United States Patent [19]

Brandenberger

[11] **3,738,288**

[45] **June 12, 1973**

[54] **THERMIC LANCE**

[75] Inventor: **Ernst Brandenberger,** Wetzikon, Switzerland

[73] Assignee: **Kubatec Kunststoff-und Bautechnik AG,** Triesen, Fla. ; a part interest

[22] Filed: **Jan. 26, 1972**

[21] Appl. No.: **220,787**

[30] **Foreign Application Priority Data**

Feb. 5, 1971 Switzerland 1725/71

[52] **U.S. Cl.** .... **110/1 R,** 29/157 R, 431/99

[51] **Int. Cl.** **F23b 7/00**

[58] **Field of Search** .... 110/1 R; 431/99; 29/157 R

[56] **References Cited**

UNITED STATES PATENTS

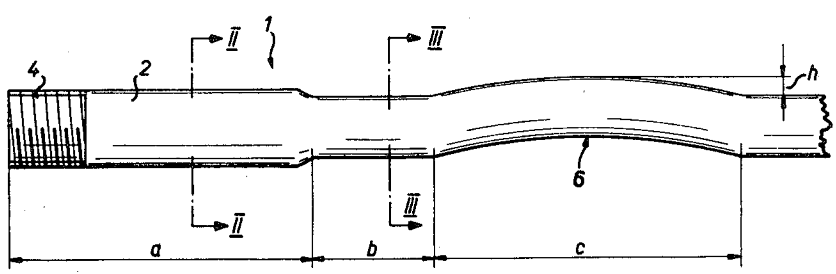
3,460,223	8/1969	Berczes et al.	110/1 X
3,500,774	3/1970	Meier	110/1
3,570,419	3/1971	Brandenberger	431/99 X

Primary Examiner—Kenneth W. Sprague
Attorney—Flynn & Frishauf

[57] **ABSTRACT**

A thermic lance which is operated by gaseous combustion and serves for forming openings, cavities or grooves in hard material such as concrete, stone, building walls and the like. The lance is equipped with a steel tube packed with a plurality of steel rods. Oxygen is passed through the tube from one end and the lance is ignited at the other end to produce an intense heat source that is applied to the material to be cut. Both the tube and rods become consumed during burning out process. The enclosing tube has with the exception of its ends a cross-sectional shape which is other than circular. For securing the rods in the tube a flat arcuate divergence is provided in the tube and the rods near the gas connecting end part of the lance. Formation of the divergent zone and deformation of the tube in a noncircular cross-sectional shape is effected simultaneously by a single press operation.

