INCORPORATED UNDER THE LAWS OF THE STATE OF

Arkansas

No 183

1/5 of $25.00 Shares

Neal Compressed-Air Motor Corp.

COMMON STOCK

THIS CERTIFIES THAT [illegible] Roy Lay is the owner of 1/5 of one $25.00 Shares of the Capital Stock of

The Neal compressed air motor inc.

transferable only on the books of the Corporation by the holder hereof in person or by Attorney upon surrender of this Certificate properly endorsed.

In Witness Whereof, the duly authorized officers of this Corporation have hereunto subscribed their names and caused the corporate Seal to be hereto affixed this 30 th day of May A.D. 1939

Bob Neal — President

Ruby Neal — Secretary

SHARES 1/5 of $25.00 EACH

For value received I hereby sell, transfer and assign
To Ray Lay 1/5 of one $25.00 share
The Neal Compressed air Motor Corp.
Shares of the within mentioned by power

to make the necessary transfer on the Books of the Corporation.
Witness my hand and seal this 15th day of
aug 1940

Witnessed by
Mrs H. A. Neal

Paul Easley
Ruby Neal Sec.

Feb. 11, 1936. B. NEAL 2,030,759

COMPRESSOR UNIT

Filed Jan. 9, 1934 3 Sheets-Sheet 1

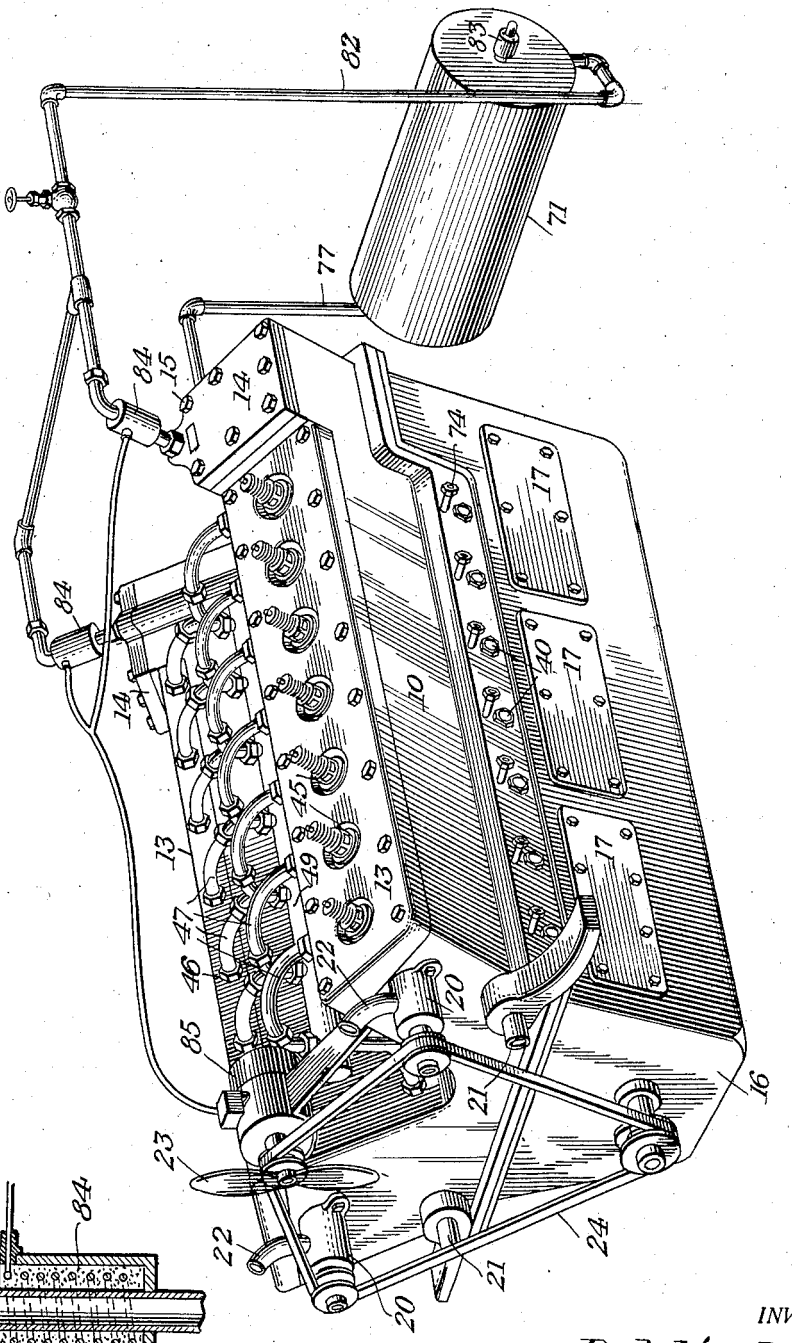


Fig. 1.

Fig. 5.

INVENTOR.

BY Bob Neal

Paul O. Parker

ATTORNEY.

Feb. 11, 1936. B. NEAL 2,030,759

COMPRESSOR UNIT

Filed Jan. 9, 1934 3 Sheets-Sheet 2

Fig. 2.

