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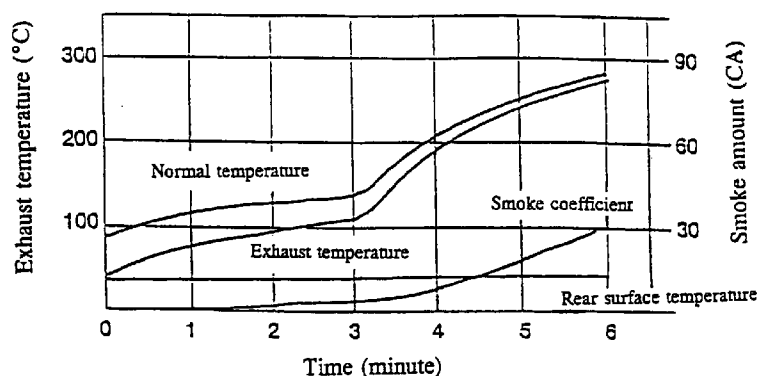
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(54) METHOD OF RENDERING WOODEN MATERIAL FLAME-RETARDANT AND PROCESS FOR PRODUCING FLAME-RETARDED PLYWOOD THEREWITH

(57) This invention relates to the method for flame-retarding treating of wooden materials meeting the requirements of public authorities. Flame-retarding materials are mixed with an aqueous solution, which includes ether and alcohol, such that the solution including the flame-retarding material of about 30 to 50% is prepared. Then, the solution is sprayed directly onto the wooden materials set under the normal temperature and pressure while the temperature of the mixed solution is kept over 60°C. The spraying is stopped when the

weight of the wooden materials increases by at least about 20 to 30% of its original weight under dry condition. Finally, the wooden materials are dried under proper condition. Thus, flame-retarding treating of wooden material is performed. And this invention also includes the manufacturing method for flame-retarding plywood using the above-mentioned method for flame-retarding treating of wooden materials. And these methods are very simple and economical.

FIG. 1



EP 0 838 316 A1

DescriptionBACKGROUND OF THE INVENTION

5 This invention relates to a method for flame-retarding treating of wooden materials which enables to attain the flame-retarding performance which fulfills the flame-retarding examination according to the JIS (Japanese Industrial Standard), fire prevention regulations, or the like, prescribed by public organizations. The invention intends to provide a new method for flame-retarding treating of wooden materials, which is easier and more economical than conventional methods, and also to provide a method for producing a flame-retarded plywood by using the new method.

10 Though building construction has not been so flourishing in Japan as compared with building construction during the period of the so-called "bubble economy", due to the policy for increasing domestic demands, as one of the policies for correcting the economic disparity between domestic and foreign economies, public investments undertaking in building houses, or the like, have been steadily carrying out. We often come across crane vehicles with their arms protruding into the sky here and there.

15 Reflecting this prosperity, new facilities or buildings such as civil halls or shopping centers have been constructed one after another not only in a metropolitan area but also in the rural cities, towns and villages. Not only for persons allowed to move into newly built houses or apartments, but also for the general public, spending time in newly built public facilities or commercial buildings has been significantly increased unknowingly, and thus opportunities surrounded by new building materials have been extremely increased.

20 Taking these circumstances into consideration, building related laws or regulations require several performances such as flame-retarding or noncombustible performances more than ever to new building materials, especially to those used in public spaces and portions or spaces such as kitchens where fire is used. It is believed that such laws or regulations will be more strengthened in the future, but never be loosened.

25 Though new building materials such as laminated plastic sheets, materials coated with plastic films, or the like, are suitable for decoration and are relatively cheap, almost all of them do not meet the above-mentioned laws or regulations. Conventional plywood is not allowed to be used under the laws or regulations. Thus, building materials which meet the above-mentioned laws or regulations will be limited to inorganic building materials such as natural stone, artificial stone, ceramic tile, or metal plates coated with inorganic materials. As a result, interior designs or plans are greatly restricted due to such limited building materials.

30 Therefore, when it is required by an owner or a designer to use wooden building materials at such portions where flame-retarding laws or regulations are imposed, such wooden materials must be qualified as flame-retarding materials such as flame-retarding plywood, wooden-bricks, or the like. However, such flame-retarding wooden building materials are terribly expensive.

35 The reason why such flame-retarding wooden building materials are extremely expensive is that a flame-retarding treating is difficult and complicated.

