Dec. 10, 1940. L. E. ARNOLD 2,224,130

ANTIPULSATOR

Filed Aug. 25, 1937 2 Sheets-Sheet 1

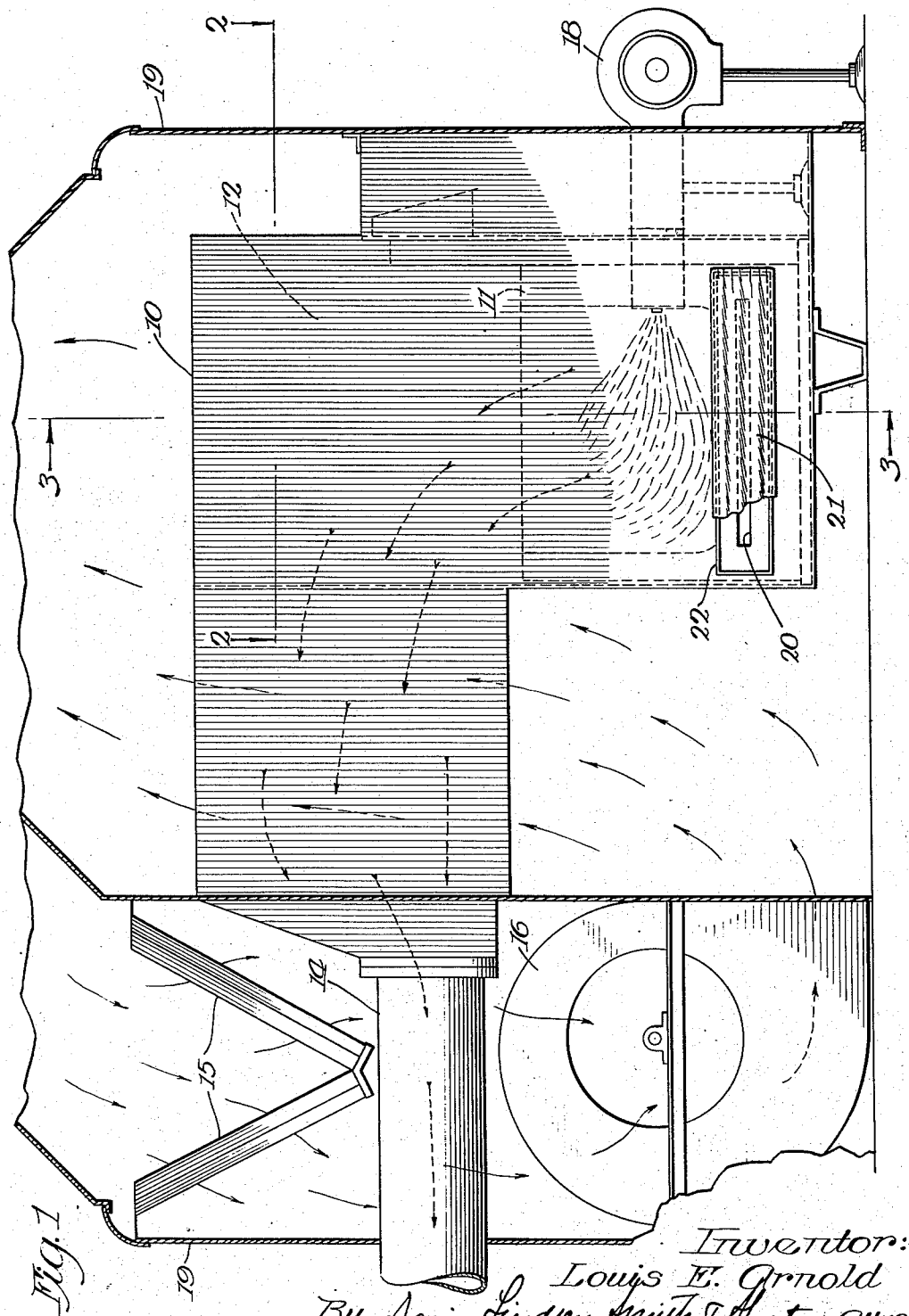


FIG. 1

Inventor:
Louis E. Arnold
By Davis, Lindsey, Smith & Shinto Attys.

