ABSTRACT: A compartment-forming jacket faced on one side with a copper plate, and cooling medium in the compartment or directly acting to carry heat applied to and conducted through the copper plate away from the copper plate. The cooling of the copper plate and maintaining the copper plate at a cool temperature provides a protective device for a vault doors and the like which resists penetration of a burning bar.
Fig. 2
BURNING BAR ATTACK RESISTANT DEVICE FOR VAULT DOORS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to protective plate structures which are incorporated in the protective walls of vault doors, safes and the like over and around lock structures and other components of vault doors which are vulnerable to attack by traditional burglary and bank robbery. Recently burning bar devices have been developed that are used in the forced entry attack of vault doors and the like by thieves.

A burning bar (see U.S. Pat. No. 3,260,076) essentially is an oxygen lance formed by an iron pipe loosely filled with a series of smaller wire rods and supplied with oxygen at a pressure of 60 to 100 p.s.i. The tip may be fit with an acetylene torch or even with a match and a piece of wood. Such burning bars have a burning rate through steel, for example, of about 4 seconds per inch, through copper, 10 seconds per inch, and through tungsten carbide, approximately 80 seconds per inch.

Vault doors and the like have been provided with many types and kinds of protective plate structures to resist various modes of attack—such as by torching, drilling, etc. However, the devastating capability of the burning bar in its ability to rapidly burn through all known types of protective devices or materials has alarmed security minded institutions and manufacturers of security equipment.

2. Description of the Prior Art

We have not been able to find any material or combination of materials that will resist the fierce burning of a burning bar. At present, the most resistant materials known are tungsten carbide, Teflon and pure carbon. Manufacturers of burning bars know of no material that will resist being burnt through very rapidly by a burning bar. Thus, even tungsten carbide, with the indicated burning rate of 80 seconds per inch of plate thickness, offers little or no resistance to burning bar attack.

In the past, copper plates have been used in protective plate structures to resist torch cutting, because of the high heat conductivity of copper which rapidly carries heat away from the zone of heat application. However, copper plates, per se, are of no avail in resisting attack by a burning bar, which as indicated, can burn through an inch thick copper plate in 10 seconds.

SUMMARY OF THE INVENTION

Objectives of the invention include providing a new protective device which may be incorporated in a vault door or the like which is more resistant to burning bar attack than any known device or material so as to prevent or delay illegal forced entry to vulnerable components of a vault door; providing a new protective device which is economically feasible to incorporate in vault door construction; providing a new protective device which is simple in construction and may be controlled to achieve efficient resistance to burning bar attack; and providing a new protective device which achieves the states objectives simply, effectively and economically and solves problems and satisfies existing needs.

These objectives and advantages are obtained by the protective plate structure and arrangement, the general nature of which may be stated as including preferably jacket walls forming a compartment, at least one of the walls being a copper plate, cooling means in the compartment or associated with the copper plate, and control means for the cooling means to dissipate through the cooling means heat conducted thereto from the copper plate.

BRIEF DESCRIPTION OF THE DRAWINGS

Preferred embodiments of the invention—illustrative of the best modes in which applicants have contemplated applying the principles—are set forth in the following description and shown in the drawings and which are particularly and distinctly pointed out and set forth in the appended claims.

FIG. 1 is a diagrammatic view of one form of improved protective plate structure;

FIG. 2 is a diagrammatic view of an alternate form of construction; and

FIG. 3 is a diagrammatic view of still another form of construction.

Similar numerals refer to similar parts throughout the drawings.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

First Embodiment

A jacket 1 having top, side, bottom and rear walls 2 preferably comprising steel plates and a copper front plate wall 3 form a compartment 4 (FIG. 1). The jacket 1 may have a size necessary to protect a lock or other component of a vault door involved. The copper plate 3 has inner and outer faces and may have a thickness for example of 1 inch. However, this may be varied depending upon the thickness of the vault door to be protected and the ultimate degree of protection against burning bar attack desired. The compartment 4 communicates through intake 5 and outlet 6 with a source of water acting as cooling means pumped by controls through compartment 4 at the rate required to carry heat away from the copper plate 3 as rapidly as the copper plate 3 is subjected to heat at its outer face (FIG. 1). Water is discharged from the copper from the outer to the inner face of plate 3 by its high heat conductivity factors to the cooling means in contact with the inner face of the copper plate 3.

