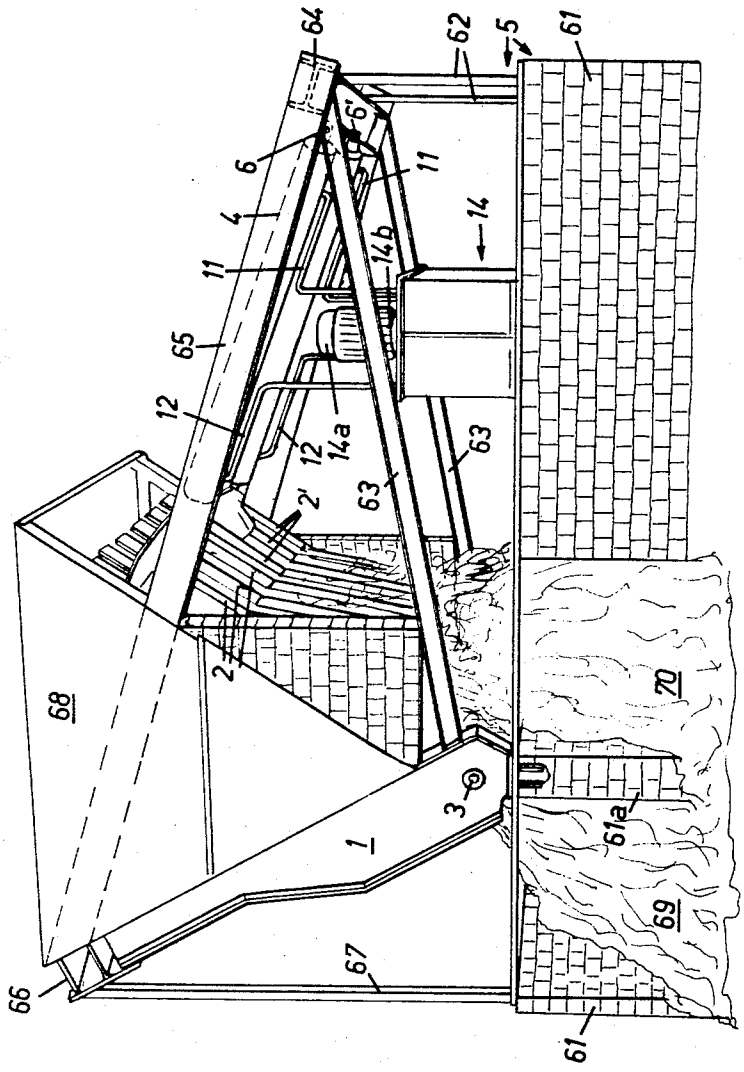
Oct. 10, 1967 F. WÜTHRICH 3,346,202

APPARATUS FOR THE SIZE REDUCTION OF REFUSE

Filed Nov. 15, 1965 4 Sheets-Sheet 1

Fig.1



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APPARATUS FOR THE SIZE REDUCTION OF REFUSE

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Fig. 2

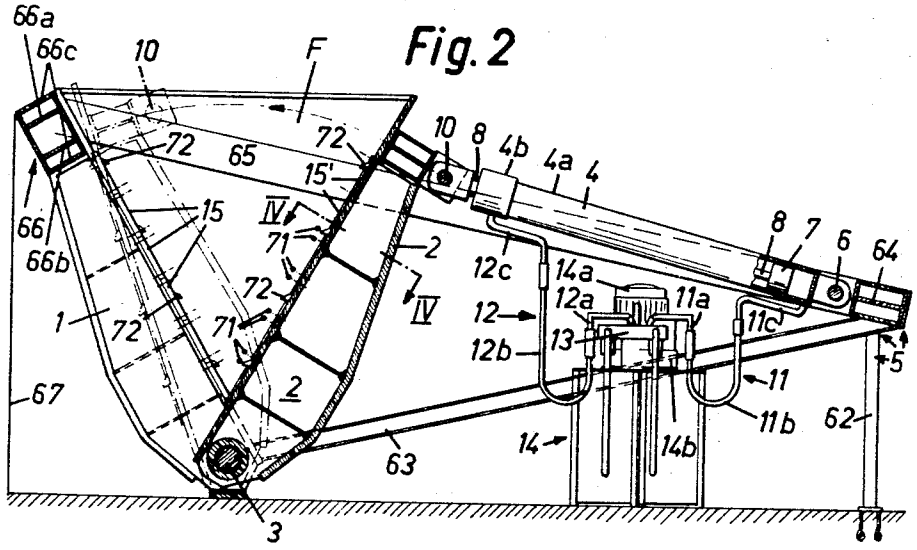
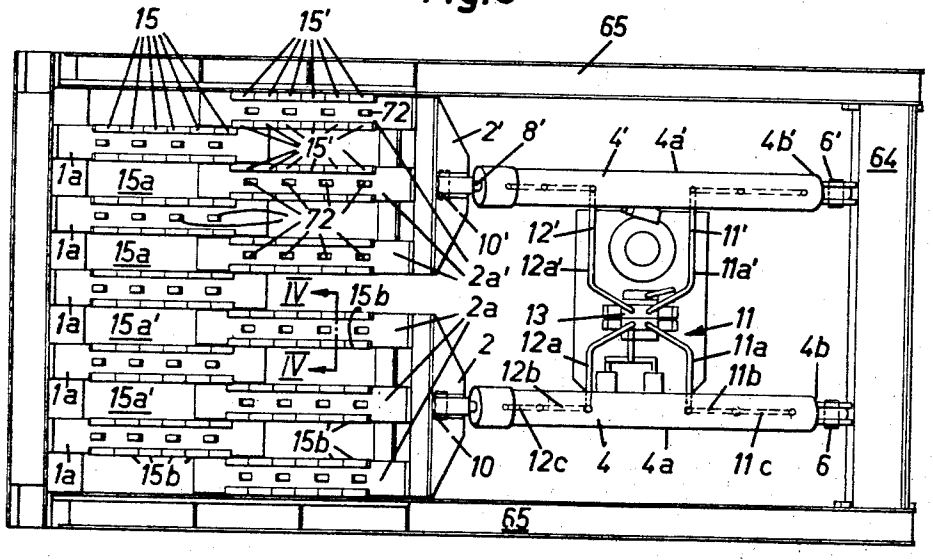


