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S. COOK ET AL
COMPRESSOR APPARATUS

2,119,201

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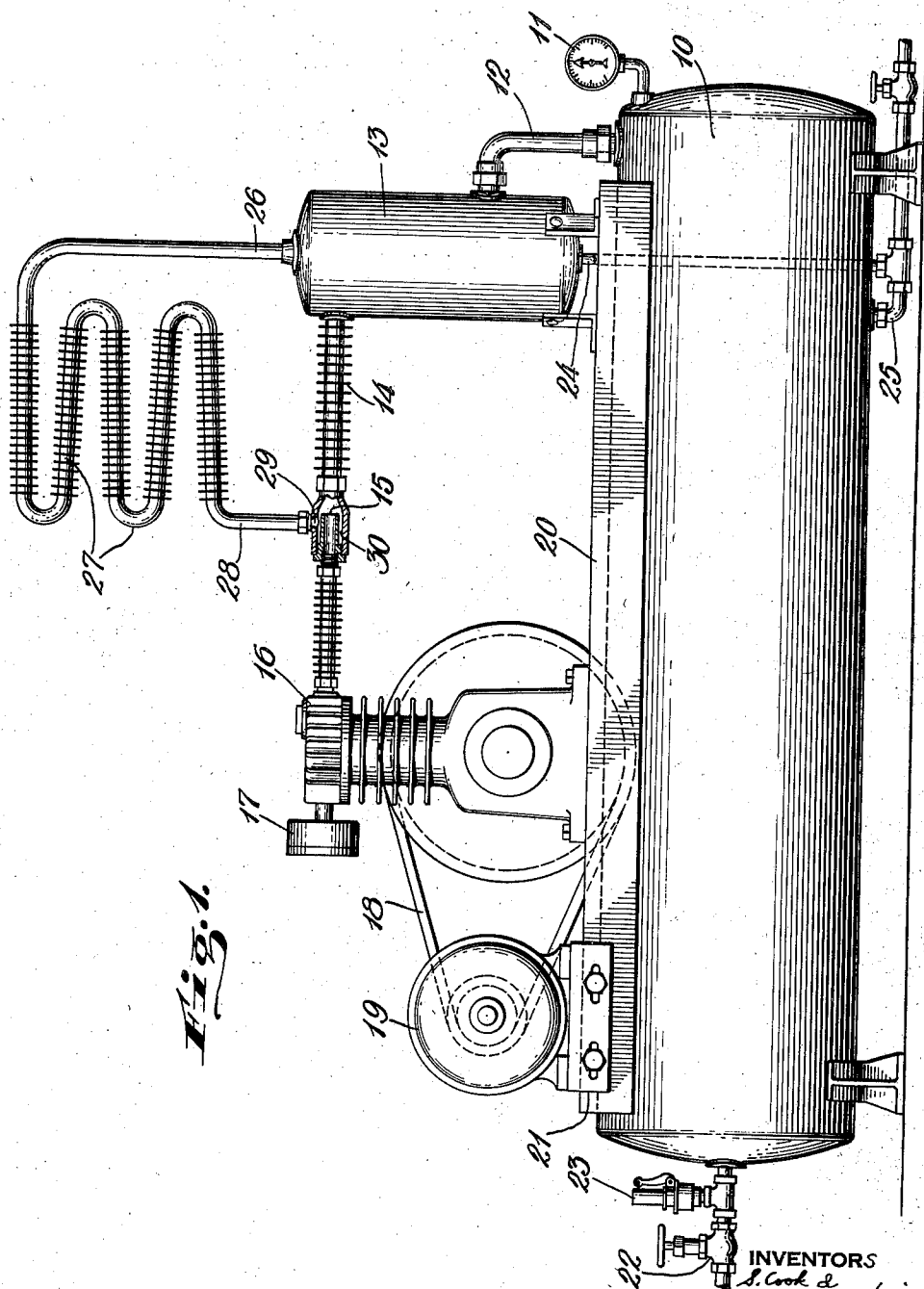


Fig. 1.

INVENTORS
S. Cook &
H. E. Novina
BY
A. H. Golden
ATTORNEY

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Fig. 3.

