Sept. 12, 1961 J. D. AULT ET AL 2,999,651

SINGLE STAGE ROCK CRUSHER

Filed July 11, 1958 2 Sheets-Sheet 1

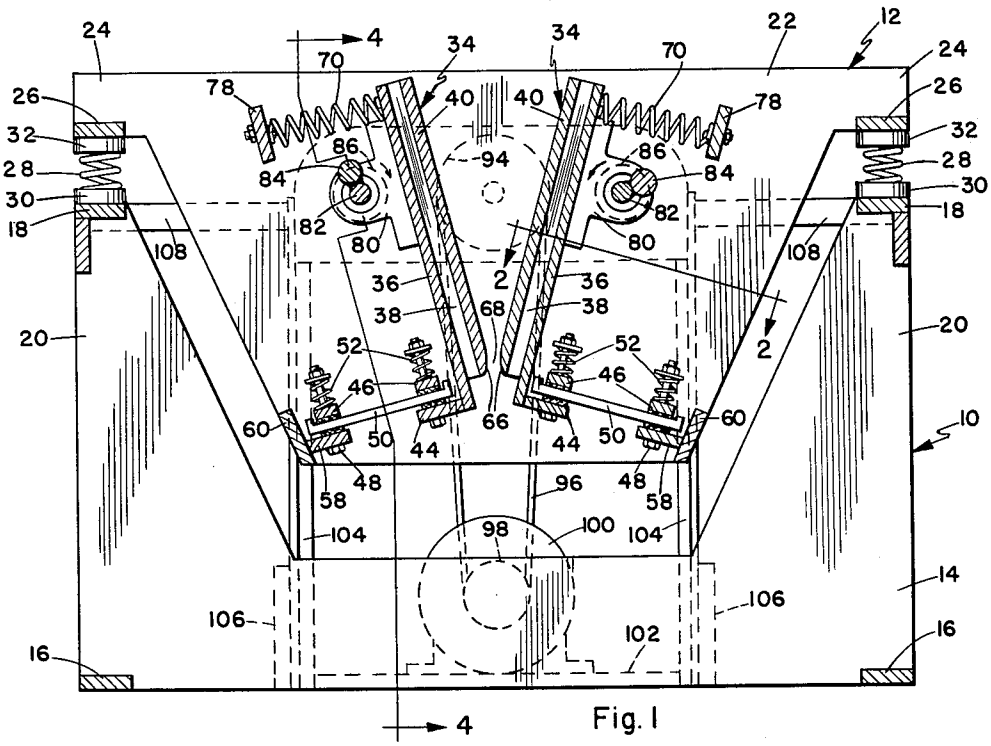


Fig. 1

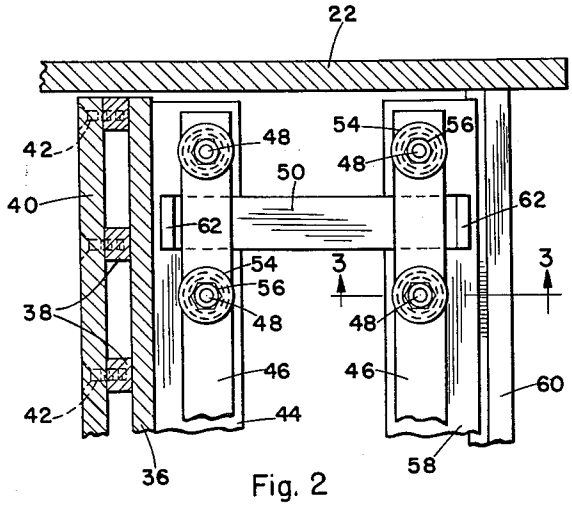


Fig. 2

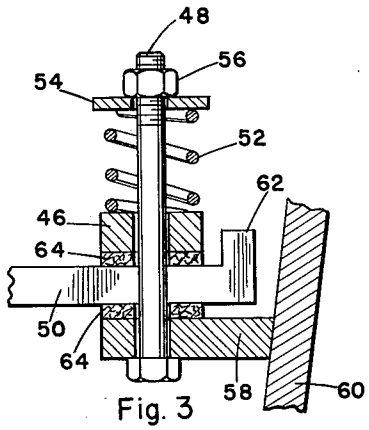


Fig. 3

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SINGLE STAGE ROCK CRUSHER

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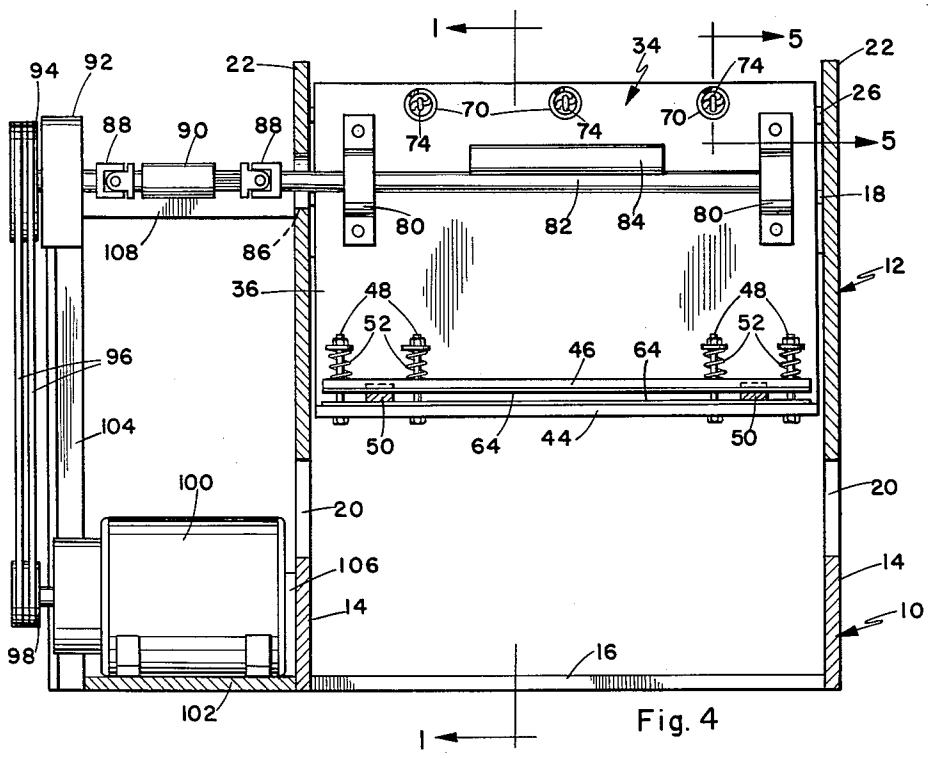


Fig. 4

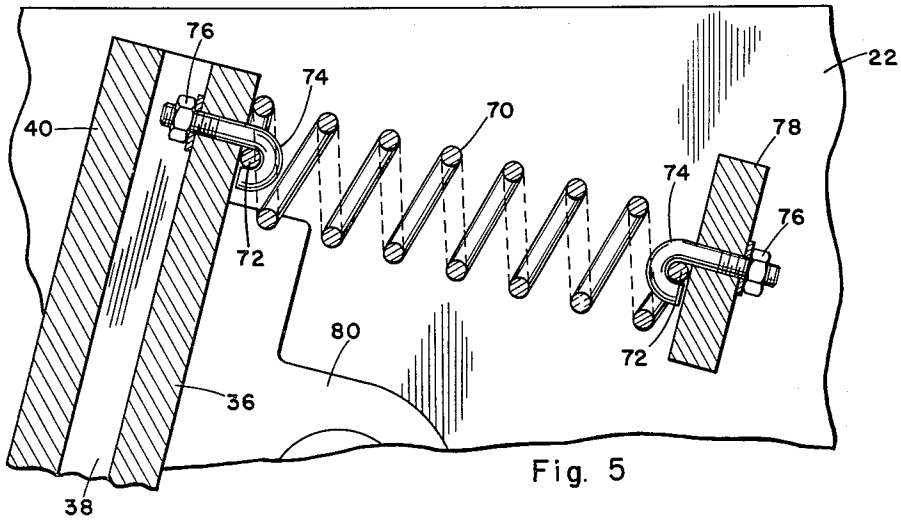


Fig. 5

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SINGLE STAGE ROCK CRUSHER

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The present invention relates generally to rock crushing machines and more particularly to a single stage rock crusher.

The primary object of this invention is to provide a rock crusher which, in a single stage, reduces large rocks to a small size normally requiring several graded stages.

Another object of this invention is to provide a rock crusher having a novel resilient jaw suspension arrangement which is very efficient in operation and minimizes noise and vibration.

A further object of this invention is to provide a rock crusher in which the jaw suspension structure is entirely spring mounted and contains no direct pivotal mountings which might be subject to excessive wear.