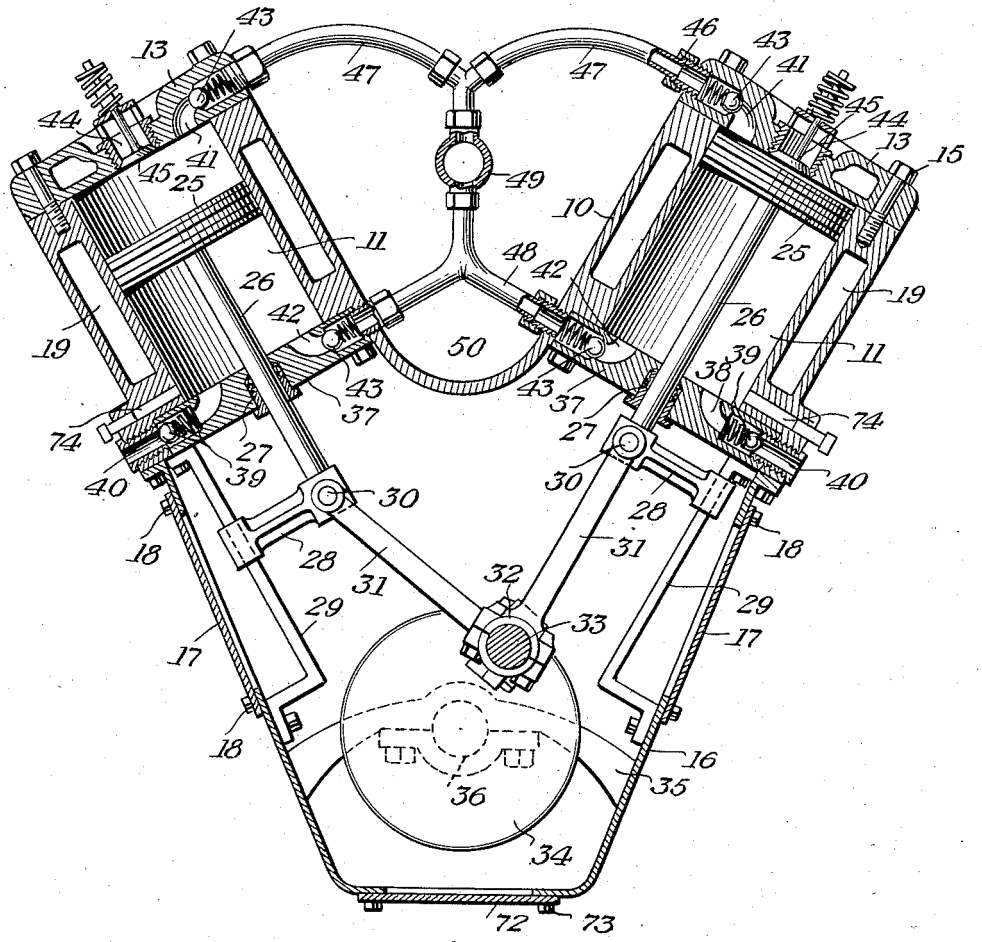
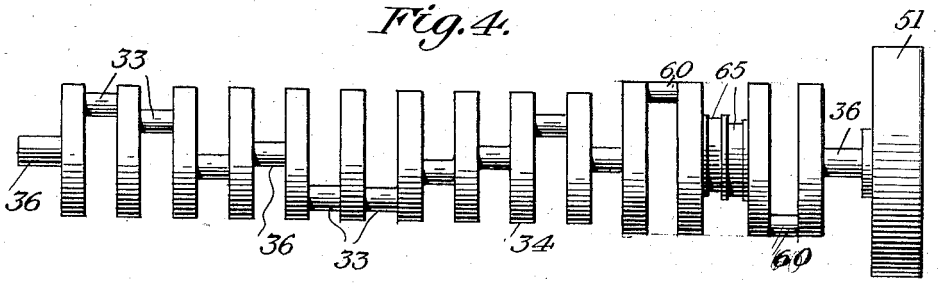


Fig. 4.



INVENTOR.

Bob Neal

BY

ATTORNEY.

Feb. 11, 1936. B. NEAL 2,030,759

COMPRESSOR UNIT

Filed Jan. 9, 1934 3 Sheets-Sheet 3

Fig.3.

