Sept. 6, 1932. B. S. NELSON 1,875,754

BOOSTER FOR EXHAUST STEAM

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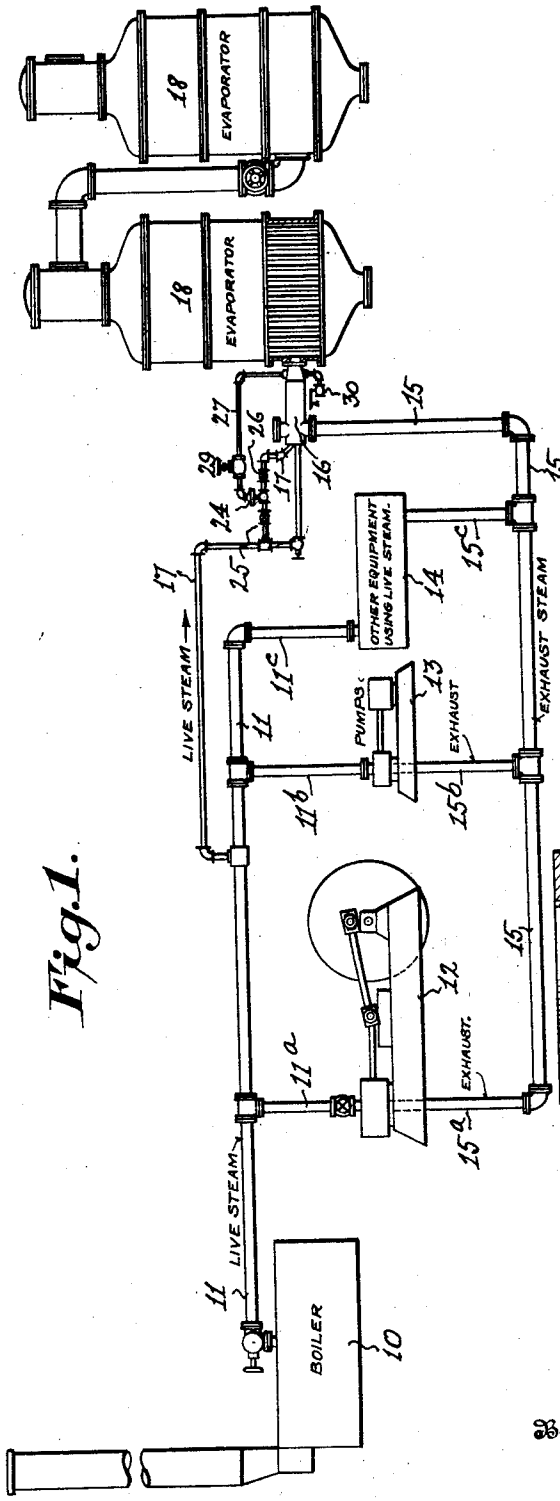


Fig. 1.

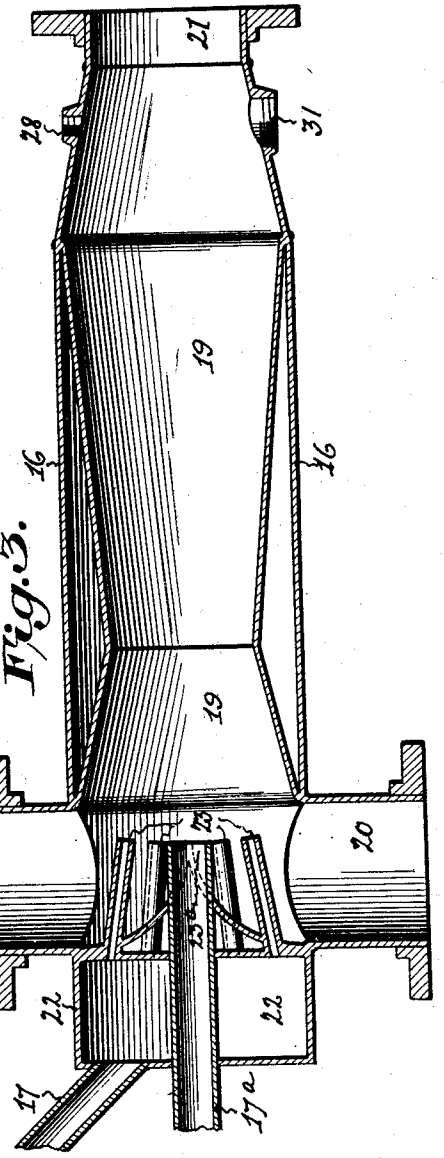


Fig. 3.

