Feb. 14, 1933. S. P. KINNEY 1,897,808

COMBUSTION APPARATUS

Filed July 1, 1929

Fig. 1.

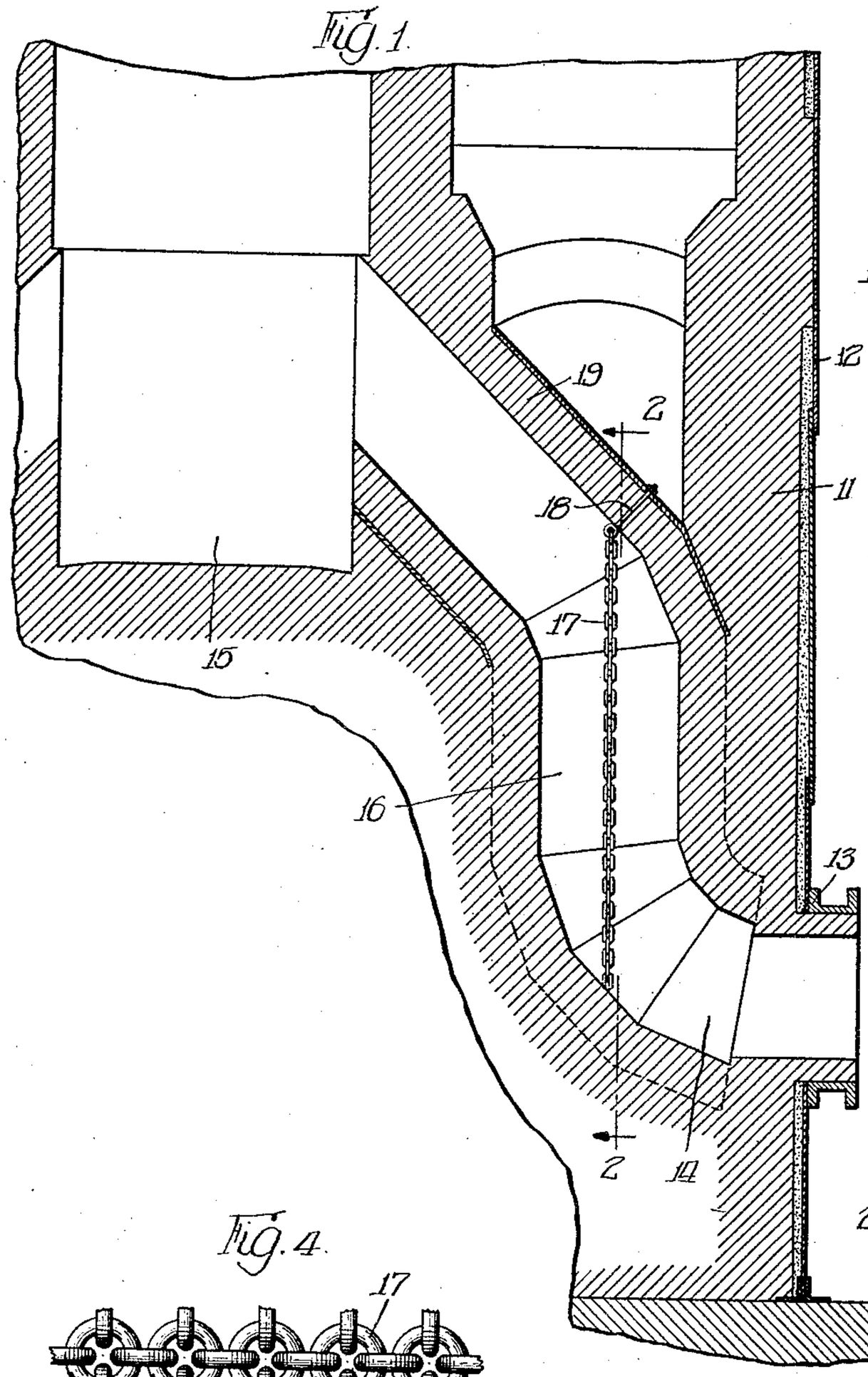

Fig. 2.