Using a burning bar to attack the outer face of copper plate 3 of a water cooled jacket 1 as described, it was found difficult to penetrate a 1-inch thick copper plate and it took approximately 15 minutes to make a pinhole penetration. From that time on, and despite considerable effort, it was impossible to make a larger final penetration.

What seemed to occur during such attempted burning bar penetration is that the steam of water emitted under pressure from the compartment 4, once a pinhole was formed, so lowered the heat output of the burning bar that the burning bar tended to burn on one side only and thus became completely inefficient. Also the steam of water frequently extinguished the burning bar thus preventing sustained burning.

Thus, the fundamental concept of the invention is the principle of cooling a copper plate so that heat applied thereto in an attempt to burn through the plate is conducted through and away from the plate substantially as rapidly as such heat is applied thereto. Further the fluid coolant for the copper plate, once the plate is penetrated, acts to extinguish the burning bar or render it totally inefficient.

Second Embodiment

The copper plate 7 shown in FIG. 2 has a side or face 8 directed to resist attack. A series of cooling coils diagrammatically indicated at 9 are brazed or otherwise fixed in heat conductivity to the rear side or face 10 of plate 7. The cooling coils 9 are connected with a typical refrigeration system including temperature control 11, orifice 12, reservoir 13, condensing coil 14 and compressor 15.

The arrangement of FIG. 2 provides a cooling system equivalent to that in FIG. 1, the interior of the cooling coils 9 being the equivalent of the compartment 4 of FIG. 1. The cooling input of compressor 15 is predetermined to be sufficient to carry the heat input of a burning bar away from plate 7.

Alternatively the cooling coils 9 in FIG. 2 may be located in a compartment behind plate 7 such as the compartment 4 of FIG. 1, such compartment being filled with brine.

Third Embodiment

The compartment 16 in FIG. 3 has a copper plate 17 facing the direction of possible attack. A tank 18 of compressed refrigerant such as carbon dioxide connected by control valve 19 and conduit 20 communicates with compartment 16 to maintain a supply of liquid refrigerant under pressure in the compartment. A safety valve 21 may be provided discharging adjacent the outer face 22 of copper plate 17 subject to attack. Face 22 may be located in a vault door with a clearance space between it and an adjacent vault door wall component.
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The heat of a burning bar used to attack the protective device of FIG. 3, will raise the temperature of the refrigerant in a liquid state in compartment 16 so that it actuates safety valve 21 discharging the refrigerant along outer copper plate face 22 and this cools the copper to such degree as to inhibit penetration by the burning bar. If the burning bar penetrates plate 17, the refrigerant discharged under pressure as a gas will maintain the cooling necessary to prevent enlargement of the penetration pin hole.

Example

The protective device of FIG. 1 was tested in an attempt to successfully burn a hole through the device of a size that would permit access to a lock protected by the device. The copper plate 3 was 1 inch thick.

Test started 8:45 a.m. Used up first burn bar 2.6 minutes, penetrated 7/16 inch deep. Put second burn bar on in 7.1 minutes, burned ¾ inch deep. Burn bar snuffed out in 8.42 minutes, 2.5 minutes to relight. Burn bar snuffed out in 9.4 minutes, 48 seconds to relight. Burn bar snuffed out in 9.87 minutes. Hole now ¾ inch deep. 40 seconds to relight. Burn bar snuffed out in 10.9 minutes. A small pinhole now in plate. 45 seconds to relight. Burn bar snuffed out in 11.05 minutes, 70 seconds to relight. Burn bar snuffed out in 11.27 minutes, 2 minutes to relight. Burn bar snuffed out in 12.07 minutes, 47 seconds to relight. Burn bar snuffed out in 12.29 minutes. Hole now only 23/32 inch deep (5/32 inch less deep). Change to fourth burn bar (no time charged to change burn bars) 45 seconds to relight. Burn bar snuffed out in 13.36 minutes. 43 seconds to relight. Burn bar snuffed out in 14.44 minutes. Out of oxygen, used 1,950 pounds of oxygen. Started with new cylinder at 100 p.s.i. instead of 80 p.s.i. 45 seconds to relight.

