

Dec. 17, 1968

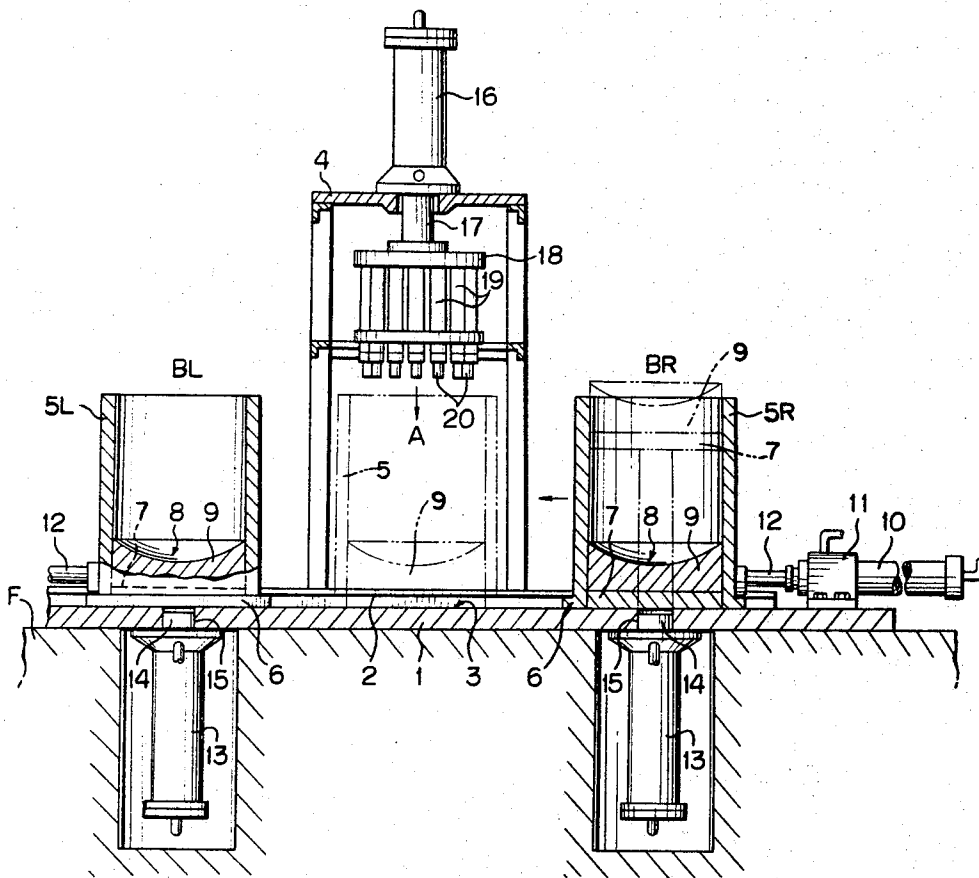
KUNITOSHI TEZUKA
SCRAP-METAL COMPRESSOR

3,416,436

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3 Sheets-Sheet 1

FIG. 1



INVENTOR.
KUNITOSHI TEZUKA

BY

John Hein

AGENT

Dec. 17, 1968

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FIG. 2