Dec. 10, 1940. L. E. ARNOLD 2,224,130

ANTIPULSATOR

Filed Aug. 25, 1937 2 Sheets-Sheet 2

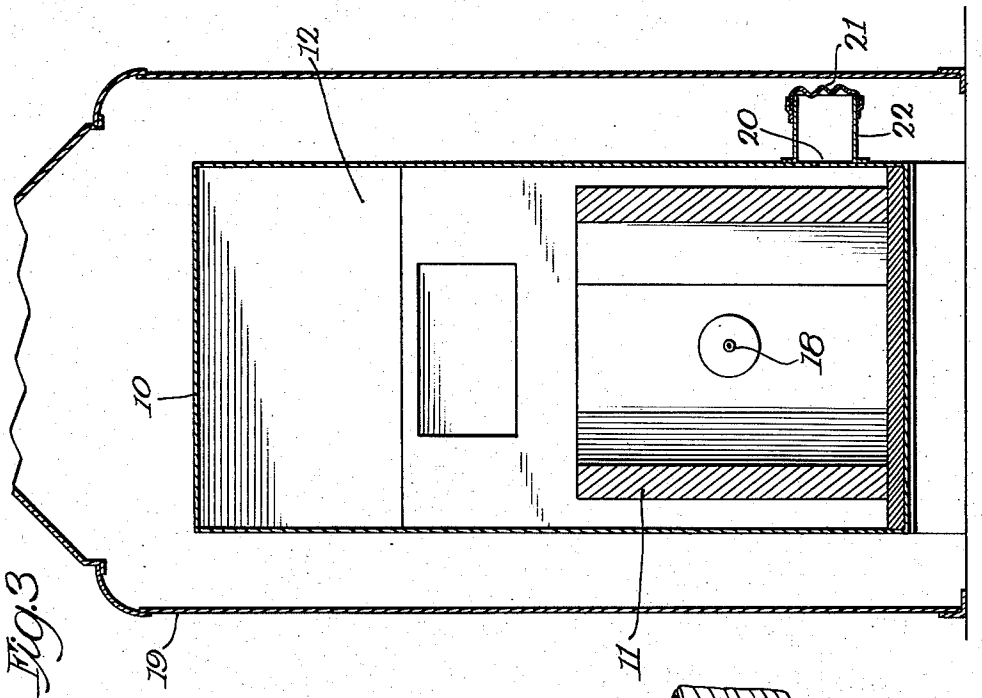


Fig. 3

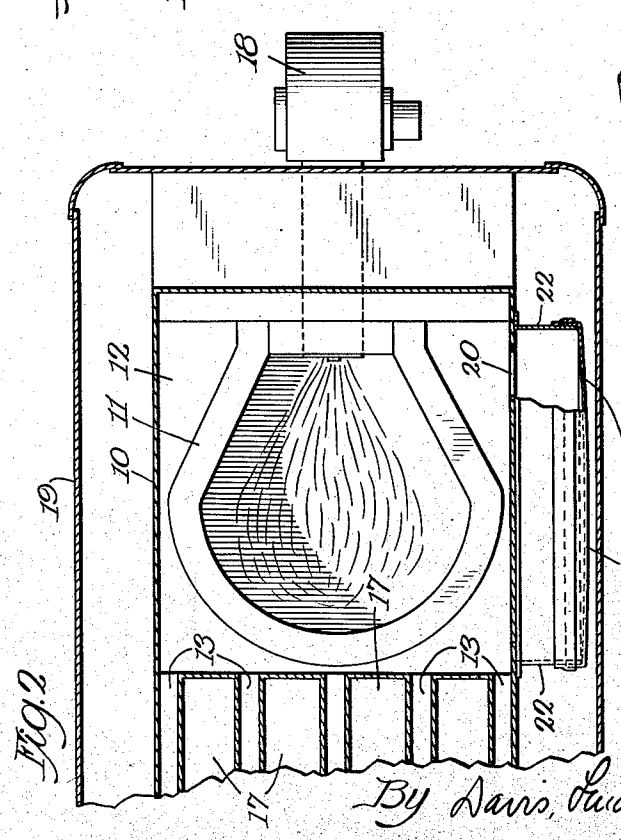


Fig. 2

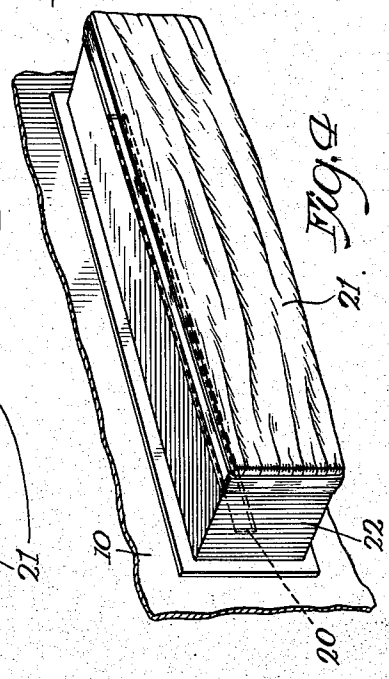


Fig. 4

Inventor:
Louis E. Arnold
By Davis, Audsley, Smith & Arnold Attys.

Patented Dec. 10, 1940 2,224,130

UNITED STATES PATENT OFFICE

2,224,130

ANTIPULSATOR

Louis E. Arnold, Moline, Ill., assignor to The George Evans Corporation, Moline, Ill., a corporation of Illinois

Application August 25, 1937, Serial No. 160,782

3 Claims. (Cl. 158—1)

This invention relates to an antipulsator. It is concerned primarily with a device that may be built into, or attached to, a furnace for preventing the phenomenon known as "panting," or "pulsating."

In certain types of furnaces, and particularly in domestic oil-burning furnaces, the combustion flames often start surging or pulsating in a rhythmic manner, such action being known as "panting" or "pulsating." This action is undesirable because it not only makes a noise that is disturbing but it also decreases the efficiency of the furnace. So far as known, nothing has heretofore been discovered for preventing the occurrence of this phenomenon, although efforts have been made to minimize it by increasing the size of the fire box or combustion space. But an increase in the size of the fire box increases the size of the furnace and thus makes it more expensive while, at the same time, the large size is undesirable from the standpoint of efficiency. The present invention has been devised to overcome these difficulties.

