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(54) **Device and method for controllably cooling metal billets to be hot extruded**

(57) A method for carrying out a controlled cooling thermal processing of aluminium billets or other metal materials to be extruded, characterized in that said billets, at a temperature of about 560°C, are arranged one at a time on a horizontally arranged cradle, including locking

jaws, said cradle, with a billet arranged therein, being rotatively driven through 90° about a horizontal pivot pin thereby performing a partial controlled immersion, at one end portion thereof, into a water basin having a temperature equal to or slightly larger than an environment temperature.

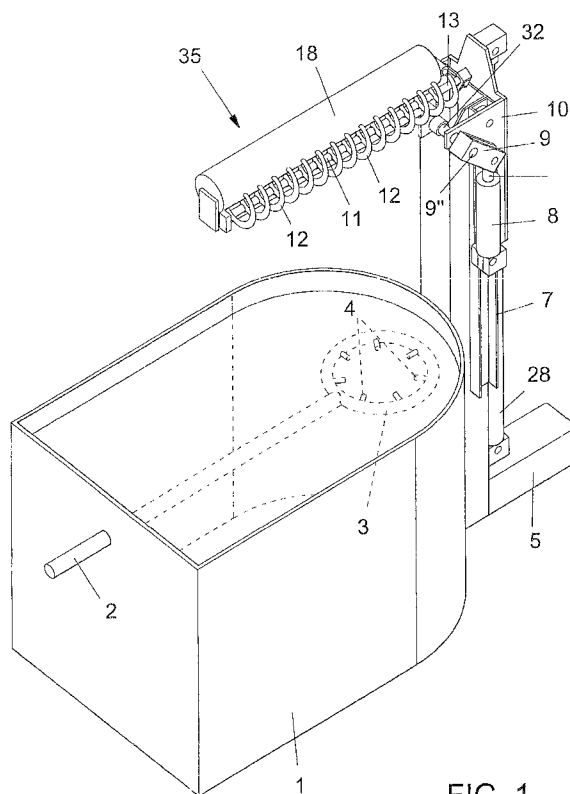


FIG. 1

Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a device for controllably cooling metal billets to be extruded.

[0002] The invention also relates to a method for controllably cooling metal billets to be hot extruded, which method constitutes an integrating part of the present invention.

[0003] The inventive device allows to take and feed a metal billet to be hot extruded while immersing said metal billet into a water basin including a plurality of jet nozzles, therefrom a water flow holding in a turbulence condition water in said water basin is ejected.

[0004] The billet is cooled in a differentiated manner, by adjusting the immersion time of said billet in said water basin.

SUMMARY OF THE INVENTION

[0005] The inventive device, differently from conventional cooling devices for a like application, does not require a complex adjusting circuit, but only a water circulating pump to hold water in a turbulence condition while controlling the billet immersion time by adjusting the billet immersion and withdrawing speed.

[0006] The system operation may be continuously visually controlled since, owing to the fact that the cooling water is held in a moderate turbulence condition, no covering assembly would be required.

[0007] The inventive system comprises an immersion cooling system, operating at at least 8,000 watt/m² K, which operating values may be easily increased to 10,000 watt/m² K in a turbulence condition, with a self-evident advantage from a cycle time level standpoint.

[0008] This capability of perfectly and quickly controlling cooling is in addition to the very simple structural construction of the device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The above and other characteristics, of functional and structural nature, of the device according to the present invention will become more apparent from the figures of the accompanying drawings, where:

Figure 1 shows a perspective view of the cooling device according to the present invention, being arranged above a cooling basin;

Figure 2 is a further top side perspective view of that same device, including a horizontally arranged cradle supporting a billet also arranged in a horizontal position;

Figure 3 shows the inventive device with the billet supporting cradle arranged in a vertical arrangement and in an immersion operating step thereof;

Figure 4 shows a further top side perspective of the

inventive device;

Figure 5 shows yet another perspective view of the billet holding cradle supporting device and driving elements for rotatively driving the cradle and closing latching devices cooperating with said cradle for gripping a metal billet; and

Figure 6 shows yet another top side perspective view of the device bed, the carriage supporting structure, the carriage wheels and a carriage raising cylinder.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0010] With reference to the number references of the figures of the accompanying drawings, the cooling device according to the present invention has been specifically designed for controllably cooling metal billets 18 to be hot extruded, said metal billets being for example made of aluminium or other metal materials.