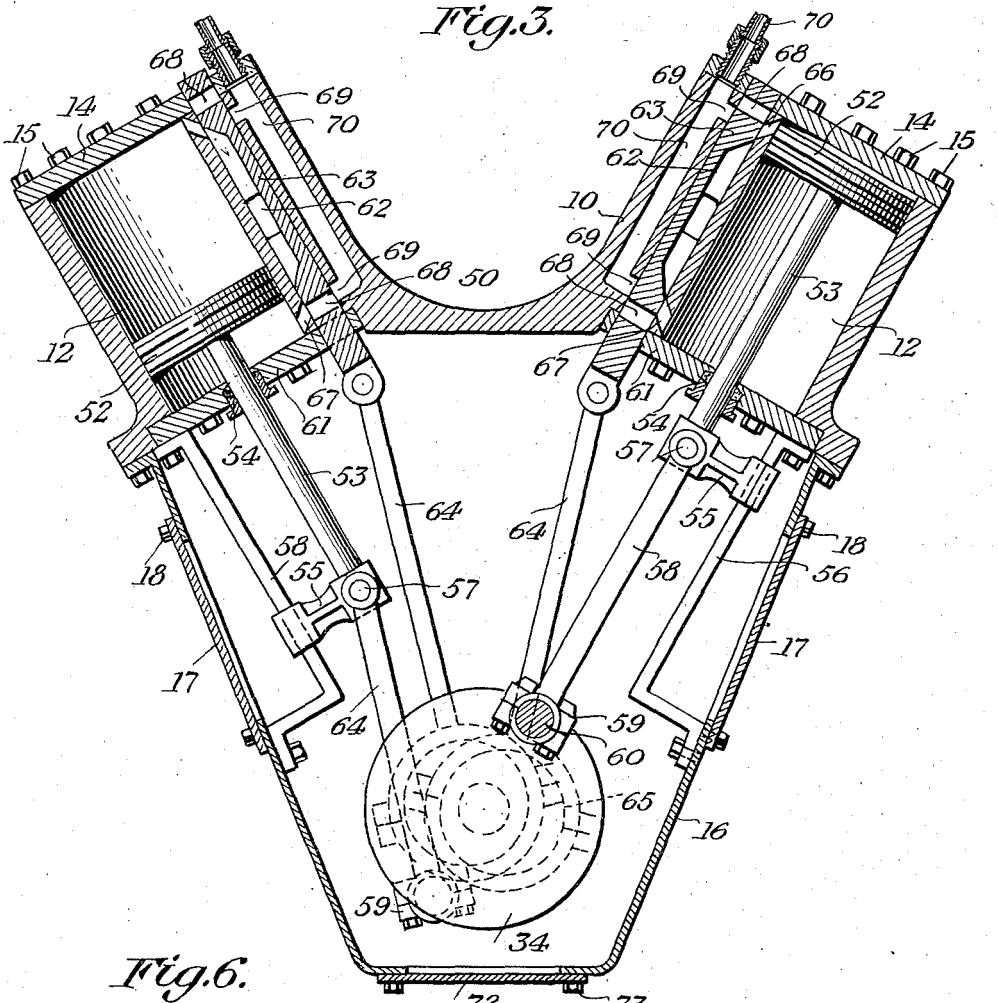
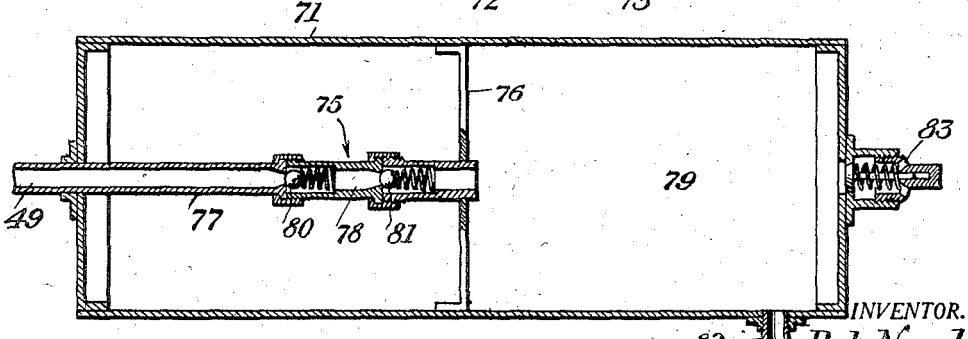


Fig.6.



INVENTOR.
Bob Neal
BY
ATTORNEY.

Patented Feb. 11, 1936 2,030,759

UNITED STATES PATENT OFFICE

2,030,759

COMPRESSOR UNIT

Bob Neal, Arkadelphia, Ark.

Application January 9, 1934, Serial No. 705,964

1 Claim. (Cl. 230—187)

The invention relates to a compressor construction, and more particularly to a combination fluid operated engine and compressor.

The primary object of the invention is the provision of a compressor of this character, wherein there is arranged an automatically counter balanced crank shaft and fluid equalizers within a storage tank, which makes it possible for the said engine to operate on constant reserve tank pressure so as to actuate additional equipment, the pistons for the engine being also automatically balanced and suspended when the said engine is in operation.

Another object of the invention is the provision of an engine of this character, wherein the same is operated from air under pressure, the said air being supplied by compressors, these being in bank with the engine construction.

A further object of the invention is the provision of an engine of this character, wherein the same is of novel construction, as the engine proper and the compressors are operated from the same crank shaft which is of the automatically balanced type, so that high efficiency is attained.

A still further object of the invention is the provision of an engine of this character, which is comparatively simple in construction, thoroughly reliable and efficient in its operation, strong, durable, and inexpensive to manufacture.

With these and other objects in view the invention consists in the features of construction, combination and arrangement of parts as will be hereinafter more fully described, illustrated in the accompanying drawings, which disclose the preferred embodiment of the invention, and pointed out in the claim hereunto appended.

In the accompanying drawings:

Figure 1 is a perspective view of the engine constructed in accordance with the invention.

Figure 2 is a vertical transverse sectional view through the compressor part of the engine.

Figure 3 is a vertical sectional view through the power part of the engine.

Figure 4 is a detail elevation of the crank shaft of the engine.

Figure 5 is an enlarged sectional view through one of the electric heaters for the engine.

Figure 6 is a vertical longitudinal sectional view through the air storage tank including the equalizer.

Similar reference characters indicate corresponding parts throughout the several views in the drawings.

Referring to the drawings in detail the engine in its entirety comprises a cylinder block 10 having formed therein the series of compressor cylinders 11 and the power cylinders 12, respectively, the block 10 being of the V-type and closing the upper ends of said cylinders are the removable heads 13 and 14, respectively, which are secured in place by head bolts 15, as is conventional. Beneath the block 10 is the crank case 16, which at opposite sides carries the detachable plates 17, these being held in place by fasteners 18 and such plates are seated so as to be leak proof. The block 10 is chambered to provide a water jacket 19 about the cylinders, while at the forward end of the said block are water pumps 20 circulating water through the inlet pipe 21 which leads into the jacket and letting said water out therefrom through the outlet pipe 22 leading from said water jacket. Next to the pumps 20 is a fan 23 operated from a belt 24 which also drives the pumps.

