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PROVISIONAL SPECIFICATION.

**Improvements in Compositions for Heating by Chemical Reaction,  
and in Means for Utilizing the same.**

We, MAX BAMBERGER of III Seidlgasse 25, Vienna, Austria, Professor at the Polytechnical University and FRIEDRICH BÖCK of III Hengasse 16, Vienna, Austria, Assistant Professor at the Polytechnical University, do hereby declare the nature of this invention to be as follows:—

5 Our invention relates to a heating composition which is capable of producing heat comparatively slowly and without undue increase of temperature no admission of air being required for and no combustion gases being evolved during such production of heat. This composition will therefore prove very useful for many purposes such as heating the contents of preserve tins, for  
10 heating liquids and many other substances and articles.

Our invention is based on the following discovery:

When a mixture of a heavy metal (such as iron, copper, zinc, or others) with substances capable of giving off oxygen or sulphur is heated at one point only to approximately a red heat a violent reaction is set up in which the heavy  
15 metal combines with oxygen or sulphur and a comparatively large amount of heat is developed and a temperature is obtained which is far too high for the purposes above indicated. But when to the above mixture a substance substantially indifferent or inert to the constituent parts of such mixture is added the reaction initiated in the manner described is retarded or moderated to such  
20 an extent that the temperature obtained is reduced to the limits desirable for the purposes above set forth the duration of the reaction being correspondingly increased.

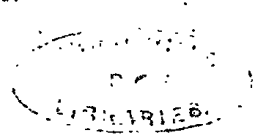
The materials or substances added to the mixture for the purpose of moderating or retarding the reaction may be entirely inert that is to say such as to  
25 take no part at all in the reaction such as burnt clay, oxide of iron, cement *etc.* or they may be such that take part in the reaction but in so doing do not produce notable quantities of heat (as silica, gypsum *etc.*) In either case besides moderating or retarding the reaction the inert or substantially inert substances added to the composition act as heat accumulators.

30 We have obtained the best results with a composition consisting of about three parts by weight of potassium permanganate, about four parts by weight of finely comminuted iron and about two parts by weight of dehydrated gypsum.

The reaction is initiated in the composition by heating the same at one point only to a red heat or nearly so; this may be done in any convenient  
35 manner, for instance by means of a match cord; a glowing or burning splinter of wood (such as an ordinary match) or a primer consisting of any pyrophoric substance. After initiating the reaction this latter propagates comparatively slowly throughout the entire mass heating the same to a red heat. A layer of the above composition 40 centimetres long, 3 centimetres broad, and 2.5  
40 millimetres thick and placed on an asbestos plate burns for about 2 minutes 40 seconds.

The composition may be brought into the form of lumps of any desired shape and size by pressure and in some cases it may be hardened by moistening it with water and drying the same again. The lumps thus obtained may be  
45 brought to the market each provided or not with any suitable coating or covering.

[Price 8d.]



*Compositions for Heating by Chemical Reaction, and Means for Utilizing same.*

Our composition may be utilized for heating the contents of receptacles of any kind in different ways. Thus the receptacles may be provided with double bottoms or walls the spaces between the double bottoms or walls being filled with our composition and an insulating layer of asbestos or the like being interposed between the composition and the outer bottom or wall; or the composition or the receptacle containing the same may be entirely independent of the receptacle containing the substance to be heated. In the latter case the composition might be filled into a small receptacle and this might be used to stir or simply be dipped into the substance to be heated after the reaction has been set up in the composition, or the composition might be placed upon a pan or into a flat box upon which the receptacle with the substance to be heated is placed.

In order to increase the duration of the reaction it is advisable particularly in the case of preserve tins having a double bottom to control the propagation of the reaction in the mass of the composition (by sub-dividing the same as by imbedding into such mass sheet metal strips or other refractory partitions or by placing the composition into grooves formed in one of the bottoms) in such a manner that the reaction can propagate through the mass only along a predetermined line (a spiral or a zigzag line.)

In preparing the improved composition the ingredients constituting the same are intimately mixed while in a state of fine comminution.

Dated this 20th February 1904.

MAX BAMBERGER,

Professor at the Polytechnical University in Vienna.

FRIEDRICH BOCK,

Assistant Professor at the Polytechnical University in Vienna.