Most of the conventional flame-retarding treating have been done by using pressure reducing means or pressure increasing means so as to inject flame-retarding materials, mainly fine metal particles or other incombustible materials, into between woody fibers. Usually, such facilities as pressure reducing or pressure increasing means are very huge and expensive. In spite of their huge sizes, they are not suitable for mass production because of their limited processing capacity. Thus, the unit costs of productions become much higher because of the large amount of the investment to the facility and its limited processing capacity.

40 The applicant has been engaged in a permeation technique long in the field of dyeing and tried to apply the technique to various fields. The applicant had a chance to research and develop the application of the permeation technique to wooden materials. Various kinds of trials has been repeatedly done. As a result, by applying the particularity of wood cell structure, a very unique method has successfully been found, which enables to surely inject the predetermined liquid into between wooden materials and keep it therein under the normal temperature and pressure without any forced operations such as pressure reducing or pressure increasing. Furthermore, this invention is a novel method for flame-retarding treating of wooden materials by using an original permeation technique instead of the above-mentioned conventional technique. The details of this invention will be disclosed as follows.

SUMMARY OF THE INVENTION

50 This invention relates to the method for flame-retarding treating of wooden materials. The method includes the following steps. At first, flame-retarding materials are mixed with an aqueous solution such that the mixed solution includes the flame-retarding material of about 30 to 50%. The flame-retarding materials include ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride of about 30, 10, 10, 20, 20, 6, 2 and 2%, respectively. The aqueous solution includes only ether, or ether and alcohol of about 10%. Next, the mixed solution is heated and stirred for a predetermined time. After that, the heating is

stopped, and the mixed solution is sprayed directly onto the surface of the wooden materials set under the normal temperature and pressure while the temperature of the mixed solution is kept over 60°C. Then, spraying the mixed solution is stopped after the predetermined time when the weight of the wooden materials increases by at least about 20 to 30% of its original weight measured under the dry condition of about 10% hydrous rate. Finally, the wooden materials are dried under proper condition.

This invention also relates to a method for producing flame-resistant plywood which relates to the above-mentioned method.

In the method, a flame-retarding material is mixed with an aqueous solution such that the mixed solution includes the flame-retarding material of about 30 to 50%. The flame-retarding material includes ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride of about 30, 10, 10, 20, 20, 6, 2 and 2%, respectively. The aqueous solution includes only ether, or ether and alcohol of about 10%. The mixed solution is heated and stirred for a predetermined time. After that, heating is stopped, and the mixed solution is sprayed directly onto the surface of the wooden materials set under the normal temperature and pressure while the temperature of the mixed solution is kept over 60°C. Then, spraying of the mixed solution is stopped after the predetermined time when the weight of the wooden materials increases by at least about 20 to 30% of their original weight measured under the dry condition of about 10% hydrous. And the wooden materials are dried under proper condition. Finally, the wooden materials, for example wooden plates, are piled up and adhered by way of a proper heat-resisting adhesive layer therebetween.

BRIEF EXPLANATION OF THE DRAWINGS

FIGS. 1-3 are graphs showing a change of exhaust temperatures and smoke amounts of samples No. 1, 2 and 3 with the passage of time, respectively. These graphs are appended to a certificate of flame-retarding test (September 17, 1992, CHOUTEI No. 1518, certified by the chief director of the foundation, Akita prefecture industrial material laboratory) which complies with the Japanese rule, flame-retarding test 3rd grade.

FIGS. 4-6 are graphs showing a change of exhaust temperatures and smoke amounts of samples No. A, B and C with the passage time, respectively. These graphs are appended to a certificate of flame-retarding test (October 30, 1992, YOYO (SHI) No. 5, certified by the Superintendent of the Tokyo Fire Board) which complies with the Japanese rule of fire prevention, §63, 2nd clause.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be described in detail as follows.

A flame-retarding material is mixed with an aqueous solution including about 10 % of ether, or ether and alcohol. Then, the aqueous solution including the flame-retarding material is heated and stirred for a predetermined time so as to prepare a mixed solution which includes flame-retarding materials falling within the range of about 30 to 50%. The flame-retarding material includes a combination of ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride of, for example, about 30, 10, 10, 20, 20, 6, 2 and 2%, respectively.

Next, the mixed solution is sprayed directly onto a wooden material under the normal temperature and pressure for a predetermined time. The wooden material, for example, is a 2 to 3 mm-thick sawed wooden plate for flame-retarding plywood. This step may continue until the weight of the wooden material increases by at least about 20 to 30% of its original weight. The original weight is measured under dry condition at which the hydrous rate is about 10%. Then the wooden material is dried.

