Nov. 28, 1961 W. D. COSKI 3,010,766

COMPRESSOR AND GRANULAR-MATERIAL CONVEYING SYSTEMS

Filed April 16, 1959

FIG. 1

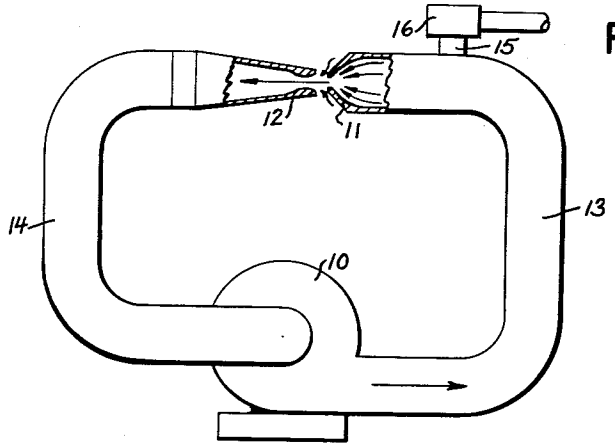


FIG. 2

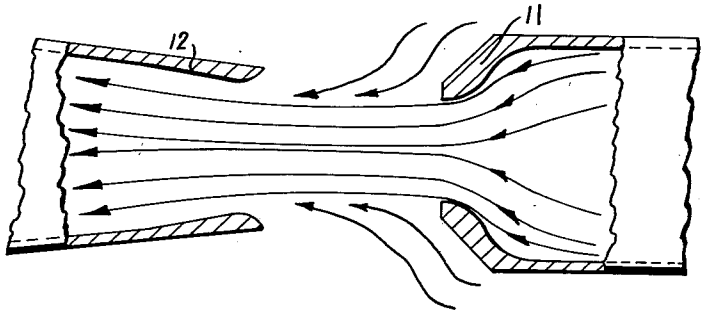


FIG. 3

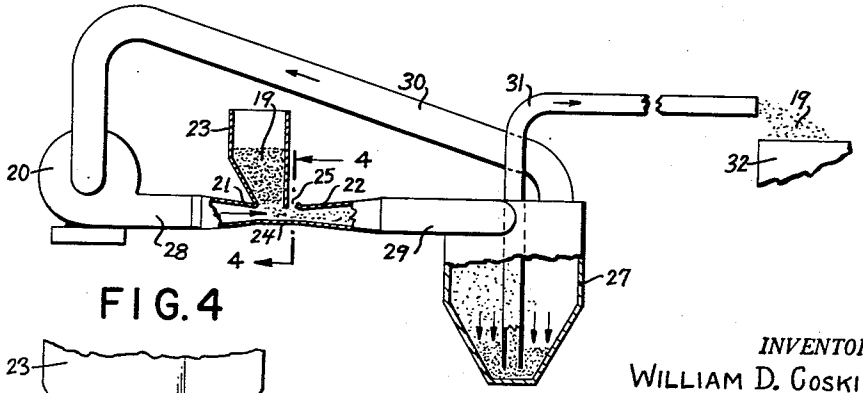
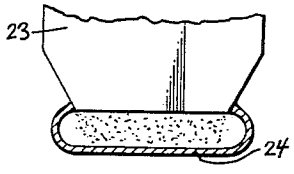


FIG. 4



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COMPRESSOR AND GRANULAR-MATERIAL CONVEYING SYSTEMS

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The present invention relates to improved compressor and granular-material conveying systems of simple and economical construction aimed at minimum maintenance and ease of operation without damage to the material being handled.

Still additional objects and advantages of the invention will, with the foregoing, appear and be understood in the course of the following description and claim, the invention consisting in the novel construction and in the adaptation and combination of parts hereinafter described and claimed.

In the accompanying drawings:

FIG. 1 is a schematic plan view, partly in section, of my compressor system.

FIG. 2 is a detail fragmentary view of the jet and diffuser arrangement.

FIG. 3 is a schematic elevational view, partly in section of my material conveying system; and

FIG. 4 is a vertical sectional detail view taken as indicated by the line 4—4 of FIG. 3.

