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(54) **METHOD FOR LINING METALLURGICAL UNITS**

(57) The present technical solution, in general, relates to the field of metallurgy, more particularly to technologies for lining metallurgical units and other thermal units by the shotcrete method and to the realization thereof in apparatus terms. The method for lining metallurgical units comprises cleaning the surface to be lined with shotcrete concrete of contaminating elements; mixing the shotcrete concrete with water using equipment for preparing a concrete mix; directing the concrete mix produced in the previous step to a concrete pump and then, via a pipeline, further to the work site where the mix is applied on the lining, wherein a nozzle for applying the concrete mix is fitted at the end of the pipeline; applying the concrete mix on the prepared surface for lining with shotcrete concrete by mixing the concrete mix with a hardener at the nozzle. The technical result consists in reduced consumption of refractory materials used for lining the working layer of walls of metallurgical units.

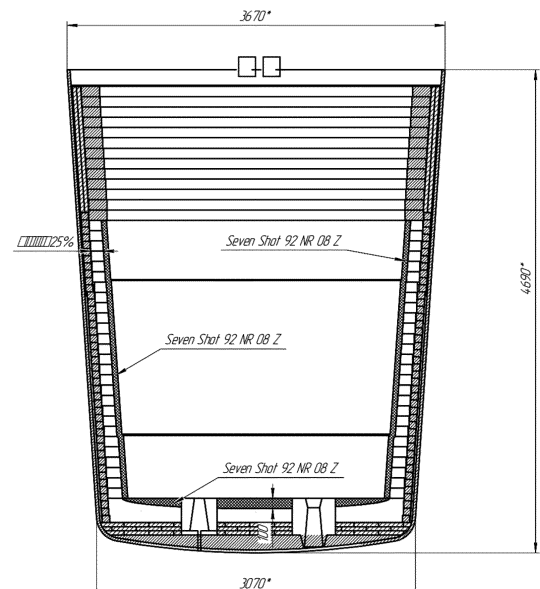


Fig. 1

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Description

TECHNOLOGY

- 5 **[0001]** This technical solution generally refers to the field of metallurgy, namely the technologies of lining metallurgical and other thermal units by the method of shotcreting and its hardware design.

THE LEVEL OF TECHNOLOGY

- 10 **[0002]** From the level of technology is known the way of lining the shotcreting of the surfaces of various units and the design of the device for its implementation are given in the reference literature. (Editorial Board: Yuri Stepanov, F.S. Demjanjuk, A.A. Znamensky, etc.) 1956, p. 954, the term "shotcreting." The method involves the application of a special cement solution (for metallurgical units -fire-resistant mixture) under the influence of compressed air, carried out by means of cement-gun (device for lining). The dry mixture is loaded into a cement cannon, from which under air pressure enters the hose, ending with a tip-nozzle. Before entering the nozzle, the mixture is automatically wetted. The resulting shotcrete concrete (pneumobeton) has great strength, density, water and breathability.
- 15 **[0003]** The lack of shotcrete technology is that the application speed of the material is 1.0-1.5 tons per hour (at a mass density of 3.0-3.20 tons/m³), while the photocreet technology allows 6-16 tons of material per hour at the same density. In addition, the lack of shotcrete technology is lower than the citation technology, the performance of the material, namely, its mechanical strength, porosity and density of padding, which ultimately affects the durability of metallurgical and other thermal units.
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THE ESSENCE OF A TECHNICAL SOLUTION

- 25 **[0004]** This technical solution is aimed at eliminating deficiencies known from the level of technology.
- [0005]** The main technical task or technical problem solved in this technical solution is to change the basic model of operation of the metallurgical unit, such as the steel bucket.
- [0006]** The technical result achieved in meeting the above technical problem is to reduce the consumption of fire-resistant materials used to lining the working layer of the steel mills.
- 30 **[0007]** This technical result is achieved using shotcrete technology and related equipment, informal fire-resistant concretes based on tabular alumina and special additives.
- [0008]** An additional technical result is an increase in the duration of the metallurgical unit's work campaign and a reduction in the total consumption of fire retardant.
- [0009]** In addition, accidents with metal leakage through the lining are reduced, and the turnover time of metallurgical units in operation increases, which allows to increase the amount of steel smelted.
- 35 **[0010]** This technical result is achieved through the implementation of a method of lining metallurgical units, in which the surface intended for lining with a strip-concrete from polluting elements is cleaned; Mix shotcrete with water through concrete mixing equipment; Direct the concrete mixture received on the previous step in a concrete pump, and then along the highway to the place of work and applying the mixture on the lining, and at the end of the highway there is a nozzle for the application of concrete mixture; Apply the concrete mixture to the prepared surface for lining the shot-concrete by mixing the concrete mixture with the hardener on the nozzle.
- 40 **[0011]** In some variants of the technical solution when mixing fire-resistant components, the shotcrete is a low-cement shotcrete or ultra-cement concrete based on tabular alumina and/or corundum with the addition of Al_2MgO_4 -spinel or shot-concrete on the basis of melted or baked periclase with the addition of melted Al_2MgO_4 -spinel or 6-valent chromium oxide.
- 45 **[0012]** In some variants of the technical solution, the concrete mixing equipment is a pneumatic vessel with a built-in forced mixer and/or blade mixer, for the processing of fireproof masses and a pump for concrete supply.
- [0013]** In some variants of the technical solution, the water temperature ranges from 5 degrees Celsius to 30 degrees Celsius.
- 50 **[0014]** In some variants of the technical solution, the hardener is sodium silicate.
- [0015]** In some variants of the technical solution, water consumption is carried out in the range of 4-10% of the total concrete mixture.
- [0016]** In some variants of the technical solution, the time of mixing the concrete mixture after the water is added is 2 to 10 minutes.
- 55 **[0017]** In some variants of the technical solution, the shotcrete is wetter after shuttering than vibrable concrete.
- [0018]** In some variants of the technical solution, fireproof material is cleaned with jackhammers and/or chain cutters.
- [0019]** In some variants of the technical solution, when applying the concrete mixture on the necessary surface, it is heated with a heat cannon or by placing a concrete mixture in a warm room.

