Dec. 4, 1928. 1,694,218

G. E. HAZARD

AIR COMPRESSING MECHANISM

Filed June 11, 1924 5 Sheets-Sheet 1

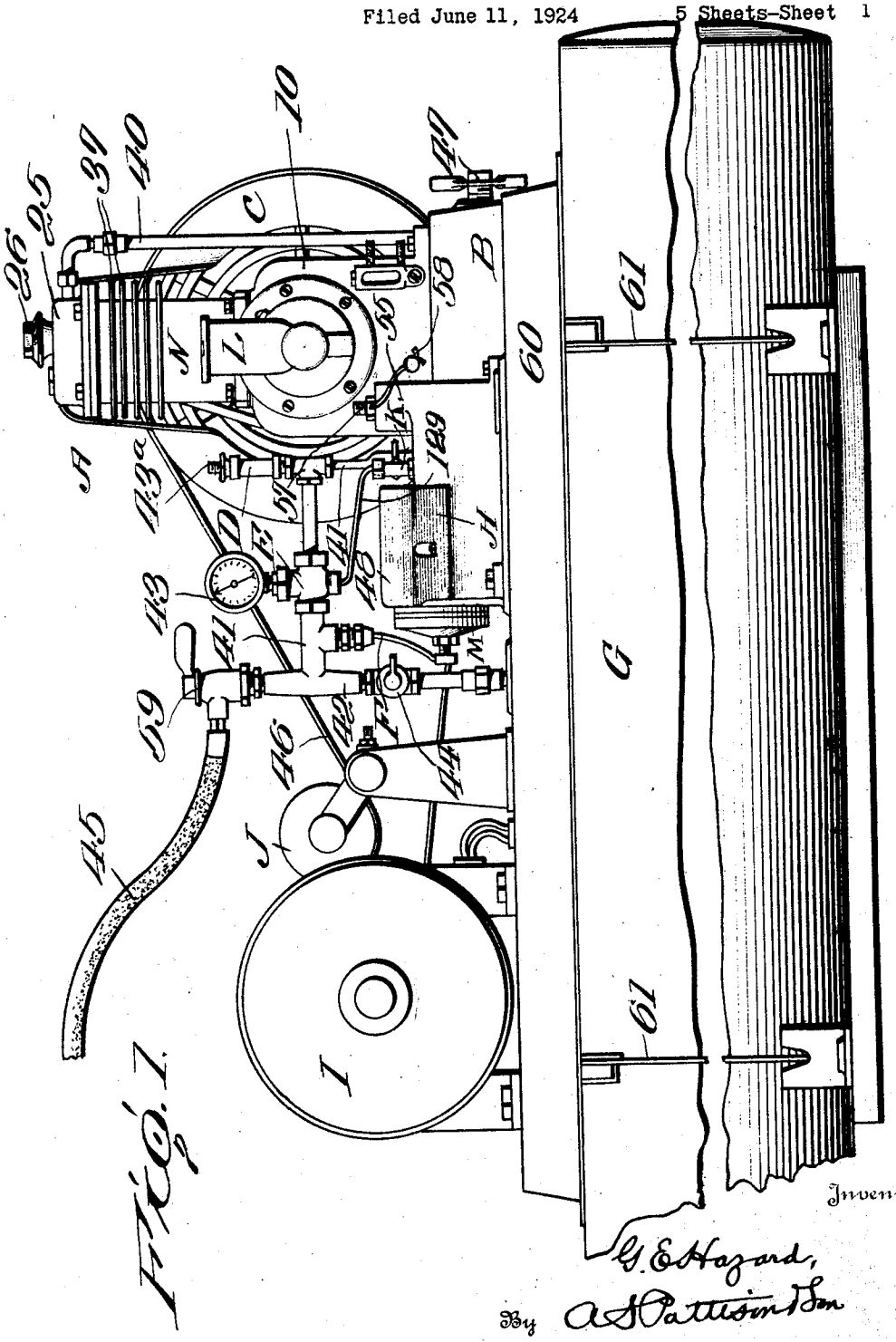


FIG. 1.