[0011] As is known, to carry out a billet hot extruding process, it is necessary to subject the metal billets to a controlled heating process at about 560°C, in which said billets are arranged on a horizontal cradle 11 comprising a plurality of locking jaws 12.

[0012] The metal billet 18 cradle 11, may rotate through 90°, around a horizontal pivot pin 32.

[0013] As shown, the cradle 11 is supported by a cradle supporting carriage 10 which may vertically slide on carriage wheels 21 along rectangular cross-section sliding guides 7.

[0014] The inventive device 15 allows an end portion of a metal billet 18 to be partially controllably immersed into a water basin 1 holding water at a temperature equal to or slightly greater than the environment temperature.

[0015] Said billet being immersed to an immersion depth of about 90% of the linear extension of said billet.

[0016] Said basin water is held in a turbulence condition so as to bring the temperature of a back portion of said billet 18, to a temperature value of about 80°-90°C less for each meter of the billet length with a temperature conical variation.

[0017] The immersion time for the mentioned controlled cooling operation represents a process variable which depends on the diameter, length and temperature conical arrangement as required.

[0018] The water basin 1 comprises a closed cooling circuit 2 and allows, by using an immersion system and a pump adapted to hold water under turbulence, to achieve a quicker and more efficient, and much more economic cooling of the billets 18.

[0019] This thermal treatment is carried out to increase the billet extruding rate, and to perform a constant profile quality control method.

[0020] The main feature of the device 35 according to the present invention is that, by carrying out the cooling operation in a turbulent water bath, an improved cooling rate is achieved.

[0021] In fact, if water would not be held in a turbulence

condition, then a steam film thereby preventing a thermal exchange between the billet 18 and cooling water from being properly achieved would be generated.

[0022] As stated, the basin 1 water is maintained in a turbulence condition, since said water basin 1 comprises a duct 2 to which a pump delivers a water flow arriving at a circular duct 3 including a plurality of nozzles 4.

[0023] Said nozzles 4 are oriented toward the central portion of said circular duct 3 at a billet 18 inlet region.

[0024] The device 35 according to the present invention comprises moreover a base 5 and upright 6, supporting the carriage 10.

[0025] Said carriage 10 comprises a raising cylinder 28 which, at the bottom thereof is anchored to the device base 5 by a plate-like element 31.

[0026] Said hydraulic cylinder 28 comprises a cylinder rod 29, coupled to a corresponding element 30 fixed to the carriage 10.

[0027] The cylinder 28 operates for raising and lowering the carriage 10, which is slidably supported along carriage sliding guides 7.

[0028] As shown, the carriage 10 comprises carriage wheels 21 and supports a cylinder 14 including a cylinder stem 16 driving a leverage 15.

[0029] Said leverage 15 rotatively drives a shaft 13 supporting clamping jaw elements 12, constituting, together with a base or bed 11, a cradle for housing a billet 18 therein.

[0030] The jaws 12, as they are closed toward the base or bed 11 operating as a cradle, allow to unlock the billet 18 or lock it, thereby vertically immersing the billet 18 into the basin 1 water.

[0031] More specifically, the billets are arranged in the cradle 11 with the carriage 10 arranged in a raised position with respect to the vertical supporting upright.

[0032] Then, the billets are locked in the billet cradle 1, by closing the jaws 12.

[0033] Then, the inventive device 35 inclines the cradle 11 through 90 degrees by operating the cylinder 8 which comprises a cylinder stem 8' coupled to a leverage assembly 9 rotatively driving a horizontal shaft 32 for downward inclining through 90° the cradle 11 - billet 18 assembly.

[0034] A partially immersion of the billet is achieved by operating the cylinder 28 and lowering the carriage 10.

[0035] The above disclosed functional and constructional features of the inventive device 35 are clearly shown in the figures of the accompanying drawings to which specifically reference is herein made.

[0036] While a preferred embodiment of the inventive device 35 has been hereinabove disclosed, it should be apparent that the disclosed embodiment is susceptible to several modifications and variations all of which will come within the scope of the invention.