13 Claims, 3 Drawing Figures



PATENTED JUN 12 1973 3,738,288

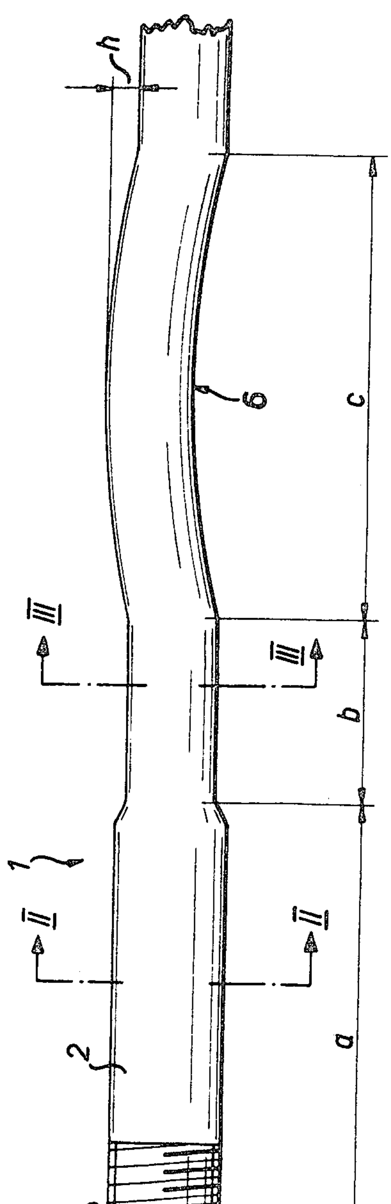


Fig. 1

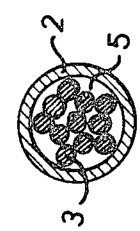


Fig. 2

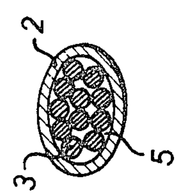


Fig. 3

THERMIC LANCE

The present invention relates to a thermic lance which is operated by gaseous combustion and serves for forming cavities, grooves or openings in hard material such as concrete, stone, building walls, severing reinforced concrete, hard to clear material and the like.

In my prior U.S. Pat. No. 3,570,419 I have described a thermic lance having a tubular shell, a number of core wires located inside this tubular shell and an oxygen connection at the end of the shell remote from the burning point, and also interspace running longitudinally between the core wires and the tubular shell for the conveyance of the oxygen. The disclosure of my prior U.S. Pat. No. 3,570,419 is incorporated herein by reference. Now as an improvement over the aforementioned patent, the present invention relates to a method and means for better securing the core wires in the surrounding tubular shell.

Thermal lances are subject to vibrations during the burning out process. As a result, that the core wires when held only by friction may somewhat alter their mutual locations, and may become somewhat loosened within the tubular shell. Moreover the oxygen pressure, which normally is up to some 110 to 220 psi, acts upon the face of the core wires at the end of the lance which is remote of the burning point. It may happen that for example a single wire becomes loose from the core-wire group and be moved in the direction of the flow of the oxygen gas.

A loose wire may burn more quickly away than the others or may be ejected when the break-through of the wall occurs or when the lance is withdrawn from the opening. But as soon as one of the core wires is lacking, the remaining wires also become loose within the tubular shell, so that finally the whole group or parcel of core wires no longer has any anchorage in the tubular shell.

It is therefore a first object of the present invention to provide means to securely hold all core wires within the tubular shell so that they cannot become loose and leave the tubular shell, even under strong vibrations occuring during the burning process.

A further object of the present invention is to provide a method for manufacturing thermal lances in a highly efficient manner.

The invention will be better understood and objects other than those set forth above, will become apparent, when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawing in which:

FIG. 1 is a plan view of the end zone of a lance,

FIG. 2 is a section through the circular part of the thermic lance along the line II — II of FIG. 1, and

FIG. 3 is a section through the oval part of the thermic lance along the line III — III in FIG. 1.

The thermic lance 1 serves for the production of bores, apertures or openings in concrete, rock, stone walls, mineral material or other hard material, by means of a burning process. The flame for cutting is obtained by a method in which oxygen of high purity is blown under pressure through a tubular shell filled with wires from one end to the other and the front end of the lance is brought up to ignition temperature. In this way combustion is initiated and developed at this end of the lance by a self-supporting thermal reaction with such an evolution of heat that concrete, rock and similar materials are fused and the combustible material is burnt. In doing this the thermic lance itself is successively consumed and must be replaced from time to time.

The thermic lance incorporates a tubular shell 2 of unalloyed steel (iron), usually several meters long; it may be a usual commercially available gas wire. Core tube 3 of round section and equal thickness to one another of unalloyed steel (iron) are drawn into this tubular shell 2, and the number of these core wires 3 is so chosen that they fill the clearance section within the round enclosing tube or tubular shell 2 as well as possible, but without making the drawing of these core wires 3 into the tubular shell difficult. In practice a tubular shell 2 with an inside diameter of one-half inch and 11 core wires has proved satisfactory. These core wires 3 advantageously consist of commercial structural steel used for example for reinforced concrete. There remain between the individual wires 3 and between the wires and the internal wall of the tubular shell interspaces or ducts 5 running longitudinally for the passage of the oxygen.

The tubular shell 2 is provided at each end with a short external thread 4, so that on the one hand two such tubes can be joined together by a coupling sleeve screwed onto them and on the other hand the other end of the tube can be connected to a hose which is connected in its turn to a source of oxygen under pressure.