[0020] In some variants of the technical solution, the concrete mixture is applied to the necessary surface of the lining continuously.

[0021] In some variants of the technical solution, the concrete mixture is applied to the necessary surface of the lining with one layer of 10-100 mm thick.

5 **[0022]** In some variants of the technical solution, when applying the concrete mixture to the necessary surface of the lining, the thickness of the application is determined by the wear and tear of the wall in the areas of steel holes and/or blowing plugs, and/or the side of the side and the condition of the rows of bricks adjacent to the slag belt.

[0023] In some variants of the technical solution, the concrete mixture is applied to the necessary surface of the lining, and the nozzle is held perpendicular to the surface of the lining.

10 **[0024]** In some variants of the technical solution, the concrete mixture is applied to the necessary surface of the lining, and the nozzle is kept at a distance of 0.5-1.2 meters.

SUMMARY OF THE DRAWINGS

15 **[0025]** The signs and benefits of this technical solution will be evident from the detailed description below and the accompanying drawings on which:

On Fig. 1 shows an example of the implementation of a metallurgical unit.

20 On Fig. 2 shows an example of the implementation of the GS800 cleaning unit, a rotary type.

On Fig. 3 shows an example of the dismantling of the remnants of slag and steel from the brick lining.

25 On Fig. 4 shows an example of the implementation of the installation of fireproof lining from the table (second belt).

On Fig. 5 shows the version of the implementation of the schedule of exposure, drying and heating of the steel bucket 380 tons.

DETAILED DESCRIPTION OF THE INVENTION

30 **[0026]** The terms and definitions used in the description of this technical solution will be discussed in detail below.

[0027] "0032" Futerovka - cladding fireproof, chemically resistant, as well as insulation materials, which covers the inner surface of metallurgical furnaces, boilers, boilers, and other equipment.

35 **[0028]** Shotcrete is a progressive way of applying one or more layers of cement, sand, functional additives, and water to the surface under compressed air pressure.

[0029] Fireproof materials (more - fire retardants) - non-metallic material with fire resistance is not lower than the temperature of 1580 degrees Celsius, used in units and devices to protect against the effects of thermal energy and gas, liquid, solid aggressive reagents.

40 **[0030]** The metallurgical unit is a set of structurally connected technological equipment and devices, providing a complex metallurgical process in the conditions of mass and flow production. The metallurgical unit has higher performance, energy intensity and product quality, and allows for more efficient solutions to production automation and environmental protection.

45 **[0031]** The method of lining the metallurgical units, performed in steps, will be revealed in detail below. As an example of the implementation of a metallurgical unit, this solution describes a steel bucket, but it is obvious to any specialist that the implementation is not limited to them.

[0032] Step 101: Clean the surface designed to be lining with a strip-concrete from the contaminant elements.

[0033] Surface preparation requires the use of correct methods of dismantling concrete and properly cleaned surfaces.

[0034] Before applying a shot-concrete surface of a brick or a layer of concrete using a monolithic lining of metallurgical units, it is necessary to clean the dust, remnants of slag, steel, and a reborn fire-retarder, as shown by Fig. 3.

50 **[0035]** Cleaning can be done with jackhammers or specialized equipment (such as a chain cutter), such as the GS800 cleaning unit, a rotary type, as shown in Fig. 2. The rotating head is reinforced by chains that clean the surface of the brick lining when rotating. In some implementation options, the preparation of a metal surface involves cleaning from loose rust, exfoliating scale and other contaminants. Preparation of the repaired lining includes removal of weak, peeling and destroyed areas on the entire thickness of the layer of shotcrete to a metal surface or to an insulating underlay with exposure of at least two anchors, blowing the surface with compressed air and, if necessary, installation of additional anchors and nets provided by the project. When blowing the surface to reduce dusting, it is recommended to enter a small amount of water.