The flame-retarding material includes at least ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride, and their concentrations in the mixed solution are usually about 30, 10, 10, 20, 20, 6, 2, 2%, respectively. Their concentrations may be variable within a reasonable range. In a particular case such that, for example, a wooden material is easy to decay, the concentration of the ammonium bromide may be increased up to 20 to 30%.

Magnesium oxide, calcium phosphate and lanthanum chloride are prepared as their solutions.

A solvent (permeator) is selected from ether and/or alcohol which meets following requirements. First, it accelerates to dissolve the flame-retarding material into water. Secondly, it makes to open pits of the cells of the wooden materials, wherein the pits are usually formed in patches of sap and have valves which control transfer of water, and the pits are usually closed after the wooden materials are cut. Thirdly, it is harmless to the human body and cheap. Fourthly, it increases its dissolving ability as the temperature rises, and its velocity of evaporation is almost the same as that of water, thus even if the temperature of the mixed solution rises, the solvent will not evaporate earlier than water so as not to change the concentration. As a solvent which meets the above-mentioned requirements, diethyleneglycol monoethylether (KARUBITORU: $C_6H_{14}O_3$) among ether is preferably selected, and propyleneglycol (propane-

diol($C_3H_8O_2$) or triethyleneglycol($C_6H_{14}O_4$) among alcohol is preferably selected, each having relatively low molecular weight and the characteristic which increases the dissolving ability as the temperature rises.

The combination of ether and alcohol as a solvent firstly may be changed depending on the type of the wooden materials to be fire-retarding treated, for example, whether it is relatively lower grade and allows to change color as lauan, whether it is higher grade and does not allow to change color, or whether it is higher grade and has fine structure which is difficult to permeate. Further, the virulence of ether should also be considered. Ether having low molecular weight is economical but virulent. As a result, if economy is given priority, only ether is selected because ether is harmless to the human body and causes no problems even if it remains somewhat in wooden materials. However, if the function of the solvent is given priority over economy and virulence should be kept as low as possible, a mixed solvent including alcohol of up to about 30% is selected.

The above-mentioned solvent of 10% to water is mixed with the prescribed volume of flame-retarding material (ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride). After that, the mixed solution is stirred and heated by vapor heating for a predetermined time. The temperature of the mixed solution rises about 103 to 105°C because of the mixtures, and the solvent and the flame-retarding material are homogeneously dissolved in water. Thus, a predetermined mixed solution can be obtained.

Thus, the mixed solution is prepared which includes a preferable amount of the flame-retarding material falling within the range of about 30 to 50%. And heating and stirring the mixed solution is stopped, thereby dropping of the temperature. Soon after stopping heating and stirring, the mixed solution is sprayed, in a manner like a shower, onto the whole surface of the wooden material while keeping the temperature over 60°C. The flame-retarding material dissolved in the mixed solution permeates and gets fixed in the wooden material. This spraying step is kept until the weight of the material increases by about 20-30% of its original weight. The original weight is measured under dry condition at which the hydrous rate is about 10%. Though the spraying time varies depending on not only the quality and thickness of the wooden materials but also the type of the solvent, it usually continues about 20-24 hours. Then, the wooden material is dried by a conventional method. Thus, the flame-retarding treating is completed.

The permeating step is conducted such that the wooden material is hung in a sealed vessel and the pressurized mixed solution is evenly sprayed onto the whole surface of the wooden material in a manner like a shower through a nozzle set in the vessel while keeping the temperature of the mixed solution over 60°C. This spraying step should be continuously kept until the weight of the wooden material increases by about 20 to 30% of its original weight which is measured under dry condition when the hydrous rate is about 10%. The step can be conducted economically in the following circulating system. In the system, for example, the mixed solution is gathered in a reservoir with steam pipes installed in the lower part of a sealed vessel and is sprayed through the nozzle while controlling the solution temperature by passing steam through the steam pipes depending on the solution temperature detected by a sensor.

Then, the wooden material is taken out from the sealed vessel and transferred to a drying room so as to be dried by a conventional method. The drying method is carried out in an atmosphere in which an appropriate amount of dry air is mixed in steam of about 125°C. Thus, a flame-retarding material in a drying condition of 10% hydrous rate is obtained.