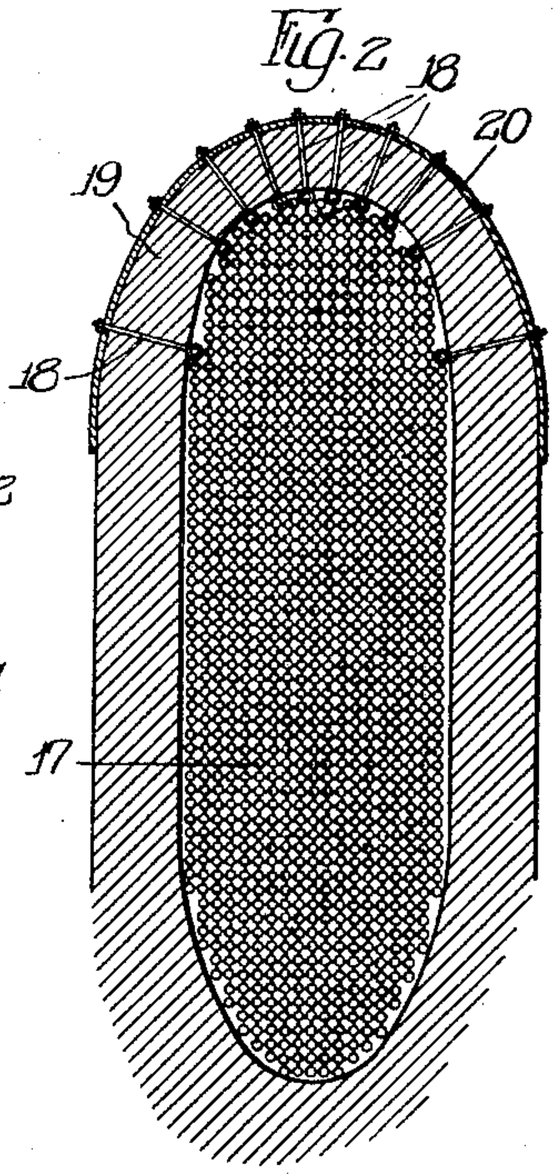

Fig. 3.

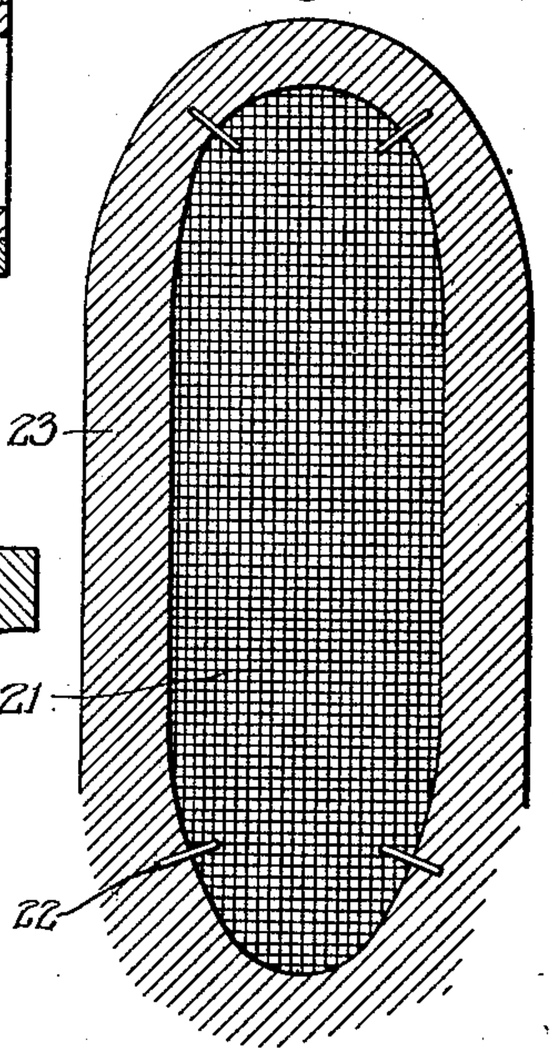

Fig. 4.

