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METHOD OF MANUFACTURING HEXAMETHYLENETETRAMINE FUEL PELLET

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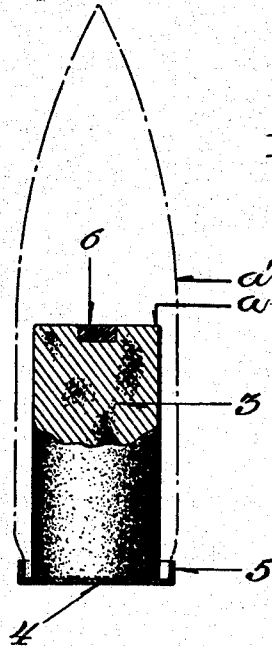


Fig. 1.

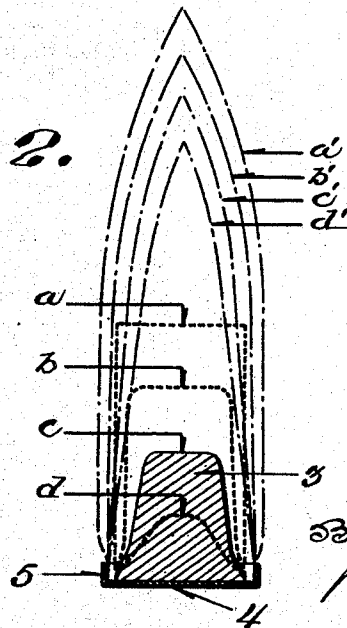


Fig. 2.

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METHOD OF MANUFACTURING HEXAMETHYLENETETRAMINE FUEL PELLET

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1 Claim. (Cl. 44-1)

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This invention pertains generally to fuel pellets and more particularly to a tablet fuel consisting of compressed chemical and other ingredients.

The invention has primarily for its object to provide an improved fuel pellet for heating or ignition purposes, and in which maximum efficiency is obtained through improved combustion and predetermined temperature control over a maximum burning period.

To accomplish the foregoing, hexamethylenetetramine $((CH_2)_6N_4)$, hereinafter referred to as "Hex," is employed as the basic ingredient of the present invention. However, it was found that in the use of "Hex" alone as a fuel, it gave off obnoxious fumes or gases during combustion. To overcome this objection other ingredients had to be added and it was found that a small proportion of an alkali metal nitrate, either sodium or potassium, best accomplished the purpose, and also served to stimulate combustion.

While fuel pellets made by the foregoing formula proved to be exceedingly high in B. t. u.'s and eliminated obnoxious gases during combustion, it was found that during combustion the pellets produced an excessive carbon blanket over their surfaces, which prevented the entry of secondary oxygen, with the result that the flame became rapidly reduced and practically ineffective from the standpoint of heat efficiency toward the end of the burning period.

Therefore, a specific object of the invention resides in overcoming the foregoing objection by the addition of paraffin and although the ingredients may be combined in various ways, to obtain the best results a further object of the invention resides in the specific formula and novel process employed in producing the fuel pellet in accordance with the explanation hereinafter set forth.

A still further object resides in forming a pellet of the foregoing character having specific relative dimensions by which maximum efficiency and controlled heat is obtained.

With the above and other objects in view, which will appear as the description proceeds, the invention resides in the novel construction, combination and method, substantially as hereinafter described, and more particularly defined by the appended claim, it being understood that such changes in the precise embodiment of the herein disclosed invention may be made as come within the scope of the claim.

In the accompanying drawings is illustrated one complete example of the physical embodiment of the present invention constructed according to the best mode so far devised for the practical application of the principles thereof.

In the accompanying drawings:

Fig. 1 is a vertical sectional view of a fuel

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pellet formed in accordance with the preferred form of the present invention; and

Fig. 2 is a similar view showing the pellet partially consumed.

As a result of extensive tests with various formulas for accomplishing the present invention, the following formula in substantially the proportions listed has been found to produce the most satisfactory results.

	Per Cent
Hexamethylenetetramine $((CH_2)_6N_4)$	96
Paraffin.....	3
Potassium nitrate or sodium nitrate.....	1
Total.....	100

As stated, in the present formula the inclusion of paraffin is considered an important feature of the invention, in that without it the pellet quickly develops an excessive carbon blanket over its exposed surface thus precluding contact of exterior or secondary oxygen with the substance of the pellet to aid combustion. Consequently, the flame rapidly becomes reduced to the extent that toward the end of the burning period its heat effectiveness is practically negligible. Also, it was found that the burning time was exceedingly limited, and a substantial residue left.

By the addition of paraffin not only is the character of combustion improved, but the burning period is materially prolonged and the pellet entirely consumed. This is due to the fact that the paraffin content breaks up the carbon formation and gives off free carbon, which in cooperation with outside oxygen causes complete combustion and prevents the accumulation of a smothering blanket of carbon over the surface of the pellet. At the same time, because of its ability to absorb gases, the paraffin serves to prolong the burning period and produces an even regulated flame.

Also, due to the absence of a carbon blanket on the pellet, should it be extinguished at any time, it can be readily ignited for further use.