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AIR COMPRESSING MECHANISM

Filed June 11, 1924 5 Sheets-Sheet 2

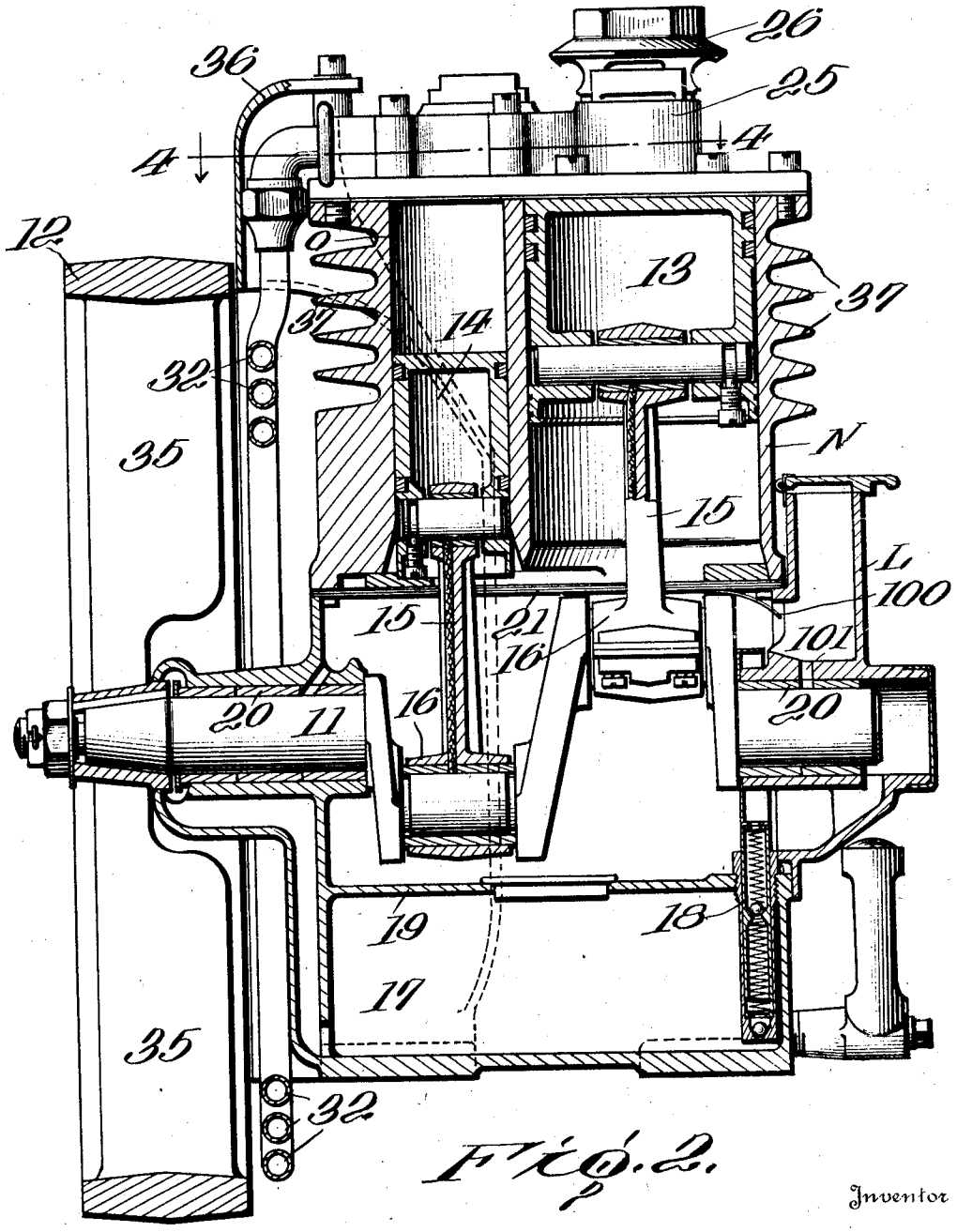


FIG. 2.

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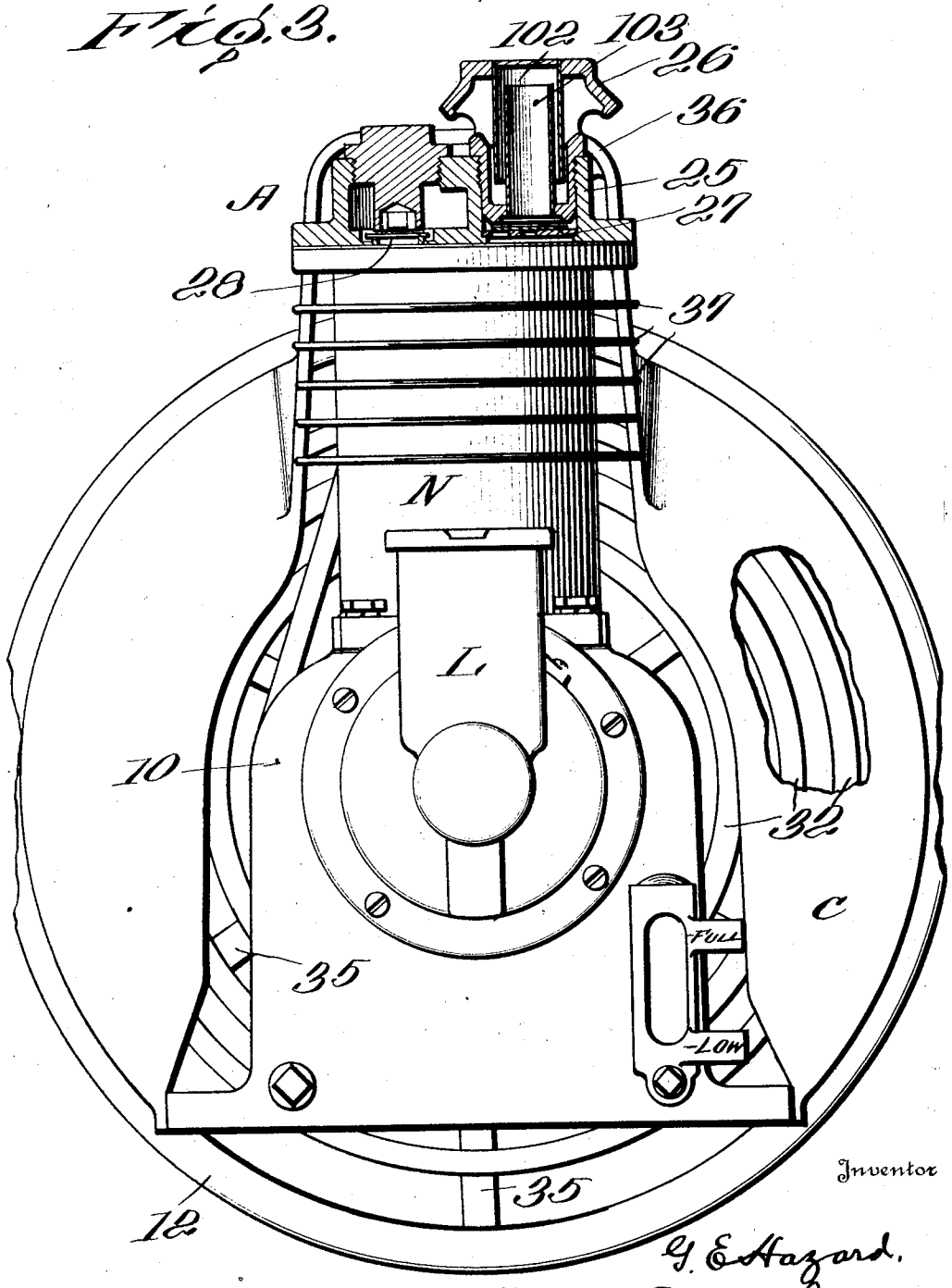
Dec. 4, 1928. 1,694,218

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AIR COMPRESSING MECHANISM

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Fig. 3.