[0036] Step 102: Mix the shot-concrete with water through concrete mixing equipment.

[0037] In this technical solution to ensure the durability of the walls of metallurgical units (without breaking the residual brick layer and accordingly without installing a new set of fire retarders for the working layer of the walls after 80 smelters) at the level (approximately A 40-40 (80) -40-120 smelting (the duration of the campaign for wall durability in the metal area) can be used as a hardener. In this technical solution, for example, periclase-carbon brick or aluminium operic carbon brick can be used as fire retardant. This technical solution can also be used for other fire retardant. As a shot-scratch-concrete can be used, for example, low-cement shotcrete or ultra-low-cement concrete based on tabular alumina and/or corundum with the addition of melted Al₂MgO₄-spinel (also possible use of shotcrete based on melted or baked periclase with the addition of melted Al₂MgO₄-spinel), on the hydraulic band of the brand 92 In other implementation options, not limited to them, chromium 6 valent oxide can be used as an additive. Sodium silicate is an additional but integral material for the process. The consumption of liquid glass (sodium silicate) can be in the range of 12-18 kg/ton of used concrete.

[0038] In the approximate version of the implementation, the number of materials for a single steel bucket (to extend the campaign from 80 to 120 smelters) may be as follows:

Название материала	Количество	Единицы изм.
Seven Shot 92 NR 08 Z	6	ТОНН
Sodium Silicate	90/122	литров/кг

[0039] The amount of Seven Shot 92 NR 08 material to repair the steel bucket walls in the metal area can be laid based on the thickness of the material applied from 10 to 100 mm (the thickness of the layer can be reduced, and the material can be distributed accordingly to other areas and/or the continuation of the campaign).

[0040] As an example of the implementation, they receive an order for the implementation of the lining for 20 tons of shotcrete and it is added 400 kg of sodium silica (the calculation is in the proportion of 1:20 kg, as the plant in the production of work there are losses of material when setting equipment, equipment winding and other negative factors). Shotcrete masses are concrete on a cement bundle and are therefore sensitive to moisture, hence they should be stored in a dry enclosed area. The liquid binder should be stored at a temperature not lower than 5 degrees Celsius.

[0041] All equipment and tools for making the concrete mixture must be cleaned of previous wet and dry materials. The cleaning equipment can be used as a pneumatic vessel with a built-in forced mixer to handle fire-resistant masses, such as the ESTROMAT 850 and/or REED models, and a concrete pump, such as the SCHWING SP 500. Cleaning is carried out with a high-pressure water pump and a hand tool.

[0042] The water used in the plant to shutter the concrete can be used to shut the concrete (the use of purified water is prohibited in chemically purified water, which negatively affect the durability of the fire, as they create light-melting compounds during the operation of the shotcrete layer). The recommended water temperature ranges from 5 degrees Celsius to 30 degrees Celsius, since at low water temperature the time of grasping concrete increases, and at high temperature is greatly reduced. Water consumption should be within the limits specified in the relevant technical sheet (for example, it can be specified in the range of 4-10%), then there is not enough moisture of concrete and it turns dry.

[0043] Step 103: send the concrete mixture received on the previous step into a concrete pump, and then along the highway to the place of work and application of the mixture on the lining, and at the end of the highway there is a nozzle for the application of concrete mixture.

[0044] After the mixture is prepared, ready to be applied, the fireproof concrete is produced in a concrete pump, and then on the hoses to the place of work and applying the material on the lining.

[0045] After the finished mixture is inserted into the pump's receiving bin, the material is delivered to the transport system at the lowest possible speed until the mixture appears at the site of the hose connection with the nozzle. To connect the nozzle to the material hose, compressed air hoses and binder material, the supply of material on the transport system stops.

[0046] Two nozzles directly carrying out the work are in the bucket. Take the collected nozzle and only on their command begins the presentation of material for the installation of fireproof lining. The technician on the concrete mixer continues to work on the preparation of the mixture.

[0047] Step 104: Apply the concrete mixture to the prepared surface for lining the shot-concrete by mixing the concrete mixture with the hardener on the nozzle.

[0048] All work on the installation of fireproof lining begins with preparatory activities:

1. Transporting equipment to the place of work.
2. Determining where the equipment and tool are installed.

3. Opening of the outfit - admission to carry out works.

[0049] Identify energy hotspots.

[0050] 5. Installation of basic and support equipment.

[0051] 6. Checking the health of the equipment in idle mode.

[0052] This diameter allows to create a higher density of fireproof lining, reduces the amount of rebound, as opposed to a diameter of 50 mm.

[0053] The installation of the fire-resistant lining should be initiated at the end of all preparatory activities.

[0054] Before applying the mixture to the prepared surface, the pipeline is lubricated.