Working within the cylinders 11 are the reciprocating pistons 25, their rods 26 being slidable through packing glands 27 and fixed to crossheads 28, which are slidably mounted upon guides 29 secured within the crank case 16 to opposite side walls thereof. These crossheads 28 are fitted with wrist pins 30 pivotally connecting therewith the connecting rods 31 which by the bearings 32 are engaged with their cranks 33 of a counter balanced crank shaft 34, which is mounted in supports 35 arranged in the crank case 16, the shaft being supplied with the required bearings 36.

The inner ends of the cylinders 11 are fitted with inner end heads 37, which are provided with air intake ports 38, these being fitted with spring ball inlet checks 39, the air having admission through passages 40 opening exteriorly of the block 10. The glands 27 are associated with the heads 37.

The heads 13 and 37 are provided with the compressed air outlets 41 and 42, respectively, these being fitted with spring ball checks 43, the heads 13 being also provided with the central air inlets 44, which are fitted with spring checks 45. By couplings 46 are attached to the air outlets 41 and 42 the outlet feed pipes 47 and 48, respectively, these leading to a main conduit 49 located in the center channel 50 in said block 10.

At the rear end of the block 10 and on the shaft 34 is the fly wheel 51, this being of conventional type.

Working within the cylinders 12 are pistons 52, their rods 53 sliding through packing glands 54 and fixed in crossheads 55 slidably mounted upon guides 56 which are secured within the crank

case 16 at opposite side walls thereof. The crossheads 55 carry wrist pins 57 connecting therewith connecting rods 58, these being engaged by bearings 59 with their respective cranks 60 of the crank shaft 34, the inner ends of the cylinders 12 being also closed by inner heads 61 with which are associated the glands 54.

On the cylinders 12 are slide valve chests 62 in which are the slide valves 63, these being operated by throw rods 64 actuated by cams 65 and such valves controlling the air admission and exhaust of air to and from the cylinders 12 through the ports 66 and 67, and these valves 63 are provided with the ports 68 for the delivery of air under pressure from the inlet passages 69 common to a lead 70 from a compressed air storage tank 71.

The bottom of the crank case 16 is fitted with a removable plate 72 which is secured in place by fasteners 73, and when this plate is removed access can be had to the crank shaft 34 and the bearings for the engine, as well as other parts within said crank case, as should be obvious.

Leading into the cylinders 11 are the passages 74 of a lubricating system (not shown).

The storage tank 71 for the compressed air includes therein a double check discharge nozzle 75, this being supported by a member 76 and leading to this equalizer is an air inlet pipe 77 which has the communication 78 with the chamber 79 formed by said tank. In the equalizer 75 are the spaced spring ball checks 80 and 81, respectively, one being for the inlet side and the other for the exhaust or outlet side of said equalizer. This pipe 77 is connected with the main conduit 49, while a pipe 82 is connected with the leads 70, the tank being also fitted with an automatic relief valve 83 of any approved type.

About the pipes 70 for the passages 69 are the electric heating units 84 which are for the purpose of heating the air under pressure above a freezing temperature when delivered from the tank 71 to the cylinders 12.

Supported on the block 10 is an electric generator 85 which is driven from the shaft 34 through a belt 24 and this generator is included in an electric circuit which also has the heaters 84 so that these will operate from current furnished by said generator.

The storage tank 71 with the equalizer is so constructed that it is possible to pump air into the said tank with a tank pressure of two hundred pounds, while the compressors are only pumping against fifteen pounds or atmospheric pressure. Outside air pressure source can be coupled with the tank to augment that pressure derived from the cylinders 11 of the engine.

What is claimed is:

In a structure of the kind described, a V-shaped cylinder block provided with upwardly divergent cylinders, end heads fitted to said cylinders at opposite ends thereof, each head having valved inlets and outlets, a main outlet lead between the cylinders of the block for a storage tank and having lateral branches to the outlets at the inner sides of said heads, one inlet being located at the center of each head at the outer ends of said cylinders while the remaining inlets are at the outer sides of the heads at the inner ends of said cylinders, a substantially V-shaped crank case fitted to the block beneath the cylinders, a counterbalanced crank shaft journaled in the crank case, pistons operating in the cylinders and having rods extended into the crank case, crosshead guides fitted to the sides of said case interiorly thereof, crossheads connecting the rods with the guides and slidable on the same and connecting rods operated by the crank shaft and pivoted to the crossheads for reciprocation of the pistons.

BOB NEAL.

Resonance in Closed-ended Pipes
(written for this work by a retired mechanical engineer)

Considering only pressure changes--that is, compressions, C, and rarefactions, R--in a closed pipe whose length, L, is adjusted to be one-fourth the wavelength of the entering sound (Fig. 1), let us follow successive regions of C and R as they move into the pipe and are reflected from the ends, remembering that change of pressure phase occurs at the open but not at the closed end.