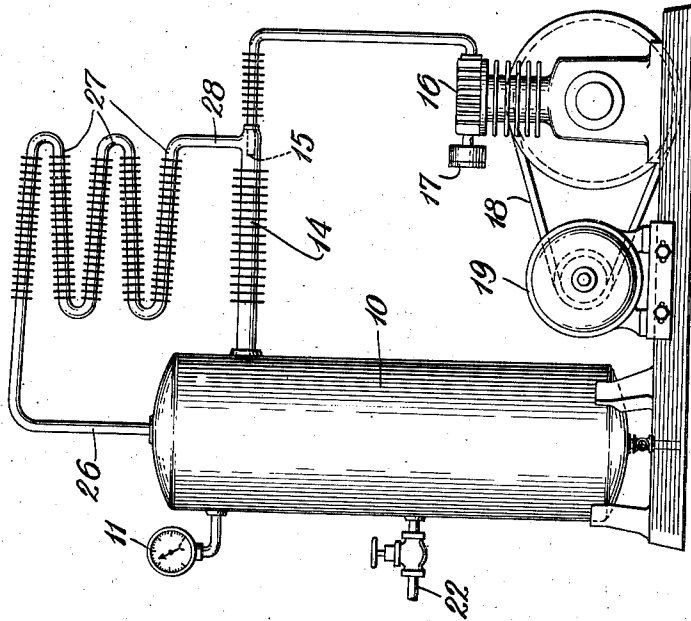
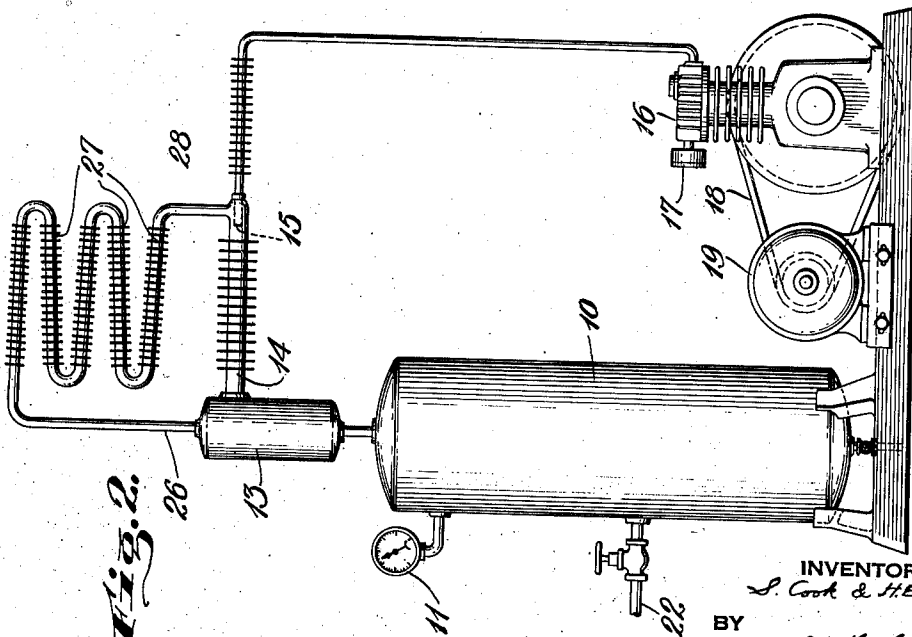


Fig. 2.



INVENTORS
S. Cook & H. E. Novine
BY
A. H. Golden
ATTORNEY

UNITED STATES PATENT OFFICE

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COMPRESSOR APPARATUS

Samuel Cook and Henry E. Nevins, Stamford,
Conn.

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16 Claims. (Cl. 62-135)

This invention relates to air compressing apparatus, and more particularly, to means for cooling compressed air and for condensing the moisture contained in compressed air. Of course, our invention is applicable to gases as well as air.

It is very important in a braking system to prevent the water of condensation from reaching the system. Similarly, it is very important in a two-stage compressor to cool the air compressed by the first stage and to condense the moisture from that air before it reaches the second stage of the compressor. This is known to anyone skilled in the art. Considering the matter further, it is important to condense the moisture from the compressed air entering automobile tires. It is also important to remove moisture from air used in industrial presses and various other tools.