The general object of the invention is to provide means for preventing "pulsating" or "panting" in furnaces.

A more particular object is to provide means for preventing "pulsating" or "panting" that can be either built into a furnace or attached to a furnace already built.

A further object is to provide an antipulsating means that will increase the efficiency of furnaces so that they can be made smaller for a given load.

Other objects and advantages of the invention will appear from the following specification and drawings in which:

Figure 1 is a sectional side elevation of a furnace embodying the invention;

Fig. 2 is a partial sectional plan view on the line 2—2 of Fig. 1.

Fig. 3 is a sectional end view on the line 3—3 of Fig. 1;

Fig. 4 is a perspective detail of the antipulsator as it is applied to the side of a furnace.

The invention is shown applied to a domestic hot-air furnace of well-known construction suitable for use with modern air conditioning systems where the air is cleaned, heated and forced through ducts to the various rooms of a building.

The particular furnace illustrated has been shown by way of example only, and it is to be understood that the invention may be used with other types of furnaces or heating devices, particularly domestic furnaces using steam or hot water, and burning any suitable fuel, though the invention is particularly useful with oil burning furnaces.

Referring to Fig. 1, the furnace has a main housing 10 sometimes called a "heating chamber." This housing is L-shaped, as viewed from the side, and the two arms of the L are of rectangular cross section as will be apparent from Figs. 2 and 3. The long arm of the L is shaped to receive a fire box 11.