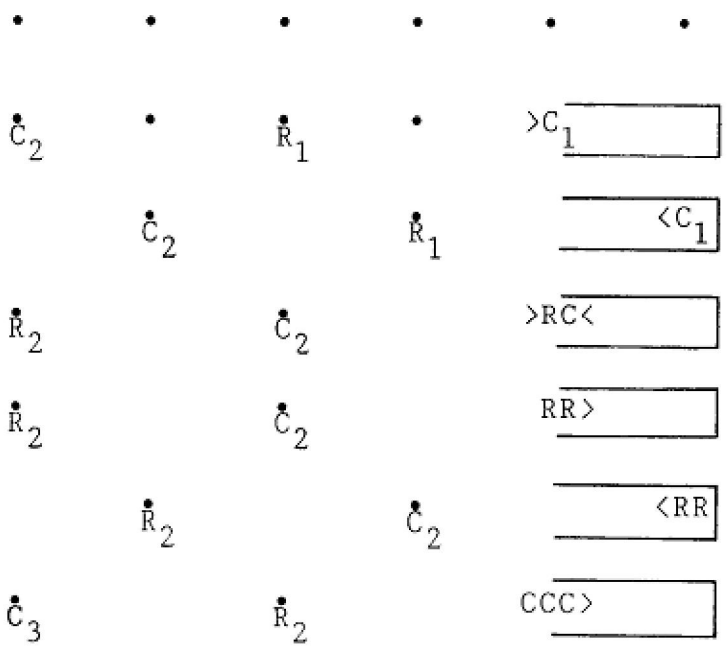


Fig. 1) resonance in 1/4- or 3/4-wave closed-end tubes

The compression wave C_1 enters the pipe, is reflected at the closed end, and reaches the open end just as R_1 is about to enter. As R_1 enters, C_1 is reflected back in the opposite phase as an R, and unites with entering R_1. The now amplified R_1 is reflected at the closed end, and on returning to the open end, is reflected as an amplified C, which is further amplified by uniting with entering C_2.

Thus the pressure disturbance traveling back and forth within the pipe is greatly augmented, and an intensity is built up within the pipe which is very much greater than that in a corresponding length of the incoming wave itself. In this way, a sound of such low intensity as to be inaudible outside the pipe becomes loud and clear on reinforcement be the resonance built up in an air column properly tuned to respond to it.

The same phenomenon occurs likewise if the closed pipe is three-quarters wavelengths of the incoming wave. Compression C_1 then unites with rarefaction R_2, and these again with C_3 and R_4; also, C_3 meets rarefaction R_3 and C_4. Similarly one gets resonance in a closed pipe if the length is any ODD number of quarter-wavelengths (see Fig. 1 again).

Resonance, closed pipe, for L = 1, 3, 5, 7,... $\frac{\lambda}{4}(2n-1)$

or for a given pipe length, response will occur for waves of length

$\lambda_{1,\ 3,\ 5,\ 7,\ 9,\ldots} = 4L,\ \frac{4L}{3},\ \frac{4L}{5},\ \frac{4L}{7},\ \frac{4L}{9},\ \ldots.$

Interview with Bob Neal's Son
Luther Rangely, October 14, 1988

(Floyd Neal started right in describing the engine hardware in some detail. I got my tape recorder hooked up while he was talking, and steered the conversation toward the equalizer, or "special valve" in the tank.)

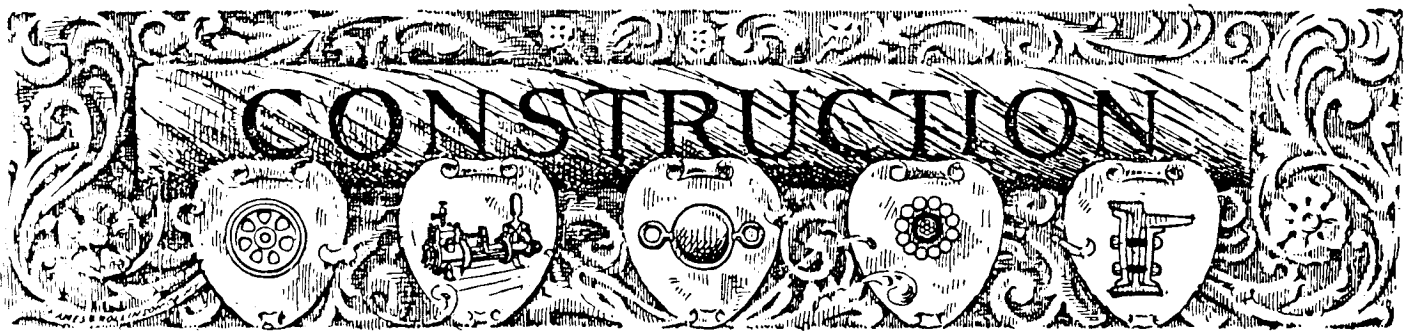
LR: Did you see the inside of the tank where that one special valve was?
FN: Now he had a special valve where he could load the tank with very little pressure. That was a--the valve looked like an extremely skinny, long plumb bob. That's about all I can remember, like I say, I was just a small boy.
LR: How old do you think you were? Maybe 16 or so?
FN: Oh no, I was younger than that. Oh, probably maybe seven or eight years old, and probably the last I had anything to do with it, 'cause I was out going to school, probably maybe 13 to 15. But I couldn't really give you any good detail.
LR: Do you know about how long or how big the tank was?
FN: Well the storage tank was a streetcar tank. If I remember right they were probably about 16 inches by probably 4 feet.
LR: Pretty big tank, huh?
FN: Yes, the reason he used that, it was available. You probably wouldn't have to have that big a tank. As far as that goes, it was actually just to start it with. 'Cause then you see it starts producing air on its own.
LR: Do you know what the principle is of being able to get the low pressure air into the tank?
FN: That was, he felt, the valve. It was a type of valve that--it was a double valve of some sort.
LR: Double check valve according to the patent.
FN: Yeah, and you could load the tank with a lot less pressure than was in the tank.
LR: Did he ever talk about water hammer or pulsejets?
FN: No...
LR: You know when your water pipes start buzzing, vibrating in the wall, that kind of principle is what makes pulsejets work, and I was thinking possibly it was similar to that.
FN: I couldn't really tell you. Have you come up with anything that you're working on?
LR: Well no, I'm just a researcher, and this is so far the only patent I've found that actually said what it was trying to do. It doesn't say what the working principle is but I think I've figured it out. I think if you make the air vibrate, then it organizes itself into high pressure zones and vacuum zones, and the vacuum waves can be used to let that low pressure air in. So it's kinda like a ram pump, and pulsejets and other wave-type machines that work on causing the fluid to vibrate and make waves. So that's what I think it is, it seems to make sense to me, and that's what my research seems to lead to.
FN: Well it's important to get that research. Have you actually developed any kind of engine?