[0055] A mixture is prepared to lubricate pipes and hoses. For greasing, an adhesive or shambolic mortar (1 pack of glue per 10 liters of water) is used, and 20 liters of lubricant must be prepared. This lubricant reduces the friction factor of the concrete when moving it through pipes and hoses. You can also use technical lubricant, such as litol or solidol. This operation is used at each beginning of the work on the shotcrete (if the pipeline of concrete supply was flushed). Technicians, directly located on the work site, pour the mixture into the hose supply of concrete. The adapter is joined and under the influence of compressed air there is an even distribution of lubricant throughout the pipeline.

[0056] On the nozzle, compressed air mixes concrete with the SODIUM SILICATE hardener (in winter, the hardener is heated to 15-25 degrees Celsius, with a heat cannon) and applied to the desired surface. From the concrete pump departs the main, which is the supply of material to the place of work, and at the end of this highway installed a nozzle, which is served liquid glass (sodium silicate) and compressed air. Heating is carried out with heat cannons or in some implementation options by placing a concrete mixture in a warm room.

[0057] Depending on the degree of wear and tear of the work lining on the fireproof material, which can be a brick, the application of the shotcrete is carried out continuously in one layer of thickness of 10-100 mm. The level of wear is usually determined at the site of the lining, depending on the procedure used by the lining of the steel in the enterprise and the scheme of hot repairs. Usually, the thickness of the application is determined by the wear of the wall in areas of steel holes, blowing corks, the edging side, and the condition of the rows of bricks adjacent to the slag belt. Shot fixing should not be interrupted because the concrete can begin to grasp in the highways and the concrete pump, which will lead to the stop of equipment for washing and washing. The nozzle should always be kept perpendicular to the surface of the application at a distance of 0.5-1.2 meters. It is at this distance of application of the mixture there is a denser application of concrete, which allows to achieve the stated indicators of strength, porosity. This distance contributes to the denser structure of the fire-resistant material after application, which will allow longer to operate the metallurgical unit." The perpendicular location of the nozzle relative to the surface on which the application occurs is due to the amount of bounce and the quality of the applied layer. The material is applied immediately necessary thickness from the bottom-up of the application site, which allows to control the thickness of the installed concrete and the quality of the installation. The rebound is never combined with the material and is not reused. After applying the shot-concrete on the walls, from the working bottom of the steel bucket removed the rebound and repaired the lining of the bottom. The use of the indicated technical solution ensures the specific consumption of fire retardant on the working layer of the walls at the level of 131 smelting:

- 0 heats - cold repair
- 40 heats - hot repair (repair of slag belt), photocreating walls (2-4 tons);
- 80 heats - wall-fixing (2 t.);
- 120 heats - the end of the campaign.

[0058] Technically, the installation of a fireproof bucket lining can consist of two belts vertically. The first belt of the lining is applied from the bottom of the steel bucket to a height of about 1.5 meters. The second belt of the lining is applied from the table, which is lowered into the bucket after the installation of the lining of the first belt, as shown in Fig.

4. The height of the second belt of the lining is limited by the height of the brick lining of the steel zone.

[0059] The formwork is not used in the installation of the lining, with the aim of creating a monolithic lining. The application of the material is carried out in a circle, first there is a "spraying" about 10-15 mm thick, on the second application formed the necessary thickness of the lining. Also, the work can be used a system of beacons, that is, at the height of the belt are made vertical strips of material width of 200-300 mm, with a step of 1.5-2 meters of the necessary thickness (thickness controls the second nozzle located also in the bucket), and then the material between the beacons is applied.

[0060] The thickness of the lining depends on the residual thickness of the brick lining. In this technical solution developed technology that the application of lining more than 100 mm is not appropriate, there is exfoliation, when drying

formed a lot of cracks.

[0061] The average thickness of the applied lining should not be more than 30-60 mm. The exception is the place of slag draining and battle zone, here the thickness of the lining reaches up to 100 mm. Therefore, the nozzle and controlling technician visually determine the thickness of the applied lining.

[0062] When installing a fireproof lining with negative environmental values, it is necessary to take early measures to store the material and binder in a room with a positive temperature, at least 5 days before the installation of the lining.

[0063] At the end of the work, work is carried out on the washing of equipment and pipeline, disconnection from energy, is completed and transported to the storage site.

[0064] An integral part of the fireproof lining is drying.

[0065] Before drying, it is necessary to withstand the applied lining for 4 hours, during aging it is necessary to ensure the temperature of the air in the steel bucket and its metal structure at least 5 degrees Celsius.

[0066] When designing drying schedules, the drying and heating stands are based on the possibility. It is necessary to organize the aging of concrete at temperatures of 150 degrees Celsius and 450 degrees Celsius, in the future the speed of heating concrete is unlimited and is determined by the possibility of a warm-up stand. In practice, the schedule of aging, drying, and heating, roughly shown on Fig, is applied. 5.

