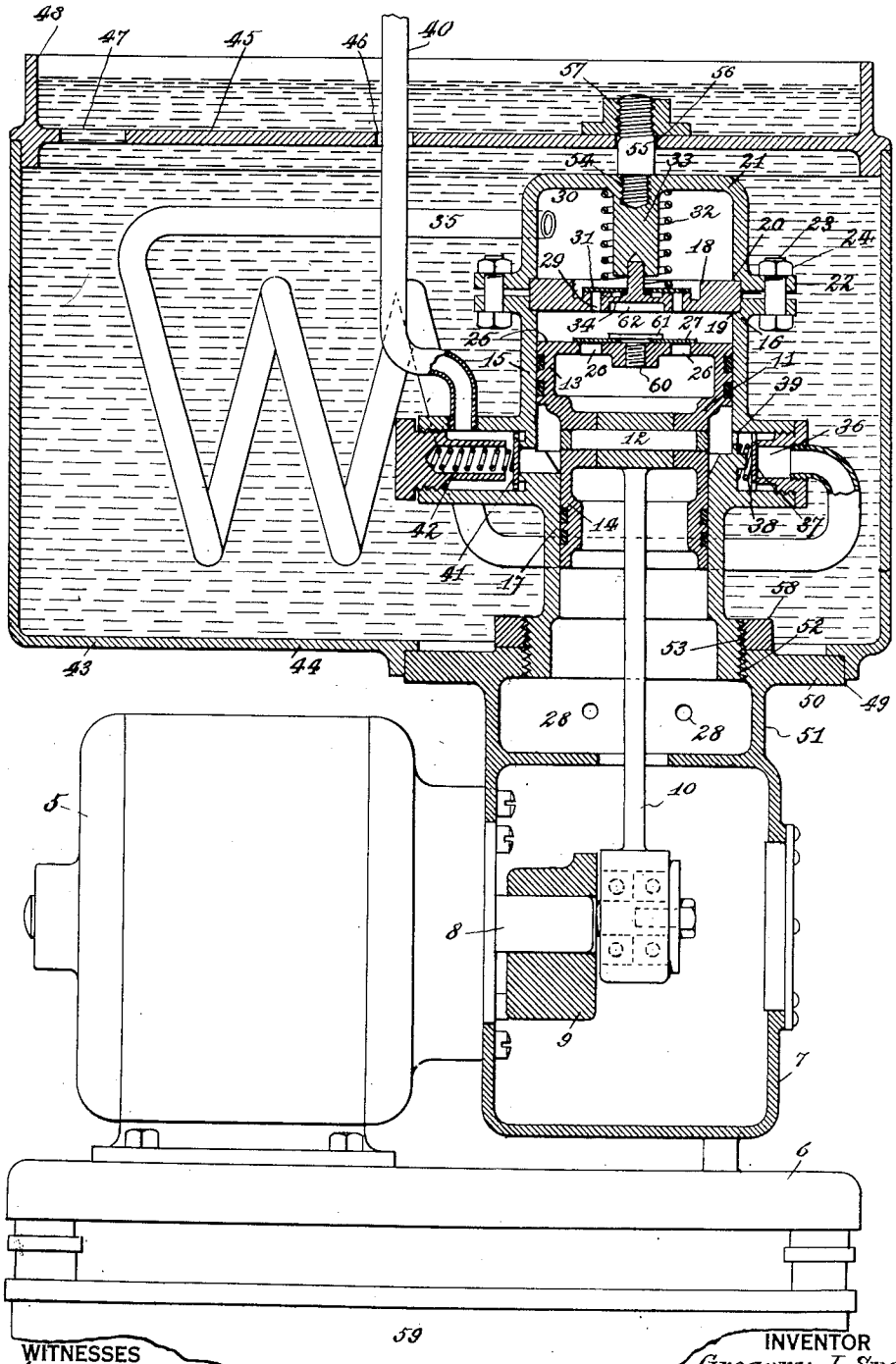
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COMPRESSOR

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WITNESSES

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COMPRESSOR

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The invention has for one of its objects to provide a motor-driven compressor which will serve to compress and cool a fluid before discharging the compressed fluid. The compressor is preferably of the multi-stage type and provides a compressor piston which has an auxiliary surface which serves to further compress the fluid and to force the compressed fluid from the compressor after the fluid has been initially compressed and cooled.