After the core wires 3 have been drawn into the inside of the circular section tubular shell 2, shell 2 is compressed to an oval over its whole length, with the exception of both end pieces about 5 to 12 cm long. In this way the internal section of the tube is deformed and with it also the section of the duct 5 for the passage of the oxygen running through it longitudinally parallel to the core wires. It is apparent that a sectional ratio of the total metal area — that is, the tubular shell plus the core wires — to the sectional area of the duct 5 for the passage of the oxygen should desirably be about 1 : 9 to 1 : 16. It has been found that particularly economical working is possible if the ratio of the cross sections of the surface of the enclosing tube 2 and of the total surface of the core rods lies between 1.4 : 1 and 1 : 1. It is desirable to distribute the duct area 5 as well and as uniformly as possible over the whole sectional area of the tubular shell in order to ensure a uniform burning of the lance. Through the reduction of the duct sectional area for the oxygen as a consequence of the deformation of the tubular shell to an oval, a better bunching of the burning jets results. In addition in this way the oxygen consumption is reduced, the heat is more concentrated and the smoke emission is reduced.

The core wires 3 — according to my U.S. Pat. No. 3,570,419 — are held inside the tubular shell 2 as a result of the deformation of the tubular shell to an oval shape entirely by the clamping effect or, in other words, by the friction of the wires one with another and on the inner wall of the tube.

In order to avoid individual core wires being able to become loose as a result of the vibration occuring during the burning out process, a flat arcuate divergence 6 or curvature is imparted to the tubular shell 2 and thus to the core wires 3 located within it, as can be seen from FIG. 1. This divergence 6 is located at the gas-connection end in the oval part or otherwise deformed part, near one end of the lance. The inside sectional shape of this slightly curved or arched part should remain as far as possible unaltered in relation to the neighbouring oval part, so that the ducts **5** for the passage of the oxygen are not restricted in section in this curved zone. The length *a* of the tubular shell **2** with a circular sectional shape is about the same length as the chord length *c* of the curved part **6.** The oval zone *b* lying between these is considerably shorter than the lengths *a* or *c* and preferably amounts to about one half or rather less. The chord length *c* is preferably about four to six times the outside diameter of the tubular shell **2** in the circular part.

As a result of the arcuate divergence **6,** it is no longer possible for the core wires **3,** even if they should become loose in the course of the burning out process, to be individually released from the tubular mantle or shell **2,** since the core wires **3** take on the same curved form as that of the tubular shell **2** surrounding them.

The divergent zone **6** is flat, that is, the height *h* of this zone is small in relation to the section dimensions of the tubular shell **2**; it is smaller than the outer diameter of the round tubular shell at the connection ends. Preferably the height of the divergent zone H = one-sixth to one-half of the external diameter of the tubular shell **2** in the circular connection zones.

When the part of the lance departing from a circular section has an oval form, the divergent zone is effected upon the flat side of the oval; that is, the arcuate divergence is produced flat-edged and not high-edged.

So that it may not matter which of the two ends of the lance is used for the oxygen connection, it is also possible to provide the divergent zone **6** described on both end zones of the lance.

It would further be possible to introduce on the divergent zone **6** as visible in FIG. **1** at least a second, directly adjacent divergent zone curved in the same or in the opposite direction, so that in this way a flat wave form results. In this way it is possible to employ even a smaller divergence height in the individual divergent zones, but the sectional shape in the waved zone should be as equal as possible to that of the principal or middle part of the lance.

Manufacturing of such thermic lances is effected by first drawing such a number of core wires **3** into a tubular shell **2** having a round section over the whole length that the section is filled as well as possible. Thereafter the tubular shell **2** together with the core wires **3** it contains is — with the exception of at least one end — compressed in a press in a single action into an oval form, and simultaneously the arcuate divergence **6** already described imparted to the lance. Since the formation of the divergent zone occurs simultaneously both in the tubular shell and also in all core wires in a single operation, this method of manufacture is particularly economical.

