

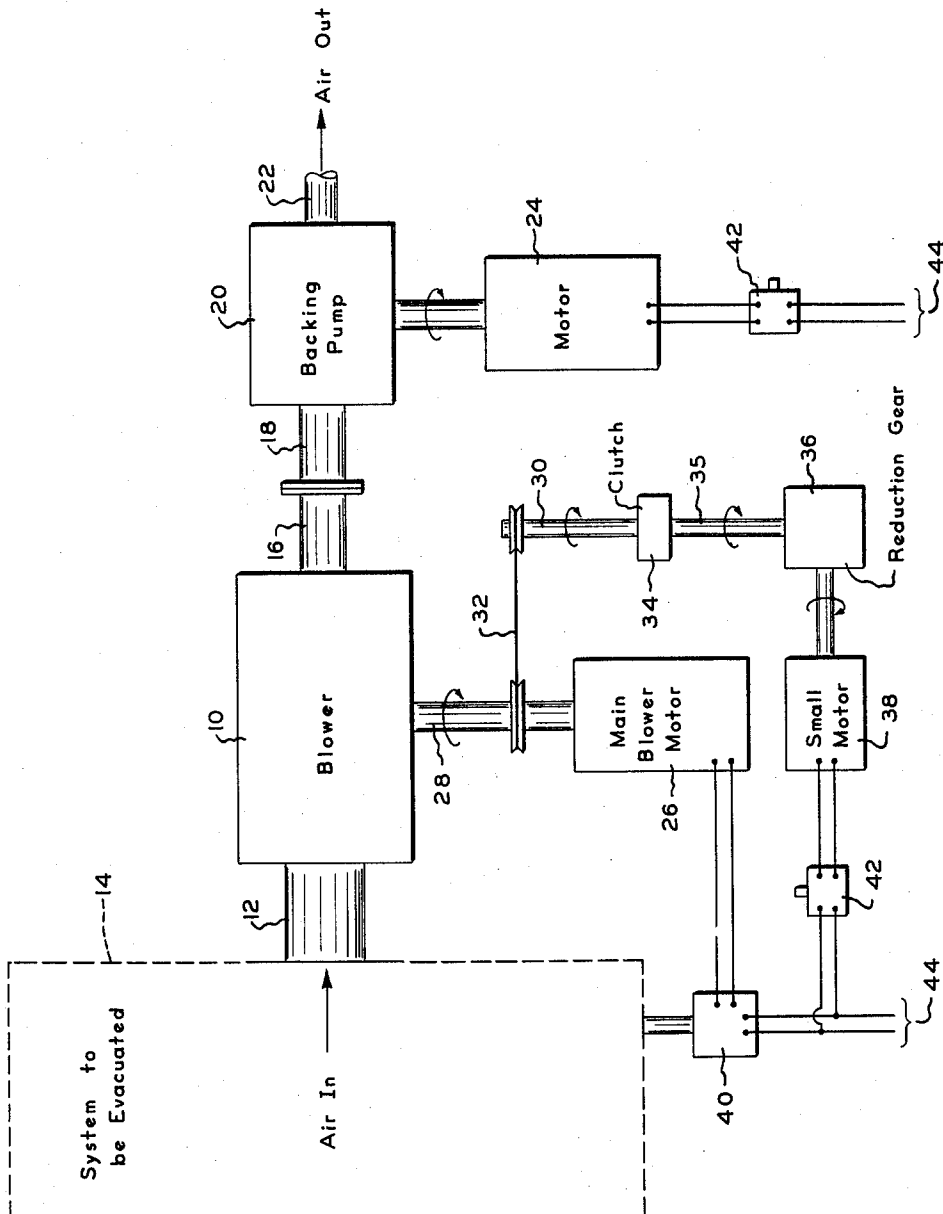
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HIGH VACUUM DEVICE

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HIGH VACUUM DEVICE

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2 Claims. (Cl. 230—45)

This invention relates to a high vacuum device and, in particular, to a vacuum pumping system. In recent years, the use of blowers (such as Roots blowers) in vacuum pumping systems has become desirable as the size of vacuum processing systems has increased. Such blowers have high volumetric efficiency and can handle enormous quantities of gases at relatively low pressures. Such blowers are usually backed up by a conventional mechanical vacuum pump of considerably smaller volumetric pumping capacity.

In the past, fairly complex arrangements have been provided for by-passing the blower during initial pump down of the system. This has been due to the fact that the theoretical pumping capacity of the blower is so much greater than that of the backing pump (or second-stage pump, as it is sometimes called) that a tremendous amount of power is required to drive the blower at high pressure. A lot of this power is expended in heating the gases being pumped, often with disastrous overheating of the blower. Patent No. 2,492,075 is illustrative of one system which provides separate drives for the vacuum pump and the blower with a by-pass around the blower through which the system is evacuated during the initial pump down.

It is a principal object of the present invention to provide a system of the general type described above which is relatively inexpensive, has a high capacity and is simple to operate and maintain. In particular, the present invention provides for the elimination of considerable piping, valves and the possibility of leaks therein.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the apparatus possessing the construction, combination of elements and arrangement of parts which are exemplified in the following detailed description and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description in conjunction with the accompanying drawing, which is a diagrammatic, schematic illustration of one preferred embodiment of the invention.