Above the fire box is a space 12 that receives combustion gases which pass rearwardly through the spaces or flues 13 (Fig. 2) to a pipe 14 that leads to a stack or chimney. Air is drawn downwardly through cleaning screens 15, around the pipe 14, through the motor-driven blower 16, and then forced upwardly through the spaces 17 (Fig. 2), between the flues 13 from where it passes upward to the various ducts leading about the building. The air is thus cleaned, pre-heated, then heated and forced throughout the building.

The fire box 11 is made of fire-resisting material such as fire clay, and is preferably pear-shaped in horizontal cross section as shown in Fig. 2, its upper end being open.

The fuel used in the furnace illustrated is oil and it is forced into the fire box by an oil burner 18 which may be of any standard type, there being many such burners on the market. This oil burner also forces air into the fire box and has the proper mechanism associated with it to ignite the mixture, the oil burner being provided with suitable automatic controls not shown.

A finished casing 19 surrounds the various parts of the furnace to give it a neat appearance.

In order that the invention may be more easily understood, an explanation of the phenomenon of "panting" will first be made.

When a fuel such as oil or gas enters a combustion chamber and is ignited, the burning may be visualized as a multitude of small explosions which result in the formation of combustion gases that fill the combustion space and tend to increase the pressure therein, depending, of course, upon the size of the combustion space and the conditions surrounding the combustion. The combustion space is enclosed except for the exit through the flues to the stack or chimney which is fairly high. The gases, following their path from the combustion chamber to the top of the chimney, form a column, which, possessing weight, is subject to the laws of inertia and momentum. If the pressure in the combustion chamber is increased as, for example, by in-

creased efficiency of combustion or greater flow of oil, or for some other reason, the increased pressure exerts a force on the column of flue gases tending to move it upward toward the top of the chimney to relieve the pressure in the combustion chamber. But, due to the path through which the gases have to pass and to the weight of the column of gases and the laws of inertia, the column does not move instantly to relieve the increased pressure. Instead, the pressure increases in the combustion chamber and thereby exerts a back pressure on the air entering with the fuel. This air is necessary for proper combustion and is supplied at a normal rate for highest combustion efficiency. When the pressure in the combustion chamber increases, it tends to cause a deficiency in the air supply because of the back pressure on the incoming air. This decreases the efficiency of combustion and results in a loss in the volume of gases that result from combustion. This reduces the pressure in the combustion chamber; and if the column of gases in the flue were to follow to compensate for this decrease, such column would have to move instantly and contrary to its general direction of flow. But it does not move rapidly enough. The result is that a high pressure in the combustion chamber is followed by a low pressure period which again is followed by a high pressure period. These pressures may be either above or below atmospheric pressure, and these alternate actions resolve themselves into a definite cycle, with the result that the periods of high and low pressure follow each other in rapid succession, causing a pulsating or "panting" that is highly undesirable.

While the above is believed to be an accurate explanation of the phenomenon of "panting," it is to be understood that it is somewhat difficult to know exactly what takes place. The existence of the phenomenon has been known for some time, and a great many efforts have been made to solve the difficulties caused by it. It has been demonstrated that the device disclosed herein will eliminate this undesirable action, but it is to be understood that the invention is not to be limited by the description of the cause of the phenomenon above given, such description being made for the purpose of explaining as accurately as possible what is believed to take place.

The present invention solves this difficulty by controlling the conditions in the combustion chamber in the incipient stages of the "panting" phenomenon so as to remove the conditions that cause it and thereby prevent the condition from actually occurring. To this end mechanism has been provided which is highly sensitive and instantaneously responsive to small changes in pressure in the combustion chamber. If the pressure should increase or decrease slightly above or below what is the normal pressure under normal combustion conditions, said mechanism will act to instantly decrease or increase the pressure, as the case may be, to thereby restore conditions in the combustion chamber to normal and thus prevent the start of a surge, or pulsation, or movement that might set up the periodic pulsating action known as "panting."

While the means employed for being sensitively responsive to small changes in pressure may take different forms, the following has been found to be the most simple and practical.