Fig. 3



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APPARATUS FOR THE SIZE REDUCTION OF REFUSE

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Fig. 4 A

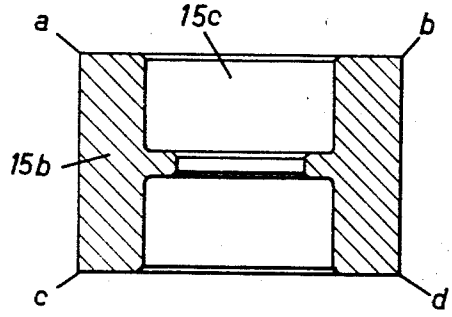
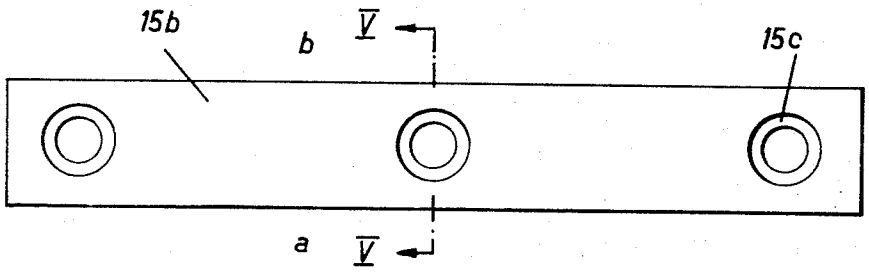


Fig. 4 B



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APPARATUS FOR THE SIZE REDUCTION OF REFUSE

Filed Nov. 15, 1965 4 Sheets-Sheet 4

Fig.4

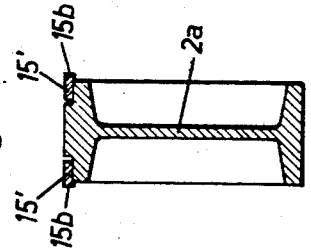
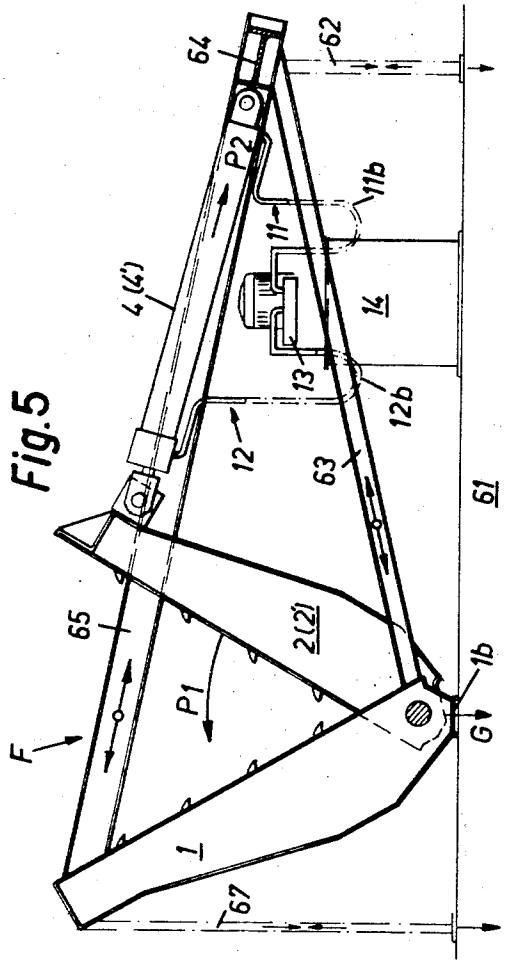