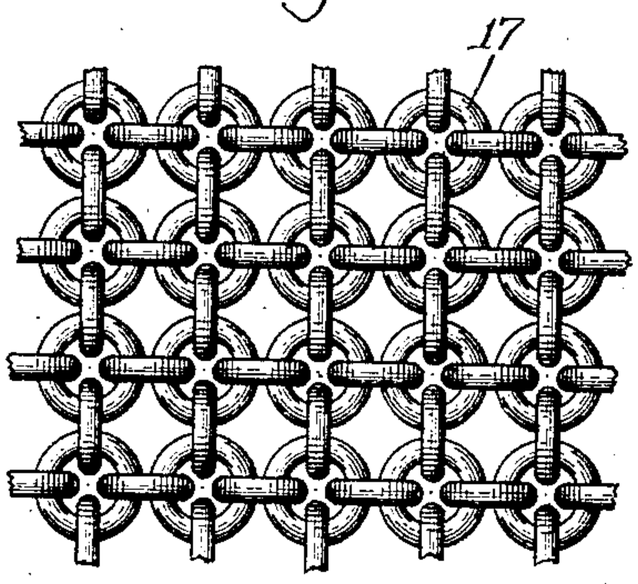

Fig. 5

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UNITED STATES PATENT OFFICE

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COMBUSTION APPARATUS

Application filed July 1, 1929. Serial No. 375,197.

This invention relates to a new and improved combustion apparatus and more particularly to apparatus for controlling the combustion of metallurgical gases in apparatus such as hot blast stoves or the like.

In hot blast stoves and other apparatus which burn metallurgical gases such as a blast furnace and producer gases, their combustion takes place in restricted chambers. The gas, together with the air necessary for combustion, are usually introduced into such chambers by means of a mixing valve or burner. In burning such gases it has been difficult and in many cases impossible to avoid pulsation during combustion. The pulsations are due to the fact that the rate of propagation of the flame in the combustible or explosive mixture of gas and air is greater than the velocity of the mixture. As ignition takes place the flame has a tendency to flash back, causing a vibration or pulsation. These pulsations may occur continuously or substantially continuously during the combustion.

Even with the most effective mixing burners and automatically correct proportioning of gas and air, it has not been possible in many cases to avoid the pulsation. The disadvantages of pulsating combustion are very great. This combustion takes place normally in combustion chambers formed of brick work and in the case of hot blast stoves or other regenerative apparatus, the brick work in the combustion chambers or flues may become loosened with the result that the brick fall out and block the chambers or flues. In such structures the pulsation may be sufficient to gradually loosen the brick work in the checkerwork and eventually the whole structure may collapse. Furthermore where these repeated explosions occur in steel jacketed structures such as blast furnace stoves, the pulsations shake the entire steel structure, loosening bolts and rivets, and may be responsible for failures of the shells of the stoves. These vibrations and shakings may cause leakage in the rivet seams, particularly where the burner casting is riveted onto the shell. These pulsations also seriously affect the burners themselves which suffer from the vibration and require more than usual repairs. Where such pulsations are present and automatic mixing burners are used the correct proportion of gas and air is not as reliable or correct as when the propagation of flames occur smoothly and without pulsation. Due to this fact less complete combustion can be effected and the affect of the pulsation may be cumulative.

It is an object of the present invention to provide new and improved combustion apparatus and more particularly apparatus whereby pusation during combustion may be avoided.

It is a further object to provide apparatus comprising means adapted to be extended across a combustion passageway or chamber, which means will serve to prevent passage of flames.

It is also an object to provide such flame interrupting means adapted to operate through lowering the temperature of the gas and air mixture or through increasing the gas velocity due to a decrease cross-sectional area for passage of the gaseous mixture.

It is an additional object to provide apparatus of this character which may be installed in existing combustion chambers and passages without material alteration therein.

It is also an object to provide a construction adapted to resist high temperatures and further adapted for commercial production and installation.

Other and further objects will appear as the description proceeds.

I have shown such preferred embodiments of my invention in the accompanying drawing in which

Figure 1 is a fragmentary vertical section of the lower portion of a hot blast stove;

Figure 2 is a section taken on line 2—2 of Figure 1;

Figure 3 is a view similar to Figure 2 but showing a modified form of construction;

Figure 4 is a face view on an enlarged scale of a section of the screen shown in Figures 1 and 2; and

Figure 5 is a section taken on line 5—5 of Figure 4.

In the drawing with particular reference to Figures 1 and 2, the brickwork of the lower portion of a hot blast stove has been shown at 11 enclosed within the metal casing 12. The metal flange 13 is secured to the metal casing or shell 12 and this flange serves for the connection of a mixing valve or burner for the introduction of a combustible mixture of gas and air into the combustion passageway 14, which leads to the combustion chamber 15 of the hot blast stove. This combustion passage 14 takes a tortuous path and has a vertically extending portion 16.