Claims

1. A method for carrying out a controlled cooling thermal processing of aluminium billets or other metal materials to be extruded, **characterized in that** said billets, at a temperature of about 560°C, are arranged one at a time on a horizontally arranged cradle, including locking jaws, said cradle, with a billet arranged therein, being rotatively driven through 90° about a horizontal pivot pin thereby performing a partial controlled immersion, at one end portion thereof, into a water basin having a temperature equal to or slightly larger than an environment temperature.
2. A method, according to claim 1, **characterized in that** said billet immersion operation is carried out by an immersion depth corresponding to about 90% of the linear extension of said billet.
3. A method, according to claim 1, **characterized in that** in said water basin the water is held under a turbulence condition thereby bringing the temperature of said billet, at the back portion thereof, to a temperature which is by about 80-90°C less for each meter of the length of said billet with a linear conical variation of said temperature.
4. A method, according to claim 1, **characterized in that** said method provides to use a water basin containing water held in a turbulence condition by a water inlet duct ending at one portion thereof with a circular pattern including a plurality of nozzles directed toward a center of said circular duct, thereby water is conveyed to said water basin and subjected to a turbulent movement, thereby providing a quicker billet cooling down.
5. A device for carrying out a method according to any preceding claims, **characterized in that** said device comprises a water basin (1), supplied with water or other liquid for cooling billets (18), the water in said water basin (1) being held in a turbulence condition by a duct (2) ending with a circular duct (3) including a plurality of nozzles (4) therefrom is ejected a water flow holding in a turbulence condition the water in said water basin (1).
6. A device, according to claim 5, **characterized in that** said device comprises a device base (5) and a device upright (6) supporting a carriage (10) including a raising hydraulic cylinder (28) clamped at the bottom thereof, to said base (5) through a plate element (31), said hydraulic cylinder (28) including a rod (29) applied to an element (30) fixed on said carriage (10).
7. A device, according to claim 5, **characterized in that** said cylinder (28) is operatively coupled to said carriage (10) to raise and lower said carriage, said car-

riage being adapted to slide on vertical sliding guides (7).

8. A device, according to claim 5, **characterized in that** said carriage (10) comprises carriage wheels (26) and supports a carriage cylinder (24) having a cylinder stem (16) operating a leverage (15). 5
9. A device, according to claim 8, **characterized in that** said leverage rotatively drives a shaft (13) supporting a plurality of jaws (12) constituting an integrating part of a cradle (11) for housing therein a billet (18). 10
10. A device, according to claim 9, **characterized in that** said jaws (12) are closed toward said cradle base (11) thereby locking and restraining said billet (18) to allow said locked billet to be vertically immersed into said basin water. 15
11. A device, according to claim 5, **characterized in that** said billets (18) are arranged and locked in said cradle (11) with said carriage (10) being arranged in a raised position with respect to the cradle vertical supporting upright (6). 20
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12. A device, according to claim 5, **characterized in that** said billet is locked in said cradle (11) by closing said jaws (12).
13. A device, according to claim 5, **characterized in that** said cradle (11) and billets (18) are adapted to be inclined through 90° by operating a cylinder (8) including a cylinder stem (8') coupled to a leverage (9) rotatively driving a horizontal shaft (32) thereby causing said cradle (11) to be downwardly inclined through 90°, thereby correspondingly inclining said billet (18). 30
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14. A device, according to claim 5, **characterized in that** said device allows a billet to be partially immersed by operating the piston (28) and lowering the carriage (10) and cradle (11) assembly. 40