Fig.5



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Patented Oct. 10, 1967

3,346,202

APPARATUS FOR THE SIZE REDUCTION OF REFUSE

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Filed Nov. 15, 1965, Ser. No. 507,862
10 Claims. (Cl. 241—262)

ABSTRACT OF THE DISCLOSURE

An apparatus for reducing the size of refuse comprising at least two cooperating frame members, at least one of which is mounted for pivotal movement with respect to the other and when moved towards the other by means of conventional motive means effects comminution of refuse inserted between the frame members; shearing means, offset with respect to each other, are carried by the frame members in comb-like interengagement and each incorporates spaced, substantially straight shearing elements that provide a recess between each two neighboring confronting shearing elements; the recesses extend throughout the thickness and substantially throughout the length of the frame members.

This application is a continuation-in-part of my commonly assigned, copending United States application, Serial No. 290,792, filed June 26, 1963, now Patent No. 3,223,334 and entitled "Apparatus for the Size Reduction of Refuse."

The present invention has reference to an improved apparatus for the size reduction of refuse, particularly refuse the destruction of which is carried out by combustion.

An apparatus of this general type is described and claimed in my aforementioned copending United States application and generally comprises a pair of frame members, wherein at least one of them is mounted for pivotable movement. Suitable drive means cooperate with the pivotably mounted frame member in order to rock such towards and away from the other frame member. Both frame members are provided with shearing means incorporating spaced shearing elements providing a window-like recess between each two neighboring shearing elements which extends throughout the thickness of the corresponding frame member. The shearing elements of any given frame member are offset with respect to the shearing elements of the other frame member to provide comb-like interengagement of the aforesaid shearing means of both frame members in an extreme position of the pivotably mounted frame member. Moreover, the exemplary embodiment of drive means for the pivotal frame member comprises a double-acting hydraulic or pneumatic cylinder and piston arrangement, wherein the piston rod of the pivotably mounted cylinder is articulated to the pivotable frame member by means of a hinge connection.

Now, with the physical structure of apparatus disclosed in my copending application, the shearing elements of the pivotable frame member are curved in convex manner in the closing direction of such pivotable frame member, whereby such shearing elements piercingly extend through the window-like recesses of the other, e.g., stationary frame member, shortly before the pivotable frame member has reached its extreme closed position. On the other hand, the upper portion of the pivotable frame member at which there is articulated the piston rod of the cylinder, and in the aforementioned extreme closed position, is still located in front of the confronting stationary frame members; in other words, this upper portion of the pivotable frame member during movement of the latter into its extreme closed position does not piercingly extend through the stationary frame member .

The aforedescribed construction of the apparatus of my copending application which employs curved shearing elements or knives, while providing an absolutely satisfactory size reduction of the refuse processed, nonetheless still possesses a number of disadvantages, particularly with regard to manufacturing costs of the equipment.

Thus, for instance, the curved shearing elements are relatively expensive to manufacture and are difficult to sharpen. Additionally, since they become worn relatively quickly, they must be frequently exchanged for new shearing elements or knives. Furthermore, in order to be able to mount the curved shearing elements at the pivotable frame member, the corresponding portions of the latter at which these curved shearing elements are mounted must likewise be curved, and specifically with the same curvature, which also increases production costs.

Further disadvantages which occur by using the principle of a shearing device reside in the following:

Similar to the operation of every type shearing device, also in the apparatus of my aforementioned patent application, there exists the tendency that the material to be comminuted, during the closing movement of the pivotable frame member, is displaced between the cooperating edges of the shearing elements towards the outside in a direction away from the joint or mounting for both frame members. Accordingly, during the shearing operation, the apparatus has the tendency of upwardly displacing the refuse during such time as it forms, between both frames in their open position, a mouth or trough which opens towards the top. However, in so doing, the shearing effect of the shearing elements is considerably adversely affected. Apart from this, the shearing elements are subject to rapid wear because the sliding and rubbing of the refuse upon and along the shearing edges, and which take place in the presence of a relatively large pressure, cause pronounced wear of the shearing edges.

Accordingly, it is a primary object of this invention to perfect an apparatus for the size reduction of refuse which improves upon the apparatus of my aforementioned copending application and in which the aforementioned disadvantages are effectively overcome.

A further considerable object of this invention relates to an improved construction of apparatus for the size reduction of refuse which is relatively simple and economical to manufacture, robust in construction, highly reliable in operation, and requires relatively little maintenance.

Another noteworthy object of this invention is to provide an apparatus of the type described which incorporates shearing elements which are simple to mount and easy to manufacture and sharpen.

An additional object of this invention concerns constructing the shearing elements such that there can be avoided frequent exchange and replacement of the old shearing elements for new ones.