Still another object of this invention is to provide a rock crusher in which each jaw is vibrated by a simple eccentric weight, the weights being driven in proper synchronization from a common source.

Another object of this invention is to provide a rock crusher which is adapted for fabrication from many different materials, so that the choice of material can be according to the dictates of availability and price considerations, the exact sizes and proportions being matters easily determined to suit particular conditions and needs.

Another object of this invention is to provide a rock crusher which is practicable and inexpensive to manufacture.

Finally, it is an object to provide a rock crusher of the aforementioned character which is simple and convenient to operate and which will give generally efficient and durable service.

With these and other objects definitely in view, this invention consists in the novel construction, combination and arrangement of elements and portions which will be hereiafter fully described in the specification, particularly pointed out in the claims, and illustrated in the drawings which form a material part of this disclosure, and in which:

FIGURE 1 is a transverse sectional view of the rock crusher as taken on the line 1—1 of FIGURE 4;

FIGURE 2 is an enlarged fragmentary sectional view taken on the line 2—2 of FIGURE 1;

FIGURE 3 is a fragmentary sectional view taken on the line 3—3 of FIGURE 2;

FIGURE 4 is a longitudinal sectional view taken on the line 4—4 of FIGURE 1; and

FIGURE 5 is an enlarged fragmentary sectional view taken on the line 5—5 of FIGURE 4.

Similar characters of reference indicate similar or identical elements and portions throughout the specification and throughout the views of the drawings.

Referring now to the drawings in detail, the rock crusher comprises a fixed base frame 10, which is supported on the ground or attached to a suitable supporting surface, and a floating frame 12 which carries the operational mechanism of the crusher. The base frame 10 comprises a pair of upright end plates 14 interconnected by lower beams 16 and upper beams 18, the specific structure and bracing thereof being a matter of choice according to requirements. Each end plate, as shown, is generally U-shaped and has upstanding sides 20.

The illustrated floating frame 12 includes a pair of flat end plates 22 shaped to fit between the sides 20 and having

laterally extending, upper arm portions 24 which are interconnected by longitudinal side beams 26. The floating frame 12 is supported at its four corners on support springs 28 which rest in lower cups 30 fixed to the upper beams 18, said floating frame having corresponding upper cups 32 fixed below the side beams 26 to fit over the support springs. Additional support springs 28 may be used if necessary according to the size and weight of the machine. Mounted in the floating frame 12 are the two opposed crusher jaws 34, each having a back plate 36 on which are a plurality of raised ribs 38, and a hardened face plate 40 secured to said ribs by suitable screws 42, as in FIGURE 2. The ribbed structure provides clearance for bolts or the like used to secure structure to the back plate 36 and when the face plates 40 become unduly worn through use, they are easily replaced by removing the screws 42. Obviously other means may be employed to mount the face plates.

Along the lower edge of each back plate 36 is an outwardly extending flange 44 on which is mounted a clamp bar 46, held in place by two pairs of bolts 48. Secured between each flange 44 and clamp bar 46 are two support bars 50 each having one end thereof between a pair of the bolts 48, said clamp bar being held tightly on the support bars by springs 52 fitted over said bolts and retained by washers 54 and nuts 56, as in FIGURES 2 and 3, the nuts being locked by any suitable means. The other ends of the support bars 50 rest on a flange 58 extending from a longitudinal beam member 60 which is fixed between the lower corners of the end plates 22, said support bars being held by a further clamp bar 46 and the assembly of bolts 48 and springs 52 as described above. The support bars 50 have upturned ends 62 to prevent them from pulling loose and pads 64 of fiber, leather, or the like are inserted above and below the support bars to absorb wear. Thus both jaws 34 rest entirely on the support bars 50 which are spring mounted at both ends, no actual pivotal support such as a shaft or hinge being used. The jaws are supported so that their lower ends are closely adjacent and are upwardly divergent, the lower opposed faces of the face plates 40 being curved, as at 66, to define a narrow throat 68.

The upper ends of the jaws 34 are supported on large coil springs 70, three being shown on each jaw although more or less may be used as necessary. Each spring 70 has its end coils turned inwardly to provide substantially diametrical end portions 72, the inner ends adjacent the back plates 36 being secured by J-bolts 74, or the like, passing through said back plates and secured by nuts 76, as in FIGURE 5. The outer ends of the springs 70 are secured to upper support beams 78, fixed between the end plates 22, by means of further J-bolts 74 clamped around the diametrical portions 72. The springs 70 act in both compression and tension and allow the jaws 34 free vibrating motion.