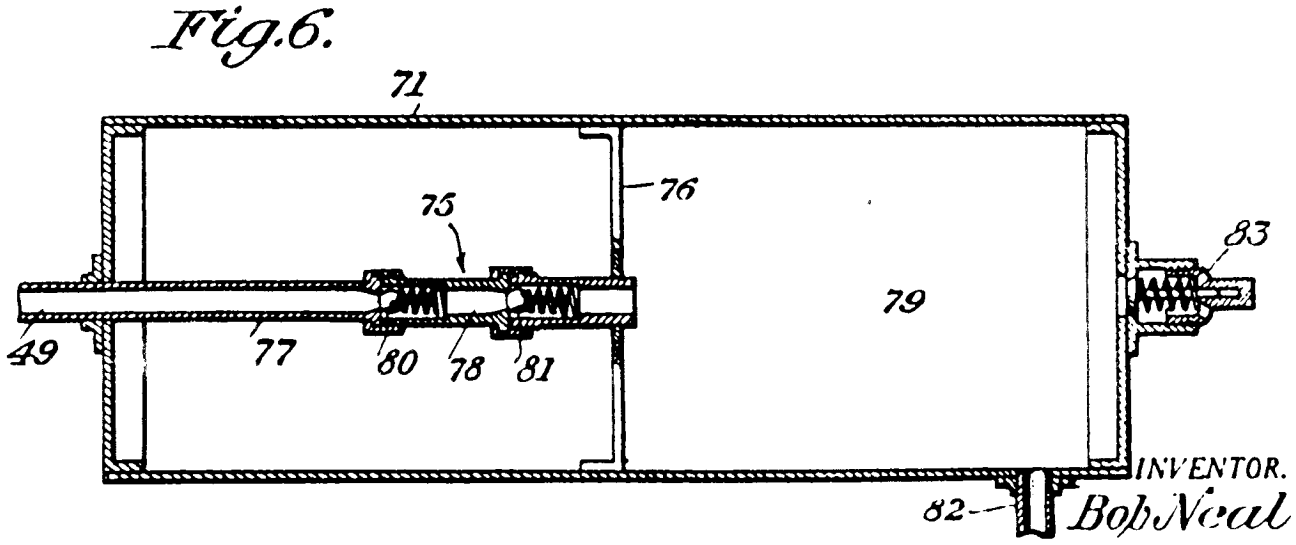
LR: No, what I've got is, I've built the tank and I put the two check valves inside the tank, sorta like the way it looked in the patent, and I've got an air motor running a rotary compressor, to put the low pressure air in. And I'm getting low pressure air into the tank all right--
FN: About what kind of pressure?
LR: About maybe ten pounds--I can get it in at two pounds but if you run the air motor faster it pumps it up to a higher pressure. It's still going in at a much lower pressure than what's in the tank. So I think it's working, and I think having the compression and engine cylinders on the same crankshaft is the secret. That's why I'm running the compressor direct with the air motor, so they're going at the same speed.
FN: Sure.
LR: Yeah. I think that's your dad's trick is to have the pulsations entering and leaving the tank at the same time so you just have that very clear, distinct wave in it.
FN: Does Mr. M. have a picture of the engine?
LR: Well he says he's got an article but he says it's off in a box somewhere and he doesn't even know where to start looking for it.
FN: I thought he might have a photograph. Of course you're trying to discover something that's altogether different?
LR: Well, yeah, I'm mainly sort of an air car advocate you might say. I'm exploring the whole area and I'm looking at all the different systems I can find, and so far I think this is the best, and I'm concentrating on it. And hopefully I'd like to build an air car that uses this principle--is the patent owned by someone now?
FN: No, you know, it's run out. It's public domain. I was thinking about, oh a few years back, renewing it, but then it wasn't right for me and I just didn't deal with it and now I have no interest in it.
LR: Well it seems to me like it sort of works similar to a perpetual motion machine, which is supposed to be impossible.
FN: You know, when he patented that thing--he had trouble patenting it. Because they notified him and told him that the United States Patent Office was not interested in perpetual motion. And he fired a letter back to them and told them he wasn't either, he just wanted to patent an engine that was functional. And as a matter of fact he got busy and made a little--a small prototype--a hand carried model. And as a matter of fact I went with him to Washington when I was a little boy, and he put it up on Garrett Whiteside's desk--he was top man at the time--started the thing up, and he called in the investigative men, and they had to issue him a patent. You can't argue with a functioning engine, right?
LR: That's right. Well that's great. So the little model had the tank and the valve and the--
FN: Yes, it had everything and he could actually carry it in.
LR: Well that's pretty good because they say in no uncertain terms that they won't grant one, and there's so many air car