**COMPLETE SPECIFICATION.****"Improvements in Compositions for Heating by Chemical Reaction and in Means for Utilizing the same."**

We, MAX BAMBERGER of 25 Seidlgasse, Professor, and FRIEDRICH BÖCK, of 16 Hengasse, Assistant Professor, both in Vienna, Austria do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

Our invention relates to a heating composition which is capable of producing heat comparatively slowly and without undue increase of temperature, no admission of air being required for and no combustion gases being evolved during such production of heat. This composition will therefore prove very useful for many purposes such as heating the contents of preserve tins, for heating liquids and many other substances and articles.

Our invention is based on the following discovery. When a mixture of a finely comminuted heavy metal (such as iron, copper, zinc or others) with sulphur or substances capable of giving off oxygen is heated at one point only to approximately a red heat, a violent reaction is set up the heavy metal combining with the sulphur or oxygen and a comparatively large amount of heat is developed and a temperature is attained which is far too high for the purposes above indicated; but when to the above mixture a substance substantially indifferent or inert to the constituent parts of such mixture is added, the reaction initiated in the manner described is retarded or moderated to such an extent that the temperature obtained is reduced to the limits desirable for the purposes above set forth, the duration of the reaction being correspondingly increased.

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The materials or substances added to the mixture for the purpose of moderating or retarding the reaction may be entirely inert, that is to say such as to take no part at all in the reaction (such as burnt clay, oxide of iron, cement or the like) or they may be such that take part in the reaction but in so doing do not produce notable quantities of heat (as silver, gypsum or the like).

In either case, besides moderating or retarding the reaction the inert or substantially inert substances added to the composition act as heat accumulators.

We have obtained the best results with a composition consisting of about three parts by weight of potassium permanganate, about four parts by weight of finely comminuted iron and about two parts by weight of dehydrated gypsum. The reaction is initiated in the composition by heating the same at one point only to a red heat or nearly so. This may be done in any convenient manner, for instance by means of a matchcord, a glowing or burning splinter of wood (such as an ordinary match) or a primer consisting of any pyrophoric substance. After initiating the reaction this latter propagates comparatively slowly throughout the entire mass, heating the same to a red heat.

A layer of the above composition 40 centimetres long, 3 centimetres broad and 2.5 millimetres thick and placed on an asbestos plate burnt for about 2 minutes 40 seconds.

The composition may be pressed into cakes or blocks of any desired shape and size and in some cases it may be hardened by moistening it with water and drying it again.

The cakes or the like thus obtained may be provided or not with any suitable coating or covering.

Our composition may be utilized for heating the contents of receptacles of any kind in different ways. Thus the receptacles may be provided with double bottoms or walls; the spaces between the double bottoms or walls being filled with our composition and an insulating layer of asbestos or the like being interposed between the composition and the outer bottom or wall; or the composition or the receptacle containing the same may be entirely independent of the receptacle containing the substance to be heated. In the latter case the composition might be filled into a small receptacle and this might be used to stir or simply be dipped into the substance to be heated after the reaction has been set up in the composition; or the composition might be placed upon a pan or into a flat box upon which the receptacle with the substance to be heated is placed.

In order to increase the duration of the reaction in a given quantity of the composition it is advisable, particularly in the case of preserve tins having a double bottom for holding the composition, to control the propagation of the reaction in the mass of the composition by subdividing the same (as by imbedding into such mass, sheet metal strips or other refractory partitions or by placing the composition into grooves formed in one of the bottoms) in such a manner that the reaction can propagate through the mass only along a pre-determined line (a spiral or a zig-zag line).

In preparing the improved composition the ingredients constituting the same are intimately mixed while in a state of fine comminution.

In the accompanying drawing:—

Fig. 1 is an inverted plan view partly in section, and

Fig. 2 a section on the line II—II Fig. 1 of a box for containing our improved composition.

Figs. 3, 4, 5, 6 and 7, 8 are similar views of modification of such boxes.

Like letters of reference indicate similar parts in all the figures.

Referring now to Figs. 1 and 2 *a* is a flat box of thin sheet metal. *C* indicates the above described composition filled into the same, *e* is a hole in one of the walls of the box and *d* is a sheet metal strip detachably secured

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preferably soldered to the outside of the box so as to hermetically close the hole *c*.