Yet a further very important object of this invention is to provide an improved construction of apparatus for size reduction of refuse which effectively prevents the undesired sliding of material undergoing comminution upon and along the edges of the shearing elements, thereby increasing the shearing effect and at the same time reducing wear of the shearing edges.

An additional, yet equally important object of this invention relates to the construction of an apparatus for the size reduction of refuse which in consideration of the forces occurring during operation is favorable, does not require a massive foundation for supporting the apparatus and, thus, ensures that it can be easily installed in almost every existing refuse destruction installation.

In order to implement these and still further objects of the invention which will become apparent as the description proceeds, the preferred constructional manifestation of apparatus for the size reduction of refuse generally comprises at least one pair of frame members, means mounting at least one of said frame members for pivotable movement, with drive means being provided for pivoting the at least one pivotably mounted frame member towards the other frame member. Additionally, each frame member includes a plurality of spaced shearing beam members provided with shearing means incorporating spaced, substantially straight shearing elements providing a recess between each two neighboring confronting shearing elements, such recess extending throughout the thickness of the corresponding frame member. The shearing beam members and shearing elements of any one frame member are offset with respect to the shearing beam members and shearing elements of the other frame member, to enable comb-like interengagement of the shearing means of both frame members in one extreme position of the pivotably mounted frame member. According to a preferred constructional manifestation, there is provided two separately pivotable frame members which can be operated conjointly or independently of one another.

Other features, objects and advantages of the invention will become apparent by reference to the following detailed description and drawings in which:

FIGURE 1 is a perspective view of a preferred embodiment of inventive apparatus for the size reduction of refuse;

FIGURE 2 is a vertical side view of the inventive apparatus depicted in FIGURE 1;

FIGURE 3 is a top plan view of the apparatus depicted in FIGURE 2;

FIGURE 4 is an enlarged view of a portion of the apparatus depicted in FIGURES 2 and 3, as viewed along the line IV—IV thereof;

FIGURE 4A is an enlarged cross-sectional view of a shearing knife viewed along the line V—V of FIGURE 4B;

FIGURE 4B is an enlarged plan view of a shearing knife used in the apparatus of the present invention; and

FIGURE 5 schematically illustrates the apparatus of FIGURES 1 to 3, depicting the forces prevailing during operation.

Describing now the drawings, the exemplary embodiment of inventive apparatus for the size reduction of refuse is here shown as a so-called twin construction in that, two adjacently arranged pivotable frame members **2**, **2'**, each equipped with a cylinder and piston arrangement **4**, **4'** respectively, cooperate with a common stationary frame member **1**. The lower end of each pivotable frame member **2**, **2'** is mounted for pivotal movement upon a pivot shaft or hinge connection **3** here shown also cooperating with the lower end of the stationary frame member **1**, so that the aforesaid pivotable frame members **2**, **2'** can be rocked towards and away from the stationary frame member **1**. Each cylinder and piston arrangement **4** and **4'** is similarly constructed and can be assumed to be pneumatically or hydraulically actuated. Considering for instance the piston and cylinder arrangement **4**, such is seen to comprise a cylinder housing **4***a* in which there is slidably mounted a piston member **7** having a piston rod **8** which piercingly extends through the upper end of the cylinder **4***a* and is articulated by means of a suitable hinge connection **10** with the associated frame member **2**. Similarly, the piston rod **8'** of the other cylinder **4***a'* is articulated by a hinge connection **10'** with the other frame member **2'**. Both of these cylinder and piston arrangements **4** and **4'** are carried upon a stationary support structure **5**. The respective lower end **4***b* and **4***b'* of the cylinder and piston arrangements **4** and **4'** respectively, are hingedly connected with the support structure **5** by means of suitable hinge joints **6** and **6'** respectively.

Each cylinder and piston arrangement **4** and **4'** is operatively associated through the agency of a control device **13** with a common pump assembly or unit **14** embodying a suitable electric motor **14***a* and a suitable pump **14***b*, via the respective supply lines or conduits **11**, **12** and **11'**, **12'** respectively. The infeed of pressurized fluid medium transmitted through the supply lines **11**, **12** and **11'**, **12'** and selectively acting against the lower and upper faces respectively, of the working pistons **7** and **7'** within the cylinders **4** and **4'** is adjustable at this control device **13**. Details of a similar pump assembly **14** and control device **13** which cooperate with a cylinder and piston arrangement have already been set forth in my aforementioned copending United States application to which reference may be readily had, so that such will only be further considered hereafter when discussing the operation of the device.

Although both piston and cylinder arrangements **4** and **4'** are connected with a common pump assembly **14** incorporatng the control device **13**, the latter could be constructed such that during operation of the apparatus only one of both cylinders **4***a* or **4***a'* is furnished with a pressurized medium to thereby pivot its associated frame **2** or **2'**, whereas the other cylinder is not supplied with such pressurized medium and its associated frame is then at standstill. This provides the possibility of, when desired, only operating one, or both, of the two pivotable frame members **2**, **2'**. This not only enables working with only one of the pivotable frame members **2** or **2'** if the quantity of refuse to be diminished in size does not warrant simultaneous operation of both frame members, but also enables the apparatus to still be used even in the event of breakdown of one of these pivotable frame members.

