June 4, 1968 KUNITOSHI TEZUKA 3,386,601

HOISTING SLING HAVING FUSIBLE CONNECTION AND METHOD FOR CHARGING MATERIALS INTO A FURNACE

Filed Sept. 2, 1966 2 Sheets-Sheet 1

FIG. 1

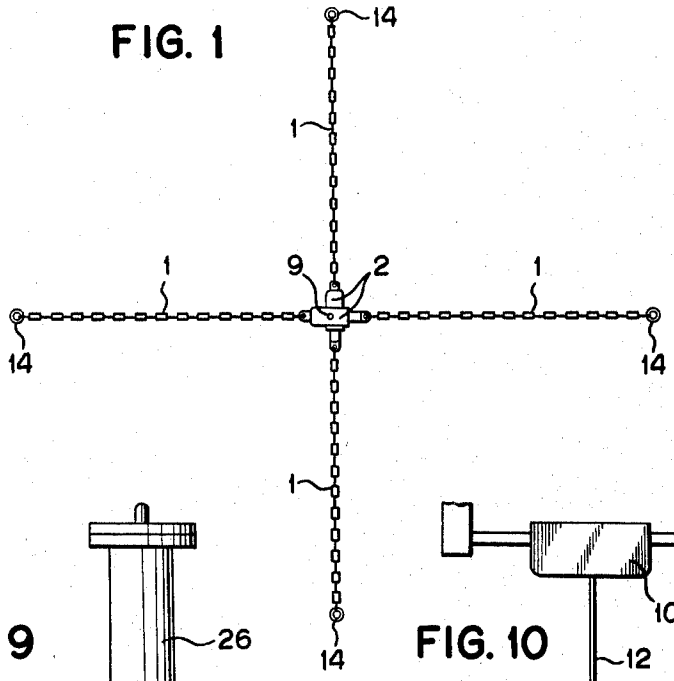

FIG. 9

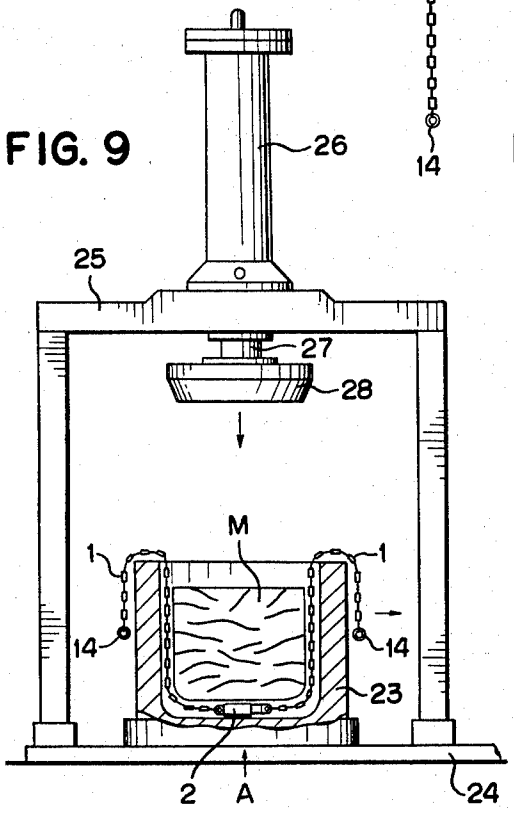

FIG. 10

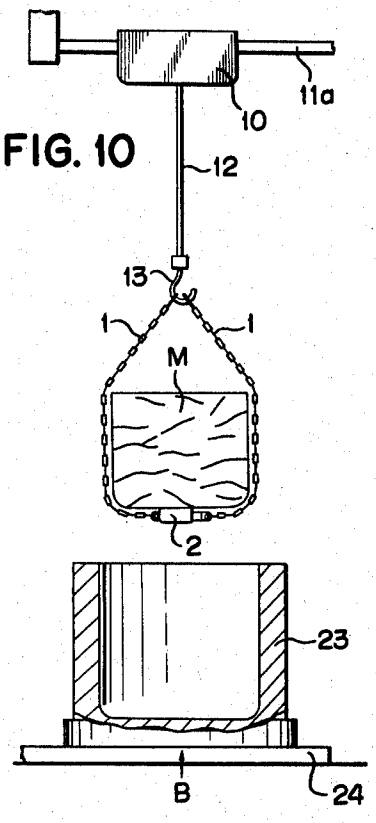

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FIG. 2

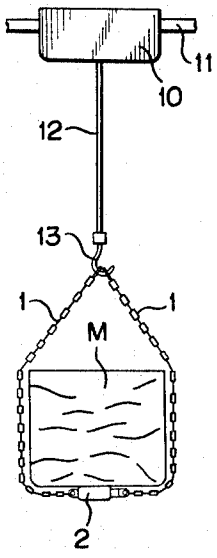


FIG. 3

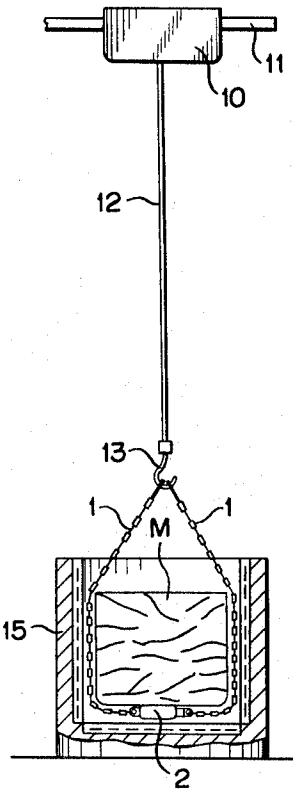


FIG. 4

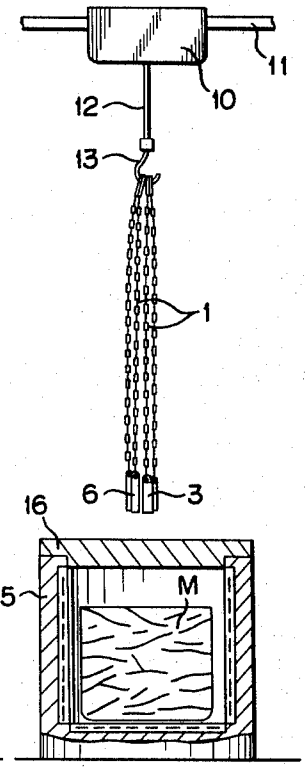


FIG. 5

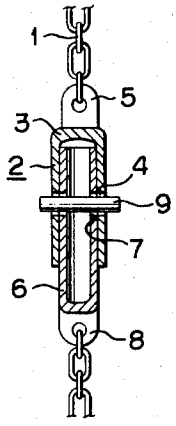


FIG. 6

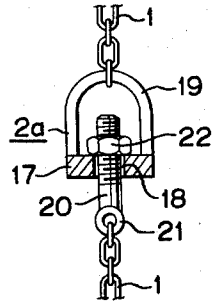


FIG. 7

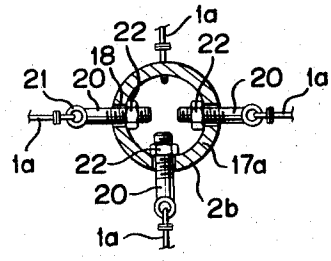
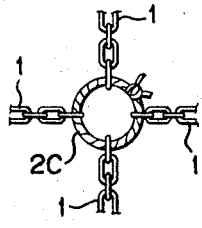


FIG. 8



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United States Patent Office 3,386,601 Patented June 4, 1968

3,386,601

HOISTING SLING HAVING FUSIBLE CONNECTION AND METHOD FOR CHARGING MATERIALS INTO A FURNACE

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Filed Sept. 2, 1966, Ser. No. 576,919
Claims priority, application Japan, Sept. 3, 1965, 40/53,642; Apr. 13, 1966, 41/22,934
13 Claims. (Cl. 214—18)

ABSTRACT OF THE DISCLOSURE

Device, such as a hoisting sling, for charging materials into a furnace, such as an electric furnace adapted for re-processing scrap-metal blocks, with cables and interconnecting means therefor, a securing member attached to one of the cables and releasably attached to the interconnecting means, and anchoring means between the securing member and the interconnecting means, having a melting temperature lower than that of the materials charged into the furnace, so that it will break off on effect of the heat applied within the furnace.