A further object of the invention is to provide a cooling tank in which a compressor cylinder is disposed, the cooling tank serving to contain a cooling fluid, in which extends a communicating means leading from the initial compressor outlet in the cylinder to the auxiliary compressor inlet in the cylinder.

The invention has as a further object to provide the piston with a reduced periphery so that the outer end of the piston will serve to initially compress the fluid and the piston at its reduced periphery will serve to further compress the fluid, the fluid being led from the initial compressor outlet to the auxiliary compressor inlet where it is compressed by the piston adjacent its reduced periphery, the by-pass leading from the initial compressor outlet to the auxiliary compressor inlet being preferably disposed in a cooling fluid.

The invention further comprehends a compressor having a crank case with which a cooling tank is connected, a compressor cylinder being disposed in the tank and having communication with the crank case and also being adjustable relatively to the crank case to regulate the action of a piston connected with a crank in the crank case, relatively to the compressor cylinder in which the piston is disposed for reciprocating. The construction is such that the crank case and a motor for rotating a crank in the crank case are mounted on a storage tank for the compressed fluid, a cooling tank containing a cooling fluid and the compressor cylinder in the said cooling tank being mounted on the crank case, all within a small compass. The compressor is particularly well adapted for compressing air for use in inflating automobile tires.

Additional objects of the invention will appear in the following specification in which the preferred form of the invention is described.

The drawing illustrates in section the compressor which is the subject matter of this application.

By referring to the drawing it will be seen that an electric motor 5 is disposed on a base 6, a crank case 7 being also mounted on the said base, the shaft 8 of the electric motor having secured thereto a crank 9 on which may be mounted any desired counterweight. Mounted on the crank 9 there is a connecting rod 10 which is connected with a hollow piston 11 by means of a pin 12. As will be seen by referring to the drawing, the hollow piston 11 has two zones 13 and 14, each of the zones being preferably provided with piston rings. The zone 13 is of greater diameter than the zone 14, so that the zone 13 of the piston 11 will travel in a zone 15 in a cylinder 16, while the zone 14 of the piston 11 will travel in a zone 17 to the cylinder 16, the inner diameter of the zone 15 of the cylinder 16 being greater than the inner diameter of the zone 17 of the cylinder 16.

The cylinder 16 has a head 18 which is held in place on the cylinder 16 by the engagement of the periphery of the head 18 by an annular shoulder 19 on the cylinder 16 and an annular shoulder 20 on the cylinder cap 21. The cylinder cap 21 and the cylinder 16 are held relatively to each other with the cylinder head 18 in position by means of ears 22 having openings through which bolts 23 are disposed, the bolts 23 being held in position by means of the usual nuts 24.

The head 25 of the piston has outlets 26 which are normally covered by an annular check valve 27, it being understood that the check valve 27 will open when the piston 11 moves in the direction of the crank case 7 to permit air to flow from the inlets 28 through the openings 26 and between the head 25 of the piston 11 and the cylinder head 18 and that when the piston 11 moves in the direction of the cylinder head 18 this air which

has accumulated between the head 25 of the piston 11 and the cylinder head 18 will be forced through the outlets 29 in the cylinder head 18 to the compartment 30 in the cylinder cap 21. Air from the compartment 30 cannot flow to the space between the piston head 25 and the cylinder head 18, inasmuch as a check valve 31 commands the outlets 29 and prevents any return flow of fluid from the compartment 30 to the space between the piston head 25 and the cylinder head 18. This check valve 31 is held yieldingly on its seat by means of a spring 32 which is disposed around a stud 33 which extends inwardly from the cap 21. A valve member 34, which forms an inner wall of the valve opening 29 is mounted on the stud 33.