As a heat-resistant adhesive used in a flame-retarding plywood according to the present invention, resorcinol resin is most preferably used, which is an addition condensation type phenolic resin and has excellent properties such as being waterproof, chemical-resistant, aging-resistant and heat-resistant over 150 to 180°C, and formaldehyde (methanol) as a hardening agent is added to the resorcinol resin.

Because formaldehyde as a hardening agent generates formalin gas when heated, hexamethylenetetramine (UROTOROPIN), which is crystallized by adding ammonia water, is added to the hardening agent so as to prevent from generating formalin gas. And zirconium oxide (ZrO_2), zirconium carbide (ZrC) and tantalum carbide (TaC) are also added so as to improve the property of being heat-resistant. The ratio thereof is 3 : 1 : 1, respectively. They are mixed at 5% in total weight.

Predetermined pieces of thus obtained flame-retarding single wooden plates, for example 5 or 7 pieces of single wooden plates comprising a plywood, are prepared and are piled by way of the above-mentioned heat-resisting adhesive layer under pressure for a predetermined time by a conventional plywood manufacturing process to manufacture a flame-retarding plywood such as 5-ply flame-retarding plywood or 7-ply flame-retarding plywood.

INDUSTRIAL APPLICABILITY

The method for flame-retarding treating of wooden material according to the present invention only includes the steps of adding predetermined solvent (permeator) and flame-retarding material to water, heating and stirring the solution to obtain a homogeneous solution, and controlling the temperature of the solution over 60°C. Thus, the method for flame-retarding treating of wooden material can be simple and economical because pressure increasing or pressure reducing operation as required in conventional methods is not required in the present invention and the treating can be performed under a normal condition.

As compared with a conventional method which requires pressure increasing or reducing, based on a trial of a researcher of Yamagata prefecture industrial material laboratory, who is in charge of technical guidance, the cost of the equipment is one third or one fourth of that of the conventional equipment. In other words, though a conventional pressure-increasing or pressure-reducing equipment costs about several ten million yen to several hundred million yen, an equipment according to this invention costs about ten million yen. More concretely, in an equipment which can produce three hundred pieces of 12 mm thick flame-retarding plywood per day, the cost can be reduced to about one fifth to one tenth, and thus the consumer price thereof will be three thousand yen to four thousand yen. Therefore, the conventional plywood price of ten thousand yen to twenty thousand yen can be reduced to one third to one fourth thereof, thus this invention is very prominent for fire-retarding treating of wooden material.

The reason why the flame-retarding treating can be done by such a simple equipment may be as follows. The wooden materials are composed of a number of cells each partitioned by cell walls each having pits. The pits are closed after the wooden materials are cut and will further be firmly closed when heated or dried to prevent sap from moving from one cell to another. Therefore, after wooden materials are cut, the flame-retarding solution is not absorbed in the wooden materials because the pits are closed. However, the mixed solution, which is peculiar to this invention, especially a predetermined amount of the solvent (permeator) included in the mixed solution, opens the pits so as to promote the permeation of the flame-retarding materials into the cells of wooden materials.

The thus obtained flame-retarding wooden materials can be increased in weight by about 20 to 30% of its original weight. As shown in Table 1, the results of performance tests are reported in a certification of flame-retarding test (conducted on September 17, 1992, CHOTEI No.1518, certified by the chief director of the foundation, Akita prefecture industrial material laboratory) which complies with the JIS (Japanese Industrial Standard) A1321 flame-retarding test 3rd grade.

Table 1

Sample No.	No. 1	No. 2	No. 3
Size (mm)	220 x 220	220 x 220	220 x 220
Tem. time area ($^{\circ}\text{C} \cdot \text{mm}$)	0	7	9
Amount of smoke per area (C_A)	30	27	23
Flame remaining time (Sec)	0	0	0
Length of fusion or crack (mm)	None	None	None
Harmful deformation	None	None	None
Surface temp. ($^{\circ}\text{C}$)	45	45	50

Graphs.1-3 show the relationship between exhaust temperatures and smoke amounts of samples Nos. 1, 2 and 3, respectively. As understood from the graphs, flame-retarding performances which exceed the regulated level are attained.

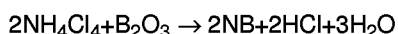
Good results shown in Table 2 are obtained from the certification of flame-retarding test(October 30, 1992, yoyo(shi) No.5, certified by the Superintendent of the Tokyo Fire Board) which complies with the Japanese rule of fire prevention, §63, 2nd clause.