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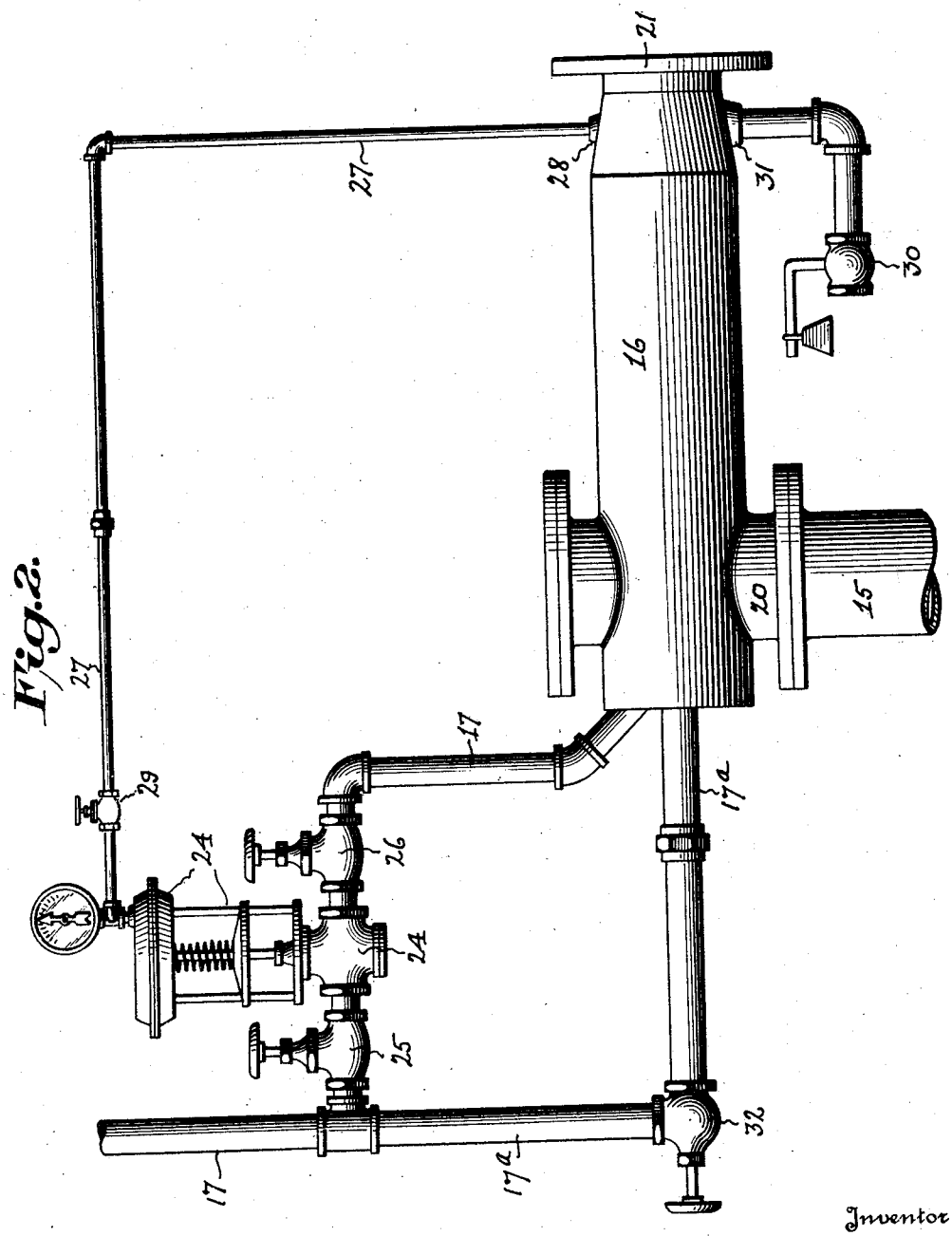
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Fig. 2.



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Fig. 4.

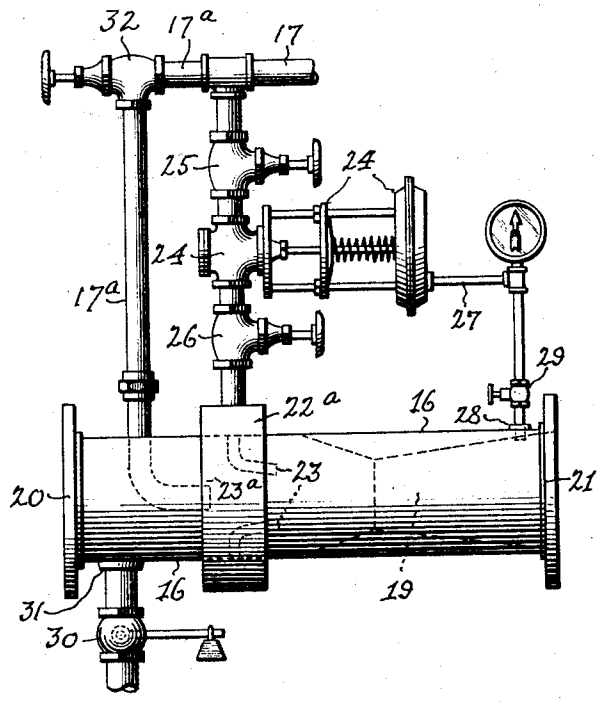
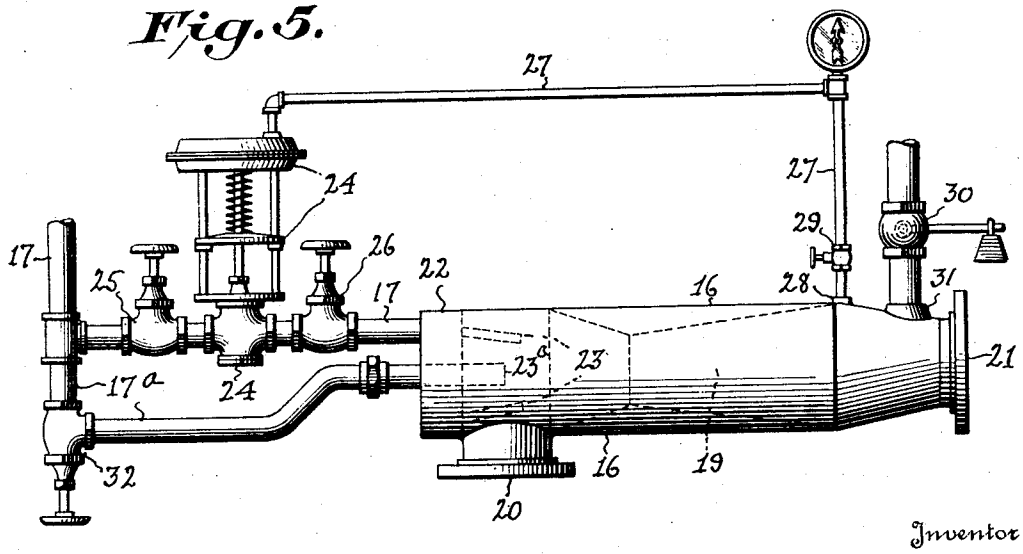


Fig. 5.



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UNITED STATES PATENT OFFICE

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BOOSTER FOR EXHAUST STEAM

Application filed August 11, 1930. Serial No. 474,630.

This invention relates, generally, to boosters for exhaust steam, its object, broadly, being to provide means for mixing a certain amount of live steam with exhaust so as to increase its temperature and pressure to a point where it may be used for various purposes which do not require live steam and wherein the use of heated exhaust steam is more efficient and economical.

There are many types of modern industrial and manufacturing plants in connection with which this invention may be employed, and there are various uses in such plants to which it may be put.

For the purpose of illustration, but not in any way as a limitation, I have elected to show the invention as used in a sugar mill and, particularly, as used in connection with certain evaporators therein employed.

More particularly, the objects of the invention are as follows:

First, to construct a booster for exhaust steam in such a way as to permit a very thorough and speedy admixture of live steam with the exhaust steam.

Second, to provide auxiliary means, readily controllable, which will permit a highly increased amount of live steam to be added, for emergency use.

Third, to accurately limit and control the flow of live steam by means of back pressure.

Fourth, other objects will be manifest from the detailed description of the invention to follow and to be specifically pointed out in the appended claims.

These objects are attained in the manner hereinafter set forth, reference being had to the accompanying three sheets of drawings, in which:

Figure 1 is a diagrammatic view illustrating the steam system of a sugar mill, and showing the invention as applied in connection with certain evaporators in such system;

Figure 2 is a side elevation of an exhaust steam booster constructed in accordance with the invention and as indicated in Figure 1;

Figure 3 is a longitudinal vertical sectional view of the mixing chamber of the structure illustrated in Figure 2; and,

Figures 4 and 5 are views similar to Figure 2 but illustrating certain modified forms of the invention.

Referring in the first instance to Figure 1 of the drawings, there is shown a sugar mill steam system embodying a steam generator or boiler 10, a live steam supply line 11, branches 11^a, 11^b and 11^c leading, respectively to engines 12, pumps 13, and other live steam using apparatus 14. From these pieces of live steam using apparatus depart, respectively, exhaust lines 15^a, 15^b and 15^c, each in communication with a main exhaust line 15.