There is a pipe or communicating means 35 which connects the compartment 30 with a chamber 36 which is held yieldingly closed by a check valve 37, the check valve 37 being held in normal position by a spring 38. However, when this check valve 37 is pressed inwardly against the resiliency of the spring 38 by means of the pressure in the chamber 36, the air will flow from the said chamber 36 through a port 39 to the cylinder 16 adjacent the zone 17 of reduced inner diameter of the cylinder 16 and at the zone of reduced diameter 14 of the piston 11. Therefore, the air or other fluid which has been initially compressed by the piston 11 at its head 25 will be introduced at the reduced diameter of the piston 11 to be further compressed against the cylinder 16 adjacent the zone of reduced inner diameter of the cylinder 16.

Having been further compressed the air or other fluid will pass outwardly to the pipe or communicating means 40 through the check valve 41, which will be pressed outwardly by the pressure of the air or other fluid against the resiliency of the spring 42. The check valve 41 and also the check valve 37 have openings at their peripheries which will permit the air to pass around the said check valves 41 and 37 when the said valves are open.

The cylinder 16 is disposed in a cooling tank 43, which is preferably filled with water, the said cooling tank 43 having a bottom 44 and a top 45, the communicating means or outlet pipe 40 passing through an opening 46 in the said top 45 of the cooling tank 43. There is also an opening 47 in the top 45 of the tank 43 through which the water or other fluid may flow to the tank 43. In addition the tank 43 preferably has a rim 48 around its top 45 for containing additional water and to assist in filling the body of the cooling tank. The pipe or communicating means 35 extends through the cooling tank 43 to cool the air after it has been initially compressed.

The bottom of the cooling tank 43 has an opening 49 in which fits a flange 50 extending radially from a collar 51 at the top of the crank case 7. This flange 50 has an inner threaded opening 52 with which meshes an outer thread 53 at the bottom of the cylinder 16. It will, therefore, be seen that the position of the cylinder 16 may be adjusted relatively to the flange 50 and the crank case 7 by turning the cylinder 16 relatively to the flange 50. As a means for holding the cylinder 16 in adjusted position relatively to the tank 43 in the crank case 7, the cap 21 is provided with a threaded opening 54 at the stud 33, a threaded member 55 meshing with the threaded opening 54 and this threaded member 55 also extending through an opening 56 in the top 45 of the cooling tank 43 and being engaged by a nut 57 for holding the cap 21 and the cylinder 16 in adjusted position. By means of this adjustment the stroke of the piston 11 relatively to the cylinder 16 and the cylinder head 18 may be regulated. A threaded nut 58 is preferably provided which meshes with the thread 53 at the bottom of the cylinder 16 above the flange 50 and which normally presses against the said flange 50.

As has been stated, the electric motor 5 and the crank 7 are mounted on a base 6. This base 6 is preferably mounted on a tank 59 with which the communicating means or outlet pipe 40 communicates, the outlet pipe being provided for receiving the compressed air or other fluid.

The valve 27 is held in position by means of a screw 60 meshing in a threaded orifice in the piston head 25 and having a head 61 with flanges to hold the valve 27 in position. There is preferably an opening 62 in the valve member 34 for receiving this head 61, thereby allowing the piston head to be disposed in close proximity to the cylinder head 18 at the end of each upward stroke.

What is claimed is:

1. In a compressor, a cylinder, a cooling tank in which the cylinder is disposed, a piston for reciprocating in the cylinder, the piston having two zones of different diameters, the zone of the piston having the greater diameter fitting the inner diameter of the body of the cylinder, a by-pass disposed in the tank and connecting an outlet in the body of the cylinder with the cylinder adjacent the path of the zone of the piston having the lesser diameter, and an additional outlet from the cylinder adjacent the path of the zone of the piston having the lesser diameter.

2. In a compressor, a cooling tank, a cylinder disposed in the tank and having a portion with a reduced inner diameter, a piston for reciprocating in the cylinder and having a portion in the cylinder beyond its reduced diameter and another portion of reduced diameter at the reduced diameter of the cylinder, and a communicating means

disposed in the tank connecting the cylinder beyond its reduced diameter with the cylinder adjacent its reduced diameter, a check valve in the communicating means, a second communicating means free from the first communicating means leading from the cylinder adjacent its reduced diameter, and a check valve in the second mentioned communicating means.