[0067] Specific tests of the way the lining and repair of the steel bucket by Seven Refractory confirms the industrial applicability of the invention.

[0068] The modifications and improvements of the above incarnations of this technology may be obvious to technicians in the field. The above description is given as an example, not for the establishment of limitations. The scope of this technology, therefore, can be limited only by the amount of the attached formula of invention.

Claims

1. A method for lining metallurgical units, including the following steps:

- Clean the surface designed for lining with shotcrete from polluting elements;
- Mix shotcrete with water through concrete mixing equipment;
- Direct the concrete mixture received on the previous step in a concrete pump, and then along the highway to the place of work and applying the mixture on the lining, and at the end of the highway there is a nozzle for the application of concrete mixture;
- Apply the concrete mixture to the prepared surface for lining the shot-concrete by mixing the concrete mixture with the hardener on the nozzle.

2. The method of lining metallurgical units according to claim 1, **characterized in that**, when mixing fire-resistant components shotcrete is a low-cement shotcrete-concrete or ultra-low-concrete concrete based on tabular alumina and/or corundum with the addition of melted Al_2MgO 4-spinals, or shotcrete-concrete based on melted or baked periclase with the addition of melted Al_2MgO_4 spinel's or 6-valent chromium oxide.

3. The method of lining metallurgical units according to claim 1, **characterized in that** the equipment for the preparation of concrete mixture is a pneumatic vessel with a built-in forced mixer and/or blade mixer, for processing fireproof masses, and a pump for feeding concrete.

4. The method of lining metallurgical units according to claim 4, **characterized in that** the water temperature is in the range of 5 degrees Celsius to 30 degrees Celsius.

5. The method of lining metallurgical units according to claim 1, wherein the hardener is sodium silicate.

6. The method of lining metallurgical units according to claim 4, **characterized in that** the water consumption is carried out in the range of 4-10% of the total concrete mixture.

7. The method of lining metallurgical units according to claim 4, **characterized in that** the time of mixing the concrete mixture after the addition of water is from 2 to 7 minutes.

8. The method of lining metallurgical units according to claim 1, **characterized in that** the shotcrete-concrete after shutter is more humid than vibrable concrete.

9. The method of lining metallurgical units according to claim 1, **characterized in that** clean fireproof material jack-

hammers and/or chain cutter.

5 10. The method for lining metallurgical units according to claim 1, **characterized in that** when applying the concrete mixture on the necessary surface it is heated with a heat cannon or by placing a concrete mixture in a warm room.

11. The method for lining metallurgical units according to claim 1, **characterized in that** they apply the concrete mixture on the necessary surface of the lining continuously.

10 12. The method for lining metallurgical units according to claim 1, **characterized in that** they apply a concrete mixture on the necessary surface of the lining with one layer of thickness 10-100 mm.

15 13. The method for lining metallurgical units according to claim 1, **characterized in that** when applying a concrete mixture to the necessary surface of the lining, the thickness of the application is determined by the wear of the wall in areas of steely holes and/or blowout plugs, and/or the side of the cable and the condition of the rows of bricks adjacent to the slag belt.

14. The method of lining metallurgical units according to claim 1, **characterized in that** they apply a concrete mixture on the necessary surface of the lining, and the nozzle is held perpendicular to the surface of the lining.

20 15. The method for lining metallurgical units according to claim 1, **characterized in that** they apply a concrete mixture on the necessary surface of the lining, and the nozzle is kept at a distance of 0.5-1.2 meters.