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AIR COMPRESSING MECHANISM

Filed June 11, 1924 5 Sheets-Sheet 4

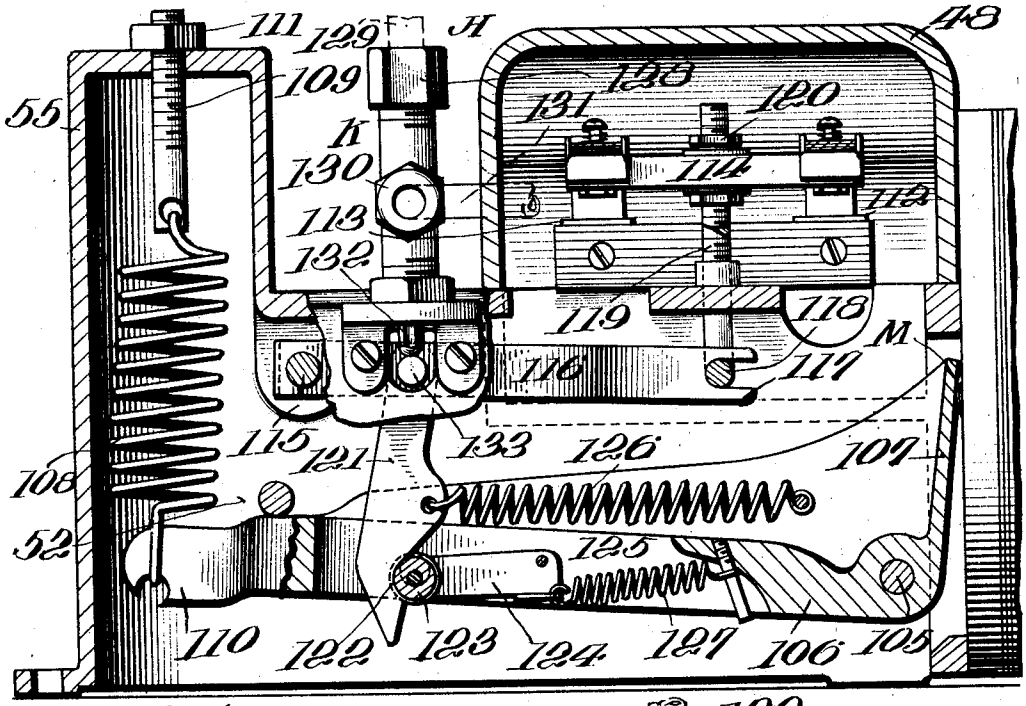


FIG. 5.

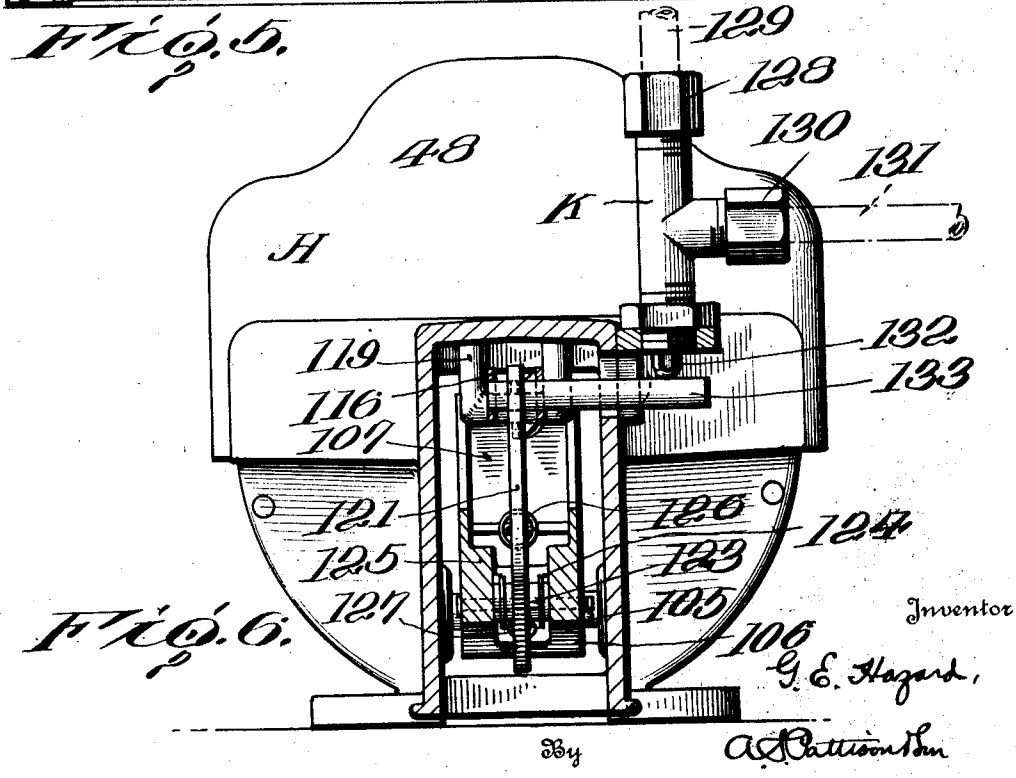


FIG. 6.

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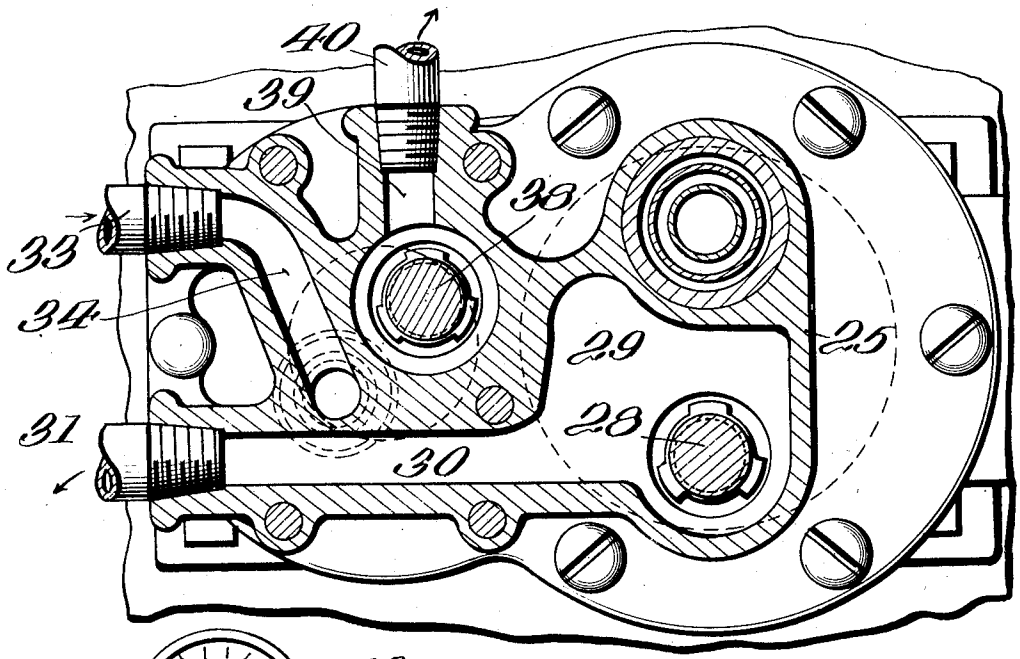
Dec. 4, 1928. 1,694,218