As best shown in FIGURES 1 and 3, the stationary support structure **5** upon which the cylinder and piston arrangements **4** and **4'** are carried is shown composed of a foundation **61** formed for instance of bricks, two upright standards **62** fixedly embedded in the brick foundation **61**, and two downwardly inclined supports **63** which extend towards the pivot shaft or hinge connection **3** articulating the pair of pivotable frame members **2**, **2'** with the stationary frame member **1**. The downwardly inclined supports **63** are connected at one end with the vertical standards **62** and at the other end with the stationary frame member **1**, for instance by welding. Such stationary support structure **5** further embodies a transversely extending crossbeam **64** to which there is mounted the hinge connections **6** and **6'** for the cylinder and piston arrangements **4** and **4'** respectively. The crossbeam **64** is connected at each of its ends with one end of one of the respective supports **65**, whereas the other respective ends of both of these supports **65** are fixedly connected with a crossbeam **66**. The latter is welded to the upper region of the stationary frame member **1** and is braced by means of vertical standards **67** upon the brick foundation **61**.

The previously mentioned structural elements **62** to **66** preferably consist of normal profiled iron beams. specifically of double T iron beams forming H or I beams which can be reinforced by welded flat sheet metal and/or profile iron members. Thus, for instance, the crossbeam **66** is here shown formed of two H profiles **66***a* and **66***b* which are welded together and reinforced by flat sheets **66***c* welded between the flanges of these profile members (FIGURE 2).

The upwardly open mouth or trough for the receipt of the refuse to be reduced in size and formed by the frames **1** and **2**, **2'** is closed at both sides of the apparatus by means of a respective sheet metal plate **68** suitably connected, for instance, to the stationary frame member **1** and to the neighboring carrier or support **65**. Accordingly, by means of the frames **1**, **2**, **2'** and both lateral plates **68** there is formed a downwardly converging filling funnel F which in cross section possesses a rectangular configuration.

Upon leaving the space between the frame members **1**, **2** and **2'**, the comminuted refuse falls into two compartments **69** and **70** provided at the brick foundation **61** and arranged to both sides of an intermediate brick partition wall **61***a*. The lower portion **1***b* (FIGURE 5) of the stationary frame member **1** provided with the hinge connection **3** rests upon this intermediate partition wall **61***a*. Both of these compartments **69** and **70** are open at one or both sides, so that at this location the comminuted refuse falls out and, for instance, can be seized by means of a suitable nonillustrated grab crane, thereafter delivered to an appropriate refuse incinerator for example.

By referring to FIGURE 3 it will be clearly recognized that each of the frames **1** and **2**, **2'** is equipped with a plurality of rows of shearing elements **15** and **15'** respectively, here shown to be in the form of straight, flat knives **15***b*. In each row of such shearing elements **15** or **15'** there are six such shearing or cutting knives **15***b* for instance. As best seen by referring to FIGURES 4A and 4B, each of the shearing knives **15***b* of these shearing elements **15** and **15'** can be equipped with four cutting edges *a*, *b*, *c* and *d*, only one of which is operable at any one time, so that it is possible to turn such knives three more times to bring a new cutting edge into operation before the entire shearing element must be re-sharpened. Each of the knives **15***b* have suitable bores **15***c* enabling attachment to the associated frame member. Naturally, each shearing element **15** or **15'** could also be formed of less or more shearing knives **15***b*, or even conceivably as an integral knife unit. It will also be noticed that at any given shearing beam **1***a* or **2***a*, **2***a'* of the frames **1** and **2**, **2'** respectively, there are arranged two rows of such shearing elements **15** and **15'** respectively, and specifically at the lateral edges of each such shearing beam **1***a* or **2***a*, **2***a'*. During the work stroke of the apparatus the spaced shearing beam members **2***a*, **2***a'* of the frames **2**, **2'** respectively, and axially offset from the spaced shearing beam members **1***a* of the frame **1**, enter the window-shaped recesses **15***a* formed between these shearing beams **1***a* of the stationary frame member **1** and, in each instance, a row of shearing elements **15** of the stationary frame member **1** cooperates with a row of shearing elements **15'** of the pivotable frame members **2**, **2'**. Finally, it is mentioned that the shearing elements **15** and **15'** can be detachably connected to the stationary frame member **1** and the pivotable frame members **2**, **2'** respectively, by means of suitable screws or other fastening expedients.