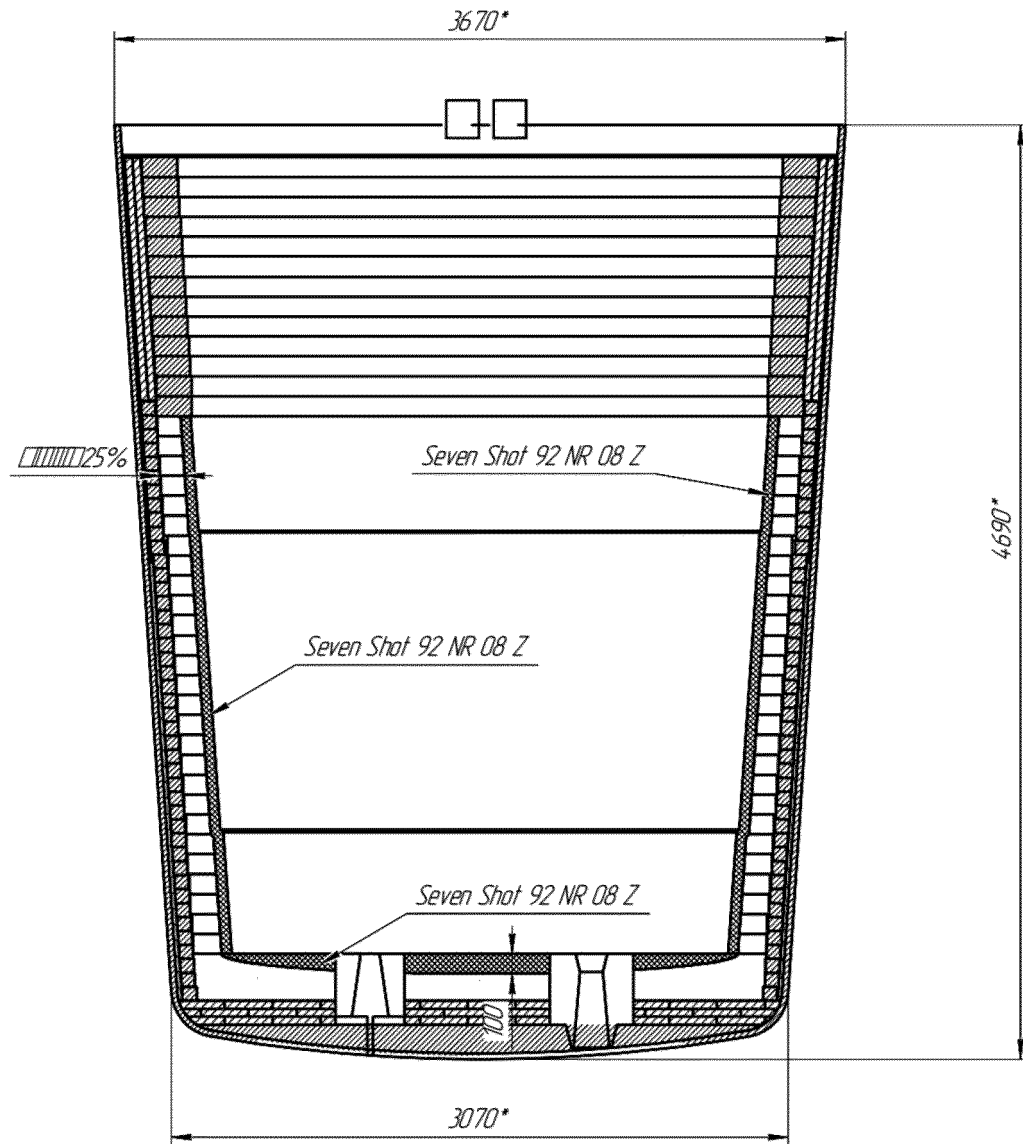


Fig. 1

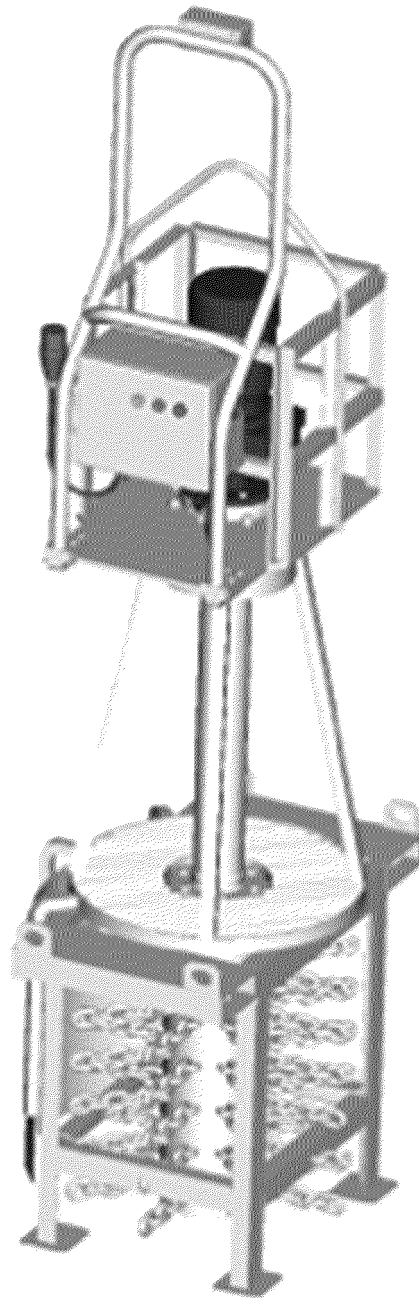


Fig. 2

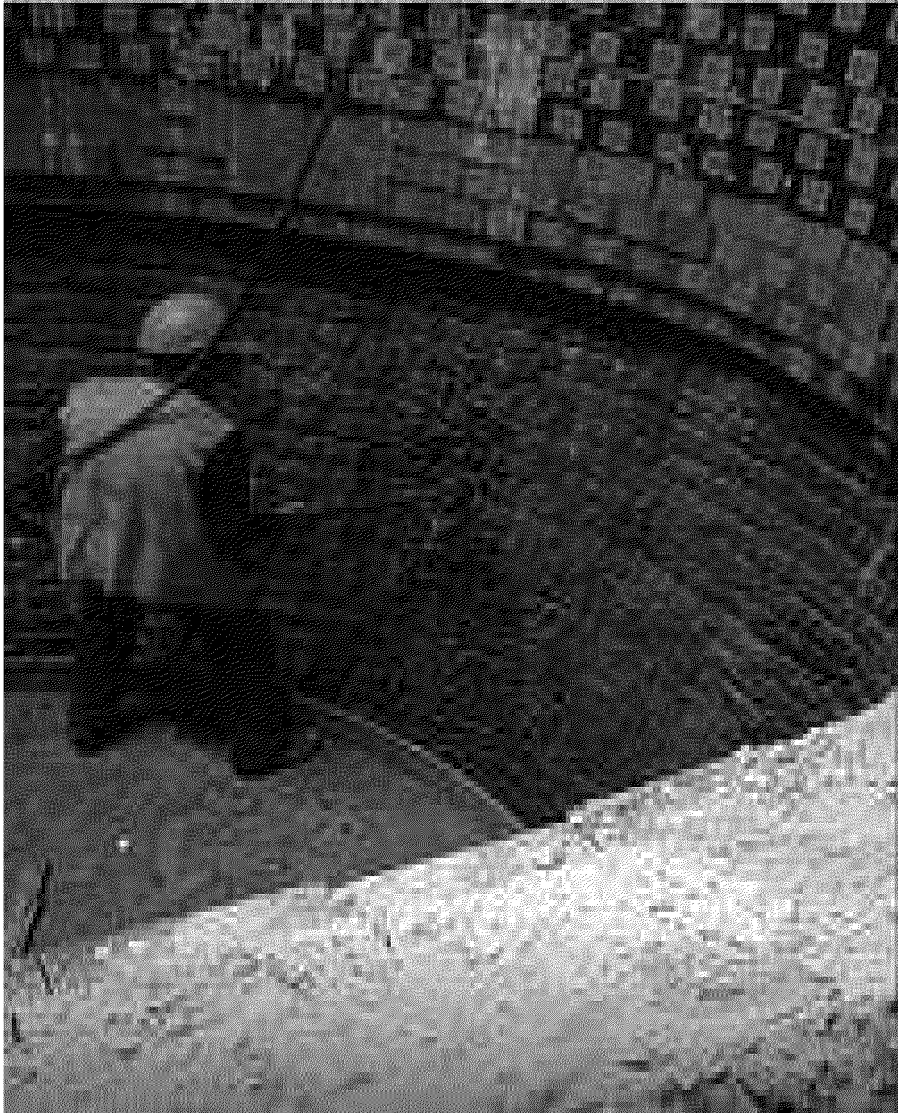


Fig. 3



Fig. 4

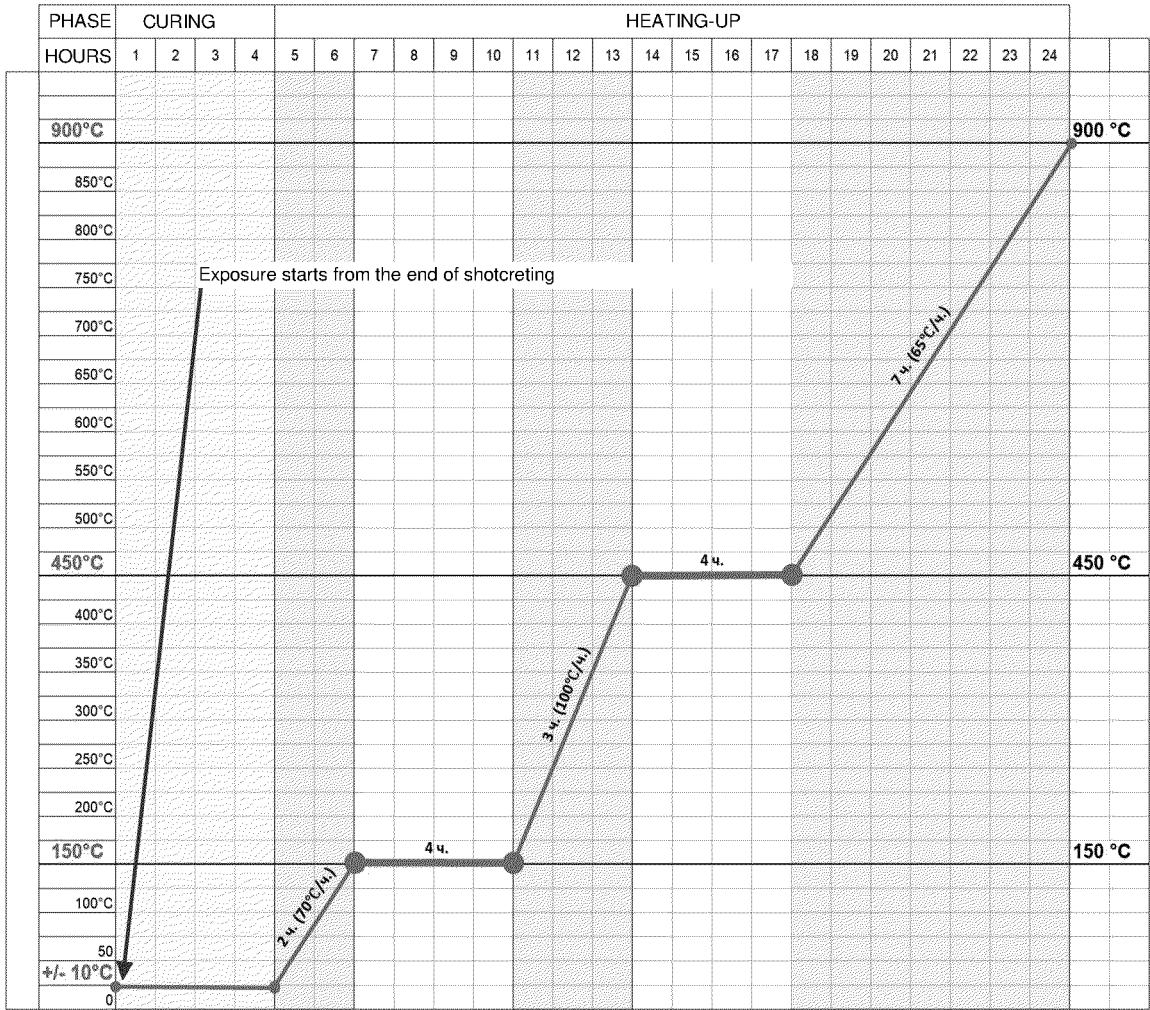


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2020/000546

A. CLASSIFICATION OF SUBJECT MATTER (see the supplemental sheet) 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) F27D 1/00-1/16, F27D 1/00-1/10, C21B 7/00-7/06, B22D 41/00-41/02, B22D 13/00-13/10, C21B 9/00-9/06																	
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched																	
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) Espacenet, PatSearch, PAJ, WIPO, USPTO, RUPTO																	
C. DOCUMENTS CONSIDERED TO BE RELEVANT																	
<table border="1"> <thead> <tr> <th>Category*</th> <th>Citation of document, with indication, where appropriate, of the relevant passages</th> <th>Relevant to claim No.