Also, method of charging materials into a furnace of the type described, with the steps of lifting the materials with cables, there being an interconnecting means between the ends of the cables, with an anchoring portion having the aforementioned lower melting temperature, introducing the materials into the furnace together with the cables and the interconnecting means, breaking off the anchoring portion by raising the temperature within the furnace to above the aforesaid melting temperature, lifting out the cables after the ends became detached from each other, and leaving the materials behind in the furnace.

The present invention relates to a device and method for charging materials into a furnace, for example, an electric furnace, for re-processing scrap-metal blocks. More particularly, the invention relates to a system for lifting with cables compressed metal blocks, formed of lumps of iron or metal scraps, and for charging these blocks into the melting furnace.

As one of the conventional systems for charging melting furnaces with compact blocks obtained from scrap lumps by way of a compressor, there is commonly known a system in which several wire ropes or cables are preliminarily laid into the compression casing of the compressor; then the scrap lumps are thrown over the cables, and they are subsequently compacted or pressed into blocks. The resultant blocks are lifted out of the casing by means of said cables, to be thrown into the melting furnace, where the blocks are melted together with the wire ropes or cables.

In such conventional systems, wire ropes are consumed in great quantities, which is a considerable drawback of these systems. Moreover, when the ropes or cables are positioned in the casing, it is difficult to correctly position the centers of the cables to that of the casing so that the compressed blocks almost invariably take an inclined position when lifted up. Because of this inclination of the blocks, the charging thereof into the furnace is very difficult or even impossible. The orderly operation of the furnace is thus considerably hampered, and sometimes costly interruptions and break-downs are encountered because of the failure of an effective melting treatment.

It is one of the principal objects of the present invention to provide a new system for charging furnaces and the like with materials, including appropriate devices and methods, in which the usual lifting cables may be

used at least semi-permanently, without being spent at every melting or charge.

Another object of this invention is to provide a system, device and method of the described kind whereby scrap-metal and other materials may be charged into a furnace in an orderly, safe and efficient manner.

The subject matter of the present invention is closely related to applicant's co-pending applications, filed on even date with the present case, entitled "Scrap-Metal Compressor," Ser. No. 576,915, "Device for Removing Materials From a Compressor," Ser. No. 576,916, "Scrap-Metal Compressor," Ser. No. 576,917, and "Rotary Scrap-Metal Compressor," Ser. No. 576,918. With a view to avoiding details in each of these applications which are only of secondary importance, it should be understood that the disclosures of the simultaneously filed and co-pending applications are to be considered as complementing each other, where necessary.

According to important features of the present invention, the device for charging materials into a furnace comprises at least three (but preferably more) cables interconnected with members which will break off at a temperature lower than the melting point of the materials in question. If the device is used for iron scraps, the cables may be made of iron, and the connecting members will be broken off at a temperature lower than the melting point of iron.

The scrap materials to be melted, for example iron scraps, are lifted up by said cables so as to have the connecting members properly positioned at the bottom center of the materials; the thus lifted iron-scrap materials are lowered into the melting furnace. After the connecting members have been broken off on account of the furnace heat, the cables may simply be lifted out of the inside of the furnace, and the material is of course left behind in the furnace.

According to the charging system of the present invention, compacted scrap-metal blocks are lifted by a plurality of cables linked with the aforementioned connecting members, or the pressed blocks are lifted by said cables by having a plurality of cables, linked with said connecting members, laid previously in the compression casing, before charging the scraps. When the connections of the cables are released, each cable will be readily disengaged from the blocks, merely by pulling the same, so that it can be used again and again for the subsequent charges.

In case each cable is laid into the compression casing, as well as when the block once lifted out of the casing according to the conventional system is raised and taken over by said cable, it will be possible that each cable applies normal pull to the block which maintains its upright posture. The connecting members will always lie at the bottom center of the block, and there will be no difficulty in readily and easily throwing the block into the furnace.

