 52 to be enclosed inside the piston. Reply 18–19. As such, piston 50 must come apart in some way to insert rotating element 52 before the piston could be deployed—a point on which NOV's expert agrees. *Id.* Flotek contends that a prior art patent corroborates testimony of NOV's expert, Dr. Akin, where the upper part of a similar piston (in a patent from the same inventor) is connected to the remainder of the piston by a threaded interface. *Id.* at 19 (referencing U.S. Pat. No. 2,780,438 to Bielstein, Ex. 1008).⁹

NOV also argues that there is no dispute that rotating element 52 is a structure that corresponds to the recited means of claim 4 and a component of the rotating valve. PO Resp. 20–22. Accordingly, independent of the

⁹ NOV argues that reliance on Bielstein '438 is improper as it is not part of Flotek's obviousness contention. *See* Tr. 28–29. Here, Flotek properly relies on Bielstein '438 to inform what an artisan of ordinary skill would know, rather than contending that claim 4 is obvious over the prior art including Bielstein '438.

characterization of valve piston 50, Bielstein's rotating element 52 is not provided separately from the recited means.

In reply, Flotek argues that, although the recited means of claim 1, from which claim 4 depends, may be considered the upward facing surface of piston 50, the upward facing surface of rotating element 52, or both, that, for the purposes of claim 4, it is necessary that the rotating valve be separate from one structure that corresponds to the means only—here, the upward facing surface of piston 50. *See* Reply 20–21.

Further in reply, Flotek argues that, even if NOV's position is correct, a claim requiring separate components is insufficient, in and of itself, to render the claim patentable subject matter, as making components separate or integral is a matter of obvious design choice. Reply 21–22. We need not address this argument, as it is offered, for the first time, in Flotek's Reply Brief. *See* 37 C.F.R. § 42.23(b) (“A reply may only respond to arguments raised in the corresponding opposition, patent owner preliminary response, or patent owner response.”). Flotek's original Petition does not assert that claim 4 is obvious as a matter of design choice. Additionally, a new, alternative obviousness theory is not an appropriate reply to any argument raised in the Patent Owner Response.

We are not persuaded that Bielstein discloses a “rotating valve [that] is provided separately of the means for creating a fluid pressure force on said mass” as required by claim 4. Flotek contends that the proper construction of the term “provided separately of” encompasses configurations where the valve and means are separated by a distance or where the valve and means are separate components. *See* Reply 15; Tr. 19–20. We are not persuaded, however, that the upward facing surface of Bielstein's valve piston 50 (the

alleged structure corresponding to the recited means) and rotatable element 52 and lower ports 65 (the alleged rotating valve) are separate components. Indeed, NOV crystalizes the issue for us: “[i]f element 50 is part of Bielstein’s rotating valve, then the rotating valve would not be ‘provided separately’ of the rotating valve and the limitations of claim 4 would not be met.” PO Resp. 15.

We find, based on our review of the record, that Bielstein’s valve piston 50 and rotating element 52 form an integral valve structure. Bielstein consistently refers to element 50 as a “valve piston” and, in claiming its invention, claims a rotating valve that includes a piston. As Flotek itself recognizes, “valve piston 50 is depicted as a single component in Figure 8 based on the cross-hatching” in Bielstein. Reply 18. We are not persuaded that even if piston 50 must be manufactured in two pieces to accommodate rotating element 52, such a configuration results in a multi-component structure. Flotek points to no evidence in Bielstein to suggest that, for example, the upper surface of piston 50 is threaded to the remainder of the piston, thus constituting two components. Bielstein’s piston could just as likely be formed by welding the top of piston 50 onto the rest of the structure after rotating element 52 is inserted, forming an integral structure.¹⁰ The record is silent as to Bielstein’s piston’s construction and, as such, fails to support a contention that a portion of piston 50 is a separate component of Bielstein’s rotating valve. Accordingly, even under Flotek’s construction of the phrase “provided separately of,” Bielstein’s piston 50 including rotating element 52 fails to satisfy the limitation of claim 4.

¹⁰ At oral argument, Flotek stated that “not integral” may be an appropriate construction for “separately provided for.” See Tr. 19–20.

We note that this issue is not one of whether a single structure in the prior art can satisfy two distinct claim elements of a claim. Here, the express language of claim 4 requires the rotating valve to be “provided separately of” the recited means—that is, claim 4 *requires* two separate structures, one corresponding to the rotating valve and a distinct structure corresponding to the means separate from the valve. Such a combination of structures are not taught in the record before us.

Also, we do not agree with Flotek’s position that the language of claim 4 merely requires that the rotating valve be provided separately from at least one of the structures that corresponds to the recited means because claim 4 uses the transitional term “comprising.” As NOV correctly notes, and Flotek does not dispute, rotating element 52 is a structure that corresponds to the recited means and is part of the rotating valve. Although the transitional phrase “comprising” creates the presumption that a claim is interpreted as not limited to the recited elements, the phrase does not give Flotek a license to parse the structures that correspond to the means. *See Crystal Semiconductor Corp. v. TriTech Microelectronics Int’l, Inc.*, 246 F.3d 1336, 1348 (Fed. Cir. 2001). For this additional reason, we are not persuaded that Bielstein discloses a rotating valve that is provided separately of the means for creating a fluid pressure force on said mass as required by claim 4.

We have considered the record before us, including the Petition, NOV’s opposition, and Flotek’s Reply, and supporting evidence. We conclude that Flotek has not shown by a preponderance of the evidence that claim 4 is obvious over Bielstein.

d. Claims 2, 3, 5, 6, 7, 9, 10, 11, 12, 13, 15, 16, 18, 20, 22, and 24

Claim 2 recites, “[a] percussion-drill according to claim 1 wherein said rotating valve rotates around a longitudinal axis” and claim 3 recites, “[a] percussion drill according to claim 2 wherein said longitudinal axis is the central longitudinal axis of said fluid transmitting body.” Ex. 1001.

5:29–33. Flotek contends that Bielstein discloses that its valve rotates on shaft 54, which is positioned at the central axis of the tubular member 11, thus satisfying claims 2 and 3. Pet. 21, 22.

Claim 5 depends from claim 1 and further recites “wherein said valve comprises two portions each defining a fluid port, such that relative rotation of the portions varies the alignment of the fluid ports and varies the flow area defined thereby.” Ex. 1001, 5:37–41. Flotek identifies valve piston 50 with ports 65 as one portion of the rotating valve, and valve element 52 as the second portion. Pet. 24. Flotek explains that rotatable element 52 rotates between an open position, where ports 65 align with the open area of element 52 (its ports), and a closed position, where valve element 52 mostly covers port 65. *Id.* This varied alignment varies flow through the valve. *Id.* Further, as valve element 52 moves from the closed position to the open position, the flow area defined by ports 65 increase to a maximum area. *Id.* at 25.

Claim 6 recites, “[a] percussion drill according to claim 5 wherein one of said portions is rotatable relative to said body.” Ex. 1001. 5:42–43.

Flotek contends that Bielstein’s rotating element 52 is a valve portion that rotates relative to the body. Pet. 25. Claim 7 recites, “[a] percussion drill according to claim 5 wherein said fluid ports are in the form of slots on a

common axis.” Ex. 1001. 5:44–45. Flotek contends that ports 65 in piston 50 corresponds to the fluid ports and are formed as slots. Pet. 26.

Claim 9 recites, “[a] percussion drill according to claim 1 wherein said valve permits fluid flow through the body in all valve configurations.” Ex. 1001. 5:52–54. Flotek contends that the embodiment disclosed in Bielstein’s Figures 8–11 satisfies the additional claim limitation of claim 9. Specifically, Flotek identifies that when the valve is in the open position, fluid flows through ports 65, and when the valve is in a closed position, fluid flows through velocity ports 53. Pet. 27. Claim 10 also depends from claim 1 and further recites “wherein said mass is spring mounted in said body.” Ex. 1001. 5:55–56. Flotek contends that Bielstein discloses that hammer 21 (corresponding to the mass) is spring mounted in the body by spring 24. Pet. 28.

Claim 11 recites, “[a] percussion drill according to claim 1 wherein said mass defines a flow passage therethrough.” Ex. 1001. 5:57–58. Flotek contends that Bielstein’s hammer 21 includes central passageway 22, which defines a flow passage through the mass. Pet. 28. Claim 12 depends from claim 11 and further recites “wherein said flow passage defines a restriction such that fluid flowing through the mass is subject to a pressure drop.” Ex. 1001. 5:59–61. Flotek contends that passageway 22 decreases in diameter from the top of the hammer towards shoulder 23, which is the direction of fluid flow. Pet. 29. Claim 13 depends from claim 12 and further recites “wherein said mass impacts directly on said drill bit support.” Ex. 1001. 6:1–2. Flotek contends that hammer 21 impacts anvil 14, and that anvil 14 and sub 18 correspond to the recited drill bit support. Pet. 29–30; *see also* Bielstein, Fig. 1 (depicting anvil 14 as the top surface of drill sub 18).

Claim 15 recites, “[a] percussion drill according to claim 1 wherein said drill bit support is splined to said body.” Ex. 1001. 6:5–6. Flotek contends that Bielstein’s key 13 and keyways 20 form a spline connection between the drill bit and the body. Pet. 30. Claim 16 also depends from claim 1 and further recites “wherein said body is adapted for mounting on a drill string.” Ex. 1001. 6:7–8. Flotek contends that Bielstein discloses that the recited body is adapted for mounting on a drill string. Pet. 31.

Claim 18 recites, “[a] percussion drill according to claim 1, wherein said body is adapted for rotation in a bore, rotation of the body causing rotation of the drill bit support and a drill bit mounted thereto.” Ex. 1001. 6:12–15. Claim 20 depends from method claim 19 and recites, “[t]he drilling method of claim 19, further comprising rotating the body, rotation of the body causing rotation of the drill bit support and a drill bit mounted thereon.” Ex. 1001. 6:27–29. Similarly, claim 22 recites, “[a] percussion drill according to claim 21, wherein said body is adapted for rotation in a bore, rotation of the body causing rotation of the drill bit support and a drill bit mounted thereto” and claim 24 recites, “[t]he method of claim 23, further comprising rotating the body, rotation of the body causing rotation of the drill bit support and a drill bit mounted thereon.” Ex. 1001. 6:42–45, 6:57–59.

Flotek contends that an artisan of ordinary skill, reading Bielstein, would understand that the recited body rotates in a bore, which causes the drill bit support and drill bit to rotate, thus disclosing the subject matter of claims 18, 20, 22, and 24. Pet. 31–32, 35, 37, 39–40. For example, Bielstein’s Figure 1 depicts drill sub 18 splined to body 11 and drill bit 19

splined to drill sub 18, such that these three structures would rotate together.
See id.

NOV does not contest any of Flotek's assertions with respect to claims 2, 3, 5–7, 9, 10–13, 15, 16, 18, 20, 22, and 24. *See generally* PO Resp. 24–32 (not addressing the patentability of these claims); *see also* Tr. 30 (indicating that NOV concedes that claims 20, 22, and 24 are not patentable over Bielstein). We agree with Flotek's assertions as to what Bielstein discloses and adopt Flotek's assertions as our own. Also, as mentioned above, the record does not include any secondary considerations to weigh.

We have considered the record before us, including the Petition, NOV's opposition, and Flotek's Reply, as well as the supporting evidence for these papers. We conclude that Flotek has shown by a preponderance of the evidence that claims 2, 3, 5–7, 9, 10–13, 15, 16, 18, 20, 22, and 24 are obvious over Bielstein.¹¹

2. Claims 1, 5, and 8 in view of Cleary

Flotek contends that Cleary renders obvious claims 1, 5, and 8 of the '294 patent. NOV concedes that these claims are unpatentable over Cleary. *See generally* PO Resp. (not addressing the unpatentability ground involving Cleary and also not including claims 1, 5, and 8 in its arguments regarding the patentability of other claims over Bielstein). Although NOV concedes

¹¹ We note that, although NOV concedes to the unpatentability of claims 20, 22, and 24, our conclusion is based on a complete review of the record and a determination that Flotek has proven by a preponderance of the evidence that claims 20, 22, and 24 are unpatentable. *See* 35 U.S.C. §§ 316(e), 318.

this ground, we analyze the evidence of record to ensure that Flotek has demonstrated, by a preponderance of the evidence, that Cleary renders obvious claims 1, 5, and 8. *See* 35 U.S.C. §§ 316(e), 318.

a. Claim 1

Flotek contends that Cleary discloses “a fluid transmitting body; a drill bit support coupled to the body; [and] a mass movable relative to the body for impacting on the drill bit support” as required by claim 1. *See* Pet. 41–45. Specifically, Flotek identifies tubular housing 11 as a transmitting body. *Id.* at 42. Flotek explains how fluid moves from the top of tubular housing 11 to a drill bit face. *Id.* at 42–44. Flotek identifies the anvil as the recited drill bit support, coupled to the body. *Id.* at 44–45. Flotek identifies hammer 17 as the recited mass. *Id.* at 45.