patents that--
FN: Yes. Don't ever mention perpetual motion.
LR: Right. Have you ever heard of anybody else that's done something like this with air?
FN: No, I heard there was someone in the South, a couple years ago, but I don't know if it was just rumors or what. But I didn't really know about it.
LR: What was your dad's relationship with Mr. M.? They were corresponding with each other? Or they were friends?
FN: Well, I don't really know how they got--oh, I know what it--my dad's sister, my aunt, and her husband were living in California somewhere, and I think they were sitting in a city park or something, and the conversation just came up, during the conversation, and my uncle said, well, his brother-in-law was--oh, it was "odd things"--but he said his brother-in-law was working on an engine that ran on air. And Mr. M. heard that, and got interested, and got his address and everything and came down. I remember when he came down. That's how that started. I think that was about '45.
LR: Well I've been working on this research for nine years and someone introduced me to Mr. M. over the phone. We had a three-way phone conversation and he started talking about this and we tracked down the patent. And I thought about it for about a year and a half before I figured out this wave principle for how it might work, and got some research to back it up. I think we're doing pretty good. Would you like to be on my mailing list in case we get something going and put out a newsletter?
FN: Yeah. You know, there was another fellow that was interested in this; that was William Lear. He was kind of interested in seeing an air engine a couple of years ago. He came down to see me a number of times also. And that was over this valve--in the tank.
LR: Did he look at it?
FN: Well, I didn't have it. He came down to my place.
LR: Oh. He's sort of like me, he was trying to get information from you.
FN: Right. And I don't know, he did come up with some sort of an engine--steam, though, I think--and busses in L.A., years ago, and also in police cars. But I don't know.
LR: Was he adapting your father's invention?
FN: Well, at the time, he didn't know if he was gonna go air or steam.
LR: Mr. M. says you had to stop making this or stop developing it because somebody came from some government or something.
FN: That was during the war years?
LR: Uh-huh.
FN: Yes, as a matter of fact, my sister was even kidnapped over it. Germany wanted it real bad. They tried to buy it. And of course my dad didn't do business with foreign powers or the enemy. Then they tried it their way. And they threatened him and said they'd have his family members killed off one at a time. What happened is he dismantled it, and scattered the parts all over the countryside. They just

literally scared the old boy to death.
LR: That was the Germans, huh?
FN: Uh-huh.
LR: That's pretty bad.
FN: Yeah. Poor timing for him.
LR: That was right after he got it patented?
FN: Yes. His first engine was a lot bigger. The first one was fourteen cylinders--air compressors--it was a big "V". Then he decided that was too much, and then his last one was--he called it the "Model 39"--it was just half a block. It looked very similar, and the same size, as an old straight-8 Buick, because the hangers and everything would drop right in on a straight-8 Buick. Because that's what he had at the time, and he wanted that to drop in there, and use the same drive line and everything. The engine actually looked like a letter T.
LR: A letter T?
FN: A letter T. Just straight like an old straight-8 and it was a "V" out front where the two pullers were, set a little off to the side. The crank on that was perfectly round. The pullers had a little larger throw. The engine was basically the same thing cut in two from the original patent. Seven compressors is like fourteen, working both up and down. I remember it, he hooked it up to a machine lathe and had it running that. It worked!
LR: All right. Well I think it'll work because I'm partially showing it myself, a pretty crude, rigged-up system.
FN: Well, have you actually produced an engine?
LR: Well, not an engine, I'm just putting components together, I've used an air motor and I'm running a compressor with it, and I'm having that compressor put the air back into the tank. It's not putting enough back in the tank yet. Does his air motor cylinder--did they use the air pretty efficiently or did they let the air come in through the whole stroke and then exhaust it?
FN: Well, evidently it was efficient but he had no way of using the same air. His engine, I believe it would fill the tank I believe to 140 or 150 pounds and then the excess would escape.
LR: And then the exhaust from the engine just exhausted, right? It wasn't recaptured?
FN: Yeah, just like a regular combustion engine.
LR: Was the safety valve letting air out all the time or only when it was idling?
FN: Well, it maintained that pressure. And if I remember right, I could hear the air leaving all the time, so I think it was producing quite a bit more even under load.
LR: So even when it was running, the safety valve was letting out a kind of a regular spurt?
FN: Yeah. Uh-huh. It made a hissing noise because he didn't muffle it. He just turned it loose.
LR: That could be a key. If the safety valve was letting air discharge all the time, then that's important because it could be causing the pulsejet effect. Sudden discharge like that--

when you suddenly let a burst of air out through your safety valve--can create a vacuum inside the tank.
FN: Sure. That's what it is, it's one of the features. That's what he said, "The valve is the feature." And like I said, as a small boy, I was thinking of other things.
LR: Right. Well, those are pretty much the questions I had for you, I really thank you for taking time with me--
FN: Well, I wish I could help you more, I just can't remember the finer details.
LR: Well, that's fine, I think that the patent's pretty complete, but they just left the working principle out. It's probably just patent lawyers' tactics, you know.
FN: Yeah, sure. That's the legal people for you.
LR: Yeah. All right, Mr. Neal, I appreciate your taking time with me.
FN: Well I appreciate talking to you. Hope it works out.