G. E. HAZARD

AIR COMPRESSING MECHANISM

Filed June 11, 1924 5 Sheets-Sheet 5

FIG. 4.



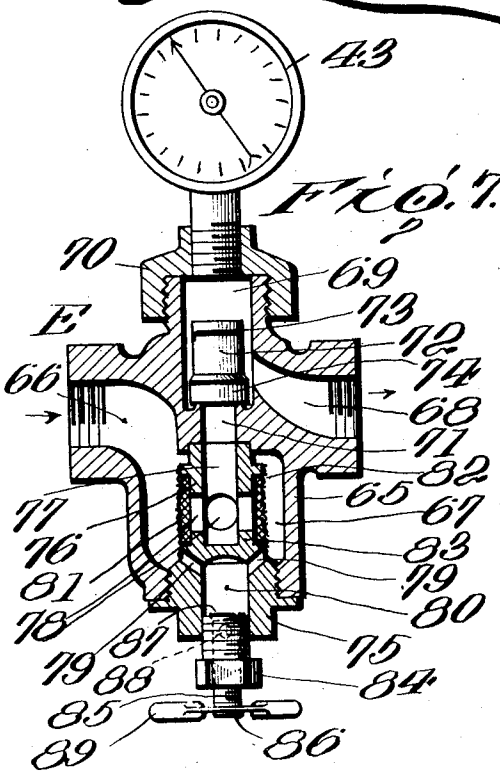


FIG. 7.

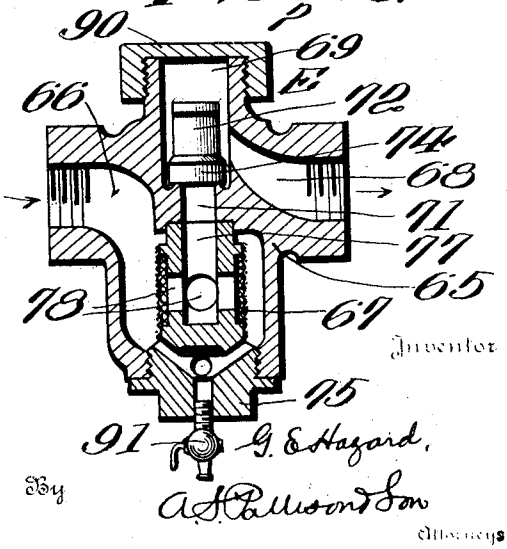


FIG. 8.

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Patented Dec. 4, 1928. 1,694,218

UNITED STATES PATENT OFFICE.

GEORGE EDGAR HAZARD, OF ROCHESTER, NEW YORK, ASSIGNOR TO KELLOGG MANUFACTURING CO., OF ROCHESTER, NEW YORK.

AIR-COMPRESSING MECHANISM.

Application filed June 11, 1924 Serial No. 719,310.

My invention relates to improvements in air compressing mechanisms.

The invention has for its object the provision of an improved air compressing mechanism.

Another object of my invention is to provide a compressing mechanism particularly adapted for use in garages, or gasoline filling stations for compressing air in a supply tank, or the compressor may be used to pump directly into pneumatic tires as desired. The compressors are also used for spraying paint and in divers other industrial work.

A further object of my invention is to provide an improved air compressing mechanism, the air being compressed in two stages and having improved cooling means for cooling the air during the time it is compressed.

A still further object of my invention is to provide an improved air compressing mechanism which is automatically stopped when the air in the receiving tank has reached a pre-determined pressure, and automatically started when the air pressure in the tank falls below a pre-determined pressure.

Another and further object of my invention is to provide an improved air compressing mechanism so constructed that it always starts against atmospheric pressure, thereby making the mechanism easy to start, and the mechanism is further so constructed as to collect deposits of moisture and oil and prevent them from being carried with the air into the air storage tank.

A still further object of my invention is to provide an improved check valve for use in air compressing mechanisms.

Other further objects, novel features of construction, and improved results of my invention will appear in the following description and accompanying drawings.

In the drawings:

Figure 1 is a view in elevation of my improved air compressing mechanism.

Fig. 2 is a vertical sectional view through the air compressor.

Fig. 3 is an end view of the compressor, the compressor head being broken away and being shown in vertical section.

Fig. 4 is a transverse sectional view taken on a line 4—4 of Fig. 2 looking in the direction indicated by arrow.

Fig. 5 is a vertical sectional view through the switch.

Fig. 6 is a sectional view taken at right angles to Fig. 5.

Fig. 7 is a vertical sectional view of my improved check valve.

Fig. 8 is a vertical sectional view of a modified form of my improved check valve.

Referring to the accompanying drawings and describing the invention broadly, the compressing mechanism as a whole constitutes an air compressor or pump A, mounted upon a retort or chamber B, into which the compressed air is forced by the compressor. The compressor or pump is provided with a fly-wheel to which are attached suitable fan blades which revolve in front of a housing C, in which a coiled pipe is mounted. The coiled pipe is an air conduit and together with the fly-wheel and housing act as a cooling medium for the compressed air in a manner which will be hereinafter more particularly described. The air is conveyed from the housing or retort B, past a safety valve D, through a check valve E, and into a storage tank G.