Burn bar snuffed out in 14.72 minutes. 80 seconds to relight. Reduced pressure to 60 p.s.i. as 100 p.s.i. was not penetrating. Burn bar snuffed out in 15.7 minutes. 45 seconds to relight. Burn bar snuffed out in 16.85 minutes. Hole now 25/32 inch deep and ¾ inch in diameter at deepest penetration. Install fifth burn bar. Took 4½ minutes to install burn bar and relight. Burn bar snuffed out in 17.62 minutes. 82 seconds to relight. Burn bar snuffed out in 18.25 minutes. 2½ minutes to relight. Burn bar snuffed out in 19.37 minutes. 5 minutes to relight. Burn bar snuffed out in 21.04 minutes. Test stopped at 10:20 a.m. Used 1,150 pounds more oxygen. Plate has small pinhole.

The results of this test are that effective pinhole penetration only, resulted after nearly 2 hours of effort, and consumption of a huge quantity of oxygen and five burn bars.

The concept of the invention of cooling and maintaining a cool temperature for the protective plate greatly improves the ability of the plate to resist penetration by a burning bar. This contrasts with the fact that no materials are known that can resist burning bar attack.

Accordingly the devices and techniques of the invention provide devices and a method for effectively resisting the attack of a burning bar upon vault doors, safes and the like; provide such attack resistance in a feasible and economically justifiable manner; and achieve the objectives described and solve a problem that exists and has alarmed the art.

In the foregoing description, certain terms have been used for brevity, clearness and understanding; but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such terms are used for descriptive purposes and are intended to be broadly construed.

Moreover, the description and illustration of the invention is by way of example, and the scope of the invention is not limited to the exact details shown or described.

Having now described the features, discoveries and principles of the invention, the manner in which the improved burning bar attack resistant protective device may be made and used, the characteristics of the new plate structures, and the advantageous, new and useful results obtained; the new and useful structures, devices, elements, arrangements, parts, combinations and methods are set forth in the appended claims.

We claim:

1. In a protective wall of a vault door having a lock structure therein vulnerable to attack by intense heat and burning; a protective plate structure in the vault door wall over the lock structure, including a copper plate having inner and outer faces; the outer copper plate face being directed to resist burning bar attack; cooling means in contact with the inner copper plate face; and control means for the cooling means; whereby the heat to which the outer copper plate face is subjected upon attack of the vault door wall by a lighted burning bar operating under oxygen pressure is conducted through the plate to the inner copper plate face and to the cooling means and is carried away by the cooling means substantially as rapidly as such heat is applied to the outer copper plate face.

2. The construction defined in claim 1 in which top, side, bottom, rear and front jacket walls form a protective plate structure compartment; in which the copper plate comprises the front compartment wall; and in which the cooling means is a liquid.

3. The construction defined in claim 1 in which cooling coils are in heat transfer contact with the inner face of the copper plate, and in which refrigerant is circulated through said cooling coils to provide the cooling means in contact with the inner copper plate face.

4. The construction defined in claim 1 in which top, side, bottom, rear and front jacket walls form a protective plate structure compartment; in which the copper plate comprises the front compartment wall; in which cooling coils are in the compartment; in which refrigerant is circulated through said cooling coils; and in which the compartment is filled with brine to provide the cooling means in contact with the inner copper plate face.

5. The construction defined in claim 2 in which the cooling means in water circulated through the compartment under pressure.

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