Table 2

Sample		Surface test		
SAMPLES	Sample No.	A	B	C
	Size (mm)	220 x 220	220 x 220	220 x 220
	Thickness (mm)	13.3	13.0	13.1
	Weight (g)	542.6	500.0	548.6
Heating time (min)		6	6	6
RESULTS OF TEST	Test day	October 5, 1992		
	Exhaust temperatures and smoke amounts	Shown in Fig. 1	Shown in Fig. 2	Shown in Fig. 3
	Temp. time area (°C • mm)	0	0	0
	Coefficient of smoke(C _A)	46.5	49.5	51.7
	Flame remaining time(sec)	None	None	None
	Length • width of harmful fusion on crack (mm)	None	None	None
	Decreased weight by heating (g)	40.0	40.0	39.6
	Rear surface temp. (°C)	70	70	65
	Evaluation	Passed (good)	Passed (good)	Passed (good)

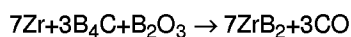
Graphs 4-6 show the relationship between exhaust temperatures and smoke amounts of samples No. A, B and C, respectively. As understood from the graphs, flame-retarding performances of the flame-retarding wooden materials obtained by the method of the present invention can be surely obtained, which exceed the predetermined flame-retarding performance required by public organization.

The flame-retarding performances may be obtained by the following reasons. The flame-retarding materials, which are fixed in the wooden materials, are decomposed by heating and incombustible materials such as ammonia gas, carbon dioxide, steam, or the like, are generated. These gases cover the surface of the wooden materials and prevent oxygen from being supplied into the wooden materials. These gases also take dissolution heat away from the wooden materials, thereby preventing the temperature of the wooden materials from rising. The flame-retarding materials contribute to flame-retarding of the wooden materials changed by heating. For example, the flame-retarding materials such as lanthanum chloride, borax, or ammonium chloride, or the like, produces material whose melting point is very high by heat reaction between themselves as follows.



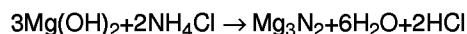
In this example, the melting point of NB is 3000 °C.

And if some materials such as zirconium oxide (ZrO₂), zirconium carbide (ZrC) and tantalum carbide (TaC) are added to the heat-resistant adhesive for plywood, a high melting point material is produced as follows,



In this example, the melting point of ZrB₂ is 3000°C.

Also a high melting point material, Mg₃N₂, is produced as follows.



Furthermore, zirconium oxide is produced by heating zirconium sulfate, Zr(SO₄)₂ over 380°C, and magnesium oxide is produced by heating over 350°C. The melting points of these materials are 2700°C and 2852°C, respectively.

As above-mentioned, the method for flame-retarding treating of wooden materials according to the present invention does not require compulsory permeation operation such as pressure increasing or decreasing operation as

required in the conventional methods, and enables flame-retarding materials to easily permeate into the cells of the wooden materials or their vicinities and fix therein by using the peculiar mixed solution under the normal temperature and pressure (normal condition). Thus, flame-retarding treating can be done by a very simple equipment. Also because of using the function of the plant organ, the permeation can be done very smoothly with high efficiency. Thus, this method enables to remarkably reduce the costs compared to the conventional methods.

Furthermore, because by heating the flame-retarding materials in the wooden materials or the heat-resistant adhesive itself, the mixture of the flame-retarding materials or the mixture of the flame-retarding materials and the heat-resistant adhesive is effective, the flame-retarding performances by the flame-retarding treating or by the manufacturing method for flame-retarding plywood using the same treating is very reliable. Therefore, they can meet the public requirements and can be widely used in buildings and structures. Also they will contribute to spread fire-prevention facilities and be helpful to protect people's lives and fortunes.

Claims

1. A method for flame-retarding treating of wooden materials, including the steps of:

mixing flame-retarding materials with aqueous solution including about 10% of ether, or ether and alcohol, said flame-retarding materials including ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride of about 30, 10, 10, 20, 20, 6, 2 and 2%, respectively, and the concentration of said flame-retarding materials being about 30 to 50% to said aqueous solution;

heating and stirring said solution for a predetermined time;

stopping heating said solution;

spraying said solution directly onto the wooden materials under room temperature and pressure while the temperature of said solution is kept over 60°C;

stopping spraying when weight of said wooden materials increases by at least about 20 to 30% of its original weight of about 10% aqueous dry condition.