Before referring to the drawings it should be understood that the output pressure of a pressure booster of the centrifugal compressor type is proportional to the pressure and density of the gas at the inlet, and that the flow quantity is a function of the pressure drop across the booster. It follows from these characteristics that if the inlet pressure of a centrifugal pressure booster were continually increased, the output pressure of the booster would also continue to increase. Furthermore, a further pressure differential across the booster would be realized because the gas density would increase responsive to the increasing inlet pressure.

Directing attention to FIG. 1, in the compressor system of the present invention the output of a centrifugal pressure booster **10** is continuously fed back to its inlet to effect a build-up of the output pressure. This arrangement necessitates the admission of additional gas to make up for the volume loss resulting from the increase in gas density as the pressure rises. This admission is accomplished by the insertion of a jet **11** and diffuser **12** in a recirculating piping circuit **13—14** interconnecting the outlet and inlet of the booster.

As illustrated in FIG. 2, the jet **11** is alined with the diffuser **12** to discharge into the flared mouth thereof. There is a gap between the jet and diffuser so that the surrounding atmosphere will be inducted into the jet stream traversing the gap. Such induction compensates for the the afore-mentioned volume loss and provides the make-up for gas drawn off for useful work through a discharge line **15** as controlled by a valve **16**. This line **15** is shown located in the outlet part **13** of the circuit because of the higher pressure therein, but could also be located in the return section **14**.

Summarizing the operation of my compressor system, it is seen that the pressure of the gas from the booster **10** is converted by the jet **11** into velocity and that the resulting high speed jet stream, by discharging into the diffuser **12**, has its velocity reconverted into pressure. Simultaneously, pressurized gas can be continuously drawn off from the circuit for useful work while a corresponding amount of gas is inducted into the circuit by the jet stream.

The booster **10**, although preferably a centrifugal type, could be a positive displacement compressor having variable speed controls to compensate for changing volume requirements of the system as the operating pressure varies.

In FIG. 3 I have illustrated my compressor system incorporated into my material conveying system, the pressure booster, jet and diffuser being denoted **20—22**, respectively. It will be noted that the material **19** to be conveyed, normally granular, is stored in a hopper **23** which is positioned to discharge into the top of the jet stream. The bottom of the latter is preferably closed at **24**, but a gap **25** is maintained in the stream for gas make-up as before. This gap is shown for purposes of example as being located between the hopper **23** and the diffuser **22**.

A separator **27** of the dynamic type, as for instance a cyclone separator, is placed in the circuit, its inlet being connected by line **29** to the diffuser and its outlet at the top being connected by a return line **30** to the inlet of the pressure booster. The bottom material collecting portion of the separator has a discharge pipe **31** feeding upwardly out of the separator, and leading to a depository **32**. This pipe **31** is purposely smaller than the circuit lines **28—30**.

In the operation of the material handling system, the material **19** falls from the hopper **23** into the jet stream and is carried thereby into the diffuser and along through line **29** into the separator **27**. In the latter the material **19** gathers at the bottom under pressure while most of the gas discharges at the top through the return line **30** for recirculating. At the same time, a relatively minor portion of the gas travels downwardly into the mouth of the material discharge line **31** and carries the separated material out of the separator through such line to the depository. While so discharging, the material is in a dense phase in which only a small percentage of gas is entrained. As before mentioned, makeup for the gas is performed by the induction at the gap **25**.

A centrifugal compressor will handle gas quantities ranging from about 50% to maximum capacity without loss in efficiency or pressure output, and hence the booster can be efficiently operated at constant speed. Since the rotor of the booster is the only moving part in the system and does not directly convey the material being handled, very little system maintenance is required.

The advantages of the invention, it is thought, will have been clearly understood from the foregoing detailed description of the illustrated preferred embodiment. Minor changes will suggest themselves and may be resorted to without departing from the spirit of the invention, wherefore it is my intention that no limitations be implied and that the hereto annexed claim be given a scope fully commensurate with the broadest interpretation to which the employed language admits.

What I claim is:

In a material conveying system, centrifugal gas compressor means, a venturi having its throat of oblong cross-

section defined by opposed pairs of wide and narrow walls, a supply of air and granular material to be conveyed opening into said venturi through substantially the full expanse of one of said wide walls, separating means, a closed piping circuit including said compressor means, venturi and separating means, said separating means being adapted to separate said granular material from said circuit, and a takeoff from said separating means for conveying said separated granular material to a remote delivery point of reduced pressure in a considerably higher material-to-air ratio than that in said circuit between said venturi and separating means.

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