An opening 20 (Fig. 1) is provided in the enclosure that forms the combustion chamber, which opening is preferably removed from the direct path of the flames of combustion so that the parts associated with said opening will not be subjected to deterioration by direct contact with said flames. This opening extends to the exterior of the combustion chamber, and it is provided with a flexible cover 21. Preferably, also, the opening is surrounded by a housing 22 so that the cover 21 will be some little distance away from the combustion chamber and thus not be subjected to high temperatures. The cover is made of a very flexible material such as fire-proofed cotton fabric and, preferably, although not necessarily, it has an area greater than the area of the opening which it covers. It is of such material that it is quite sensitive to very small changes in pressure in the combustion chamber; and, in fact, in the practical operation of the furnace, this cover often vibrates very rapidly.

In normal operations the cover occupies a somewhat relaxed or non-extended position as shown in Figs. 3 and 4. If the pressure in the fire box never changed, the cover would, for the most part, continue to occupy this position. But as soon as the pressure increases a little, the cover will expand, thereby increasing the effective volume of the combustion chamber and decreasing the pressure. Vice versa, if the pressure in the combustion chamber decreases, the flexible cover will move inwardly, thereby decreasing the effective volume of the combustion chamber and tending to restore the pressure to normal. While the flexible cover allows for a considerable expansion in the effective volume of the combustion chamber, in actual practice, if there are changes in the pressure, the cover vibrates rapidly so as to compensate for these changes instantly, thereby maintaining the effective volume and the pressure constant. This instantaneous response to the slightest change in pressure causes the phenomenon of "panting" to be anticipated. The surging or pulsations are prevented from getting started, with the result that the phenomenon is entirely eliminated. Not only is "panting" eliminated while the furnace is operating, but the starting surge that often occurs when a furnace is started, and the finishing "kick" that occurs when a furnace is shut off, are both eliminated.

One of the advantages of the invention, in addition to eliminating the noise of "panting" and the decreased efficiency in combustion, is that smaller fire boxes may be used than heretofore in furnaces of the same capacity. No efficient means having heretofore been provided to eliminate the phenomenon of "panting," it has been the practice to make the fire box and combustion chamber larger than would otherwise be necessary, in order that the large volume or space thus provided might tend to decrease the action, owing to the larger space for the gases to expand. But, with the present invention, the size of the fire box and the combustion chamber can be reduced without the danger of undesirable "panting" which, of course, means that the cost of the furnace may be reduced, the space it occupies correspondingly reduced, and the efficiency increased.

It is to be understood that the construction shown is for purposes of illustration only and that variations may be made in it without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. In a furnace having a combustion chamber

that is substantially pressure-tight except for the inlet for fuel and the outlet for combustion gases, a means for preventing pulsating comprising a housing communicating through a port with the interior of the chamber of said furnace in which combustion takes place, said housing having a port therein, and a flexible cover for the port in said housing sensitively responsive to small changes in pressure in said chamber to thereby instantly vary the volume of said housing in response to changes in pressure in said chamber to maintain said pressure constant to prevent pulsating.

2. In a furnace having a combustion chamber that is substantially pressure-tight except for the inlet for fuel and the outlet for combustion gases, a means for preventing pulsating comprising a housing communicating by means of a port with the interior of the chamber of said furnace in which combustion takes place, said housing having a port therein, and a flexible closure for the port in said housing having an area greater than said port, said flexible closure being sensitively responsive to small changes in pressure in said chamber to thereby instantly vary the volume of said housing in response to changes in pressure in said chamber to maintain the pressure constant to prevent pulsating.

3. In a furnace having a combustion chamber that is substantially pressure-tight except for the inlet for fuel and the outlet for combustion gases, a means for preventing pulsating comprising a housing communicating through a port with said combustion chamber, and means associated with said housing highly sensitive to small changes in pressure in said chamber, and operating without allowing combustion gases to escape from said chamber to the outside air or air to get into said chamber, to maintain the pressure in said chamber constant to prevent pulsating.

LOUIS E. ARNOLD.