The exhaust line 15 carries the exhaust steam to a booster 16 wherein it is heated for further use by having mixed with it a certain amount of live steam supplied through a branch pipe 17 from the main live steam line 11, and from whence the heated exhaust steam is delivered to evaporators 18 wherein it is utilized.

As before pointed out, it is not only in sugar mills that my invention may be used, nor, therein, is its use limited to evaporators. For example, in a sugar mill, it may be used in connection with vacuum pans, or other equipment, as those skilled in the art will readily understand.

Referring to Figures 2 and 3 of the drawings, wherein my invention is illustrated in detail, the booster 16 is shown as being provided with a mixing chamber 19 to which exhaust steam from the line 15 is admitted through a port 20, and from which heated steam is delivered, to the evaporators 18, through a port 21.

Situated at that end of the booster removed from the delivery port 21 is a manifold 22 to which live steam is admitted from the supply pipe 17, and from which it is discharged, into the mixing chamber 19, through a series of nozzles 23.

To accurately control the amount of live steam to be admitted to the booster in order that the best results may be obtained, there is interposed in the supply line 17 control elements comprising an automatic pressure regulator 24 of any desired type, and flanking cut-off valves 25 and 26, as shown in Figure 2.

In order that a further control may be

exercised over the amount of live steam to be admitted, and this to be governed by the amount of back pressure in the booster, a pipe 27 is provided leading from the mixing chamber 19 at a point 28 adjacent the delivery port 21 to the pressure regulator 24. This pipe 27 is provided with a valve 29 whereby it may be closed, if desired.

A back pressure safety valve 30 is preferably provided, the same being in communication with the mixing chamber 19 at a point 31 adjacent its delivery port.

At times, an emergency may occur when it is desirable or even necessary to quickly permit a much greater amount of live steam to enter the mixing chamber than will be permitted by the automatic pressure control mechanism. Foreseeing such emergencies, I provide a by-pass pipe 17ª around the pressure control means, such pipe leading from the supply line 17 outwardly beyond the control elements passing through the manifold 22, and terminating in a nozzle 23ª in line with the nozzles 23 and adapted to shoot live steam directly into the mixing chamber 10. This by-pass pipe is normally closed by means of a valve 32 which may be quickly opened in the event of necessity.

In that modification of my invention shown in Figure 4 of the drawings, an annular manifold 22ª is provided in place of the one as shown in the preferred form of the invention, the exhaust steam admission port 20 is at the end of the mixing chamber 19 rather than at a side thereof, the safety valve 30 is differently positioned, and the necessary rearrangement of live steam supply pipes is effected.

In that modification of my invention shown in Figure 5 of the drawings, the safety valve 30 is differently positioned in yet other manner; and another different rearrangement of the live steam supply pipes is made.

From these disclosures it is evident that many changes, rearrangements and modifications may be made in my invention without departure from the spirit thereof, which comprises the introduction of jets of high pressure steam in the throat of a properly proportioned Venturi tube to so impart the kinetic energy of the high pressure steam expanding through the jet nozzle by impact on to the low pressure steam so as to give it sufficiently high velocity in the throat of the Venturi tube, and by converting this velocity head into pressure head the pressure of the mixture of live and exhaust steam is raised several pounds higher than the original pressure of the exhaust steam, and by so doing I raise its temperature to a level where the heat contained may be utilized, and I make the claims with such possibilities in mind.

What is claimed is:

1. The combination, in a booster for exhaust steam, of a casing enclosing a mixing chamber having an inlet end and an outlet end, means for admitting exhaust steam to the inlet end of said chamber, a manifold, means controlled by the resultant pressure of the mixed live and exhaust steams at the outlet end of said mixing chamber for exclusively admitting live steam to said manifold, a series of live steam discharge nozzles projecting from said manifold into the inlet end of said mixing chamber, and supplementary means, independent of said manifold, for admitting live steam to the inlet end of said mixing chamber in proximity with the live steam discharged from said nozzles.

2. The combination, in a booster for exhaust steam, of a casing enclosing a mixing chamber having an inlet end and an outlet end, means for admitting exhaust steam to the inlet end of said chamber, a manifold, means for admitting live steam to said manifold, means actuated by the resultant pressure of the mixed live and exhaust steams at the outlet end of said mixing chamber for exclusively controlling said live steam admitting means, a series of live steam discharge nozzles projecting from said manifold into the inlet end of said mixing chamber, supplementary means, independent of said manifold and adjacent to said nozzles, for admitting live steam at the inlet end of said mixing chamber, and manually operable means for controlling said supplementary live steam supply to said mixing chamber.

In testimony whereof, I hereunto affix my signature.

BERNARD STANLEY NELSON.