Retaining and blocking cam pieces **72** are fixedly secured to the shearing beams **1***a*, **2***a*, **2***a'* of the frame members **1**, **2**, **2'** respectively. These restraining cams **72**, four of which are shown arranged between two rows of shearing elements **15** or **15'** respectively, of a shearing beam **1***a*, **2***a* and **2***a'* respectively, prevent the refuse to be reduced in size from being upwardly displaced upon and along the cutting edges of the shearing elements **15** and **15'** respectively, that is, during the time that the pivotable frame members **2** and **2'** are moving into the phantom line closed position depicted in FIGURE 2. Due to this measure, not only is the shearing effect increased but also the wear of the cutting edges at the shearing elements **15** and **15'** is minimized.

The enlarged vew of FIGURE 4 clearly shows the manner in which the straight, flat shearing elements **15'** are constructed and connected to shearing beam **2***a* of the pivotable frame member **2**; this arrangement and construction can be assumed to be the same for the shearing elements **15** and **15'** of the frame members **1** and **2'** respectively. Thus, it will be recognized that the shearing elements **15** and **15'** are not only easy to manufacture because of the simplicity in their simple, straight form, but also need be seldom exchanged for new shearing elements since each time one of its four cutting edges becomes worn it can merely be turned to expose a new cutting edge and used further. Moreover, by virtue of the substantially linear form of these shearing elements **15**, **15'** they can be easily sharpened. These shearing elements **15** and **15'** are preferably formed of high wear resistant tool steel.

It should be readily apparent that the previously described apparatus for the size reduction of refuse particularly manifests itself by its relatively low production costs since the shearing elements **15**, **15'** are relatively inexpensive owing to their straight form, and the frame members **1**, **2**, **2'**, due to the simple form of the shearing elements **15**, **15'**, can also be formed from standard iron profiles or sections.

FIGURE 5 schematically depicts the basic construction of the previously described apparatus and the forces which occur during operation. It will be recognized that a rigid framework of triangular configuration is formed by the stationary frame member **1**, the support **63** and the support **65**, which is braced at both ends by the upright supports **62** and **67** and, above all, in the middle region upon the brick foundation **61** via the lower end **1***b* of the stationary frame member **1**.

During the closing stroke of the pivotable frame members **2** and **2'**, the cylinders **4***a* and **4***a'* in accordance with the laws of action and reaction exert a rearwardly directed force P_2 upon the crossbeam **64** which corresponds to the effective work force P_1 of the pivotable frame members **2** and **2'**. This rearwardly directed force P_2 is, however, taken up at both sides of the crossbeam **64** by both supports **63** and **65**, whereby in these supports **63** and **65**, totalling four in number, there advantageously only occur tension forces, generally represented by the double-headed arrows of FIGURE 5, and which roughly considered, in each instance, only amount to one-quarter of the force P_2 exerted by the cylinders.

Thus, the apparatus forms a strong, self-closed unitary structure wherein all of the forces brought about by the work force P_1 are held in force equilibrium as so-called bar tensions or bar stresses in the above-mentioned triangles formed of the members **1**, **63** and **65** and forming a closed polygon of forces. Consequently, the vertical supports **62** and **67**, shown in phantom lines in FIGURE 5, as well as also in particular the base portion **1***b* of the stationary frame member **1**, are not loaded by the forces resulting from the work force P_1, rather only need transmit the weight G of the machine to the foundation **61**. It is for this reason that a relatively light constructed foundation **61** is sufficient, and the further advantage is provided that the inventive apparatus can be easily installed in almost every refuse destruction installation.

Since the pump unit **14** with the associated control device **13** is only operatively connected via two flexible hoses **11***b* and **12***b* which are connected with both conduits **11** and **12** of the cylinder **4***a* for the pressurized fluid, yet otherwise freely rests upon the brick foundation **61**, this pump unit is completely free of any forces which occur during the operation of the apparatus, so that the control device **13** in particular is not subjected to possible undesired externally caused tensile loads. It will also be recognized that, as best shown in FIGURE 3, the control device **13** is also connected by flexible hoses **11***a'* and **12***a'* with the supply conduits **11'** and **12'** respectively, leading to the other cylinder **4***a'*.

The manner of operation of the heretofore described apparatus is as follows: The pivotable frame members **2**, **2'** are located in their open position depicted in FIGURES 1 and 2. In this position both of these frame members **2**, **2'** together with the stationary frame member **1** form a mouth or hopper which opens towards the top and into which there is introduced from above a charge of refuse which is to be reduced in size. Thereafter, the pistons **7** and **7'** (the latter is not visible in the drawings) of the cylinders **4***a* and **4***a'* respectively, have applied to their lower respective face a pressurized fluid medium, such as oil, via the corresponding supply lines **11** and **11'** respectively. As a result, each piston **7** and **7'** together with