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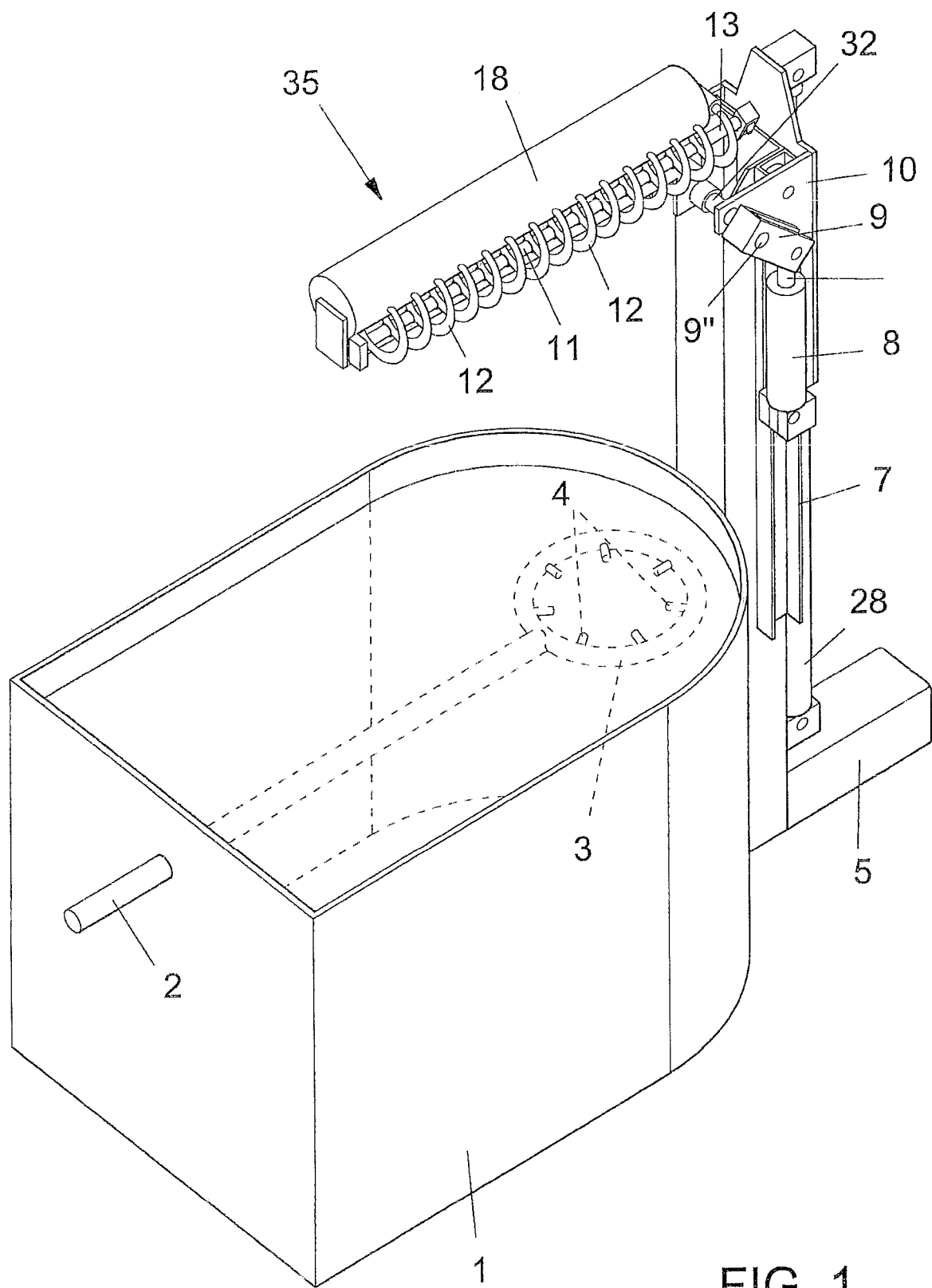
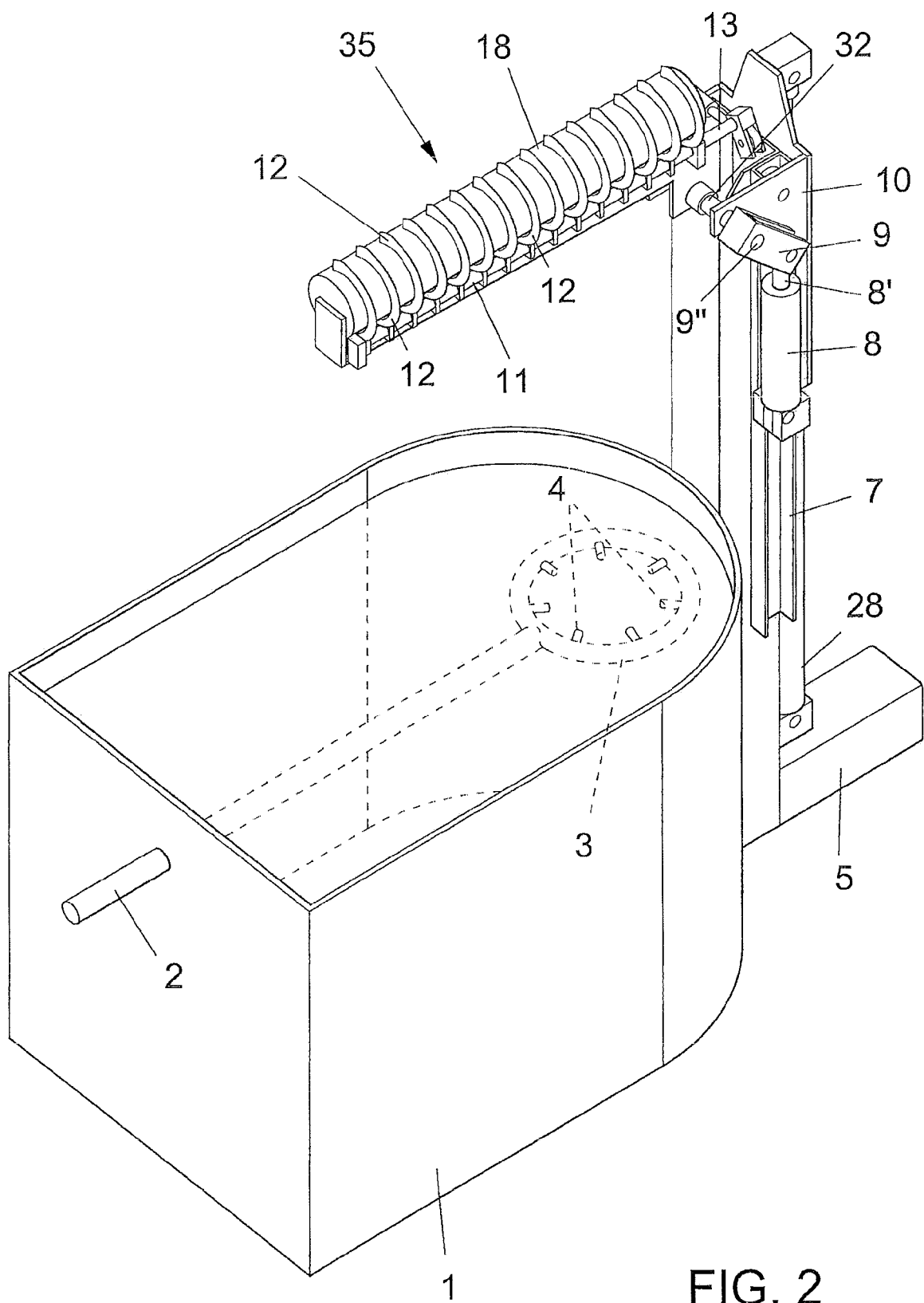