3. In a compressor, a cylinder having two zones, one with an inner diameter which is greater than the inner diameter of the other zone, a hollow piston for reciprocating in the cylinder and having two zones of different diameters fitting the two zones in the cylinder respectively, a check valve in the cylinder at its zone with the greater inner diameter, a communicating means leading from the check valve to the cylinder adjacent its zone of reduced inner diameter, a check valve adjacent the connection of the communicating means with the cylinder at its zone of reduced diameter, an outlet from the cylinder adjacent its zone of reduced inner diameter, and a check valve at the outlet and a tank in which the cylinder and the outlet are disposed.

4. In a compressor, a cylinder having two zones, one with an inner diameter which is greater than the inner diameter of the other zone, a hollow piston for reciprocating in the cylinder and having two zones of different diameters fitting the two zones in the cylinder respectively, a check valve in the piston, a communicating means connecting the cylinder at one of its zones with the cylinder adjacent its other zone, a check valve for regulating the passage of a fluid in the communicating means, an outlet from the cylinder adjacent its zone of reduced diameter, and a check valve for controlling communication through the outlet and a tank in which the cylinder, the communicating means and the outlet are disposed.

5. In a compressor, a cylinder having two zones, the inner diameter of one of the zones being greater than the inner diameter of the other zone, a hollow piston for reciprocating in the cylinder having two zones of different diameters fitting the two zones in the cylinder respectively, a check valve in the piston, a check valve in the cylinder at one zone in the cylinder disposed substantially opposite the check valve in the piston, a check valve in the cylinder adjacent its other zone, a communicating means connecting the two check valves in the cylinder, an outlet from the cylinder, and a check valve at the outlet, and a tank in which the cylinder, the communicating means and the outlet are disposed.

6. In a compressor, a crank case, a crank in the crank case, a cooling tank at the crank case, a compressor cylinder in the tank and communicating with the crank case, means for adjustably securing opposite ends of the compressor cylinder relatively to the crank case and the cooling tank, a piston in the compressor cylinder, and means connecting the crank with the piston for reciprocating the latter in the compressor cylinder.

7. In a compressor, a crank case, a crank in the crank case, a cooling tank at the crank case, a compressor cylinder in the tank and communicating at one end with the crank case, means for adjustably securing the other end of the compressor cylinder relatively to the cooling tank, a piston in the compressor cylinder, and means connecting the crank with the piston for reciprocating the latter in the compressor cylinder.

8. In a compressor, a crank case, a crank in the crank case, a cooling tank at the crank case, a compressor cylinder in the cooling tank, the compressor cylinder communicating with the crank case and having two zones, one of the zones having an inner diameter which is greater than the inner diameter of the other zone, means for adjustably securing the compressor cylinder relatively to the crank case, a piston for reciprocating in the compressor cylinder having two zones of different diameters fitting the two zones in the compressor cylinder respectively, means connecting the crank with the piston, communicating means connecting one of the zones in the compressor cylinder with the compressor adjacent its other zone, a communicating means leading from an outlet in one of the zones in the compressor cylinder, check valves for controlling communication in the communicating means, and a check valve in the piston.

9. In a compressor, a crank case, a crank in the crank case, a cooling tank at the crank case, a compressor cylinder in the cooling tank, the compressor cylinder communicating with the crank case and having two zones, one of the zones having an inner diameter which is greater than the inner diameter of the other zone, means for adjustably securing the compressor cylinder relatively to the crank case, a piston for reciprocating in the compressor cylinder having two zones of different diameters fitting the two zones in the compressor cylinder respectively, means connecting the crank with the piston, communicating means extending in the cooling tank and connecting one of the zones in the compressor cylinder with the compressor cylinder adjacent its other zone, a communicating means leading from an outlet in one of the zones in the compressor cylinder, check valves for controlling communication in the communicating means, and a check valve in the piston.