its piston rod 8 and 8' is moved upwardly in its cylinder 4a and 4a' respectively, and, thereby, at the same time rocking the associated pivotable frame member 2, 2' towards the stationary frame member 1. As a result, the charged material is crushed and reduced in size, whereby however the momentary closing stroke of the frame members 2, 2' is automatically limited by the mechanical resistance of the refuse charged, since previously the adjustable or settable infeed of the pressurized fluid medium and therewith the driving force of the pistons 7 and 7' has been adjusted at the control device 13 to a specific resistant force acting against the pistons 7 and 7'. The physical structure of the control device 13 does not form part of the invention and since details of its construction are not necessary for understanding the teachings of the present invention and the physical structure of a control device suitable for the present invention has already been fully disclosed in my aforementioned copending United States application, Serial No. 290,792, to which reference may be readily had. Consequently, as soon as the increasing resistance of the material to be processed equals the adjusted working force of the pistons 7, 7' (for instance a permissible set oil pressure of for example 150 atmospheres absolute pressure), the latter are brought to rest. Then the control device 13 immediately switches the oil through the respective supply lines 12, 12' to the upper face of each piston 7, 7' respectively, so that these pistons 7, 7' again move downwardly in their cylinders 4a and 4a' respectively, and at the same time pivot the frame members 2, 2' back into their opening position.

Consequently, the material disposed between the frame members 1 and 2, 2' slides downwardly in the direction of the pivot shaft or hinge connection 3. After the frame members 2, 2' have reached their open position, the control device 13 again switches the oil infeed through the respective supply lines 11, 11' to the lower face of each piston 7 and 7' respectively, so that each such piston is again upwardly displaced and the corresponding frame member 2 and 2' is pivoted towards its closing position, wherein the major portion of each shearing beam 2a, 2a' of the frames 2, 2' enters the window-shaped recesses 15a of the stationary frame 1. In this manner the material is once again acted upon, i.e., is still further crushed and comminuted. The transmission ratio of the lever system between the respective hinge joints 10 and 10' serving as the point of attack of the force of the piston rods 8 and 8' respectively, and the shearing location is thus increased, because due to the downward sliding of the refuse in the apparatus, the upper lever arm between the shearing location and the point of application of the forces at hinge joints 10 and 10' becomes longer, whereas the lower lever arm between the shearing location and the pivot axis or hinge joint 3 of the pivotable frame members 2 and 2' becomes correspondingly shorter. Due to the thus increased transmission ratio the refuse can be comminuted without overloading the machine during the next work stroke of the pivotable frames 2 and 2'. Hence, due to a number of repeated opening and closing movements of the frame members 2, 2' with continuous sliding of the material, there results a continuous crushing and shearing of such material by means of the compressive forces exerted by the frame members 2, 2' which become increasingly effective from one closing movement to the other, as aforedescribed. Due to the described construction and operation, the operating personnel required for the machine is reduced to the person operating the grab crane who is responsible for charging the apparatus with refuse.

It is here indicated that an apparatus for the size reduction of refuse has been constructed in the previously described manner which exhibited a throughput of materials of between approximately 120 and 200 cubic meters per hour, depending upon the composition of the refuse, and with a motor power or output of only 37 kilowatts and a maximum permissible oil pressure of 150 atmospheres absolute pressure for the hydraulic cylinders 4a and 4a'. The total weight of the apparatus amounted to only 28 tons. With this apparatus it is possible to reduce in size bulky refuse of almost any type without previous sorting, such as for instance chests, tables, beds, boxes, mattresses, wood, trunks of trees and poles, sections of tree trunks, wooden planks, large cardboard boxes, tires, iron barrels, refrigerators and so forth; in other words, practically all types of material .The inventive apparatus distinguishes itself by its great reliability in operation and its capability of performing relatively noise free and without generating a great deal of dust. Additionally, the operating and maintenance personnel are held to a minimum and the relatively slow shearing operation precludes the formation of dangerous sparks, so that there is effectively prevented any possibility of explosions.

Finally, it is pointed out and to be clearly understood that the apparatus, instead of possessing the previously described twin construction, could also be constructed with only a single work unit, that is, with only one pivotable frame member which would be formed from the same structural elements and, in principle, assembled in the same manner. On the other hand, it could also be formed of more than two pivotable frame members. Whether there is one, two or more pivotable frame members, in all instances the apparatus retains the previously mentioned advantages.

While there is shown and described present preferred embodiments of the invention it is to be distinctly understood that the invention is not limited thereto but may be otherwise variously embodied and practised within the scope of the following claims.

What is claimed is:

1. Apparatus for the size reduction of refuse, particularly for refuse to be destroyed by combustion, comprising at least two cooperating frame members, means mounting at least one of said frame members for pivotable movement, drive means for pivoting the pivotably mounted frame member towards the other frame member, shearing means provided for both of said frame members, said shearing means of each frame member incorporating spaced, substantially straight shearing elements providing a recess between each two neighboring confronting shearing elements, said recess extending throughout the thickness and substantially throughout the length of the corresponding frame member, said shearing means of any one frame member being offset with respect to said shearing means of the other frame member, to enable comb-like interengagement of said shearing means of both frame members throughout substantially the full longitudinal extent of said frame members in one extreme position of said pivotably mounted frame member.