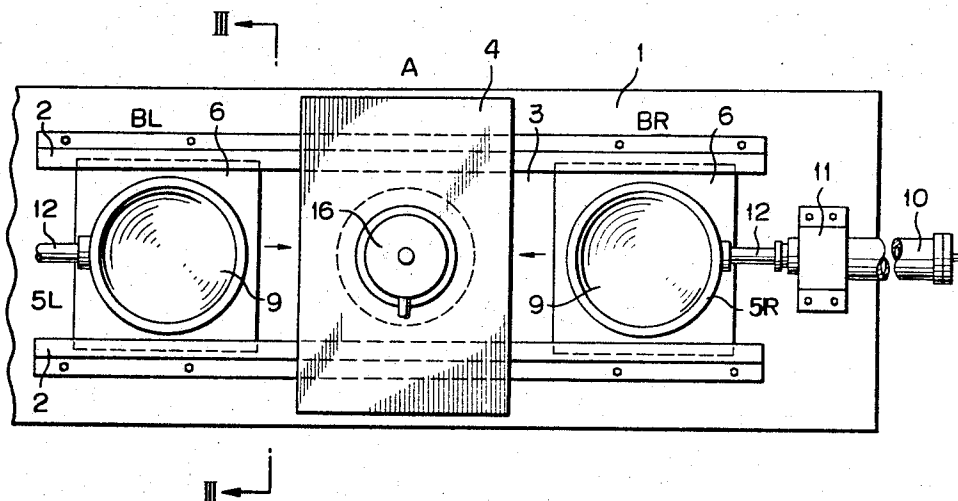


FIG. 3

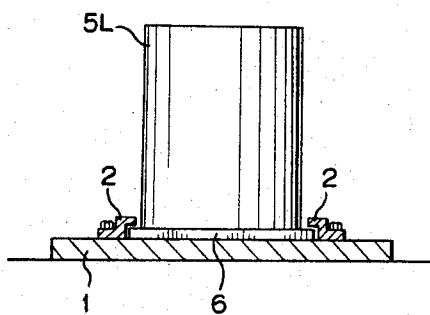
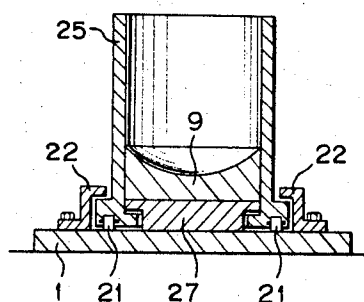


FIG. 4



INVENTOR.
KUNITOSHI TEZUKA

BY

Job Heim

AGENT

Dec. 17, 1968

KUNITOSHI TEZUKA

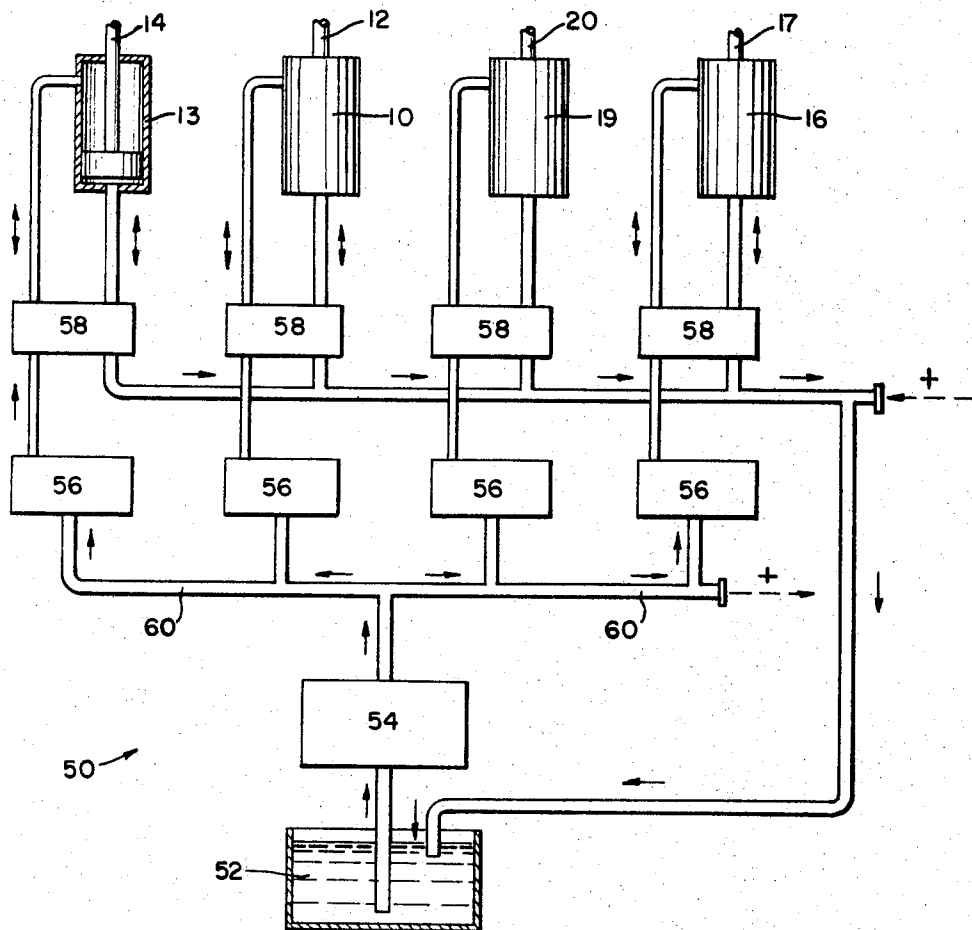
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FIG. 5