10. In a compressor, a cooling tank having opposite walls, a crank case adjacent the cooling tank, a compressor cylinder disposed in the cooling tank and having an open end communicating with the crank case through an opening in one of the walls of the cool-

ing tank, the other end of the compressor cylinder having a stud, means for securing the stud relatively to the other wall of the cooling tank, a piston in the cylinder, a crank in the crank case, and means connecting the crank with the piston.

11. In a compressor, a cooling tank having opposite walls, a crank case adjacent one of the walls of the tank, a compressor cylinder disposed in the cooling tank and having an open end communicating with the crank case through an opening in one of the walls of the cooling tank, the other end of the compressor cylinder having a stud, means for securing the stud relatively to the other wall of the cooling tank, the compressor cylinder having two zones, one zone being of greater diameter than the other zone, a piston for reciprocating in the compressor cylinder having two zones fitting the two zones in the compressor cylinder respectively, a communicating means leading from one zone in the compressor cylinder to the compressor cylinder adjacent its other zone, a communicating means leading from an outlet in one of the zones of the compressor cylinder, check valves for regulating the flow of fluids through the communicating means, a check valve in the piston, a crank in the crank case, and means operatively connecting the crank with the piston.

12. In a compressor, a crank case having a fluid inlet, a cooling tank at the crank case, a compressor cylinder in the cooling tank, the compressor cylinder communicating with the crank case and having two zones, one of the zones having an inner diameter which is greater than the inner diameter of the other zone, a piston for reciprocating in the compressor cylinder having two zones of different diameters fitting the two zones in the compressor cylinder respectively, means in the crank case for reciprocating the piston in the cylinder, communicating means connecting one of the zones in the compressor cylinder with the compressor cylinder adjacent its other zone, a communicating means independent of the first communicating means and leading from an outlet in one of the zones in the compressor cylinder, check valves for controlling communication in the communicating means, and a check valve in the piston.

13. In a compressor, a crank case having a fluid inlet, a cooling tank at the crank case, a compressor cylinder in the cooling tank, the compressor cylinder communicating with the crank case and having two zones, one of the zones having an inner diameter which is greater than the inner diameter of the other zone, a piston for reciprocating in the compressor cylinder and having two zones of different diameters fitting the two zones in the compressor cylinder respectively, means in the crank case for reciprocating the piston in the compressor cylinder, communicating means extending in the cooling tank and connecting one of the zones in the compressor cylinder with the compressor cylinder adjacent its other zone, a communicating means independent of the first communicating means and leading from an outlet in one of the zones in the compressor cylinder, check valves for controlling communication in the communicating means, and a check valve in the piston.

14. In a compressor, a cooling tank, a compressor cylinder in the cooling tank, the compressor cylinder having a cap with an inwardly extending stud, means on the stud for securing the compressor cylinder relatively to the cooling tank, the compressor cylinder having a head with an opening, a valve member mounted on the stud disposed in the opening and spaced from the head to form a port between the valve member and the head, a valve commanding the port, and a piston for reciprocating in the compressor cylinder.

15. In a compressor, a cooling tank, a compressor cylinder in the cooling tank, the compressor cylinder having a cap with an inwardly extending stud, the compressor cylinder having a head with an opening, a valve member mounted on the stud disposed in the opening and spaced from the head to form a port between the valve member and the head, a valve commanding the port, a piston for reciprocating in the compressor cylinder, and a check valve in the piston.

16. In a compressor, a cooling tank, a compressor cylinder in the cooling tank, the compressor cylinder having two zones, one of the zones having an inner diameter which is greater than the inner diameter of the other zone, a piston for reciprocating in the compressor cylinder having two zones of different diameters fitting the two zones in the compressor cylinder respectively, the cylinder having a head with a check valve, a communicating means disposed in the cooling tank and connecting the check valve with a zone in the compressor cylinder spaced from the head, an outlet from the last mentioned zone in the compressor cylinder extending in the cooling tank, and a check valve in the piston.

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