2. A method of manufacturing flame-retarding plywood utilizing the method as recited in claim 1, including the steps of:

mixing flame-retarding materials with aqueous solution including about 10% of ether, or ether and alcohol, said flame-retarding materials including ammonium phosphate, ammonium bromide, boric acid, borax, ammonium chloride, magnesium oxide, calcium phosphate and lanthanum chloride of about 30, 10, 10, 20, 20, 6, 2 and 2%, respectively, and the concentration of said flame-retarding materials being about 30 to 50% to said aqueous solution;

heating and stirring said solution for a predetermined time;

stopping heating said solution;

spraying said solution directly onto wooden plates under room temperature and pressure while the temperature of said solution is kept over 60°C;

stopping spraying when weight of said wooden materials increases by at least about 20 to 30% of its original weight of about 10% aqueous dry condition;

drying said wooden materials; and

adhering the wooden plates with each other by way of a heat-resisting adhesive layer.

3. The method for flame-retarding treating of wooden materials, or a method for manufacturing plywood, as recited in claim 1 or 2, wherein the content of the alcohol in the aqueous solution is about 0 to 30% as compared to said ether.

4. The method for manufacturing flame-retarding plywood as recited in claim 2 or 3, wherein said adhesive is made by adding zirconium oxide, zirconium carbide, tantalum carbide and formaldehyde added ammonia water as a hardening agent, to resorcinol resin, the content of the hardening agent being 20 parts.