It should be noted that the term referred to in this specification as "breaking off" of the connecting members by the furnace heat, is intended to include and encompass the separation of said members due to softening and subsequent melting by the furnace heat, and also the cutting off of said members due to burning when suffering said heat.

The invention contemplates the use of various materials to be used for the connecting members, for example, synthetic resins like vinyl-chloride resin, acrylic resin, polyethylene resin, styrene resin, and others, which soften or melt at temperatures lower than the melting point of iron; non-ferrous metals such as aluminum and aluminum alloys; other connecting elements of a screw-in or key-insertion type, etc., whose engaging member is made of materials as mentioned above. The connecting lines may

consist of cord, rope or the like, made of materials like cotton, hemp, synthetic fibers, etc., which burn or melt at temperatures lower than the melting temperature of iron, and these materials may be selectively and appropriately employed. The cables may of course be partly rigid or partly flexible, such as chains, wire rope, belts, and the like.

The present invention will be better understood, and additional advantages thereof will become more apparent, upon perusal of the following description of exemplary, preferred embodiments thereof, taken in conjunction with the appended drawings, wherein

FIG. 1 is an extended plan view of cables with connecting members, forming the hoisting sling device for charging materials into a furnace, according to the present invention;

FIG. 2 is a frontal view of the inventive system, showing a condition in which a scrap block is lifted by the cables and connecting members of FIG. 1;

FIG. 3 is a somewhat schematic, vertically cross-sectional view of an exemplary furnace into which a block, lifted by said cables, has been lowered;

FIG. 4 is a view similar to that of FIG. 3, after the cables have been withdrawn from the furnace and a lid has been applied thereto;

FIG. 5 is an enlarged, partly sectional, vertically frontal view of a key-insertion type connector or coupler according to the present invention;

FIG. 6 is a view similar to that of FIG. 5 of a screw-fitting coupler;

FIG. 7 is another view similar to that of FIG. 5 of a screw-fitting coupler of a modified embodiment;

FIG. 8 is an enlarged frontal view of a cord-type connector or coupler;

FIG. 9 is a partly sectional, schematic frontal view of a scrap-metal compressor, equipped with the charging device according to this invention, laid into the compression casing (before the scrap metal has been compacted); and

FIG. 10 shows the casing in another position, in a condition in which the compressed scrap-metal block has been lifted out by means of the inventive charging device (before introduction into the furnace, as shown in FIG. 3).

Referring to FIG. 1, four chains or cables **1** are connected each, in pairs, by a key-insertion type coupler or connector **2**, and the thus connected two pairs of chains are laid crosswise on the floor or other surface.

The coupler **2** is shown in detail in FIG. 5. It has a cylindrical, socket-like joint **3** open at one end and having a key hole **4** diametrally of its wall, and also an eye **5** formed at its closed end, for anchoring one of the chains **1**. A plug-like joint **6**, inserted into said socket joint **3**, is similarly cylindrical, open at one end, having a key hole **7** diametrally of its wall, in alignment with the key hole **4** if assembled, and also having an eye **8** formed at the closed end, for anchoring the other one in a pair of chains. The two chains are interconnected by inserting said plug **6** into said socket **3** and also inserting a key **9**, preferably made of aluminum, as an anchoring member into both key holes **4** and **7** which match in said cylindrical joints **3** and **6**.

Above an electric furnace or the like, where the device according to the invention is to be used, there is provided overhangingly a rail **11**, extending from above the position where said chains **1** have been disposed (FIG. 1), allowing a crane **10** or like device to travel therealong. A hook **13** is connected with the lower end of a wire (or wires) **12** which can be raised or lowered from said crane **10**.

The materials to be handled by the inventive device, for example, scrap blocks schematically shown and identified by letter M, and previously compacted by an appropriate scrap compressor, are removed from the compression casing of the compressor by conventional means known per se, and deposited in the middle of the crosswise arranged chains **1**. Hereafter rings **14** disposed at the outer chain ends are anchored with the hook **13** of the crane **10** so as to be wound up (or down) by the wire **12**. Thus the block M will be lifted up by the chains **1**, as shown in FIG. 2. Thereafter the crane **10** is made to travel on rail **11** so as to transport the block M up to just above an electric furnace **15** (FIG. 3) where the wire **12** is unwound to lower the block M into the furnace. It will be understood that the single block M is shown as a matter of example, and may be constituted by several smaller blocks, even by scrap metal as such, or any other material to be charged into the furnace by way of the inventive device.