INVENTOR
KUNITOSHI TEZUKA

BY

John Rhein

AGENT

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3,416,436

SCRAP-METAL COMPRESSOR

Kunitoshi Tezuka, 34, 7-chome, Minamisuna-machi,
Koto-ku, Tokyo, Japan

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11 Claims. (Cl. 100—218)

ABSTRACT OF THE DISCLOSURE

Scrap-metal compressor for forming into blocks various iron and metal materials to be re-processed in a furnace, with at least two casings into which the materials are alternatively introduced, at preparatory positions spaced apart from a central compressing position, compressing means at the latter position, and track means interconnecting the positions, for moving the casings to and from the compressing position.

The present invention relates to a device for compressing scrap metal of various kinds into blocks or other compact shapes, suitable of being charged into melting furnaces for re-processing. More particularly, the invention relates to a scrap-metal compressor which has movable casings so as to increase productivity.

Hitherto, various types of devices have been proposed and used for the compression of metal scraps but almost all of them have such a construction as to provide a single compression casing provided with pressing means; in the casing, the successive operations of charging the metal, compressing the same, removing the compressed blocks, and so forth, are carried out. For large-scale and fast operations, a conventional device of this kind would require a complicated mechanism and additional means, which would evidently make the device expensive.

It is one of the principal objects of the present invention to provide a new scrap-metal compressor which is capable of carrying out the charging of the scraps into one or more compression casings, the compression proper, and the removal of the compressed blocks, in a most efficient and time-consuming manner.

Another object of the invention is to provide a compressor of this kind which is capable of carrying out large-scale and continuous operation with a single compression means and at least two alternately used movable compression casings.

A further object relates to the provision of a scrap-metal compressor which is capable to press scraps into blocks of large apparent specific gravity, utilizing the compressive force of the device.

The subject matter of the present invention is closely related to applicant's co-pending patent 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, "Rotary Scrap-Metal Compressor," Ser. No. 576,918, and "Hoisting Sling Having Fusible Connection and Method for Charging Materials into a Furnace," Ser. No. 576,919. 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 scrap-metal compressor comprises a track along which a number of compression casings may be moved from respective preparatory positions to a preferably centrally located compressing position. At the latter, compression means are provided for processing the scrap metal introduced into the casings.

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According to further features, each compression casing has an open upper end and a bucket vertically slidable in its interior; appropriate means are provided for elevating the buckets at each of the preparatory positions.

In the compressor according to the present invention, satisfactory compression of scrap metal can be carried out by transferring the filled casings to the compressing position; after compression, the casing is transferred back to the periphery position whereupon the compressed blocks may be easily removed from said casing.

When charging the casings with scrap metal, it is also possible to introduce the metal directly from scrap collecting trucks. When the blocks are removed, any type of conventional removing means, like cranes or the like, may be employed. The track connecting the compressing position with one or more preparatory positions may be extended as far as the charging port of an electric furnace, for immediate reprocessing of the compressed metal blocks. The track may also be extended to the underside of a crane installation, thereby increasing the efficiency of operation of charging the blocks into the furnace.

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 a somewhat schematic, vertically cross-sectional view of the scrap-metal compressor according to the present invention;

FIG. 2 is a top plan view of the compressor set-up shown in FIG. 1;

FIG. 3 is a partly sectional view of a preparatory position with a compression casing, taken along lines III—III of FIG. 2;

FIG. 4 is a vertically cross-sectional view of an alternative compression casing provided with wheels; and

FIG. 5 is a schematic illustration of an actuating system for the rams and cylinders of the scrap-metal compressor.

Referring to the drawings, a bed 1 is provided on a floor F, and a straight track 3, composed of two rails 2, is provided on said bed; the rails preferably have an L-shaped cross-section. In the preferred, exemplary embodiment of the inventive scrap-metal compressor, as illustrated in FIGS. 1 and 2, a substantially central compressing position A is provided, flanked by, for example, two preparatory positions identified as BL and BR, to denote the left-hand and right-hand positions, respectively.

At the compressing position A, a vertical framework 4 is installed for supporting compressing means, substantially in the center of the track 3, to be described later in more detail. As shown in FIG. 2, proper distances are observed between the compressing position A and the two preparatory positions BL, BR. At each of the latter, a compression casing is provided, identified respectively as 5L and 5R, which can be made to reciprocate between the assigned preparatory position and the central compressing position.

In their preferred, illustrated form, the casings 5L, 5R are cylindrical and open at their upper ends. At the lower ends of the casings, protruding square flanges 6 are attached, as shown in FIG. 2, so that each casing may slide along the track 3, without rotation, by proper fitting of the flanges 6 between the rails 2. In the following, other means and mechanisms attached to the casings 5L, 5R will be described for one of them only, since they are identical both in structure and in function. A disk-like operational plate 7 is slidably inserted into each casing, and a bucket plate 9 is slidably mounted thereabove, with a plate-like concave surface 8 at its top.

An oil-pressure cylinder 10 is arranged as drive means for sliding each casing along the track; the cylinder 10 is held by a bracket 11 fixed to the bed 1 slightly out-

wardly from each preparatory position. Each cylinder 10 has a ram 12, the fore end of which is connected with the respective casing 5L, 5R. For the sake of simplicity, only the right-hand oil-pressure drive means 10-12 has been illustrated in the drawings. Depending upon which of the cylinders is actuated, compression casing 5L or casing 5R can be made to be displaced to under the compressing means at position A. Appropriate control and safety means may be installed, if necessary, for selectively operating the rams 12, and/or for preventing one to be energized while the other is in its advanced position, as will be explained later with reference to FIG. 5.

At each preparatory position, an oil-pressure cylinder 13 is mounted for elevating the respective bucket plate 9, preferably disposed vertically in a well underneath the bed 1. A push ram 14 of each cylinder 13 passes through a respective ram hole 15 of said bed 1, so that the rams 14 may protrude through said bed, or recede into the illustrated position (FIG. 1), depending upon actuation of the cylinders 13.

When the casing 5L or 5R is at the respective preparatory position, the plate 7 will be pushed up by the advancing ram 14, thereby elevating the bucket plate 9 to a position slightly protruding beyond the upper edge of the casing (as shown in dot-dash lines for casing 5R in FIG. 1); when the ram 14 recedes, the plates 7 and 9 will be lowered again to the bottom of the casing.

Coming now to the compressing means installed at position A, conventional, known devices may be used for this purpose, such as one which carries out compression by means of a plate or presser element that is reciprocable by a drive mechanism. Alternatively, a falling hammer or other known expedients may be provided to this end. In the illustrated, preferred embodiment, a plurality of spot-pressure rams are used. Means for actuating the spot-pressure rams constituting the compressing means will also be described later with reference to FIG. 5.

An oil-pressure cylinder 16 is vertically mounted on the framework 4, and a number of small oil-pressure cylinders 19 are vertically mounted at substantially equal intervals from each other at the underside of a disk 18 secured horizontally to the lower end of a cylinder ram 17. Each cylinder 19 has a respective spot-pressure ram 20 protruding from its lower end. The rams are guided along the framework. When a hydraulic fluid is sent into said cylinder 16, the lower ends of the rams 20 will all be lowered to a compressing position at the time the disk 18 and the cylinders 19 come down; the lower ends of the rams 20 will be brought to a position higher than the top edge of the compression casing, when elevated (see center part of FIG. 1). On the other hand, when a hydraulic fluid is applied to any or all of the small cylinders 19, the respective pressure rams 20 will advance, and by doing so, each ram will apply a concentrated force to the materials (e.g. scrap lumps) contained in the casing underneath the particular ram 20. Thus, selective application of one or more of the rams 20 will allow localized but concentrated pressure to be applied to the scrap.

The scrap lumps fed into the compression casings may include scraps of a variety of kinds and shapes, thickness, as well as size, and their interior will necessarily contain voids of variously different sizes. Such scrap lumps, while placed in the casings and suffering the spot compression, will shift mutually and be mixed up, thereby filling up the voids, so that uniformly compact scrap blocks will result whose specific gravity is large.

In the following, the operation of the inventive compressor will be described as follows: The showing of FIG. 1 can be considered as the starting point. First, scrap lumps are thrown into casing 5R whereafter hydraulic fluid is applied to the respective (right-hand) cylinder 10 so as to shift casing 5R to the compression position A, by means of ram 12; the casing is identified there by numeral 5 alone.

Thereafter, by virtue of the cylinder 16, cylinders 19 and

rams 20 will be introduced into the casing, at which time the lower end of each ram 20 will be in touch with the scrap lumps, or at least in a position to compress them to some degree. Hereafter each ram 20 is made to protrude by means of the respective cylinder 19 so as to apply spot compressions to the scrap lumps thereunder.

In addition, fresh scrap lumps will be placed in the other casing 5L still located at the preparatory position BL, while the above-mentioned compression is carried out (at position A). Subsequent to the compressing process, the rams 20 are made to recede so as to clear the casing 5R which can then be returned to the preparatory position BR by way of the appropriate drive means 10-12.

For removing the scrap blocks formed in the casings, push ram 14 is made to advance by energizing cylinder 13 so that the bucket plate 9 carrying the compressed block is pushed up to a position slightly exposed beyond the upper end of the casing. The blocks can now be gripped and lifted, and subsequently transported to a furnace by way of conventional means, such as a crane or the like.

After removal of the block, bucket plate 9 is lowered to its original position for receiving another batch of scrap lumps to be charged into the respective casing.

In the meantime, when casing 5R has been returned to position BR after completing the compression at position A, as explained hereinabove, the casing 5L, filled up in the meantime while at the position BL, is then shifted to position A, so as to undergo the same treatment as casing 5R in the previous operational phase. Thus, compression by way of the spot pressure rams 20 (and with the aid of the cylinder ram 17), will be alternately and successively carried out in casing 5L, 5R while shifting them alternately from their respective preparatory positions BL, BR to the compressing position A at the center of the set-up.

While FIGS. 1, 2 and 3 all relate to the above-mentioned exemplary embodiment, FIG. 4 shows an alternative compression casing 25 provided with wheels 21. While the bed 1 and rails 22, as well as the bucket plate 9 inside the casing 25 have been shown substantially as before, a somewhat modified disk-like operational plate 27 has been shown. Frictional forces will be substantially reduced by this arrangement, thereby increasing the speed with which the casings can be reciprocated, and reducing the power requirement of the cylinders 10.

With reference to the schematic illustration of FIG. 5 it should be noted that the invention contemplates the provision of an actuating system or mechanism generally designated by numeral 50, for the rams and cylinders of the compressor. In a conventionally known manner, the feed pipes leading to the various oil-pressure or hydraulic cylinders are connected in the system 50 to a source of hydraulic fluid, for example an oil tank 52. A conventional hydraulic pump 54 may convey the fluid to said feed pipes (not numbered in FIGS. 1, 2 or 5) over appropriate valves 56 and change-over switches 58. A pressurized fluid tank (not shown) may be provided on the discharge side of the pump 54 which branches off to the feed pipes by way of a single feed pipe 60, by the intermediary of the valves 56. The discharge pipes lead back to the tank 52 either directly, as shown, or by way of the same valves (not shown).

Owing to this arrangement, each ram may be moved back and forth, synchronously or separately. Details of this operation were described earlier.

The change-over valves 58 may be provided, in conjunction with controlling and supervisory devices (not shown), depending upon the degree of automation desired when operating the scrap-metal compressor according to the invention.

Instead of the above-mentioned pressurized-water, oil or other hydraulic-fluid system, other hydraulic or similar systems may be used to the same effect. The cylinders and rams mentioned in the specification should be considered with these possible mechanical and functional equivalents in mind.

It should be noted that one or more hydraulic pumps 54, compressors, or other sources of pressurized fluid may be provided in the actuating system 50 in a conventional manner.

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 scrap-metal compressor comprising, in combination, stationary compressing means installed in an elevated position at a substantially central compressing position, at least two compression casings for receiving materials to be compressed, positioned at respective preparatory positions spaced apart in a radial direction from said compressing position, said casings having an open top, including each a longitudinally slidable bucket plate for receiving the materials and being adapted to be individually moved to and from said substantially central compressing position where the materials are compacted, the height of said elevated compressing means being sufficient to allow said casings to be moved thereunder, track means interconnecting said compressing position with each preparatory position, and reciprocable push ram means at each preparatory position for displacing the respective bucket plate from the bottom of the respective casing to said open top thereof.

2. The compressor as defined in claim 1, wherein said track means includes rails and said casings are fitted with rolling means adapted to roll along said rails.

3. The compressor as defined in claim 1, further comprising push ram means for moving at least one of said casings from the respective preparatory position to said compressing position.

4. The compressor as defined in claim 1, wherein said compressing means includes at least one spot-pressure ram for applying a compressive force to the materials when one casing is located underneath said compressing means at said compressing position.

5. The compressor as defined in claim 4, wherein said compressing means further includes a substantially central ram for moving said at least one spot-pressure ram toward and away from said one casing when underneath said compressing means.

6. The compressor as defined in claim 5, further comprising a substantially vertical framework for supporting said compressing means, a disk member interposed between said central ram and said at least one spot-pressure ram, and means for guiding said at least one spot-pressure ram along said framework.

7. The compressor as defined in claim 6, further comprising oil-pressure actuating means for said central ram and said at least one spot-pressure ram, allowing selective raising and lowering thereof independently from each other.

8. A scrap-metal compressor comprising, in combination, stationary compressing means installed in an elevated position at a compressing position, at least two compression casings for receiving materials to be compressed, normally positioned at respective preparatory positions spaced apart from said compressing position, said casings having an open top, including each a longitudinally slidable bucket plate for receiving the materials and being adapted to be moved to and from said compressing position where the materials are compacted, the height of said elevated compressing means being sufficient to allow said casing to be moved thereunder, track means interconnecting said compressing position with each preparatory position, at least one preparatory position having reciprocable push ram means for displacing the respective bucket plate from the bottom of the respective casing to said open top thereof, and an operational plate interposed between said push ram means and said bucket

plate, the latter having a substantially concave top surface.

9. A scrap-metal compressor comprising, in combination, stationary compressing means installed in an elevated position at a compressing position, at least two compression casings for receiving materials to be compressed, normally positioned at respective preparatory positions spaced apart from said compressing position, said casings being adapted to be moved to and from said compressing position where the materials are compacted, the height of said elevated compressing means being sufficient to allow said casings to be moved thereunder, track means interconnecting said compressing position with each preparatory position, push ram means for moving at least one casing from the respective preparatory position to said compressing position, and bed means extending underneath said compressing position and said preparatory positions, said track means being secured to said bed means, and wherein said push ram means has a bracket fixed to said bed means outwardly from said respective preparatory position with respect to said compressing position.

10. A scrap-metal compressor comprising, in combination, stationary compressing means installed in an elevated position at a compressing position, at least two compression casings for receiving materials to be compressed, normally positioned at respective preparatory positions spaced apart from said compressing position, said casings being adapted to be moved to and from said compressing position where the materials are compacted, the height of said elevated compressing means being sufficient to allow said casings to be moved thereunder, track means interconnecting said compressing position with each preparatory position, wherein said compressing means includes at least one spot-pressure ram for applying a compressive force to the materials when one casing is located underneath said compressing means at said compressing position, said compressing means further including a substantially central ram for moving said spot-pressure rams toward and away from said one casing when underneath said compressing means, a substantially vertical framework for supporting said compressing means, a disk member interposed between said central ram and said spot-pressure rams, means for guiding said spot-pressure rams along said framework, hydraulic actuating means for said central ram and said spot-pressure rams, allowing selective raising and lowering thereof independently from each other, means for elevating said bucket plates from the bottom of said casings to said open top thereof, and means for moving said casings from the respective preparatory positions to said compressing position, said actuating means also controlling said elevating means and said moving means in a selective manner.

11. The compressor as defined in claim 10, further comprising bed means extending underneath said compressing means and said casings, having openings for protruding ram members of said elevating means, which are aligned with respective openings in said bottom of the casings when moved to said preparatory positions.

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BILLY J. WILHITE, *Primary Examiner.*

U.S. Cl. X.R.

100—229, 269, 237, 224