The mechanism is automatic in operation, after having been once started, being driven through a suitable electric motor I, or the like, by a belt in engagement with the fly-wheel of the pump. The automatic feature of the mechanism is the switch H, operated through a diaphragm M, upon which is constantly acting the air pressure of the tank G through the pipe connection F. The switch H is of such a construction that it can be automatically set to break the electric current connection to the motor I when the air pressure in the tank G has reached a predetermined point and to automatically renew the electric connection to the motor when the air pressure in the storage tank has fallen below a predetermined point.

A pressure release valve K is in communication through the check valve E with the retort or air chamber B and is actuated by the switch H, so that when the driving motor is automatically stopped, the release or escape valve K is actuated to allow the accumulated air pressure in the retort B to escape through the check valve and the release valve. The purpose of this is that when the pressure in the storage tank falls and the mechanism is started that the compressor or pump will start against zero, or atmospheric pressure and also to clean from the check valve any

accumulated dirt, oil or moisture collected by the check valve screen.

The compressor or pump is what is known as a two-stage compressor, consisting of a low pressure cylinder N and a high pressure cylinder O.

Having described my invention in general terms, a specific description of the device will now be given, wherein similar reference numerals as used in the drawings designate similar parts throughout the description.

The compressor A is of a two-stage type, consisting of the low pressure cylinder N and the high pressure cylinder O, mounted upon a suitable base 10, through which extends the crank shaft 11, upon the front end of which is suitably mounted a fly-wheel 12. The cylinders N and O are provided with pistons 13 and 14 respectively, and are provided with connecting rods 15 having suitable connection, as at 16, with the crank shaft 11. The base 10 has in its bottom an oil reservoir 17. A pump 18 is in communication with the oil reservoir and the lubricating system is of a constant level splashing system type. The pump maintains the oil level constant in the tray 19 of the base and the connecting rods dip into said tray splashing oil into pockets above both the main bearings 20 and keeping a constant flow in them, the excess returning to the reservoir. A steel baffle plate 21, between the cylinders and crank case prevent excess oil being thrown into the cylinders. This baffle plate is provided with a small extending finger 100 bent downwardly which collects oil from the under side of the plate and conveys it to the oil hole 101 in the rear main bearing 20. A lubricating system of this type assures proper lubrication to the working parts of the compressor. Oil is supplied to the reservoir through the vent or spout L.

The head of the compressor is designated at 25 and is cast in one piece, as clearly appears in Fig. 4 of the drawing. Air is drawn into the low pressure cylinder N, through the inlet 26, past the valve 27, which has been drawn downwardly from its seat, thus allowing the air to pass around it. Between the inlet 26 and the valve 27 there is mounted a muffler comprising the concentrically arranged pipes 102 and 103. This muffler construction causes the incoming air to follow a zigzag course. Without this device the air intake is very noisy but the muffler overcomes this annoyance. This, of course, takes place on the downward stroke of the low pressure piston and as that piston is driven upwardly the valve 27 is forced against its seat thus closing the inlet 26. As the piston ascends, the air additionally lifts the valve 28 from its seat and permits the air to enter the chamber 29 in the head 25. This chamber has an outlet 30 from which leads the end 31 of the coiled pipe 32.

The pipe 32 is formed in several coils, as clearly appears in Figs. 1, 2 and 3 of the drawing, and has its opposite end 33 connected to the inlet 34, which leads to the high pressure cylinder O.

The fly-wheel 12 is provided with a plurality of fan blades 35 and is adjacent the front end of a housing 36. The coiled pipe 32 is positioned within this housing and the housing confines the cooling draft which is created by the fan-blades of the fly-wheel. It will, therefore, be readily seen that the air is cooled after leaving the low pressure cylinder of the pump and is delivered to the high pressure cylinder at a low temperature, which is obviously advantageous. The coiled pipe 32 is preferably made of copper. Attention is also directed to the fact that the cylinders of the pump are provided with fins 37, for radiating the heat from them. It will also be seen that the housing around the coiled pipe will also deflect the air against the cylinder and cylinder fins and thereby materially aid the cooling of the cylinder.

As stated, the air from the low pressure cylinder after having passed through the cooling coil 32, enters the high pressure cylinder through the channel 34, and past a suitable valve in the cylinder head into the cylinder. The valve at the bottom of this channel is constructed to open only on a downward stroke of the high pressure piston. As the high pressure piston ascends, the valve will close the inlet opening 34 and lift the valve 38 from its seat, thus allowing the air compressed in the high pressure cylinder to escape through the cylinder head channel 39, into the outlet pipe 40.

The lower end of the outlet pipe 40 is in communication with the retort or air chamber B, upon which the compressor or pump is mounted. The compressed air enters at one side of this retort and passes out through the pipe 41 at the other side. The function of this retort is two-fold, viz, first, it acts as an air filter to collect any moisture or oil carried by the air and thereby assures that dry air is supplied to the storage tank; secondly, the chamber acts as a starting retort so that the compressor when first started will begin against zero, or atmospheric pressure. The manner in which the second function of the retort acts will be hereinafter described. The air upon leaving the air chamber or retort B is dry and is carried to the storage tank G through the pipes 41 and 42. Mounted upon the pipe 41 is a safety valve D. This safety valve is of the usual construction having a ball which is retained upon its seat through the medium of spring tension and is adjustable by a screw 43ª, so that the valve will unseat at any predetermined pressure. The purpose of the safety valve is to safeguard any harm being done to the compressor, should the automatic switch for stop-

ping the compressor fail to operate for any reason, or in the event that the check valve E should fail to operate and thereby allow excessive pressure of air being built up in the compressor itself.

The check valve E is also mounted upon the pipe 41, and is of a particular construction. A specific description of the check valve will be hereinafter made.

An air pressure gauge 43 for designating the air pressure in the storage tank is usually provided, and in the form herein shown the gauge is mounted in the top of the check valve E.

A shut off valve 44 is provided in the pipe line 42, between the storage tank and the check valve. This valve provides a means whereby the compressor can be made to pump air directly through the outlet hose 45, if desired. It is sometimes desirable to pump directly through the outlet hose 45 as, for instance, when it may be desired to inflate large tires. Often a large truck comes in for air and if the storage tank is of a small air-capacity and should the air in the tank be at a low point, without the valve 44, it would be necessary to fill both the storage tank and the tire at the same time. Such a proceeding would consume considerable time, which could be avoided by merely closing the valve 44 and pumping directly into the tire.

