Dec. 23, 1952 H. C. WESCOMBE 2,622,791

TWO-STAGE AIR COMPRESSOR

Filed Dec. 14, 1948 2 SHEETS—SHEET1

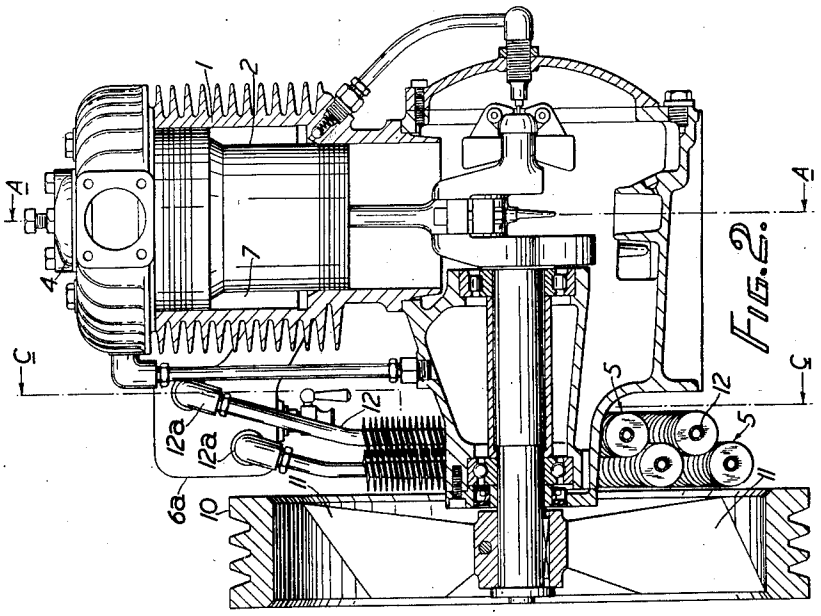


FIG. 2.

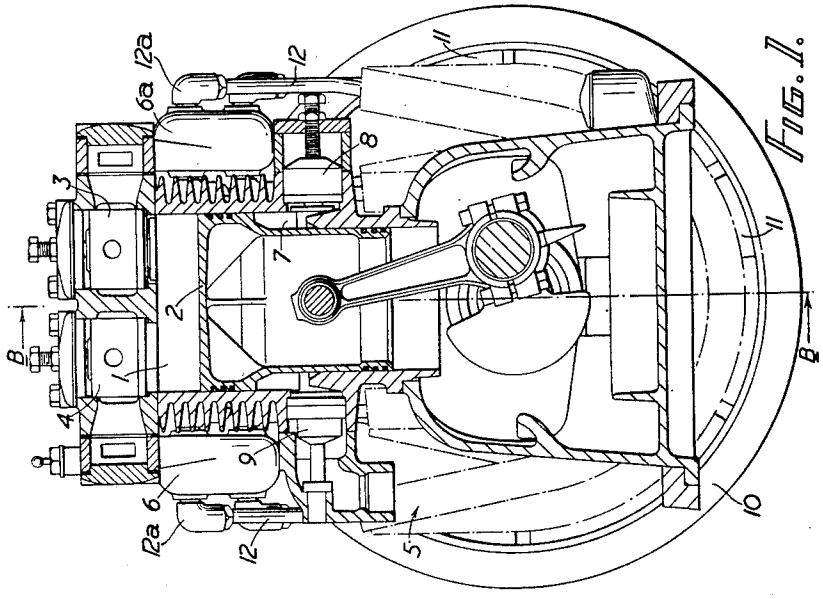


FIG. 1.

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FIG. 4.