As shown in FIG. 3, the chain connector or coupler **2** will now be located between the underside of the block M and the inner bottom of the furnace. While the furnace is in operation, the key **9** of the coupler will become heated and subsequently melted, thus allowing separation of the socket **3** from the plug **6**. Hereupon the wire **12** is wound up, and the chains **1** can be separated from each other and lifted out of the furnace while the block M is left inside the furnace **15**.

FIG. 4 shows this condition, with a lid **16** placed upon the furnace **15** so that the block M can be melted and re-processed in a conventional manner, by continuation of the heating in the furnace. The chains can then be connected again by way of a new key **9**, to be inserted across the socket **3** and the plug **6**, which are then again interconnected, laid on the floor as explained before, and used over again.

FIG. 6 shows an alternative screw-fitting coupler **2***a* which can be substituted for the above-described key-insertion type coupler **2**. An iron disk-like joint **17** has a hole **18** in its center and also a clip **19** on one side, for coupling the second chain **1**. The chains are connected by inserting the joint **20** through the hole **18** of the disk **17** and screw-fitting a nut **22** as an anchoring member, made from hard vinyl-chloride resin, for example. Similarly as aforementioned, the nut **22** will be melted upon suffering the furnace heat so that the screw **20** and the disk **17** will be ready for separation from one another, when the chains **1** are withdrawn from the furnace **15**. Joint **20** may have an eye **21** for the second chain.

Another example of a screw-fitting coupler **2***b* is shown in FIG. 7, in which an iron or similar joint **17***a* is formed in a ring form, having holes **18** at three point which constitute right angles with respect to each other, substantially as illustrated. Instead of the chains, cables **1***a* are shown in this modified embodiment, which can be connected with each other by coupling the ring **17***a* with one of the cables **1***a* and inserting a screw **20** coupled with the other three cables **1***a* through the respective holes **18**. Then, nuts **22** made, for example, of the aforementioned hard vinyl-chloride resin, are screw-fitted to the screws **20**. It will be understood that wire ropes may also be used instead of the cables **1***a* or chains **1**.

A cord-type coupler is shown in FIG. 8. A cord made of cotton fiber or similar material is passed through a link at one end of each chain **1**, and then both ends of the cord are tied up or anchored. The operation of the alternative connectors or couplers will be self-explanatory to those skilled in the art.

As a matter of example, the use of the device according to the invention will be described in connection with a compression stage for compacting scrap-metal blocks. Referring now to FIGS. 9 and 10, a compression casing **23** of a compressor is slidably mounted on a bed **24**. A frame **25** is built over a compressing position A on the bed **24**; an oil-pressure cylinder **26** is vertically fixed onto the frame **25**; a presser plate **28** is secured to the lower end of a ram **27** of the cylinder **26**; and the presser plate **28** is adapted to be elevated by means of hydraulic fluid introduced into the cylinder. A rail **11***a*, similar to rail **11** discussed in connection with FIGS. 2 to 4, extends overhangingly from above a preparator position B (FIG.

10) at some distance from the above-mentioned compressing position position A (FIG. 9), to the furnace **15** (FIGS. 3 or 4).

Four chains **1**, connected by couplers or connectors **2**, **2***a*, **2***b* or **2***c*, are laid crosswise into the casing **23**, shifted to the position B in a condition such that each coupler is located in the center of the inner casing bottom while the outer chain ends are allowed to hang freely outside the casing. Scrap lumps are now thrown into the casing where the chains are already disposed, and then the casing **23** is shifted to the position A where the presser plate **28** is lowered so as to compact and compress the scraps, to obtain scrap-metal blocks, as shown at M in FIG. 9.