2. Apparatus for the size reduction of refuse according to claim 1, wherein said two cooperating frame members each incorporate a plurality of spaced, substantially straight shearing beam members, said shearing beam members of any one frame member being offset with respect to said shearing beam member of the other frame member, each of said shearing beam members carrying said shearing means.

3. Apparatus for the size reduction of refuse according to claim 2, wherein there are provided at least two separate pivotably mounted frame members, each of said pivotably mounted frame members being provided with said shearing beam members and said shearing means incorporating spaced, substantially straight shearing elements.

4. Apparatus for the size reduction of refuse according to claim 3, wherein said drive means operates each pivotably mounted frame member, said drive means incorporating a cylinder and piston arrangement for each pivotably mounted frame member, so that said pivotably mounted frame members can be operated conjointly or independently of one another.

5. Apparatus for the size reduction of refuse, particularly for refuse to be destroyed by combustion, comprising at least two cooperating frame members, means mounting at least one of said frame members for pivotal movement, drive means for pivoting the pivotably mounted frame member toward the other frame member, shearing means provided for both of said frame members, said shearing means of each frame member incorporating spaced, substantially straight shearing elements providing a recess between each two neighboring confronting shearing elements, said recess extending throughout the thickness of the corresponding frame member, said shearing means of any one frame member being offset with respect to said shearing means of the other frame member, to enable comb-like interengagement of said shearing means of both frame members in one extreme position of said pivotably mounted frame member, said two cooperating frame members each incorporate a plurality of spaced, substantially straight shearing beam members, said shearing beam members of any one frame member being offset with respect to such shearing beam member of the other frame member, each of said shearing beam members carrying said shearing means, said shearing beam members of said two cooperating frame members are each provided with means which prevent the refuse material from sliding upwardly along and upon said shearing means of each frame member.

6. Apparatus for the size reduction of refuse according to claim 5, wherein said means for preventing upward sliding of the refuse comprises a plurality of spaced cam members provided at each shearing beam member.

7. Apparatus for the size reduction of refuse, particularly for refuse to be destroyed by combustion, comprising at least two cooperating frame members, means mounting at least one of said frame members for pivotal movement, drive means for pivoting the pivotably mounted frame member toward the other frame member, shearing means provided for both of said frame members, said shearing means of each frame member incorporating spaced, substantially straight shearing elements providing a recess between each two neighboring confronting shearing elements, said recess extending throughout the thickness of the corresponding frame member, said shearing means of any one frame member being offset with respect to said shearing means of the other frame member, to enable comb-like interengagement of said shearing means of both frame members in one extreme position of said pivotably mounted frame member, said two cooperating frame members each incorporate a plurality of spaced, substantially straight shearing beam members, said shearing beam members of any one frame member being offset with respect to such shearing beam member of the other frame member, each of said shearing beam members carrying said shearing means, said shearing elements of each frame member comprise cutter means having a plurality of substantially straight cutting edges, said shearing elements being detachably mounted to said shearing beam members of the associated frame member such that it is possible to selectively bring a given cutting edge of each cutter means into operable position.

8. Apparatus for the size reduction of refuse particularly for refuse to be destroyed by combustion, comprising at least two cooperating frame members, means mounting at least one of said frame members for pivotal movement, drive means for pivoting the pivotably mounted frame member toward the other frame member, shearing means provided for both of said frame members, said shearing means of each frame member incorporating spaced, substantially straight shearing elements providing a recess between each of two neighboring confronting shearing elements, asid recess extending throughout the thickness of the corresponding frame member, said shearing means of any one frame member being offset with respect to said shearing means of the other frame member, to enable comb-like interengagement of said shearing means of both frame members in one extreme position of said pivotably mounted frame member, said two cooperating frame members each incorporate a plurality of spaced, substantially straight shearing beam members, said shearing beam members of any one frame member being offset with respect to such shearing beam member of the other frame member, each of said shearing beam members carrying said shearing means, said shearing beam members each having oppositely disposed lengthwise edges at which there are arranged said substantially straight shearing elements, said shearing element at each lengthwise edge of one shearing beam member of one frame member cooperating with a confronting shearing element of a neighboring shearing beam member of the other frame member, said shearing beam members extending lengthwise throughout the major portion of the height of the associated frame member, so that said pivotally mounted frame member almost entirely enters the recesses of said other frame member in said one extreme position.

9. Apparatus for the size reduction of refuse according to claim 1, further including a pair of support members fixedly connected to each end of said other frame member at vertically spaced points, the support members of each pair of support members enclosing therebetween an acute angle, to thereby form a triangular shaped support structure at each end of said other frame member, said other frame member being stationarily mounted.

10. Apparatus for the size reduction of refuse according to claim 9, further including a transverse beam for interconnecting both triangular-shaped support structures with one another.

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