FIG. 1

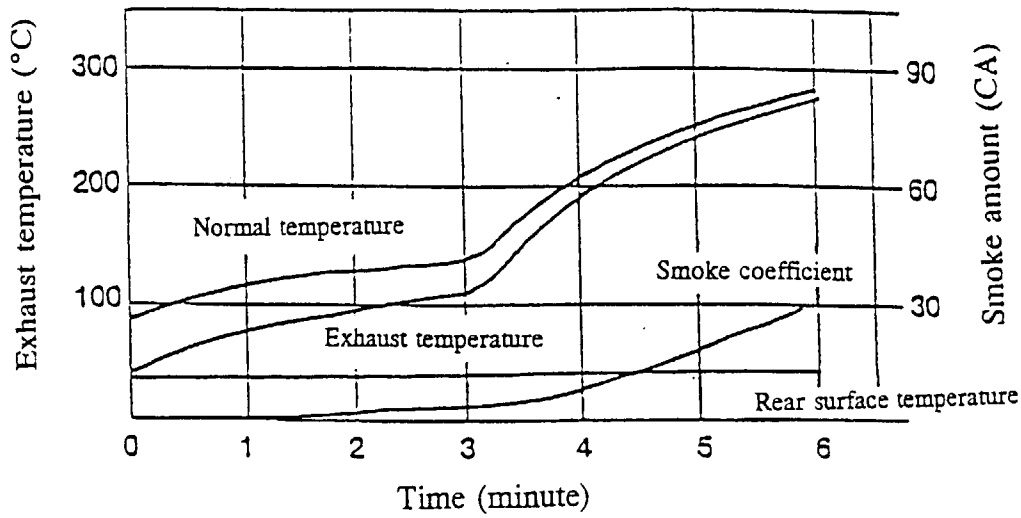


FIG. 2

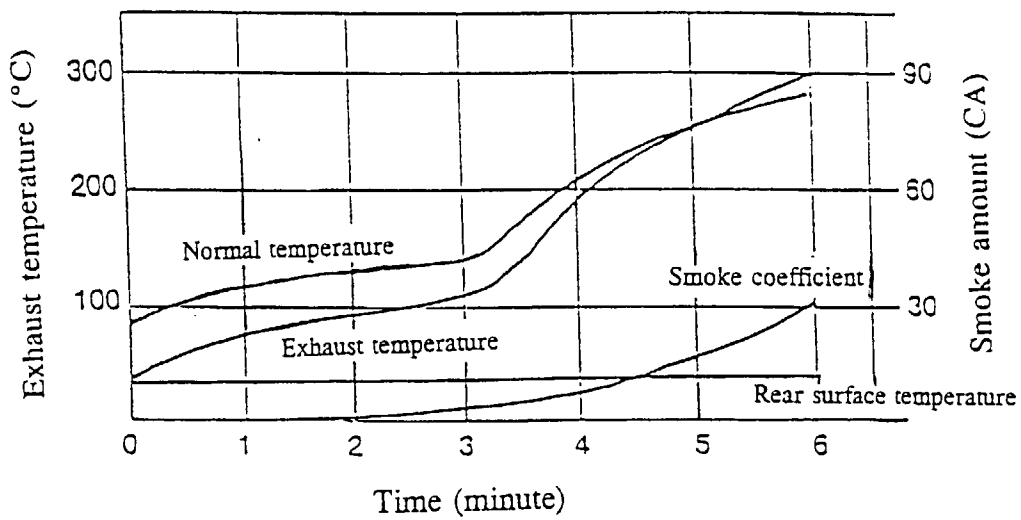


FIG. 3

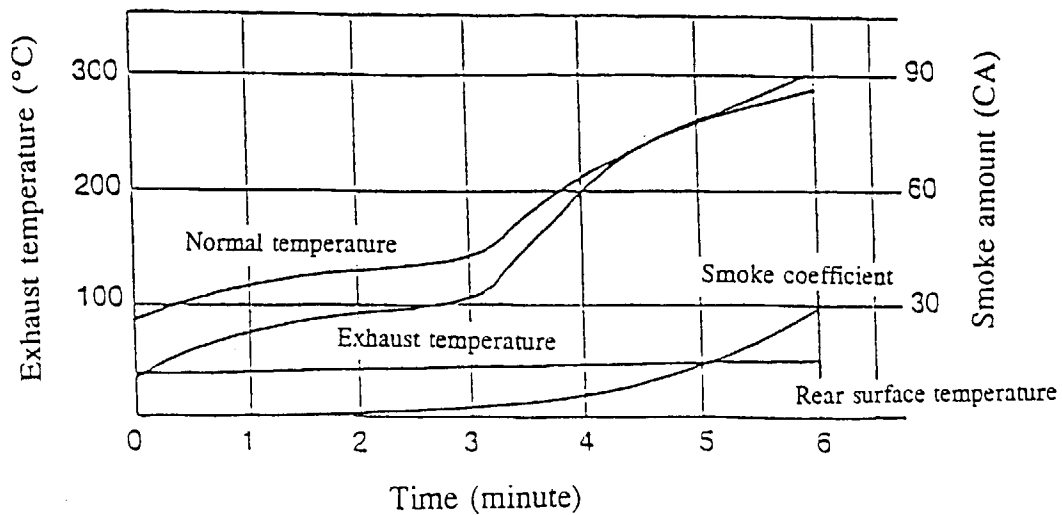


FIG. 4

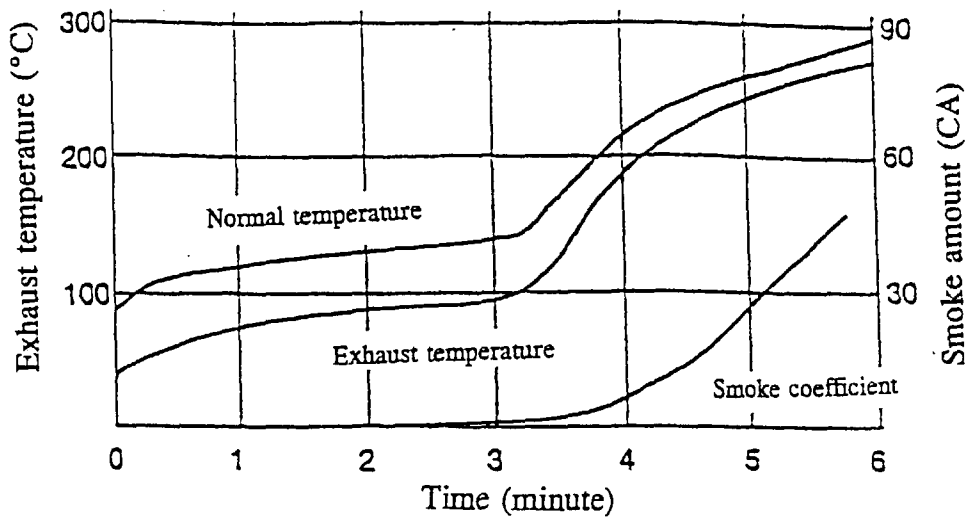


FIG. 5

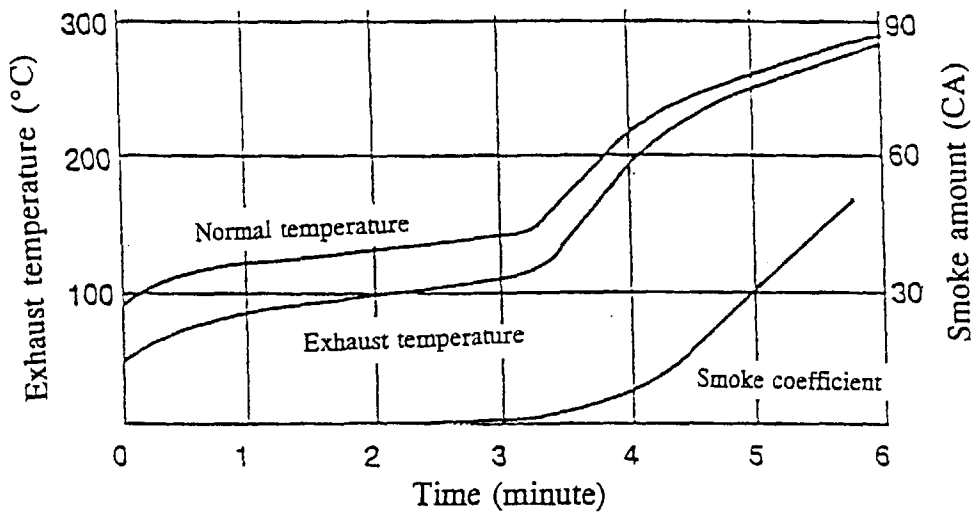
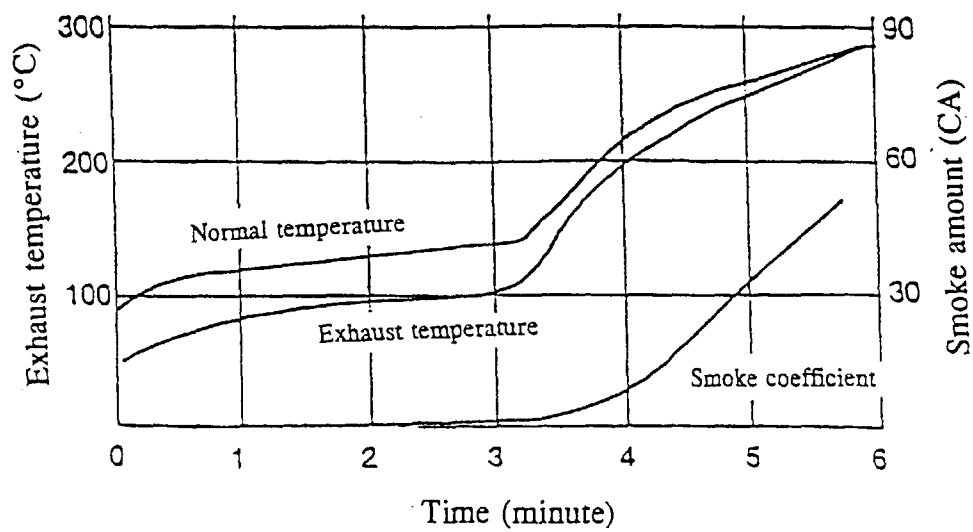


FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP96/01189

A. CLASSIFICATION OF SUBJECT MATTER Int. Cl ⁶ B27K3/52 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int. Cl ⁶ B27K3/00-B27K3/52 Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1933 - 1996 Jitsuyo Shinan Kokai Koho 1972 - 1996 Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP, 4-173102, A (Sueo Ishikawa), June 19, 1992 (19. 06. 92) (Family: none)	1 - 4
A	JP, 62-231074, A (Tomoaki Murata), October 9, 1987 (09. 10. 87) (Family: none)	1 - 4
A	JP, 62-20584, A (Hiisus Mryo Kontorelas), January 29, 1987 (29. 01. 87) (Family: none)	1 - 4
A	JP, 53-51699, A (Ermanno Savio), May 11, 1978 (11. 05. 78) & BE, 856993, A1 & SE, 7708386, A & DE, 2732561, A1 & FR, 2359194, A1 & BR, 7704843, A & US, 4102794, A & AU, 2716377, A1 & AU, 511818, B2 & GB, 1589021, A & FR, 2349194, B1 & IT, 1070005, A & IT, 1075018, A	1 - 4
A	JP, 49-49498, A (The Furukawa Electric Co., Ltd.), May 14, 1974 (14. 05. 74) & JP, 51-035078, B4	1 - 4
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search September 5, 1996 (05. 09. 96)		Date of mailing of the international search report September 17, 1996 (17. 09. 96)
Name and mailing address of the ISA/ Japanese Patent Office Facsimile No.		Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)