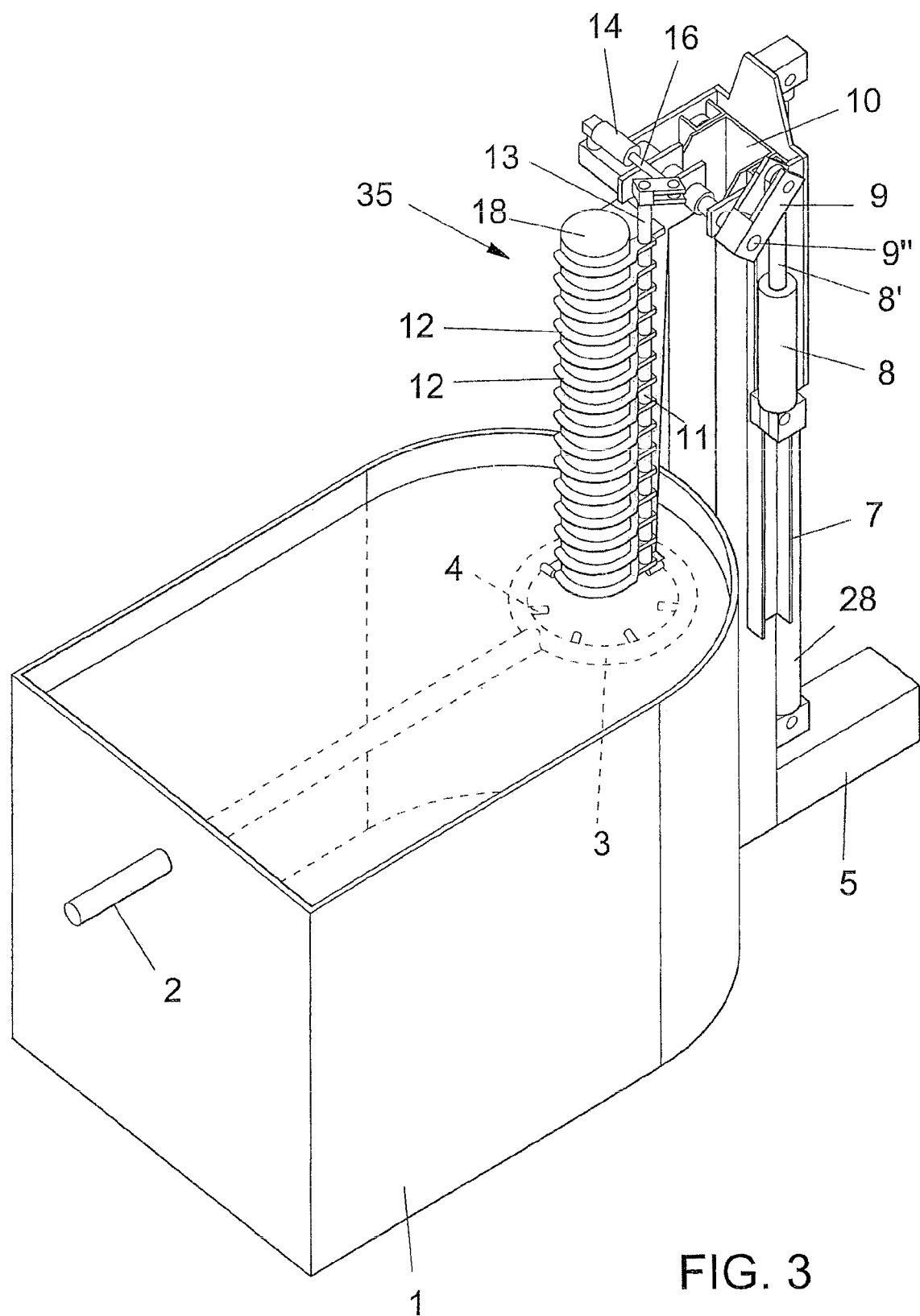
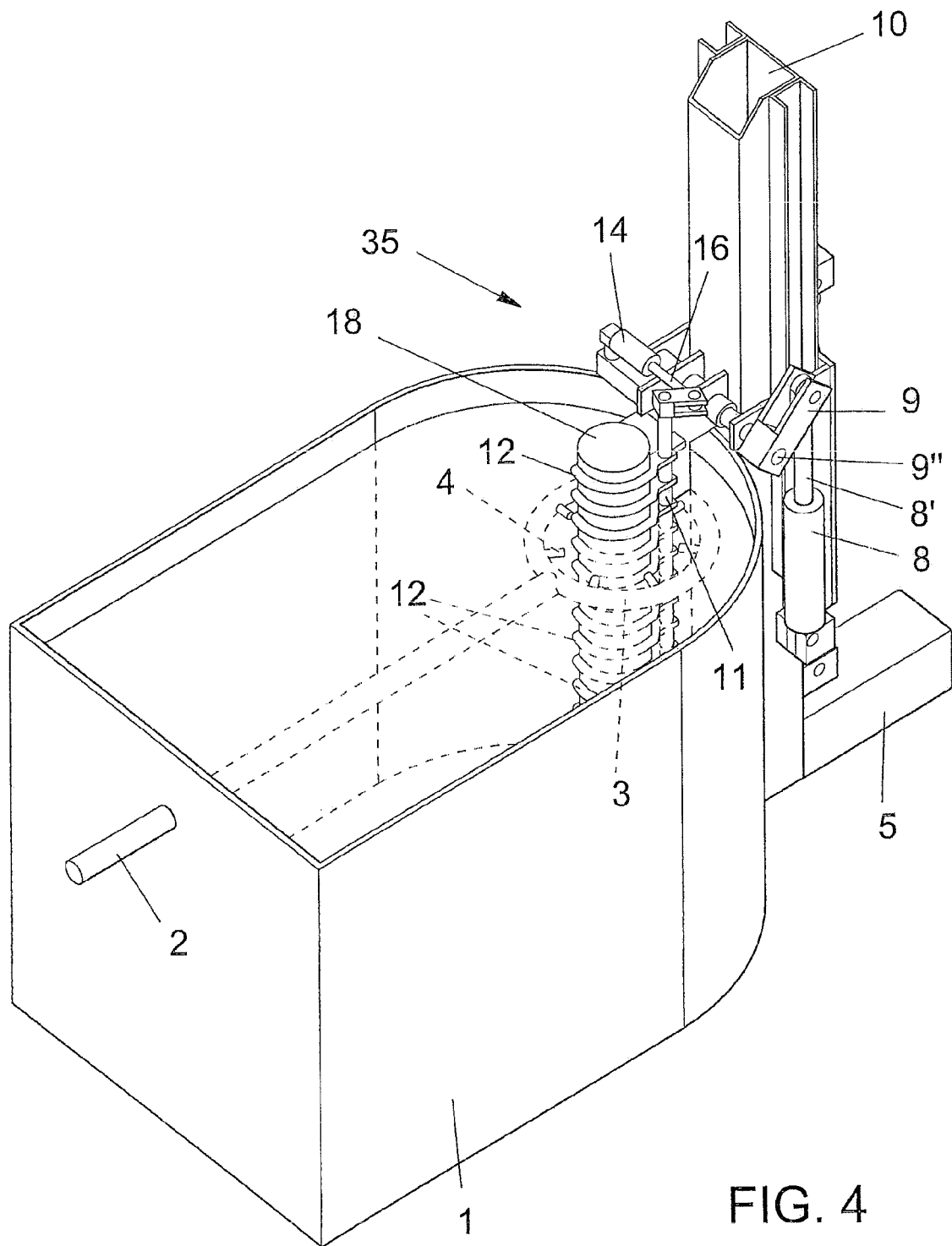