The chain screen 17 extends vertically in the vertical section 16 of the passage 14 and is suspended from the bolts 18 which extend through the brickwork 19 constituting the upper portion of the passageway 14. A metal plate 20 is shown housing the brickwork 19 and serving to distribute the load from the bolt 18 over the brickwork. This foraminous screen 17, as shown in Figure 2, covers substantially the entire cross-sectional area of the passageway 14 and is made up of interlinked rings as shown in detail in Figures 4 and 5. A modified form of construction is shown in Figure 3 in which the screen 21 made up of bars or rods, is retained in the same relative position as the chain curtain 17, the screen 21 being held in place by the pins 22, which are set into the surrounding brickwork 23.

The rings of the chain curtain 17 or the bars of the screens 21 may be formed of any desired heat resistant material. For example they may be formed of metal where the temperatures are such as to permit the use of metal. Where higher temperatures are to be encountered they may be formed of ceramic material or may be formed of metal coated or covered with ceramic or refractory material.

It will be noted that the curtains 17 or screens 21 as placed in the tortuous passageways 14 are greater in area than the direct cross-sectional area of the passageway. With the screen or curtain extending as shown the total screen area thus may be materially greater than the cross-sectional area of the passage, and the screen may have an effective area for the passage of gases fully equal to the cross-sectional area of the passage, so that it does not serve as a constriction to materially retard the passage of gases.

The screen will serve to effectually prevent propagation of the flame back of the screen. Combustion will take place in the chamber 15 and in the upper portion of the passage 14 between the screen 17 and the chamber 15. No combustion, however, will take place between the screen 17 and the burner attached to the flange 13. The action of the screen may be used to lower the temperature of the gas and air mixture as the mixture passes through the screen, or the screen may be used to increase the velocity of the air and gas mixture due to a decreased cross-sectional free area, and small passageways formed through the screen, thereby resulting in an increased rate of gas flow. This speed of gas flow through the screen may be, therefore, brought to a point where it exceeds the velocity of flame propagation, so that no flame will pass through the screen. The cause of pulsation is a greater velocity of flame propagation than the velocity of the mixture of gas and air. The principal effectiveness of a metallic screen compared to the use of refractory material, however, consists of its dissipation of heat. The temperature of the gas is lowered below the ignition point, and combustion is thus stopped at the screen.

While I have shown my invention as applied to the combustion passageways of a hot blast stove it will be obvious that it may be applied for use in combustion chambers or flues or furnaces where air and gas mixtures are burnt, and wherever a pulsation results due to intermittent combustion. It will be understood also that the nature of the screen may vary under different conditions and it may be wholly built of steel or other metal rings or rods or wires, or of any suitable high temperature resisting alloys. It also may be formed in whole or in part of refractory material, the refractory material being in the form of rods, bars or bricks or made up solidly in the form of a perforated screen or curtain. The refractory material would preferably be used where very high temperatures prevail at the point where the screen is to be applied.

While I have shown certain preferred embodiments of my invention by way of illustration, it is capable of change and modification to meet varying conditions of use and installation, and I contemplate such changes and modifications as come within the spirit and scope of the appended claims.

I claim:

1. Combustion apparatus comprising a passage carrying a gaseous combustible mixture and a screen of heat resistant material extending across the passage area, said screen comprising metallic links and hanging vertically in the passageway.

2. In a hot blast stove, a tortuous passageway for carrying a combustible mixture of gas and air, said passageway having a vertically extending portion, a chain curtain hung in said vertically extending portion and extending across substantially the entire passage area.

3. In a hot blast stove, a passageway in said stove connecting at one end to the combustion chamber and having a burner open-

ing at the other end, said passageway having a substantially vertical intermediate portion, and a verticallv extending perforate screen extending across substantially the entire effective passage area in said vertical portion.

4. In a hot blast stove, a passageway in said stove connecting at one end to the combustion chamber and having a burner opening at the other end, said passageway having a substantially vertical intermediate portion, and a vertically extending perforate screen comprising a suspended metallic chain curtain extending across substantially the entire effective passage area in said vertical portion, the effective area for passage through the screen being not less than the cross-sectional area of the passage.

Signed at Chicago, Illinois, this 22nd day of June, 1929.

SELWYNE P. KINNEY.