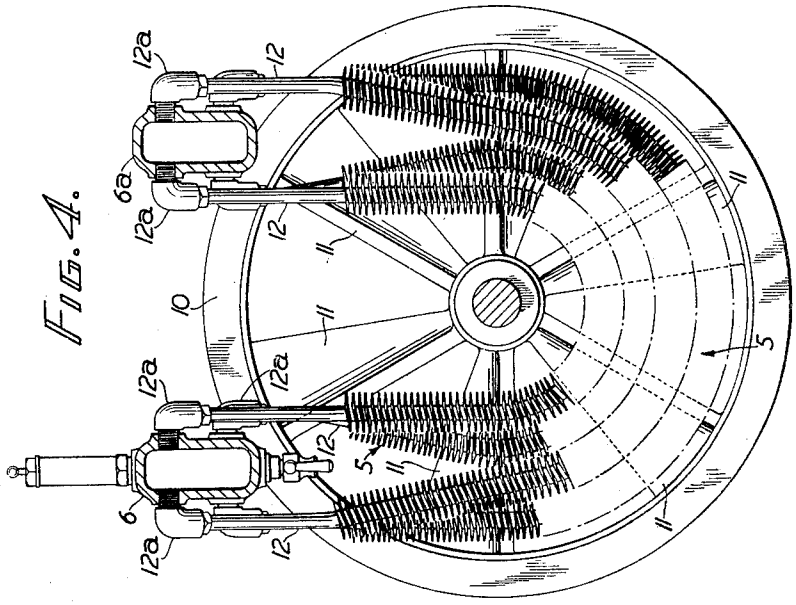
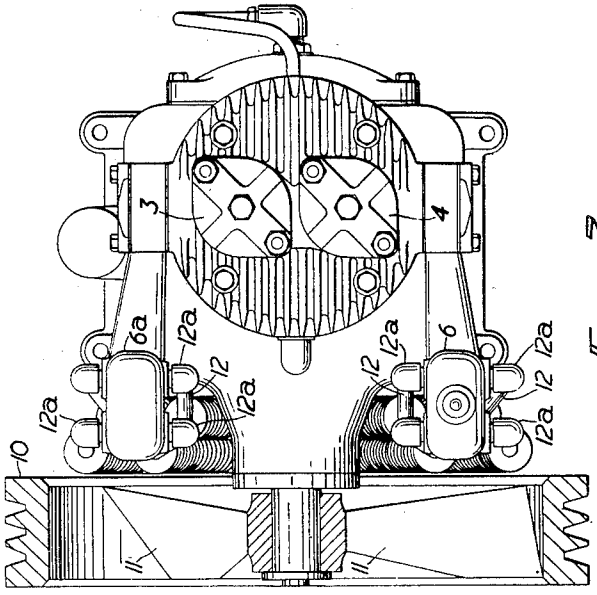


FIG. 3.



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UNITED STATES PATENT OFFICE

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TWO-STAGE AIR COMPRESSOR

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6 Claims. (Cl. 230—182)

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The invention consists broadly of an air compressor in which air is compressed in two or more stages wherein a mechanically generated air blast, in addition to its utilisation for cooling the air during its passage from a lower pressure cylinder to a higher pressure cylinder by means of an inter-cooler, is directed onto the compression cylinder or cylinders so that cooling is also effected during the actual compression.

In the accompanying drawings the invention is shown applied to a two-stage compressor, Figure 1 being a sectional view of the compressor on the line A—A of Figure 2, Figure 2 is a sectional view on the line B—B of Figure 1, Figure 3 is a plan of Figure 2 and Figure 4 is a section on the line C—C of Figure 2.

Referring to these drawings, the numeral 1 designates the compressor cylinder and 2 is the piston. In Figure 1 the piston is shown at or toward the end of its high compression stroke and in Figure 2 the piston is shown at the end of its low compression stroke. Air which is compressed to comparatively low pressure, for example, some 30 lbs. to the square inch in the top end of the cylinder 1 enters the cylinder during the high compression stroke through the inlet valve 3 and the air compressed to the required low pressure is discharged through the outlet valve 4 to the inter-cooler 5 by way of the header 6 and passes thence into the high pressure header 6a and thence to the annular high pressure cylinder or chamber 7 through the high pressure inlet valve 8 and after compression to the high pressure, for example some 100/200 lbs. to the square inch, is discharged through the high pressure outlet valve 9 to the receiver (not shown) in conventional manner which will be readily understood by those skilled in the art. The apparatus, in the example shown, is driven by the belt-driven fanwheel 10 through the usual crank and connecting rod mechanism which needs no description. The fanwheel 10 has the usual fan blades 11. The inter-cooler 5 which consists of gilled pipes connected up to the headers 6 and 6a by the pipes 12 and connections 12a is arranged in the path of the air-blast coming from the lower part of the fan. As will be best seen on reference to Figure 4 the gilled portion of the inter-cooler coils are disposed substantially semi-circularly in the way of the blast from the lower part of the fanwheel and the gilled portions of the coils, which are spread over as large an area as possible so that all the coils are subject to as much of the cooling blast as possible, terminate well below the compression cylinders, so

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that the inter-cooler offers no interference with the blast from the top of the fan which thus impinges directly on the cylinder wall and cools the air compressed in the cylinder during both stages of compression but particularly during the high compression stage.