When it is desired to use the composition for heating purposes the strip *d* is removed in any convenient manner and a glowing or burning splinter of wood such as an ordinary match is brought into contact with the composition through the hole *c*. The reaction thus initiated in the composition will propagate through the entire mass thereof uniformly in all directions and the heat produced thereby may be utilized for heating the contents of a receptacle *f* placed on the box *a*.

In the case of preserve tins we prefer to permanently secure, say by soldering the box *a* to the body of the preserve tin *g* as shown in Figs. 3 and 4, so that the box is in contact with the contents of the preserve tin. In these latter figures *h* indicates a pyrophoric primer such as pyrophoric iron or another primer which is adapted to be ignited by heat, friction or otherwise and which is imbedded in the composition in front of the hole *c*. On removing the strip *d* the primer will come into contact with the atmosphere and will thus be heated to a red heat whereby the reaction is initiated in the composition automatically if a pyrophoric primer is used, if another primer is used it has to be ignited in any suitable manner.

In order to still more prolong the duration of the reaction in the composition contained in the box *a*, partitions *i. i.* of some refractory material such as sheet iron reaching from the top to the bottom of the box may be imbedded in the composition as shown in Figs. 5 to 8 which are so shaped and arranged that the composition forms a continuous strip or strips running in a tortuous path from the hole *c* to a distant point of the box. We have found by experiment that such partitions form a bar to the propagation of the reaction in the mass of the composition and therefore when the reaction has been initiated at the hole *c* it must follow in its propagation the tortuous path between the partitions *i. i.* whereby its duration is considerably prolonged.

In Figs. 5 and 6 the partitions *i. i.* form a sort of spiral so that the composition forms a spiral shaped strip too, the hole *c* is in the centre and the reaction when once initiated will propagate along the spiral shaped strip of the composition in the direction of the arrows towards the periphery of the box *a*.

In Figs. 7 and 8 the partitions *i. i.* divide the composition into two zig-zag shaped strips both of which start from the hole *c* at a point near the periphery of the box and end at an approximately diametrically opposite point.

The shape and arrangement of the partition *i. i.* may of course be varied at will provided they divide the composition into a continuous strip or strips starting at the hole *c* and running in a tortuous path to some distant point or points of the composition. The partitions *i. i.* may consist of sheet metal or wire loosely set between the top and the bottom of the box *a* as shown in Figs. 5 and 6 or they may be formed by corrugations in the bottom of the box reaching to the top thereof or *vice versa*.

We prefer to so shape the primer *h* that it somewhat projects from the hole *c*. By these means the ignition of the primer is greatly facilitated because when the primer is flush with the edges of the hole *c* the metal of the box abstracts so much heat from the igniting flame that the primer is liable not to catch fire. Of course the strip *d* must be suitably bulged above the hole *c* to permit the primer to project beyond the said hole as indicated in Fig. 4.

As the substance capable of giving off oxygen we use such compounds as are very rich in and readily parting with oxygen such as nitrates, chlorates, perchlorates, and preferably permanganates as with the last named no gases at all are evolved in the course of the reaction.

We wish it to be understood that we do not claim a composition consisting of sulphur or of a compound rich in and readily parting with oxygen and of a heavy metal, but only the combination of this composition with a sub-

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stantially indifferent or inert substance such as hereinbefore set forth capable of retarding or moderating the reaction. The object of this slowing down of the reaction is to prevent the heat supplied by the composition to the substance to be heated (articles of food, beverages, the contents of preserve tins and the like) from raising the temperature of the latter to such a degree as to cause the same to boil violently or to burn.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1. A heating composition consisting of a mixture of a heavy metal, sulphur or a compound rich in and readily parting with oxygen and a substance or substances substantially inert with relation to the heavy metal and the said compound or sulphur, the said ingredients being finely comminuted and intimately mixed.
2. A heating composition consisting of an intimate mixture of finely comminuted iron, permanganate of potassium and a substance or substances substantially inert with relation to the iron and the permanganate of potassium.
3. A heating composition consisting of an intimate mixture of finely comminuted iron, permanganate of potassium and dehydrated gypsum.
4. A process for manufacturing the heating composition hereinbefore described, consisting in intimately mixing the finely comminuted ingredients, bringing the mixture into the form of cakes or the like by pressure and finally hardening such cakes.
5. A process for manufacturing the heating composition hereinbefore described consisting in intimately mixing the finely comminuted heavy metal and the sulphur or the compound rich in oxygen with dehydrated gypsum or cement, bringing the mixture into the form of cakes or blocks, moistening such cakes with water and then drying them.
6. A box filled with the composition hereinbefore described and having a hole and provided (or not) with a primer projecting into the composition in front of or also projecting through the hole in the box and having a detachable cover for hermetically closing such hole substantially as described.
7. A box filled with the composition hereinbefore described and provided (or not) with a primer projecting into the composition in front of or also projecting through the hole in the box and having a detachable cover for hermetically closing such hole, a refractory partition or partitions being imbedded in the composition and subdividing the same into a strip or strips leading in a tortuous path from the hole or primer to a distant point or points of the box substantially as and for the purpose described.
8. In combination with a box filled with the composition hereinbefore described and having a hole and provided or not with a primer and having a detachable cover for the hole the composition in the box being or not subdivided by refractory partitions imbedded in the same into a strip or strips leading in a tortuous path from the hole or primer to a distant point or points of the box, a preserve tin the said box being permanently secured to the body of the preserve tin so that the box is in contact with the contents of the preserve tin substantially as described.