The art has already recognized the necessity for cooling compressed air and for ridding compressed air of its moisture, and the usual air compressor system provides a cooling coil between the compressor and the storage tank for cooling the air and condensing the moisture out of it. Similarly, in a two-stage compressor, a cooler is usually provided to cool the air compressed by the first stage and to condense the moisture out of it before the air is compressed by the second stage. Such coolers and condensers as are provided by the prior art, while probably quite effective, do not function with such real efficiency as is desirable. Our invention contributes a condensing and cooling system which operates along extremely novel lines and with outstanding efficiency.

In general, we provide in the normal compressor system utilizing a storage tank and a compressor, a cooling circuit adapted to circulate the hotter air of the storage tank so as to cool this air and to condense the moisture out of it, the air to be circulated through this cooling circuit through the operation of the compressor in feeding the compressed air into the storage tank.

More in detail, the storage tank is provided with a cooling circuit in the form of a pipe leading from the upper portion of the tank where the air is hottest through a condenser and then to a portion of the tank in which the air is relatively cool. Near the point where the circuit reenters the tank, it is joined by a pipe leading from the compressor and through which the compressed air is fed from the compressor into the tank.

It will be readily appreciated by those skilled

in the art that the flow of air from the compressor will create a suction in the cooling circuit so as to cause a flow of the tank air through the cooling circuit. This will act to cool the compressed air just leaving the compressor, since this heated compressed air will be mingled with the cooler circulated air. This will also help to condense the moisture out of the air which has just left the compressor. Naturally, only the hotter air from the tank will be circulated through the cooling circuit, and it will be this air which will be cooled, and it will be the moisture from this hotter air which will be condensed.

Even more in detail, our invention utilizes an ejector through which the compressed air from the compressor is fed into the tank, and it is the expansion of the compressed air in this ejector which helps to create the suction in the cooling circuit, and to cause a circulation through that cooling circuit. As a further modification of our invention, we prefer to utilize what we term a separator tank into which the compressed air is fed, and which separator tank is connected to a cooling circuit. It is only after the air is fed into this tank and cooled by its cooling circuit, that it is then fed into the final storage tank from which the compressed air supply is drawn off.

Having now described our invention generally, we shall refer to the drawings to describe in detail preferred embodiments of our invention. It should be understood that our invention is relatively broad and that we do not therefore wish to be limited in our patent monopoly to the modifications we are about to describe. Our invention may be readily adapted to many fields, as will be readily appreciated by those skilled in the art.

Fig. 1 shows an air compressor system in which is incorporated our invention. Fig. 2 is a modified form of the invention shown in Fig. 1, while Fig. 3 shows still a further modification.

Referring now more particularly to the drawings and especially to Fig. 1, our invention utilizes a storage tank 10 having a pressure gauge 11 and connected through a pipe 12 with a separator tank 13. The separator tank 13 is in turn connected through a cooling coil 14 with the ejector 15 carrying the compressed air from the compressor 16. This compressor 16 is of a conventional type, receiving its air through a filter 17, and operated through a belt 18 by an electric motor 19. The motor 19, and the compressor 16, and the separator tank 13 are all mounted

on a plate 20 carried by the storage tank 10, the motor 19 being adjustable through its mounting plate 21 to vary the belt tension.

A compressed air supply outlet from the tank 10 is designated by reference numeral 22, there being a pressure relief valve 23 to relieve the pressure in tank 10, should it increase beyond desired limits. This outlet 22 should preferably be displaced substantially from the point where the cooling circuit leaves the tank; that is, the portion of the tank containing the hotter gases. The separator tank 13 has a drain pipe 24 running therefrom, and which preferably joins a drain pipe 25 running from the storage tank 10.

From the upper portion of the separator tank 13, which is the portion containing the hotter air, there is a pipe 26 leading to condenser coils 27, which terminate in a pipe 28 opening at point 29 into the ejector chamber 30, into which the ejector 15 feeds.