It is to be understood that where high output is required, the number of differential cylinders can be increased. For example, two or three cylinders can be arranged side by side so long as care is exercised in seeing that the blast from the fanwheel—or maybe blast from an additional fan—is caused to impinge directly both on the inter-cooler and onto the compression cylinders.

It will also be understood that the invention is not limited to the specific construction shown and described herein, the characteristic of the invention being the provision of means in a compressor in which air is compressed in two or more stages, whereby a mechanically generated air cooling blast is utilised to cool both the inter-cooler or inter-coolers and the compression cylinder or cylinders.

The invention has been particularly described in relation to a two-stage compressor, but of course the same general principles are applicable to cases where more than two stages of compression are employed. Thus one differential cylinder could effect the first and second stages of compression and another similar but smaller differential cylinder could effect third and fourth stages of compression with inter-cooling between both the first and second and second and third stages.

I claim:

1. A two-stage air compressor comprising a single cylinder including a low pressure space at one end and a high pressure space at the other end, a differential piston reciprocable in said cylinder and operable to effect low-stage compression in said low pressure space and high-stage compression in said high pressure space, blower means for producing an air blast, and intercooler conduit means communicating with said cylinder spaces for conducting air from the low pressure space to the high pressure space, said cylinder spaces, said blower means and said conduit means being disposed in positions relative one to another in which the air blast of the blower means impinges directly and unobstructedly upon said high pressure cylinder space and said conduit means.

2. A two-stage air compressor comprising a single cylinder including a low pressure space at one end and an annular high pressure space at

the other end, a differential piston reciprocable in said cylinder and operable to effect low-stage compression in said lower pressure space and high-stage compression in said high pressure space, finned intercooler coils communicating with said cylinder spaces for conducting air from the low pressure space to the high pressure space, substantially the entire finned portion of said coils being disposed in staggered relationship with said cylinder, and fan means disposed laterally spaced relative to the cylinder and the intercooler coils and arranged to produce an air blast guided to impinge directly and unobstructedly against said high pressure cylinder space and said main portion of the intercooler coils.

3. An air compressor as described in claim 2, wherein said cylinder is vertically disposed, and wherein the main portion of said finned intercooler coils is positioned below the level of the lower end of the cylinder.

4. An air compressor as described in claim 2, wherein said piston has two opposite faces with different effective areas, the face with the larger effective area facing the said low pressure space and the face with the smaller effective area facing the said high pressure space, said latter space forming an annular ring space encompassing and concentric with a portion of said piston.

5. A two-stage air compressor comprising a single cylinder including a low pressure space at one end and a high pressure annular space at the other end, a differential piston reciprocable in said cylinder and operable to effect low-stage compression in said low pressure space and high-stage compression in said high pressure space, finned intercooler coils communicating at each end with said cylinder spaces for conducting air from the low pressure space to the high pressure space, the main portion of said finned coils being curved to form an open loop, high and low pressure headers communicating with said loop, the general plane of said coil loop and the general plane of said cylinder being positioned substantially plane-parallel one to the other, and fan means mounted laterally spaced relative to the cylinder and the coil loop and arranged to

produce an air blast guided to impinge directly and unobstructedly upon said high pressure cylinder space and said coil loop.

6. A two-stage air compressor comprising a single cylinder, a reciprocable piston having differential effective areas, said cylinder including a low pressure compression space whose air content is subject to compression by the larger area of said piston and an annular high compression space whose air content is subject to compression by the smaller annular area of said piston, a driving shaft, a crank on one end of said shaft, a connecting rod connecting said crank to said piston, a driving wheel on the end of the shaft remote from the crank, a fan connected with said driving wheel for rotation in unison therewith and positioned to direct its blast on to the high compression zone of the cylinder, and an intercooler comprising coils connected to conduct air compressed in the low pressure compression space of the cylinder to the high pressure compression space of the cylinder, said coils conforming in curvature substantially to the curvature of a part of the fan periphery remote from the cylinder, said intercooler being positioned between the fan and the cylinder position, whereby the blast of cooling air from one part of the fan acts directly and unobstructedly on to the cylinder wall and from another part of the fan directly and unobstructedly on to the intercooler coils.

HUGH CARLISLE WESCOMBE.

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