FIG. 1







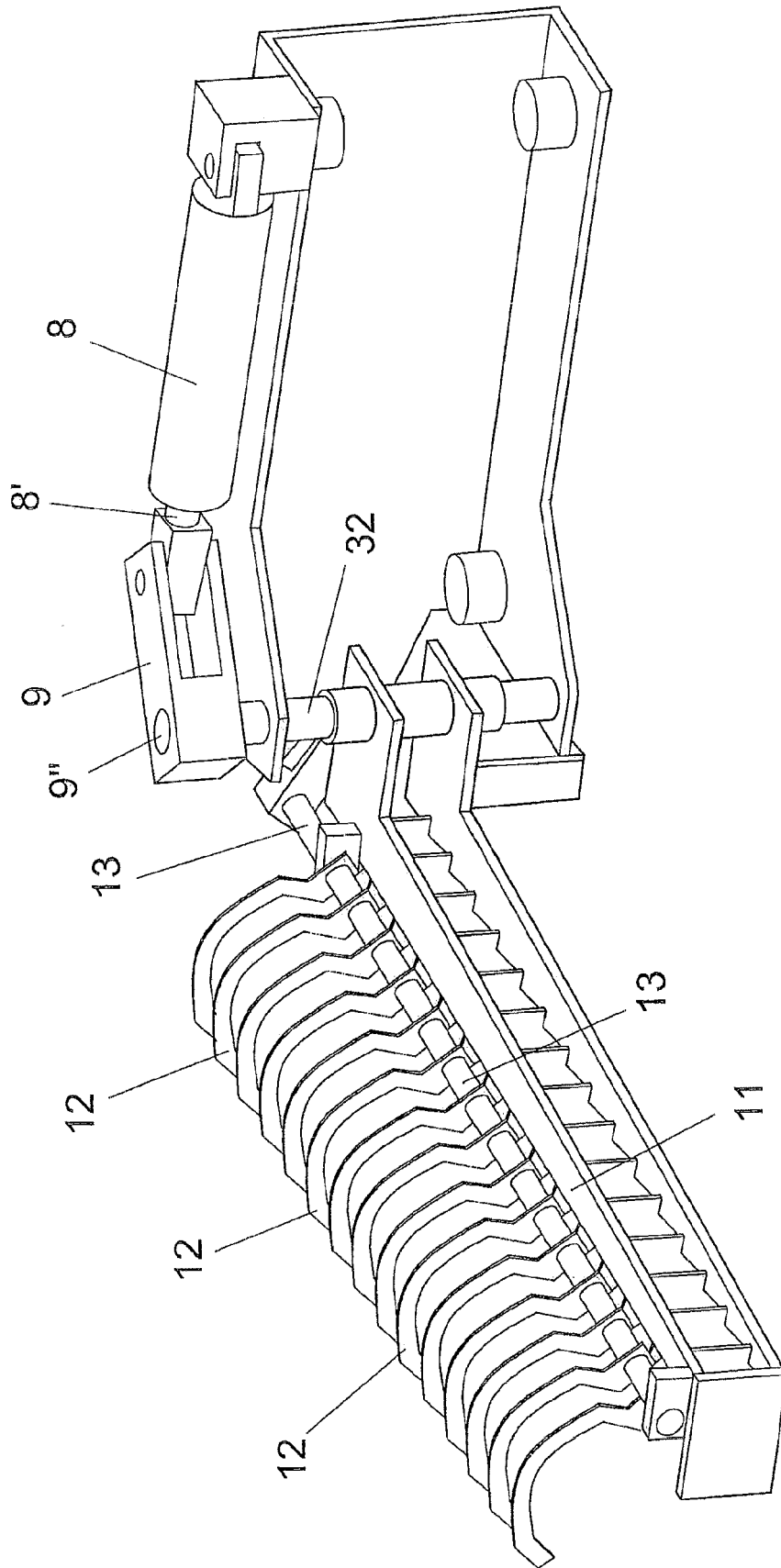


FIG. 5

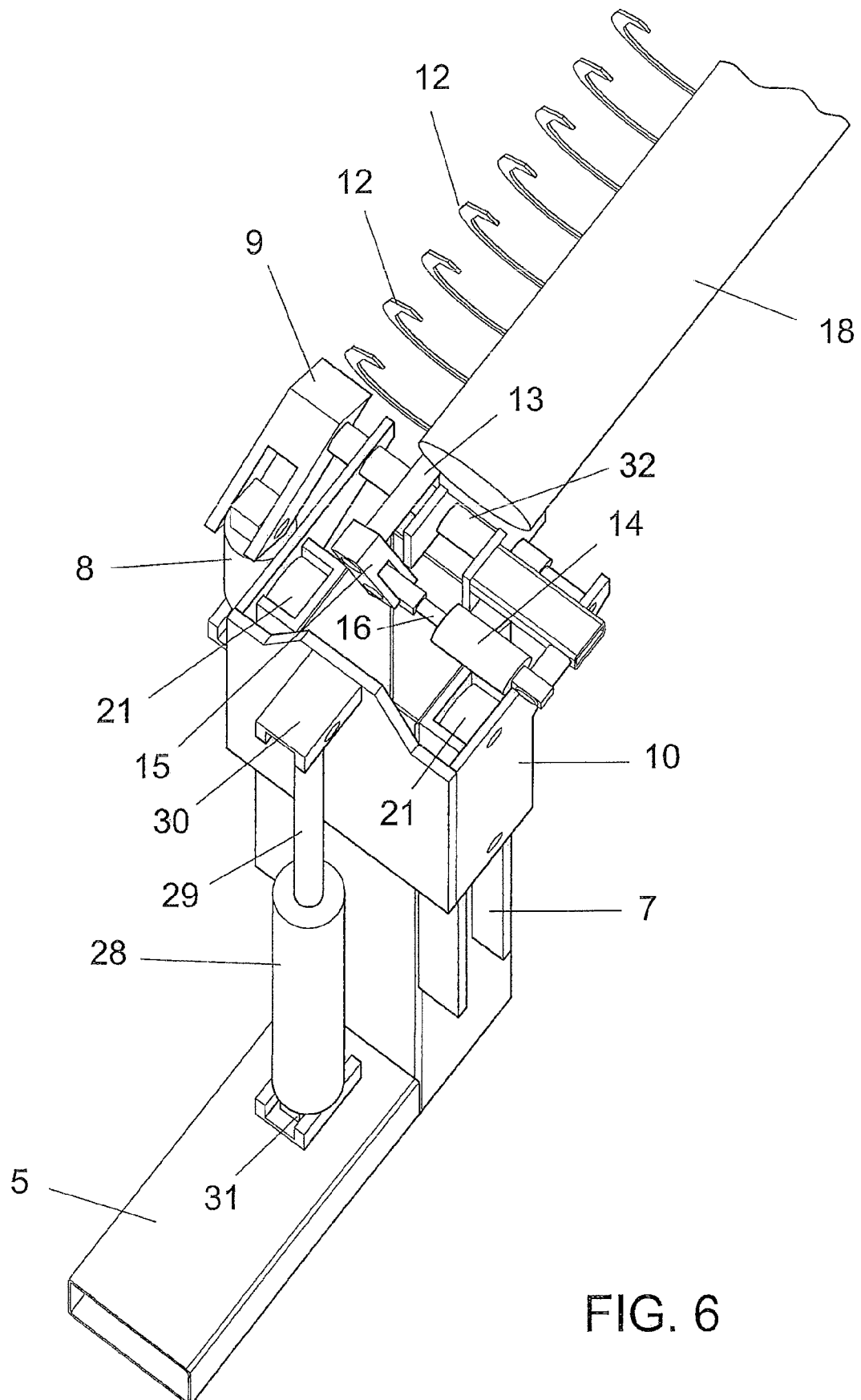


FIG. 6



EUROPEAN SEARCH REPORT

Application Number
EP 12 16 9719

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 681 407 A (YU HO [US] ET AL) 28 October 1997 (1997-10-28) * figures 1-5 * * column 2, line 52 - column 17, line 29 * -----	1-4	INV. C22F1/04 C21D1/64 C21D9/08 B21C29/00
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 September 2012	Examiner Zimmermann, Frank
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503.03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 12 16 9719

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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