Bob Neal's U.S. Patent #2,030,759 shows an equalizer (75) that lets the compression cylinders pump low pressure air into a high pressure tank (71) without compressing it to get it in. Possibly the Maxwell's Demon that physicists have been debating for over a hundred years, the Neal Equalizer may decrease the cost of compressing air to nearly zero.

Dec. 25, 1951 B. NEAL Des. 165,540

PURSE

Filed June 1', 1951

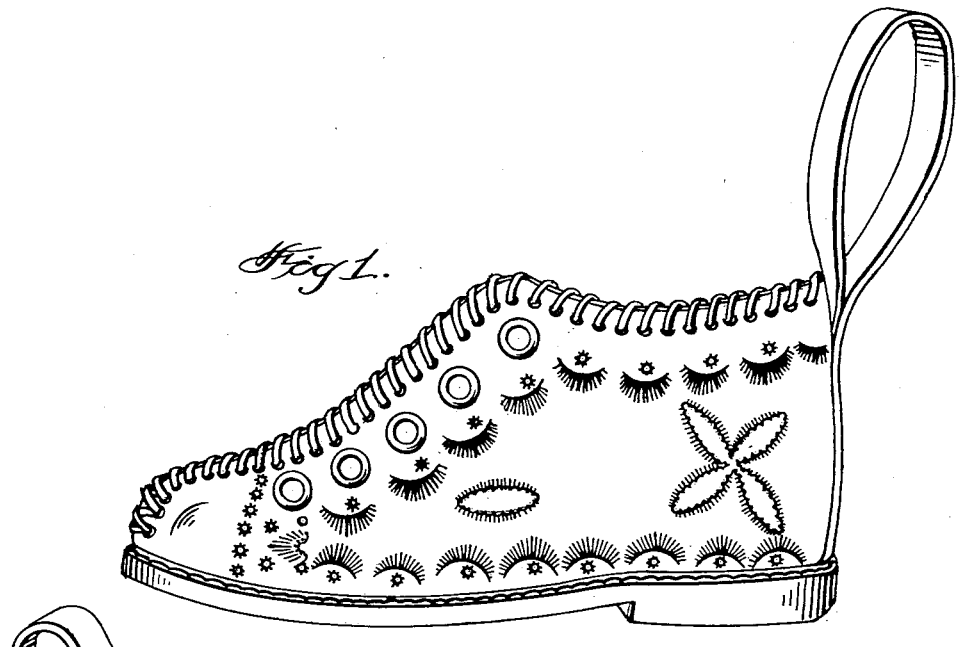


Fig 1.

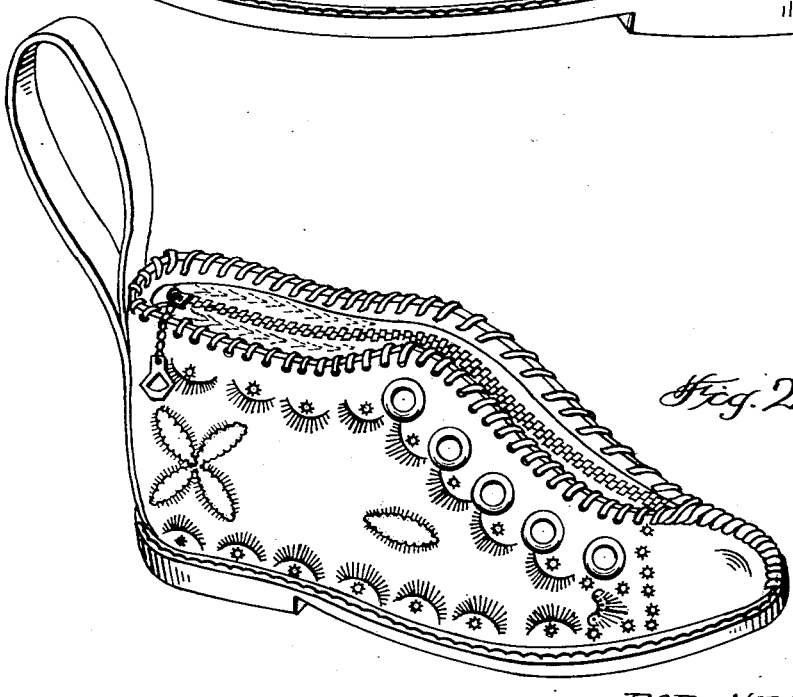


Fig. 2.

INVENTOR

BOB NEAL

BY

ATTORNEY

UNITED STATES PATENT OFFICE

165,540

PURSE

Bob Neal, Hot Springs, Ark.

Application June 1, 1951, Serial No. 15,374

Term of patent 7 years

(Cl. D87—3)

To all whom it may concern:

Be it known that I, Bob Neal, a citizen of the United States, residing at Hot Springs, State of Arkansas, have invented a new, original, and ornamental Design for a Purse, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

Figure 1 is a side elevation of a purse showing my new design, and

Figure 2 is a perspective view of the opposite side thereof.

I claim:

The ornamental design for a purse, as shown.

BOB NEAL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
D. 83,854	Funk et al.	Apr. 7, 1931
D. 149,236	Treat	Apr. 6, 1948

OTHER REFERENCES

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"The Navajo & Pueblo Silversmiths," by Adair, published 1946 by University of Oklahoma Press, page 105, plate V.