After the compacting, the casing **23** is shifted to the position B; ring **14** at the outer end of each chain **1** or **1***a* is anchored with hook **13** of crane **10**; then wire or wires **12** are wound up, as shown in FIG. 10, so as to lift the block M out of the casing **23**; the block is then delivered by way of rails **11**, **11***a* over to furnace **15**, by making use of crain **10**. As has been described before, the block M is placed in the furnace, the connector or coupler **2**, **2***a*, etc. is broken off by the furnace heat, and then the chains **1**, **1***a* can be lifted, whereafter the afore-mentioned operations can be repeated over again.

It will be understood that in the examples shown and described, the number of chains or cables is not necessarily limited to four but may be increased at will, to suit the shape and the nature of the materials to be processed, although the minimum number of chains or cables should be three.

The foregoing disclosure relates only to preferred, exemplary embodiments of the invention, which is intended to include all changes and modifications of the examples described, within the scope of the invention as set forth in the appended claims.

What I claim is:

1. A device for charging materials into a furnace, comprising, in combination, at least three cable means of substantially the same length, means for interconnecting said cable means, at least one securing member attached to one of said cable means and releasably attachable to said interconnecting means, and anchoring means between said securing member and said interconnecting means, having a predetermined melting temperature lower than that of the materials charged into and processed in the furnace, so that it will break off on effect of the heat applied to the device within the furnace.

2. The charging device as defined in claim **1**, wherein said anchoring means is made of a synthetic resin.

3. The charging device as defined in claim **1**, wherein said anchoring means is made of a non-ferrous metal.

4. The charging device as defined in claim **1**, wherein said anchoring means is made of a natural fibrous material.

5. The charging device as defined in claim **1**, wherein said interconnecting means is in the form of a socket joint attached to at least one of said cable means, said securing member is in the form of a plug joint attached to at least another one of said cable means and matingly engageable with said socket joint, and wherein said anchoring means is a substantially cylindrical key insertable into openings provided in both of said joints, which are substantially aligned when in mating engagement.

6. The charging device as defined in claim **5**, further comprising eyes attached to opposite ends of said joints, for attaching the respective cable means.

7. The charging device as defined in claim **1**, wherein said interconnecting means is in the form of a disk joint attached to at least one of said cable means, said securing member is in the form of a threaded joint insertable in a hole of said disk joint, and wherein said anchoring means is a nut engageable with said threaded joint.

8. The charging device as defined in claim **7**, wherein said interconnecting means includes a clip inserted between said disk joint and said at least one cable means.

9. The charging device as defined in claim **1**, wherein said interconnecting means is in the form of a ring joint attached to one of said cable means, said securing member is in the form of a threaded joint insertable in a hole of said ring joint and provided for at least two of said cable means, and wherein said anchoring means includes a nut engageable with each of said threaded joints.

10. The charging device as defined in claim **1**, wherein said interconnecting means and said securing member are combined with said anchoring means in the form of a single annular member passed through the ends of all of said cable means.

11. The charging device as defined in claim **10**, wherein said annular member is made of a piece of cord having its ends interconnected.

12. A method of charging materials into a furnace, comprising the consecutive steps of lifting up said materials with at least three cables having interconnecting means between the ends by which said materials are supported, at least one anchoring portion of said interconnecting means having a predetermined melting temperature lower than that of said materials; introducing said materials into said furnace together with said cables and said interconnecting means; breaking off said anchoring portion by raising the temperature within said furnace to above said predetermined melting temperature; lifting out said cables after said ends became detached from each other; while leaving said materials behind in said furnace.

13. The charging method as defined in claim **12**, further comprising the initial steps of disposing said cables with said interconnecting means and said anchoring portion in a compression casing of a compressor; introducing said materials in non-compressed condition into said casing and above said cables and said interconnecting means; compressing said materials within said casing; and lifting out the pressed materials from said casing together with said cables and said interconnecting mean therebetween, all these steps preceding said lifting-up step which will be performed with said pressed materials.

References Cited

UNITED STATES PATENTS

3,061,016	10/1962	Hodgman	169—42
3,339,965	9/1967	Berns	214—18 XR

ROBERT G. SHERIDAN, *Primary Examiner.*