The operation of the system will probably be clear in view of the general description of the invention already set forth, but it is thought best to explain it in detail here. The compressor 16 compresses air which it feeds into the ejector chamber 30 through the ejector 15. The compressed air then passes through the cooling coil 14 into the separator tank 13. Naturally, the air will be cooled in coil 14, and such water of condensation as is there formed will run into the drain pipe 24.

As has already been indicated, the pipe 26 leads from the upper portion of the separator tank where the air is hottest. Therefore, if a flow of air through the pipe 26 and through the condenser coils 27 can be set up, there will naturally be created a cooling circuit for the upper relatively hot air of the separator tank 13. This flow is actually established through the suction created in pipe 28 and the condenser 27 because of the flow of freshly compressed air from the compressor 16 through the ejector 15. Suction is established at the mouth 29 of pipe 28 in the ejector chamber 30, forcing the hotter air from the separator tank 13 through the entire cooling circuit.

Once the compressor starts working, this cool air will mix with the freshly compressed air coming through the ejector 15, thus immediately cooling and condensing some of the moisture from this freshly compressed air. The cooler air will flow off tangentially from the air stream entering the tank 13 through the cooling coil 14, as will be appreciated, and the hotter air will circulate again and again through the cooling circuit until cooled and itself replaced.

Referring now to Fig. 2, we show substantially the same apparatus as is shown in Fig. 1, except that we utilize a vertical tank 10 instead of a horizontal tank 10 as in Fig. 1.

In Fig. 3, we show a modification of our invention in which we do not utilize the separator tank 13. Instead, the cooling circuit comprising the pipe 26, the condenser coils 27, and the pipe 28, lead from the storage tank itself, which in this case is shown as vertical. The operation is exactly the same as that in Fig. 1, except that the water of condensation is all collected in the storage tank 10, rather than in the separator tank 13 and in the storage tank 10, as in Fig. 1.

We now claim:

1. Gas compressor apparatus comprising a compressor, a storage tank into which the gas compressed by said compressor is fed, a cooling circuit exterior of said compressor leading from

one portion of said tank and back into said tank, and means whereby said compressor forces a circulation of the hotter gases of said tank through said cooling circuit.

2. Gas compressor apparatus comprising a compressor, a storage tank into which the gas compressed by said compressor is fed, a cooling circuit exterior of said compressor leading from one portion of said tank and back into another portion of said tank, and means whereby the compressed gas fed into said tank from said compressor forces a circulation of the hotter gases of said tank through said cooling circuit.

3. Gas compressor apparatus comprising a compressor, a tank into which the gas compressed by said compressor is fed, a cooling circuit leading from one portion of said tank normally containing the hotter gases and terminating in a cooler portion of said tank, a pipe connecting said compressor to the tank whereby to feed the compressed gas into said tank, said pipe leading into a portion of said cooling circuit and through said cooling circuit into said tank, whereby said compressed gas moving through said pipe from said compressor forces a circulation through said cooling circuit.

4. Gas compressor apparatus comprising a compressor, a tank into which the gas compressed by said compressor is fed, a cooling circuit leading from one portion of said tank to a condenser and then back to said tank, a pipe leading from said compressor and through which compressed gas is fed into said tank, said pipe entering said tank through said cooling circuit and joining said cooling circuit at a point between the condenser and the point where said circuit reenters the tank, whereby said compressed gas moving through said pipe from said compressor forces a circulation through said cooling circuit.

5. Gas compressor apparatus comprising a compressor, a storage tank, an ejector, means for feeding compressed gas from said compressor to said ejector and then from said ejector into said tank, a cooling circuit leading from one portion of said storage tank and back to said storage tank through said ejector, the movement of the compressed gas from said compressor through said ejector creating a circulation through said cooling circuit.

6. Gas compressor apparatus comprising a compressor, a tank, an ejector through which the compressor is connected to said tank for feeding compressed gas into said tank, a cooling circuit leading from the upper portion of said tank to a condenser and then to said ejector and through said ejector back to said tank, the movement of the compressed gas from said compressor through said ejector creating a circulation through said cooling circuit.