</th> </tr> </thead> <tbody> <tr> <td>X</td> <td>RU 2692390 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTIU "SEVEN REFRAKTORIZ") 24.06.2019, p. 6, lines 12-26, p. 12, lines 25- 31, p. 15, lines 13-16, examples</td> <td>1, 3, 4, 5, 8, 9, 11-15</td> </tr> <tr> <td>Y</td> <td></td> <td>2, 6, 7, 10</td> </tr> <tr> <td>Y</td> <td>RU 2437862 C1 (ZAKRYTOE AKTSIONERNOE OBSCHESTVO "OPYTNYI ZAVOD OGNEUPOROV") 27.12.2011, the claims, example</td> <td>2, 6, 7</td> </tr> <tr> <td>Y</td> <td>RU 2687211 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTIU "GAZPROM PROEKTIROVANIE") 07.05.2019, p. 9, lines 3-24</td> <td>10</td> </tr> </tbody> </table>	Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.	X	RU 2692390 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTIU "SEVEN REFRAKTORIZ") 24.06.2019, p. 6, lines 12-26, p. 12, lines 25- 31, p. 15, lines 13-16, examples	1, 3, 4, 5, 8, 9, 11-15	Y		2, 6, 7, 10	Y	RU 2437862 C1 (ZAKRYTOE AKTSIONERNOE OBSCHESTVO "OPYTNYI ZAVOD OGNEUPOROV") 27.12.2011, the claims, example	2, 6, 7	Y	RU 2687211 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTIU "GAZPROM PROEKTIROVANIE") 07.05.2019, p. 9, lines 3-24	10		
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Y	RU 2687211 C1 (OBSCHESTVO S OGRANICHENNOI OTVETSTVENNOSTIU "GAZPROM PROEKTIROVANIE") 07.05.2019, p. 9, lines 3-24	10															
☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.																	
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<table border="1"> <tr> <td>Date of the actual completion of the international search</td> <td>Date of mailing of the international search report</td> </tr> <tr> <td>25 December 2020 (25.12.2020)</td> <td>28 January 2021 (28.01.2021)</td> </tr> </table>	Date of the actual completion of the international search	Date of mailing of the international search report	25 December 2020 (25.12.2020)	28 January 2021 (28.01.2021)													
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/RU 2020/000546

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CLASSIFICATION OF SUBJECT MATTER

F27D 1/16 (2006.01)
F27D 1/10 (2006.01)
C21B 7/06 (2006.01)
B22D 41/02 (2006.01)
B22D 13/10 (2006.01)
C21B 9/06 (2006.01)
C21C 5/44 (2006.01)
F23M 5/00 (2006.01)