Instead of shaping or deforming the tubular shell into an oval sectional shape, it is also possible that this tubular shell may be caused to assume cross-sectional shapes other than circular, for example a triangular, polygonal, half-round or other shapes, and the divergent zones **6** are provided in a similar manner, where here also it is ensured that the sectional shape in the divergent zone is as equal as possible to that of the sectional shape departing from a circular form in the principal part of the lance, in order to avoid a contraction of the oxygen ducts in the divergent zone **6.**

It will be understood that the present invention is not limited to the specific materials, steps and other specific details described above and may be carried out with various modifications without departing from the scope of the invention as defined in the appended claims.

I claim:

1. Thermic lance for gaseous combustion for forming cavities, grooves or openings in hard material such as concrete, stone, building walls, comprising a metallic tube, and a plurality of metallic rods enclosed by said tube, said tube having gas connecting means at one end, intermediate spaces being formed between said rods and between said rods and said tube extending in the longitudinal direction of said tube serving for the conveyance of gas for combustion, and said tube having a cross-sectional shape other than circular except at least one of its end parts, in the vicinity of said gas connecting means said tube and said rods having at least one relatively flat divergence for securing said rods in said tube.

2. Thermic lance as defined in claim **1** wherein the divergent zone is located in the part of the tube the cross-sectional shape of which departs from the circular shape.

3. Thermic lance as defined in claim **1** wherein the part of the lance departing from a circular shape has an essentially oval shape in cross-section, the divergent zone being formed upon the flat side of the oval.

4. Thermic lance as defined in claim **1** wherein the tube has substantially the same sectional form in the divergent zone as in the part of the lance departing from the circular shape.

5. Thermic lance as defined in claim **1** wherein the height (h) of the divergent zone is smaller than the external diameter of the tube in said end part.

6. Thermic lance as defined in claim **1** wherein the height (h) of the divergent zone is smaller than half the external diameter of the tube in said end part and the chord length (c) of the divergent zone amounts to four to six times the external diameter of said end part of said tube.

7. Thermic lance as defined in claim **1** wherein said divergence zone has the form of a wave.

8. A method for manufacturing a thermic lance comprising the steps of introducing a plurality of core wires into a shell having a circular cross-sectional shape, giving the shell an oval shape over the whole length except at least one of its end parts, forming at least one arcuate divergence in said shell and the core wires in the vicinity of one of said end parts, said oval shape and said arcuate divergence being formed simultaneously in a single pressing operation.

9. Thermic lance for gaseous combustion for forming cavities, grooves or openings in hard material such as concrete, stone, building walls, comprising

an essentially straight metallic tube having end parts and an intermediate part, and a plurality of metallic rods located within and enclosed by said tube, said tube having gas connecting means at least at one end part, intermediate spaces being formed between said rods and said tube extending in the longitudinal direction of said tube serving for the conveyance of gas for combustion, and

said tube, in the vicinity of said gas connecting means, having at least one relatively flat divergence from the straight axis of the tube for securing said rods in their location in said tube and prevent loosening of said rods in said tube.

10. Thermic lance as defined in claim **9,** wherein the tube has substantially the same sectional form in the divergent zone as in the part of the lance remote from the gas connecting means.

11. Thermic lance as defined in claim **9,** wherein the height (h) of the divergent zone is smaller than the external diameter of the tube in said end part.

12. Thermic lance as defined in claim **9,** wherein the height (h) of the divergent zone is smaller than half the external diameter of the tube in said end part and the chord length (c) of the divergent zone amounts to four to six times the external diameter of said end part of said tube.

13. Thermic lance as defined in claim **9,** wherein said divergence zone has the form of a wave.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,738,288 Dated June 12, 1973

Inventor(s) Ernst BRANDENBERGER

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the initial page of the patent, change the Assignee to read:

--Kubatec Kunststoff-und Bautechnik AG
Triesen, Liechtenstein--.

Signed and sealed this 8th day of April 1975.

(SEAL)
Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks