Feb. 23, 1965 J. J. MARTIN 3,170,577

FUEL CHARGING APPARATUS FOR LARGE FURNACES

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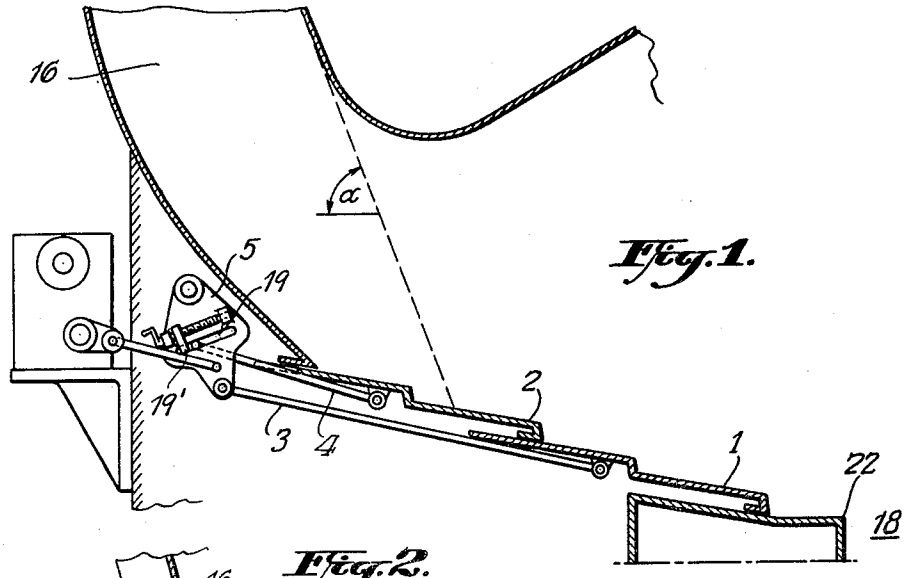

Fig. 1.

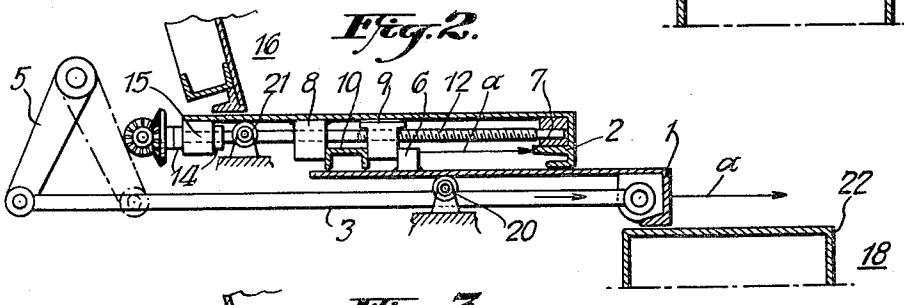

Fig. 2.

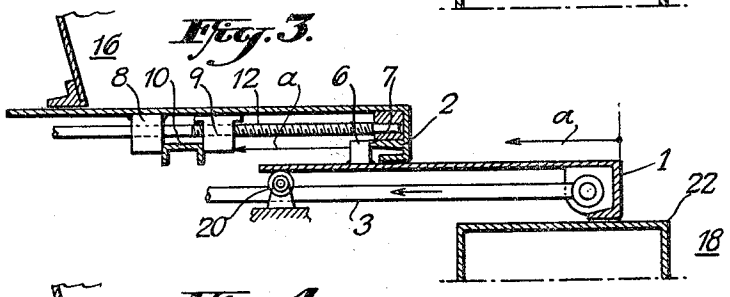

Fig. 3.

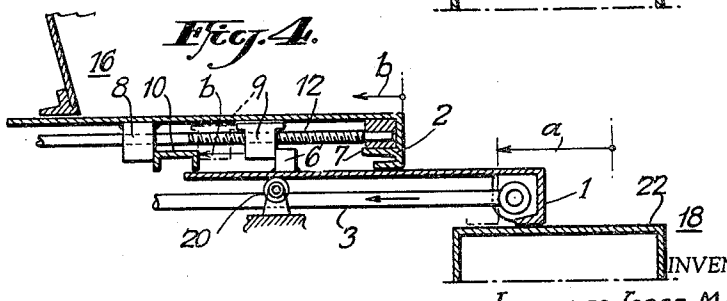

Fig. 4.

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Fig. 5.

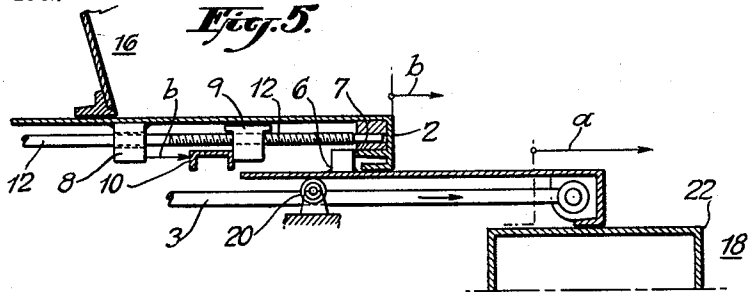


Fig. 6.

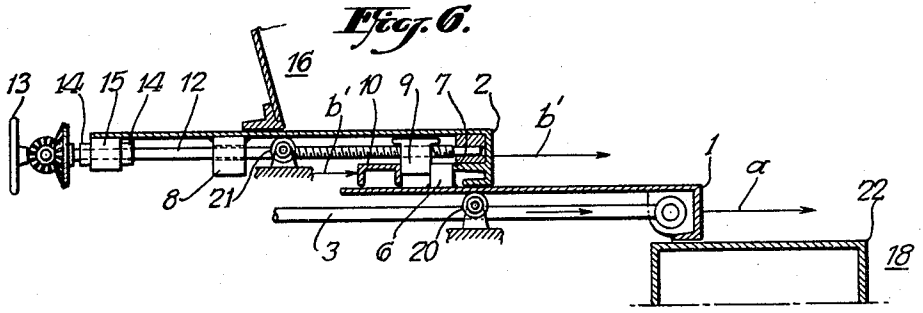
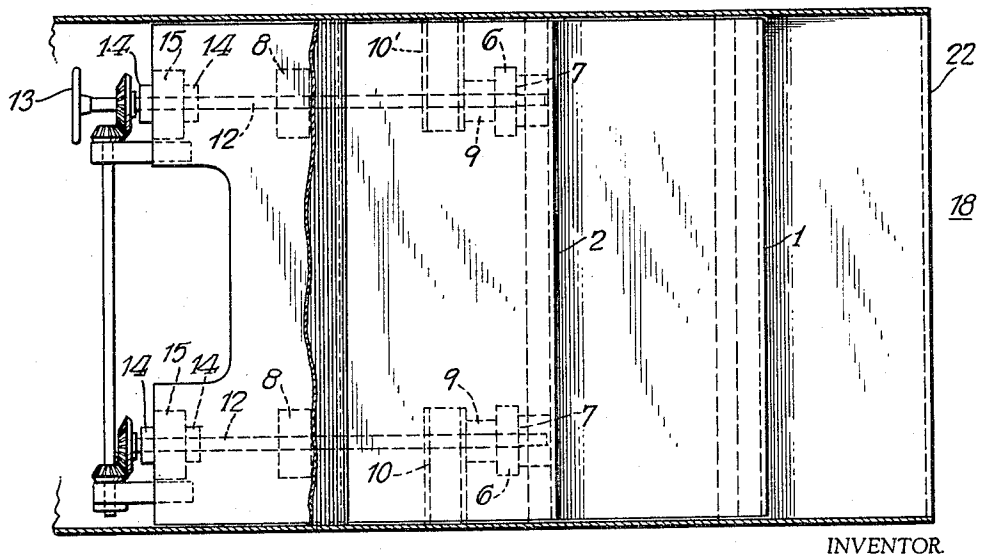


Fig. 7.



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FUEL CHARGING APPARATUS FOR LARGE FURNACES

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7 Claims. (Cl. 214—23)

The present invention relates to fuel charging apparatus for large furnaces, particularly for furnaces burning rubbish and refuse.

It is known to provide superimposed relatively movable rams for receiving fuel from a chute and pushing it into a furnace. It is also known to drive the grate bars of step grates so that one grate bar is moved by another grate bar after the latter has moved through a predetermined distance.

The conventional arrangements are satisfactory as long as they are used for supplying fuel to furnaces which is substantially homogenous. Refuse is not homogenous and may consist of matter in the form of powder or may consist of large lumps and sticks, or of anything in between.

It is the object of the present invention to provide a fuel charging apparatus for large furnaces, particularly for furnaces for burning rubbish and refuse of all kinds and configurations whereby the matter to be burnt is efficiently supplied to the furnace and the charging apparatus can be adjusted to suit changing configurations of the pieces of which the matter to be burnt is composed. The charging apparatus according to the invention can be used for burning extremely bulky matter as well as for burning matter consisting of small individual pieces.

The charging apparatus according to the invention comprises superimposed relatively movable rams and drive means for continuously reciprocating one ram and including adjustable lost motion means for reciprocating the second ram either continuously with the first ram or intermittently and at shorter and adjustable strokes than the first ram, depending on the setting of the adjustable lost motion means.

In a preferred embodiment of the invention one ram is continuously reciprocated and the second ram is driven by a catch fast on the first ram and engaging an abutment adjustably mounted on the second ram. Depending on the position of the adjustable abutment the catch will engage the abutment sooner or later during the movement of the first ram in one direction and, upon engagement with the abutment, will take the second ram along for the rest of the movement of the first ram in said direction. Upon movement of the first ram in the opposite direction the catch will leave the adjustable abutment and will idle along through a distance defined by the position of the adjustable abutment until the catch abuts against an abutment which is fast on the second ram. If the stroke of the first ram is not completed at this moment the catch will take along the second ram. In order to define the limits of the movement of the second ram a stationary abutment may be provided against which the adjustable abutment abuts after moving in one direction and against which an abutment fast on the second ram abuts after the second ram has moved through a predetermined distance in the opposite direction.

Due to the adjustability of the length of the stroke of one of the rams forming an apparatus for feeding refuse of variable shape and composition to a furnace, the feeding effect of the apparatus can be controlled according to the character of the refuse. It has been found that with conventional arrangements of superimposed relatively movable rams cavities are formed by the material to be

charged in front of the lower ram which cavities are not immediately filled by matter pushed forward by the upper ram. The invention makes it possible to so adjust the movement of the upper ram relative to the lower ram that these cavities are filled from above and not by compressing the matter in front of the lower ram. In this way the refuse reaches the furnace in a loose condition, permitting passage of air without forming large cavities. Compacting of the refuse as experienced with conventional charging apparatus and which hinders passage of combustion air is avoided by the apparatus according to the invention.

The novel features which are considered characteristic of the invention are set forth with particularity in the appended claims. The invention itself, however, and additional objects and advantages thereof will best be understood from the following description of embodiments thereof when read in connection with the accompanying drawing wherein:

FIG. 1 is a schematic sectional view of an apparatus according to the invention.

FIGS. 2 to 6 are schematic sectional views of a modified apparatus according to the invention in five different operating positions.

FIG. 7 is a schematic top view of the apparatus shown in FIGS. 2 to 6.

Referring more particularly to FIG. 1 of the drawing, numeral **1** designates a lower ram having two steps and numeral **2** designates an upper ram also having two steps. The refuse to be burnt arrives in a chute **16** and is consecutively pushed by the rams **2** and **1** over a step **22** into a combustion chamber **18**. The lower ram **1** is reciprocated by means of a connecting rod **3** having an end pivotally connected thereto and having a second end pivotally connected to a guide or rocker arm **5** which is rocked by a crank drive. The upper ram **2** is connected to the guide **5** by a connecting rod **4** having an end pivotally connected to the ram **2** and having a second end guided in an oblong hole **19** in the guide **5**. In this way the upper ram is moved only during a fraction of the time the lower ram is moved and the extent of movement of the upper ram is smaller than that of the lower ram.

It has been found of advantage to move the forward end of the upper ram **2** within or just outside of the marginal portion of the slope formed by the rubbish or refuse. The angle of this slope is designated by the letter *a* in FIG. 1. The lower ram **1** preferably operates outside of the slope formed by the rubbish. With this arrangement only the upper ram on which rests the weight of the rubbish in the chute moves rubbish outside of the natural slope whereas the lower ram spreads the rubbish supplied by the upper ram and merely transports it but does not pull rubbish out of the chute. By making the slot **19** of different length, for example, by providing an adjustable abutment **19'** therein, the distance along which the upper ram pulls rubbish from the chute can be changed.

In the embodiment of the invention shown in FIGS. 2 to 7 the lower ram **1** forms only one step and is reciprocated by means of a connecting rod **3** which is actuated by a rocker arm **5**. The upper ram **2** is not directly driven by the rocker arm **5** but is reciprocated by the lower ram to which it is operatively connected by means of suitable abutments. A catch **6** is rigidly connected to the ram **1**. Abutments **7** and **8** are rigidly connected to the ram **2**. At least one threaded spindle **12** is rotatably supported by the upper ram **2**. The spindle can be rotated by manipulating a handwheel **13** (FIGURES 6 and 7) which is operatively connected to the spindle **12** by a suitable conventional drive mechanism. Axial movement of the spindle **12** is prevented by collars **14** placed on the spindle on either side of a bearing **15**.

A nut element 9 is screwed on the threaded portion of the spindle 12. Rotation of the element 9 is prevented by providing the element with a surface slidably engaging a surface of the ram 2. A stationary abutment 10 adapted to be abutted by the abutment 8 and by the nut element 9 limits the extent of reciprocating movement of the ram 2. The rear portions of the rams 1 and 2 are supported by rollers 20 and 21, respectively, which may be mounted on the rail forming the abutment 10.

By suitable placement of the element 9 on the spindle 12 the length of the stroke of the upper ram 2 can be adjusted between zero and a maximal stroke length *a* which is equal to the stroke of the lower ram 1. FIG. 2 shows the apparatus in position for stroke length zero of the upper ram. In this case the nut element 9 is in its rearmost position and abuts against one side of the abutment 10. The other side of the latter is abutted by the abutment 8. The lower ram 1 is free to move through the distance *a*.

FIG. 3 shows the lower ram 1 in its foremost position to which it has been moved while the upper ram 2 remained in the position shown in FIG. 2. Upon continued reciprocation of the lower ram the catch 6 moves between its end positions shown in FIGURES 2 and 3 without moving the upper ram 2.

If the movable abutment, namely the nut element 9, is moved through a distance *b* toward the abutment 7 to the position shown in FIG. 4, movement of the upper ram 2 relative to the lower ram 1 is effected by the catch upon return movement of the ram 1 and abutment of the catch 6 against the element 9, i.e. after the ram 1 has moved through the distance *a–b*. The working stroke of the upper ram corresponds to the distance the movable abutment 9 has been moved toward the abutment 7 which distance is equal to *b*. The left end position of the upper ram is determined by abutment of the element 9 against the stationary abutment 10.

FIG. 5 shows the apparatus in position when, during the forward stroke of the ram 1 the catch 6 abuts against the abutment 7 with unchanged position of the element 9 relative to the abutment 7. Continued movement of the ram 1 to the right causes movement of the upper ram 2 to the right through the distance *b*. Movement of the upper ram to the right is limited by abutment of the abutment 8 against the abutment 10.

If the movable abutment 9 is moved through the distance *b'* toward the abutment 7, as shown in FIG. 6, the element 9 is in its right extreme position and the catch 6 can move the upper ram through a stroke which is equal to the stroke of the lower ram, i.e., $b'=a$.

The rams of the embodiment shown in FIGURES 2–6 may be provided with steps as are the rams of the embodiment shown in FIG. 1. The catch 6 may be made fast on the upper ram 2 and an element 9 may be adjustably mounted on the lower ram 1.

The stationary abutment may not be in the form of a rail extending over the entire width of the rams, but may be formed by short elements 10' as schematically shown in FIG. 7.

I claim:

1. Charging apparatus for large furnaces, particularly for burning refuse, comprising at least two relatively movable superimposed rams, drive means for reciprocatingly moving one of said rams, a catch rigidly connected to one of said rams, an abutment connected to the second of said rams, and means connected to the second ram and to said abutment for adjusting the position of said abutment relative to the second ram, said catch being adapted to abut against said abutment for moving, by said ram moved by said drive means, the other ram through a distance defined by the position of said abutment.

2. Charging apparatus for large furnaces, particularly for burning refuse, comprising two superimposed rams individually movable in parallel directions, drive means for reciprocatingly moving one of said rams, a catch rigidly connected to one of said rams, a spindle having a threaded portion and being rotatably supported by the second ram parallel to the direction of movability of said rams, a nut element screwed on said threaded portion and slidably abutting said second ram for preventing rotation of said element and affording movement of said element longitudinally of said spindle upon rotation of the latter, said catch and said element each having a portion movable on a common path and adapted to abut each other for moving, by said ram moved by said drive means, the other ram through a distance defined by the position of said nut element.

3. Charging apparatus as defined in claim 2 including a stationary abutment, said nut element being placed between said catch and said stationary abutment.

4. Charging apparatus according to claim 3 including an abutment fast on the ram supporting said spindle, said catch being interposed between said last mentioned abutment and said nut element.

5. Charging apparatus according to claim 4 wherein said stationary abutment has an inner side facing said nut element and an outer side averse from said nut element, a second abutment being rigidly connected to the ram supporting said spindle and being placed at and adapted to abut against said outer side of said stationary abutment.

6. A fuel charging apparatus for large furnaces, particularly for burning refuse, comprising:
- a reciprocatingly movable lower ram,
- a reciprocatingly movable upper ram superimposed on said lower ram,
- drive means connected to said rams for reciprocatingly moving said rams, and
- adjusting means interposed in the drive means connected to said upper ram for altering the extent of reciprocating movement of the upper ram,
- said adjusting means including lost motion means including an adjustable abutment for adjusting the extent of the lost motion.

7. A fuel charging apparatus for large furnaces, particularly for burning refuse, comprising:
- a reciprocatingly movable lower ram,
- a reciprocatingly movable upper ram superimposed on said lower ram,
- drive means common to both said rams,
- means for separately connecting said rams to said drive means for separately reciprocatingly moving said rams, and
- adjusting means interposed in the means connecting the upper ram to said drive means for altering the extent of reciprocating movement of the upper ram,
- said adjusting means including lost motion means including an adjustable abutment for adjusting the extent of the lost motion.

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