As an example, actual tests of 100 grain pellets with and without paraffin content, under identical conditions, establish the following facts:

	Without Paraffin	With Paraffin
Burning Period.....	12.65 Min.	15.05 Min.
Temperature input to liquid heated.....	47 $\frac{3}{4}$ ° Cent.	57 $\frac{3}{4}$ ° Cent.
Character of flame.....	Variable	Substantially constant.
Rate of burning.....	do.	Substantially uniform.
Residue.....	Present	None.

From the foregoing it will be apparent that a pellet produced in accordance with the present

formula has a materially higher efficiency than one containing no paraffin.

At the same time use of the present ingredients result in substantially complete combustion of the gases with the elimination of obnoxious fumes.

While the invention contemplates combining the ingredients set forth by any method, the specific novel process here developed is considered highly important to obtain the most desirable results.

Although merely coating the pellet with paraffin produces some advantages, it is not completely effective inasmuch as some of the coating must be burned off before the other ingredients become active.

To mix paraffin in liquid form with the other ingredients, it must be heated to a temperature that causes melting of the powdered "Hex," which detrimentally effects and retards its combustion.

Also, paraffin in its normal state, because of its waxy character, cannot be flaked or reduced fine enough for the desired mixing with other ingredients.

Therefore the novel method contemplated by the present invention consists in grinding the paraffin at a temperature of approximately -20° Fahrenheit in which condition it can be ground to an extremely fine mesh capable of intimate and uniform mixture with the other ingredients to bring about the most effective cooperation. The mixture is then compressed into pellets at an even low temperature to prevent the paraffin from becoming soft.

As previously stated one of the purposes of the present invention resides in so proportioning the dimensions of the pellet to obtain predetermined controlled combustion. To accomplish the best results it has been found that the critical dimension of the height of the pellet with relation to its width should be in the proportion of approximately two to one. This provides a pellet of minimum bulk having maximum effectiveness in that it produces intensive initial heat output for rapid input to the material to be heated and as the material reaches the desired temperature, and the taper of the flame becomes gradually restricted because of consumption of the pellet, sufficient input is maintained to hold the material at the desired temperature.

For instance in boiling water the initial flame emitted from both the top and extended side of the pellet provides immediate maximum heat for quickly bringing water to a boil, and thereafter as the taper of the flame becomes gradually restricted the heat output is conserved, but remains sufficient to maintain the water at boiling temperature, thus substantially prolonging the burning period. In a wide wafer shaped pellet practically the entire flame is emitted from the top surface and remains constant. Consequently either a longer period of time is required to heat the water to the desired temperature, or if the heat output is sufficient for quick boiling, there is a subsequent waste of heat output, and unnecessary reduction in the burning period.

In the drawing (Fig. 1) a pellet 3 of the preferred proportioned dimensions is shown, mounted in a shallow cup 4, the lip 5 of which is slightly spaced from the side of the pellet so as not

to interfere with combustion. While the contour of the pellet is preferably round, it may be square, hexagonal, or any other shape without departing from the invention.

In some instances it may be desirable to provide means for igniting the pellet by friction instead of a flame, in such instance a fuse 6 such as shown in the drawing may be inserted in the top of the pellet. The fuse can be formed of any conventional materials, such as charcoal and potassium nitrate, which is ignitable by friction.

Fig. 2 of the drawing illustrates the manner in which the pellet burns and the corresponding character of the flame.

A one-half consumed pellet is shown in full lines while the normal pellet and different stages of burning are shown in dotted lines. The resultant flame for each stage is shown in dot and dash lines.

During operation the whole pellet *a* upon ignition produces a flame *a'*, when reduced to *b* the flame *b'* results, etc.

Thus it will be seen that initially maximum heat output is obtained, after which the flame is gradually restricted but continues to be sufficient to maintain the desired temperature of the material being heated, it being understood that such material is contained in a suitable receptacle supported closely above the pellet.

From the foregoing explanation, it is thought that the advantages of a fuel pellet produced in accordance with the present invention will be apparent in that it is non-poisonous, compact, light and not effected by atmospheric conditions. Also being a solid there is no spillage as in liquid fuels, and no costly packing required.

The foregoing makes the pellet particularly adaptable for military and emergency purposes, as well as for outings, and ignition of charcoal or wood fires.

I claim:

The method of producing a solid fuel pellet composed of approximately 96% hexamethylenetetramine, approximately 3% paraffin and approximately 1% of an alkali metal nitrate, which comprises: grinding the paraffin at a temperature of approximately -20° Fahrenheit to reduce it to an extremely fine particle size; thoroughly mixing the ground paraffin with the hexamethylenetetramine and nitrate; and then, at substantially the same temperature, compressing the mixture into a pellet.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,947,790	Minnice	Feb. 20, 1934
1,248,557	Schrimpe	Dec. 4, 1917
1,923,313	Koster	Aug. 22, 1933
1,452,239	Gutlin	Apr. 17, 1923
2,161,385	Ringer	June 6, 1939

FOREIGN PATENTS

Number	Country	Date
512,956	Germany	Nov. 20, 1930