In case any adjustment is necessary to the check valve, or in the case the check valve should need cleaning, the valve 44 can be closed and the air pressure in the storage tank retained, while the cleaning or adjustment of the check valve takes place.

The compressor pump is preferably driven through the medium of an electric motor I having communication with the fly-wheel 12 of the compressor by means of a belt 46. An automatic self-adjusting idler pulley J is provided to keep the proper tension on the belt at all times.

A removable plug 47 is provided in the retort or air chamber B, so that the accumulated moisture or oil collected in this chamber can be drawn off. This will be necessary occasionally to prevent the same being passed on into the reservoir.

The switch for automatically stopping and starting the mechanism is designated at H. The switch is provided with a diaphragm M, upon which is constantly acting the air pressure of the reservoir G. The air pressure of the reservoir G is carried to the diaphragm through the pipe connection F, which is in communication with the pipe 44, between the storage tank and the check valve. The automatic switch H consists of a main housing 52 upon one end of which is supported a removable cover 48 which extends above the top of the housing while the opposite end of the housing is provided with an upwardly extending portion 55.

Pivotally mounted within the switch housing at 105 is a lever 106 having its end 107 adjacent its pivotal support in contact with the switch diaphragm M. The end 107 of the lever is in constant contact with the diaphragm through spring tension caused by the coil spring 108 supported within the portion 55 of the switch housing by means of the bolt 109 and having its lower end connected to the end 110. It will be readily seen that through the medium of the bolt nut 111 the tension upon the spring can be adjusted as desired. When the proper adjustment has once been made a seal or lock 58 is inserted through the nut and bolt to prevent the adjustment of the spring being tampered with. Through the adjustment of this spring the predetermined maintained pressure in the air reservoir is controlled.

Beneath the removable cover 48 of the switch housing are provided the electrical contacts 112 and 113 through which the current flows to the motor I through the switch bars 114.

Pivotally mounted above the lever 106 upon the downwardly extending portion 115 of the switch housing top is a lever 116 having a notched end 117. The notched end of this lever engages the lower end 118 of the rod 119 the upper end of which is fastened at 120 to the switch bars 114. The lever 116 is provided with a downwardly extending arm 121 having adjacent its lower end a notch 122 adapted to receive and engage the free end 123 of a pivotally mounted arm 124 carried within the opening 125 in the lever 106. The notch 122 of the arm 121 is held in constant engagement with the end 123 of the member 124 by reason of the coil spring 126 while a downward pull is put upon the end 123 of the arm 124 by reason of the coil spring 127.

As clearly appears in the drawings, particularly Figures 1, 5 and 6, the release valve K is mounted upon the switch housing between the removable cover 48 and the upwardly extending end portion 55. This release valve is normally closed and has its inlet end 128 in communication with the check valve E by means of the pipe 129. The outlet or escape of the release valve is shown at 130 and can be provided with an extending escape pipe 131 if desired. The release valve construction can be made as desired but as here shown takes the form of a needle valve the control rod of which extends downwardly through the valve so that its lower end 132 extends into the housing 52 of the switch where it is in engagement with the arm 133 carried by the lever or rod 116.

The operation of this mechanism is as follows:

The air pressure of the reservoir G is carried to the switch diaphragm M through the pipe connection F which is in communication with the pipe 44 between the storage tank and

the check valve E. When the pressure in the pressure tank which is constantly acting upon the switch diaphragm, is sufficient to depress the end 110 of the switch lever 106 against the tension of the coil spring 108 the pivotally mounted lever 116 will be lifted upwardly through the medium of the downwardly extending arm 121 and the pivotally mounted bar or lever 124. When this takes place the flow of current to the electric motor is broken as the end 117 of the lever 116 lifts the switch bars 114 from their contacts and breaks the electric circuit. At the same time the lower end 132 of the needle valve of the release valve K is lifted through the action of the arm 133 carried by the lever 116. When this needle valve rod is lifted the release valve is opened and allows the air pressure in the reservoir B to escape through the pipe 41, the check valve E, down the pipe 129 and through the outlet or escape 130 of the release valve.

It will now be seen that there is no air pressure in the retort B or in the pipe line between this retort and the check valve E or the release valve K so that when the compressor again starts it will start against zero or atmospheric pressure.

Attention is directed to another important feature which is that when the pressure release valve is opened the air pressure in the chamber B reaches the release or escape valve K through the check valve E, which will discharge through the check valve any foreign matter such as oil or water or carbon deposit which has been collected by the screen 81 of the check valve. This dirt or foreign substance escapes through the release valve K. It will therefore be seen that from the time the compressor is automatically stopped the check valve is likewise automatically cleaned.

It will be readily understood that when the pressure in the storage tank fills sufficiently to permit the spring 108 to lift the end 110 of the lever 106 that the switch bars will be lowered and make electrical contact to start the electric motor and that the release valve K will likewise automatically be closed.

It will, of course, be readily understood that the air supplied to the outlet hose 45 is controlled by a suitable valve 59.

In the form of the invention, as shown in the drawings, the entire unit is supported upon a suitable base 60, which is in turn mounted upon the reservoir G, in any suitable manner, such as by the circular bands 61. If desired, the reservoir can be mounted upon a hand truck or the like, so that the unit can be readily moved about as desired.