Regarding the “means . . . for creating” claim limitation of claim 1, Flotek explains that, through the rotation of tubular valve 31, ports in the valve align with passages in the hammer to direct fluid to an area above the hammer, creating a fluid pressure force on the hammer to accelerate the hammer towards the anvil. Pet. 45–46. Flotek also explains that through the rotation of tubular valve 31, ports in the valve align with passages in the hammer to direct fluid to an area below the hammer, creating a fluid pressure force on the hammer to accelerate the hammer upwards and away the anvil. *Id.* at 47 n.1.

As for the “rotating valve” claim limitation, Flotek contends that “Cleary discloses tubular valve 31 [that] rotates within tubular housing 11 to control the flow of fluid through the body to produce a varying fluid pressure on the mass and induce acceleration of the mass.” Pet. 49.

With respect to the “valve motor” limitation of claim 1, Flotek contends that Cleary discloses that tubular valve 31 is driven by rotary drive means 35 positioned near the top of housing 11 and valve 31. Pet. 50–51.

As discussed above, NOV does not contest these assertions, which we adopt as our own. Also, the record does not include any secondary considerations to weigh. Also, we need not assess Flotek’s reasons for modifying Cleary, as Flotek does not propose any modification of Cleary—that is, Cleary discloses each of the claim limitations of claim 1.

We have considered the record before us, including the Petition, NOV’s opposition, and Flotek’s Reply, as well as the supporting evidence for these papers. We conclude that Flotek has shown by a preponderance of the evidence that claim 1 is obvious over Cleary.

b. Claims 5 and 8

Claim 5 depends from claim 1 and further recites “wherein said valve comprises two portions each defining a fluid port, such that relative rotation of the portions varies the alignment of the fluid ports and varies the flow area defined thereby.” Ex. 1001, 5:37–41. Flotek identifies tubular valve 31 as the recited first portion and hammer 17 as the second portion. Pet. 53. Flotek explains that Cleary discloses that the valve rotates to vary alignment of its inlet port 37 with passages in the first hammer passages 27 and, as the ports 27 and 37 go in and out of alignment, the flow area through this interface varies. *Id.* at 54; Ex. 1002 ¶ 182.

Claim 8 depends from claim 5 and further recites “wherein one of said valve portions provides fluid communication with alternative fluid paths through said body, one of said paths providing fluid communication with the

means for creating fluid pressure force on the mass; and another of said paths bypassing said means.” Ex. 1001, 5:46–51. Flotek contends that Cleary discloses the recited alternative flow paths. Flotek explains that through the rotation of tubular valve 31, ports in the valve align with passages in the hammer to direct fluid to an area below the hammer, creating a fluid pressure force on the hammer to accelerate the hammer upwards and away the anvil. Pet. 55–58. Flotek further explains that Cleary discloses “bypass passage 95” around central bore 25 or 25' that allows for fluid to pass directly between inlet port 37 and exhaust port 39. Pet. 58 n.2. When flow passes through bypass passage 95, it is not directed toward the upper surface 19 of hammer 17, bypassing the recited means. *Id.*

As discussed above, NOV does not contest these assertions, which we adopt as our own. Also, the record does not include any secondary considerations to weigh.

We have considered the record before us, including the Petition, NOV’s opposition, and Flotek’s Reply, as well as the supporting evidence for these papers. We conclude that Flotek has shown by a preponderance of the evidence that claims 5 and 8 are obvious over Cleary.

III. CONCLUSION

For the foregoing reasons, we are persuaded that the information presented in the Petition establishes, by a preponderance of the evidence, that claims 1–3, 5–13, 15, 16, and 18–24 of the '294 patent are unpatentable. Further, we are not persuaded that the information presented in the Petition establishes, by a preponderance of the evidence, that claim 4 of the '294 patent is unpatentable.

IV. ORDER

After due consideration of the record before us, it is:

ORDERED that claims 1–3, 5–7, 9–13, 15, 16, and 18–24 of the '294 patent are held to be *unpatentable* under 35 U.S.C. § 103(a) over Bielstein;

FURTHER ORDERED that claims 1, 5, and 8 of the '294 patent are held to be *unpatentable* under 35 U.S.C. § 103(a) over Cleary;

FURTHER ORDERED that claim 4 of the '294 patent has *not* been shown by a preponderance of the evidence to be unpatentable; and

FURTHER ORDERED, that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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For PETITIONER:

James P. Murphy
Aaron M. Levine
POLSINELLI PC
jpmurphy@polsinelli.com
alevine@polsinelli.com

PATENT OWNER:

Robert McAughan
David Terrell
SUTTON MCAUGHAN DEEVER PPLC
bmcaughan@smd-iplaw.com
dterrell@smd-iplaw.com