Dated this 24th day of November 1904.

CHARLES BAUER, IMRIE & Co.,  
72 Cannon Street London, E.C.  
Agents for the Applicants.

Fig. 2.

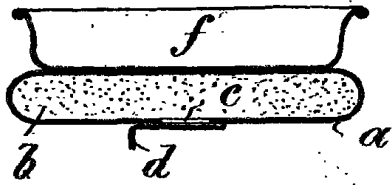


Fig. 4.

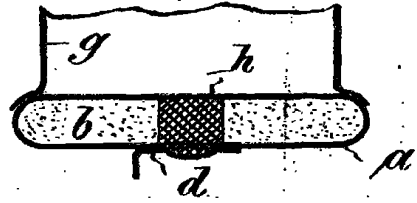


Fig. 1.

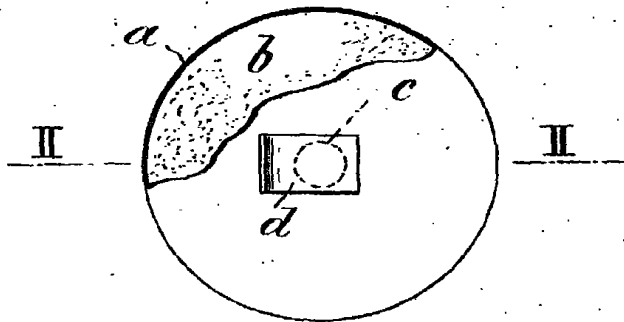


Fig. 3.

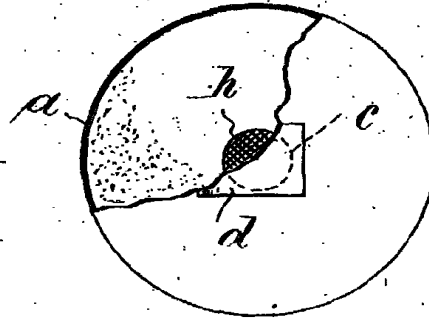


Fig. 6.



Fig. 8.

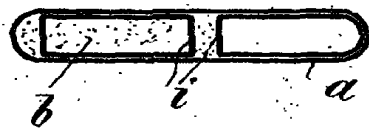


Fig. 5.

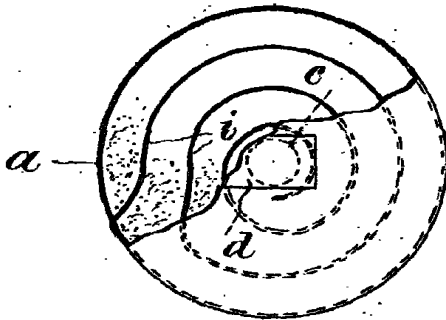
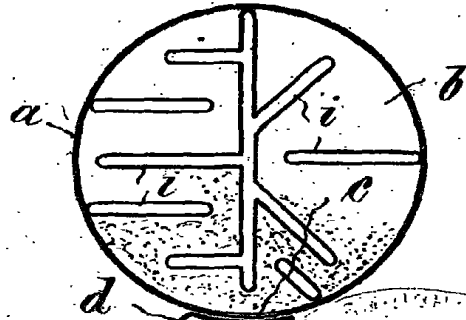


Fig. 7.



[This Drawing is a reproduction of the Original on a reduced scale.]

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