As will readily appear from the drawings, the low pressure cylinder N is much larger in capacity than the high pressure cylinder O. The air which is compressed on one stroke of the lower pressure piston is exhausted into the coil pipe 32. In compressing the air from the low pressure cylinder into the high pressure cylinder the difference in volume of the two cylinders causes a constant pressure in the low pressure cylinder regardless of the pressure which the high pressure cylinder is operating against. In the particular pump set forth in the drawings and description the difference in volumes of these two cylinders give a constant pressure of 45 pounds per square inch which is a low pressure and which is never exceeded in the low pressure cylinder. In compressing the air in the low pressure cylinder heat is of course generated which causes the air to become expanded and if this air were not cooled before reaching the high pressure cylinder the pressure of the air in the high pressure cylinder, before compression in that cylinder takes place, would be greater due to the increase in volume through the heat expansion. Furthermore, if the high pressure cylinder had high temperature or hot air in it at the time it begins its compression stroke the discharged air from that cylinder would be very hot and would be expanded still further than would be the case if the air was at atmospheric temperature when it enters the high pressure cylinder prior to being compressed therein. By keeping down the temperature of the air it is possible to take a larger volume of air into the low pressure cylinder and the compressor is kept cooler which increases the efficiency considerably in respect to the amount of actual discharged air under high pressure. It will therefore be seen that by delivering air thus to the high pressure cylinder at a low temperature makes the mechanism a most efficient two stage compressor.

Referring now to Figs. 7 and 8 of the drawing, I will describe modified forms of my check valve which may be put to many uses and therefore the escape pipe 129 of Fig. 1 is not shown. The check valve has been formerly designated by the letter E, and consists of a cast housing 65. At one side of the housing is a downwardly leading port or inlet 66, which terminates at the bottom of the housing in an enlarged chamber 67. At the opposite side of the housing is an upwardly leading port or outlet 68, which terminates at the top of the housing in a chamber 69. In the form herein shown, the chamber 69 is closed by a suitable plug 70 in the top of which is carried the pressure gage 43. The bottom of the chamber 69 is provided with an outlet port 71. A plunger 72 is mounted within the chamber 69. The upper end of the plunger 72 is slightly reduced in size by flattening it as at 73, while the lower end of the plunger has an enlarged head 74. The head 74 of the plunger normally closes the outlet port 71 of the chamber 69, as appears in Fig. 7 of the drawing. The purpose of the plunger being made in the manner shown and described is only

found necessary to bring about the best operation and which will allow the air to pass easily around the body of the plunger and escape through the opening 68 of the check valve. This construction also permits the air to readily circulate over the top of the plunger in the chamber 69 of the check valve. The construction also prevents the plunger from sticking or jamming to the side walls of the chamber 69 as the majority of the plunger surfaces have been eliminated. The upper part of the plunger in reality merely serves to form a guide so that the plunger will rest squarely on its seat instead of tipping to one side or the other which would probably happen were the plunger not properly guided at its top. It has been further found that as air pressure acts over the entire area of the plunger the flattened sides at the top are necessary as without them the plunger when rising from its seat would compress air to a certain extent between its top and the top of the chamber 69 which would cause an improper reading of the pressure gage.

The bottom of the housing 65 is provided with a plug 75, which has an inwardly extending elongated hollow stem 76, the upper end of which projects into a socket which surrounds the lower end of the outlet port 71, so that the outlet port 71 of the chamber 69 registers with the channel 77 of the stem. The stem is provided intermediate its length with a series of ports 78 while the plug is provided with a series of radially disposed ports 79, which communicate with the plug chamber 80. A screen 81 is carried upon shoulders 82 and 83 of the stem, so that the screen is in spaced relation to the stem 76, and its outlet ports 78. A plug 84 is screw-threadedly mounted in the bottom of the plug chamber 80. This plug screw-threadedly carries a hollow stem 85, having an open bottom 86 and a closed top 87. Adjacent the top 87 of the stem, a port 88 is in communication with the interior of the stem. The stem is provided at its outer end with a suitable handle 89.

In using my improved check valve in my compressor mechanism, the valve is mounted in the pipe-line between the compressor pump and the storage tank. The port 66 is in communication with the pump and constitutes the inlet port, while the port 69 is in communication with the storage tank and constitutes the outlet port of the valve. The drain cock in the valve bottom is eliminated, the pipe 129 joining the check valve with the relief valve, being substituted. It will be seen that as the compressed air from the pump enters the port 66, the air will pass through the screen 81, which will remove any foreign element from the air, and into the stem channel 77, through the ports 78. The air will pass upwardly through the hollow stem 76 and into the chamber 69, through its bottom port 71, lifting the plunger 72 from its seat. The air will then pass from the chamber 79 through the outlet port 68 into the compressor tank. The back pressure from the storage tank is constantly in the chamber 69 and acting upon the plunger 72 normally holds the plunger upon its seat thus sealing the chamber 69 to the air inlet. As the pressure gauge 43 is in communication with the chamber 69, the air pressure of the reservoir will be indicated upon the dial of the gauge. As the compressor supplies compressed air to the check valve, this air will lift the plunger 72 and allow the air to enter the chamber 69 and escape into the reservoir.

Any foreign matter carried to the check valve by the air is prevented from entering the reservoir, due to the screen 81. This foreign matter will fall to the bottom of the chamber 67, where it will discharge through the relief valve K when the compressor is automatically stopped, as has been described. This foreign substance will most probably be moisture, either water or oil.

In the modified form the oil or water accumulated in the chamber 80 can be drawn off by turning the stem 85 inwardly until the stem port 88 is above the inner end of the plug 84. At this time the port 88 of the stem will be in communication with the plug chamber 80 and allow the oil and water to drain from the chamber through the hollow stem 85.

It will be readily seen that I have provided a check valve which is easily cleaned, the stem 76 being integral with the plug 75 and the plug 84 and stem 88 being carried by the plug 75. By removing the plug 75 the entire check valve can be readily cleaned as desired. Additionally I have provided a simple means by which the accumulation of oil and water in the check valve can be drawn off. It is necessary to insure that no oil-laden air enters the air reservoir. Oil-laden air will do great injury to automobile tires. By the use of my retort or chamber B, together with my check valve, this happening is doubly guarded against.

In Fig. 8 of the drawings, a modified form of my check valve is shown. Reference numerals similar to those in Fig. 7 are used upon Fig. 8. I wish it to be understood that it is not necessary that the pressure gauge be mounted in the check valve. In the modified form of the check valve the plunger chamber 69 is closed by a cap 90, in place of the cap 70 of the preferred form. In the modified form, I have done away with the plug 84 and its hollow stem 85, using in their place the ordinary pet-cock 91 for draining the lower plug chamber 80. The check valve construction shown in the modified form

would be put to many uses as will be readily understood, so likewise can the preferred form of the valve.