7. Gas compressor apparatus comprising a compressor, a tank, an ejector through which the compressor is connected to said tank for feeding compressed air into said tank, a cooling circuit leading from the upper portion of said tank to a condenser and then to said ejector and through said ejector back to said tank, the entry of said cooling circuit into said ejector being at such an angle and at such a distance from the entrance of the compressed gas from the compressor into said ejector, as to create a suction in said cooling circuit upon movement of compressed gas from said compressor through said ejector thereby causing a circulation through said cooling circuit.

8. Gas compressor apparatus comprising a compressor, a storage tank into which the compressed gas is fed, a cooling circuit leading from one portion of said tank and back into said tank, means whereby said compressor forces a circulation of the hotter gases of said storage tank through said cooling circuit while itself feeding gas into said tank whereby to condense the moisture out of said compressed gas, and a supply pipe leading from a portion of said tank substantially displaced from the one portion leading to said cooling circuit.

9. Gas compressor apparatus comprising a compressor, a storage tank, an ejector through which the compressor is connected to said tank for feeding compressed air into said tank, a cooling circuit leading from one portion of said tank and back to said tank through said ejector, the movement of the compressed gas from said compressor through said ejector creating a circulation through said cooling circuit, and a supply pipe leading from a portion of said tank substantially displaced from the one portion leading to said cooling circuit.

10. Gas compressor apparatus comprising a compressor, a storage tank, an ejector through which the compressor is connected to said tank for feeding compressed air into said tank, a cooling circuit leading from the upper portion of said tank to a condenser and then to said ejector and through said ejector back to said tank, the movement of the compressed gas from said compressor through said ejector creating a circulation through said cooling circuit, and a supply pipe leading from a portion of said tank substantially displaced from the said upper portion connected to the condenser.

11. Gas compressor apparatus comprising a compressor, a separator tank, a storage tank, means connecting said compressor to said separator tank, a cooling circuit for said separator tank to facilitate the separation of moisture from the gas, and a connection from the separator tank to the storage tank.

12. Gas compressor apparatus comprising a compressor, a separator tank, a storage tank, a connection from the compressor to said separator tank, a cooling circuit for said separator tank, means for creating circulation through said cooling circuit actuated by the feeding of compressed gas to the separator tank by said compressor, and a connection from the separator tank to said storage tank leading from a part of said separator

tank substantially displaced from the portion thereof leading to said cooling circuit.

13. The method of cooling compressed gas fed into a storage tank by a compressor, which comprises circulating through a cooling circuit exterior of the compressor the gas normally rising to the upper portion of the storage tank, and so circulating the gas through the pressure induced by the feeding of the freshly compressed gas into said storage tank by said compressor.

14. Gas compressor apparatus comprising a compressor, a storage tank into which compressed gas is fed, an outlet from said storage tank whereby compressed gas may be withdrawn therefrom, a cooling circuit for said gas maintained exterior of said compressor and leading from a portion of the tank to which the warmer gases in the tank rise, and means whereby the feeding of compressed gas by said compressor into said tank forces a circulation of the warmer gases in said tank through said cooling circuit.

15. Gas compressor apparatus comprising a compressor, a separator tank, a storage tank, an ejector through which the compressor is connected to said separator tank for feeding compressed gas into said separator tank, a cooling circuit leading from the upper portion of said separator tank to a condenser and then to said ejector and through said ejector back to said separator tank, the entry of said cooling circuit into said ejector being at such an angle and at such a distance from the entrance of the compressed gas from the compressor into said ejector as to create a suction in said cooling circuit upon movement of compressed gas from said compressor through said ejector, whereby to establish circulation through said cooling circuit.

16. Gas compressor apparatus comprising a compressor, a separator tank, a device in the form of an ejector through which the compressor is connected to said separator tank, a cooling circuit leading from the upper portion of said separator tank to a condenser and then to said device and through said device back to said separator tank, the movement of compressed gas from said compressor through said device causing an expansion of said gas and thus establishing circulation through said cooling circuit, the expanded gas of said device blending with the cooler gas of the cooling circuit to precipitate the moisture from said gases.

SAMUEL COOK.
HENRY E. NEVINS.