In the present invention, the vacuum pumping system includes a blower of the Roots type or of the axial flow type as illustrated in U.S. Patents 2,287,716 and 2,345,780, and a mechanical backing pump whose inlet is directly connected to the outlet of the blower. The blower preferably has a pumping capacity on the order of ten times the pumping capacity of the backing pump. Each pump has its own electric motor, the blower motor being of a size sufficient to drive the blower at maximum volumetric capacity only when the blower is operating as a vacuum pump (i.e., in the pressure range below about 15 mm. Hg abs. as measured at the blower outlet). In the present invention, the main blower motor is not used to drive the blower until this low pressure has been reached in the pumping system. However, since the blower constitutes an impedance in the pumping system

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between the inlet of the backing pump and the system to be evacuated, it is desirable to drive the blower at a relatively slow speed, as, for example, one tenth of its normal speed, while the system is being pumped down to 15 mm. Hg abs. or thereabouts. This is accomplished by providing a third motor, which is preferably a fractional horsepower geared motor. The reduction gear of the fractional horsepower motor is preferably coupled to the drive shaft of the blower through a clutch which can be disengaged to permit the main blower motor to drive the blower at a high speed when the required low pressure has been obtained. In a preferred embodiment of the invention, the clutch is an overriding clutch, which permits the main blower motor to start while the small motor is driving the blower and also permits the main blower motor to rapidly take over the drive of the blower and get the blower up to speed irrespective of the fact that the small fractional horsepower motor is still operating.

Referring now to the drawing there is illustrated one specific preferred embodiment of the invention wherein the blower is indicated at 10 as having an inlet 12 which is adapted to be connected to a system 14 to be evacuated. The blower has an outlet 16 which is directly coupled to the inlet 18 of the backing pump 20. The backing pump is arranged to discharge air from the system directly to the atmosphere through outlet 22. The backing pump 20 is driven by an electric motor 24, while the blower 10 is driven by the main blower motor 26 connected to blower drive shaft 28. The drive shaft 28 is also connected to an auxiliary drive shaft 30 by means of a belt 32, the auxiliary shaft 30 being connected through a clutch 34 to a second shaft 35 connected to a reduction gear 36, which is in turn driven by a fractional horsepower motor 38. The motor 38 and gear 36 are preferably an integral unit. The clutch 34 is preferably an overriding clutch which is disengaged when the shaft 30 rotates faster than the shaft 35. In one embodiment of the invention, the operation of blower motor 26 is controlled by a pressure-responsive switch 40, this switch energizing motor 26 when a predetermined low pressure (e.g., 15 mm. Hg abs.) has been reached at the inlet to blower 10. Manual switches 42 are employed for controlling operation of motors 24 and 38 from the main power lines which are indicated at 44.

In one specific embodiment of the invention, the blower 10 has a capacity of 1000 c.f.m. and is arranged to be driven at a speed of 3000 r.p.m. with an inlet pressure range of 1 mm. Hg abs. to about 0.01 mm. Hg abs. and a compression ratio of about 10 to 1. The backing pump has a capacity of 100 c.f.m. at a speed of 335 r.p.m. with an inlet pressure range of about atmosphere to 10 mm. Hg abs., the outlet being to atmosphere. With this arrangement, the main blower motor 26 is a 10 H.P. 3600 r.p.m. electric motor directly coupled to the blower. Motor 24 is a 5 H.P. 1800 r.p.m. motor directly coupled to the backing pump. Motor 38 is a 1/2 H.P. 1800 r.p.m. motor and reduction gear 36 has a ratio of about 9.5 to 1, so that blower 10 is operated at about 190 r.p.m. by motor 38. With this arrangement, the backing pump motor 24 and fractional horsepower motor 38 are started together by operating the two switches 42. This causes pump 20 to operate at 1800 r.p.m. and blower 10 to operate at 190 r.p.m. As the pressure in inlet 12 is reduced (due to the evacuation of system 14) to a pressure on the order of 15 mm. Hg abs., the pressure switch 40 is operated and main blower motor 26 is started, this motor rapidly bringing shaft 28 and blower 10 up to operating speed of 3000 r.p.m. As soon as shaft 28 increases its speed, clutch 34 is disengaged and motor 38 can be stopped.

Since certain changes may be made in the above

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apparatus without departing from the scope of the invention herein involved, it is intended that all matter contained in the above description, or shown in the accompanying drawing, shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. In a vacuum pumping system of the type which includes a high vacuum blower and a mechanical backing pump connected to the outlet of the blower, the inlet to the blower being arranged to be connected to a system to be evacuated and the outlet of the backing pump being arranged to discharge to atmosphere and wherein separate motors are provided for driving the blower and backing pump, the improvement which comprises a third motor for driving said blower, said third motor having substantially less power than the blower motor, a reduction gear between the third motor and a drive shaft for the blower so that the third motor can drive the blower at a speed substantially less than the speed at which the blower has optimum vacuum pumping action, and a clutch between the reduction gear and the blower drive shaft which can be disengaged to permit the blower motor to drive the blower at a high speed when the blower is disconnected from the reduction gear.

2. In a vacuum pumping system of the type which includes a high vacuum blower and a mechanical backing pump connected to the outlet of the blower, the inlet to

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the blower being arranged to be connected to a system to be evacuated and the outlet of the backing pump being arranged to discharge to atmosphere and wherein separate motors are provided for driving the blower and backing pump, the improvement which comprises a third motor for driving said blower, said third motor being a fractional horsepower motor, a reduction gear between the third motor and a drive shaft for the blower so that the third motor can drive the blower at a speed on the order of one-tenth and less of the speed at which the blower has optimum vacuum pumping action, and an overriding clutch between the reduction gear and the blower drive shaft which can be disengaged to permit the blower motor to drive the blower at a high speed when the blower is disconnected from the reduction gear.

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