From the foregoing description it will be seen that in all the forms of the check valve that the screen at the bottom of the valve collects all foreign matter carried by the air passing through the valve. This foreign matter may possibly be water, oil, dirt or flakes of carbon due to carbonization in the pump and prevents any of this foreign matter lodging on the seat of the check valve which would cause the check to leak and thereby impair the operation of the whole system.

Having thus described my invention what I claim and desire to secure by Letters Patent is:

1. A compressor mechanism, comprising a compressor having low and high pressure cylinders, an intercooler connecting said cylinders, a fly wheel having fan blades, a housing between said fly wheel and said cylinders, and the intercooler mounted in said housing, for the purpose described.

2. In a compressor mechanism, a compressor having a plurality of cylinders, a fly wheel having fan blades, a housing between the fly wheel and the cylinders, an intercooler mounted within said housing and connecting the compressor cylinders, and the housing adapted to direct the flow of cooling air from the fly wheel around the intercooler over the compressor cylinder wall, for the purpose described.

3. In a compressor, the combination of low and high pressure cylinders, fan blades for creating a flow of air towards said cylinders, an intercooler connecting said cylinders and comprising a coiled pipe arrangement between the cylinder and said fan blades, and means for directing the flow of air from the fan blades over the intercooler.

4. A compressor mechanism, comprising a compressor having low and high pressure cylinders, an intercooler in the form of a coiled pipe connecting the said cylinders, a fly-wheel having fan blades, a housing between the said fly wheel and said cylinders, and the intercooler mounted in said housing, for the purpose described.

5. An air compressor and liquid separating mechanism, comprising a plurality of cylinders in parallel relation mounted above a compression receiving chamber, an intercooler comprising a coiled pipe connecting said cylinders and being positioned between the cylinders and the compressor fly-wheel, fan-blades on said fly-wheel for causing a flow of air, and a housing for directing said air-current against said intercooler, compressor cylinders and compression chamber.

6. In a compressor mechanism, a compressor having low and high pressure cylinders, the cylinders provided with radiation accelerating means, an intercooler connecting the cylinders, a fly wheel provided with fan blades, a housing between the fly wheel and the cylinders, the intercooler mounted in said housing, and the housing adapted to direct the flow of air from the fly wheel around the intercooler and upon the cylinder radiation accelerating means, for the purpose described.

7. In a compressor mechanism, a two cylinder compressor, an intercooler connecting the cylinders, an air receiving chamber, a fly wheel carrying fan blades, an intercooler mounted between the cylinders and the fly wheel, the compressor mounted upon the air receiving chamber, and means for confining and directing the course of air current created by the fly wheel blades.

8. A compressor mechanism constructed as defined in claim 7, the means for confining and directing the air current of the fly wheel blades comprising a housing mounted between the fly wheel and the engine cylinders.

9. In a compressor mechanism, a pair of vertically arranged parallel cylinders, one of said cylinders being a high pressure cylinder and the other a low pressure cylinder, an intercooler connecting the cylinders, a fly wheel for the compressor provided with fan blades, the intercooler supported between the cylinders and the fly wheel, means to direct the air blast from said fan blades over said intercooler, an air receiving and liquid separating chamber in communication with the high pressure cylinder, and the air receiving chamber in communication with an air receiving reservoir.

10. A two-stage compressor with intercooler comprising a relatively low and a relatively high pressure cylinder, the low pressure cylinder being larger in diameter, a crank shaft operatively connected with pistons located in the respective cylinders, a fan attached to the driving shaft and located adjacent one of the said cylinders, an intercooler having its ends connected respectively with the said cylinders, the intermediate portion of the intercooler having a vertically arranged coil located between the fan and adjacent one of the said cylinders, and means for confining the air current from said fan whereby air is forced through the coil for cooling the compressed air fed to the high compression cylinder.

11. A two-stage compressor with intercooler comprising relatively low and relatively high pressure cylinders, a crank shaft operatively connected with pistons located in the said cylinders, a fan located adjacent one of the said cylinders, and an intercooler having its ends connected respectively with the said cylinders and its intermediate portion formed in a vertically arranged convolute coil, and a surrounding housing arranged be-

tween the fan and the said cylinder whereby all of the air is forced through the said coil for the purpose described.

12. A two-stage compressor and intercooler comprising relatively low and high pressure cylinders, a drive shaft operatively connected with pistons located in said cylinders, a fly wheel having its spokes arranged to form a fan and of a diameter to have its lower edge extend beyond the said cylinder and its structure, and an intercooler comprising a pipe having its ends connected respectively with the two said cylinders and its intermediate portion arranged in a vertical plane between the said fan spokes and one of the said cylinders, and the lower portion of the coil extending below the housing, whereby air is forced through the lower portion of the coil and through the upper portion and against the said cylinders for the purpose specified.

13. A two-stage compressor and intercooler compressor comprising relatively low and high pressure cylinders, a crank shaft operatively connected with pistons located in the said cylinders, a fly wheel having its spokes formed into fan blades, the high pressure cylinder located adjacent the said fly wheel and an intercooler consisting of a pipe having its ends connected respectively with the two-stage cylinders and arranged in a vertical convolute coil, and a housing for confining the air set in motion by the fan, and directing the same over and through the intercooler, whereby air is received directly from the low pressure cylinder and cooled in the coil and air is also forced directly on the high pressure cylinder which is hotter than the low pressure cylinder, thereby cooling the air in the intercooler and cooling both of the cylinders to substantially a proper working temperature.

14. A two-stage compressor and intercooler comprising a drive shaft, relatively high and low pressure cylinders arranged tandem in a line with the drive shaft, the drive shaft operatively connected with pistons located in the said cylinders, a fan attached to the drive shaft, the high pressure cylinder located adjacent the said fan, and an intercooler pipe having its ends connected with the said cylinders and having an intermediately arranged vertical coil located between the said high pressure cylinder and the said fan, a housing between said fan and said high pressure cylinder, the intercooler positioned in said housing whereby part of the air strikes the said high pressure cylinder before striking the low pressure cylinder, thereby maintaining the two cylinders at substantially the same temperature.

In testimony whereof I hereunto affix my signature.

GEORGE EDGAR HAZARD.