Fixed to the upper portion of each back plate 36 adjacent the ends thereof are two pillow blocks 80 carrying a longitudinal shaft 82 on which is fixed an eccentric weight 84, the end of each shaft extending through an enlarged opening 86 in one end plate 22 and being provided with an assembly of two universal joints 88 and an axial movable splined connection 90. This arrangement is necessary to accommodate the vibrating motion of the shafts 82 when in operation. The shafts 82 are rotated in opposite directions, through a suitable gearbox 92, by means of a driven pulley 94 connected by belts 96 to the drive pulley 98 of a motor 100, said motor being mounted on a base plate 102 extending from the base frame 10. The gearbox 92 is supported on upright posts 104 braced from the base plate 102 by side plates 106, said gearbox having upper stays 108 extending to the adjacent end plate 22 for additional support. The specific structure of the

motor and gearbox support is not critical and may be arranged to suit a particular installation of the machine. In operation, the shafts **82** are rotated in opposite directions in synchronization, the unbalance of the eccentric weights **84** imparting a powerful vibratory action to the jaws **34**. Rock is fed between the jaws manually or from a hopper and is crushed by impact between the two jaws **34**, the pieces of rock progressing downwardly as they become smaller by continued crushing action. The fully crushed rock drops through the narrow throat **68** and is collected in suitable receptacles. It has been found in tests that rocks up to eight inches or more across may be reduced to approximately one-twelfth of an inch in size in a single passage between the jaws, while in other types of machines, several stages of crushing are necessary to achieve similar size reduction. The very efficient crushing action is due to the extremely free, resilient mounting of the jaws **34** and the violent, rapid vibratory motion made possible thereby. Vibration in the machine itself is minimized due to the resilient connection between the jaws and their supports and by the spring mounting of the floating frame **12**, together with a comparable reduction in noise. The few parts of the machine subject to wear are easily replaceable and little maintenance is required.

The operation of this invention will be clearly comprehended from a consideration of the foregoing description of the mechanical details thereof, taken in connection with the drawings and the above recited objects. It will be obvious that all said objects are amply achieved by this invention.

It is understood that minor variation from the form of the invention disclosed herein may be made without departure from the spirit and scope of the invention, and that the specification and drawings are to be considered as merely illustrative rather than limiting.

We claim:

1. A single stage rock crusher, comprising: a fixed base frame; a floating frame resiliently mounted on said base frame; a pair of opposed crusher jaws operatively mounted in said base frame and converging at their lower edges to define a throat therebetween; a plurality of support bars resiliently connected at one end thereof to the lower edge of each of said jaws; the other ends of said support bars being resiliently connected to said floating frame; resilient support means interconnecting the upper portions of said jaws with said floating frame; and means for vibrating said jaws toward and away from each other.

2. A single stage rock crusher, comprising: a fixed base frame; a floating frame resiliently mounted on said base frame; a pair of opposed crusher jaws operatively mounted in said base frame and converging at their lower edges to define a throat therebetween; a plurality of support bars resiliently connected at one end thereof to the lower edge of each of said jaws; the other ends of said support bars being resiliently connected to said floating frame; a plurality of springs terminally secured at one end thereof to the upper portion of each of said jaws; the other ends of said springs being secured to said floating frame; and means for vibrating said jaws toward and away from each other.

3. A single stage rock crusher, comprising: a fixed base frame; a floating frame resiliently mounted on said base frame; a pair of opposed crusher jaws operatively mounted in said base frame and converging at their lower edges to define a throat therebetween; a plurality of support bars resiliently connected at one end thereof to the lower edge of each of said jaws; the other ends of said support bars being resiliently connected to said floating frame; a plurality of springs terminally secured at one end thereof to the upper portion of each of said jaws; the other ends of said springs being secured to said floating frame; a shaft rotatably and fixedly mounted on the upper portion of each of said jaws; each of said shafts having an eccentric weight fixed thereto; and means for rotating said shafts in opposite directions simultaneously to vibrate said jaws.

4. A single stage rock crusher, comprising: a fixed base frame; a floating frame resiliently mounted on said base frame; a pair of opposed crusher jaws; each of said jaws including a back plate and a face plate removably attached thereto; an outwardly extending flange fixed to the lower edge of each of said back plates, and a corresponding flange member fixed in said floating frame in alignment with each of said flanges; a plurality of support bars terminally attached to said flanges and flange members; clamp bars resiliently secured to said flanges and flange members and retaining said support bars thereon; and means connected with said back plates and movable bodily relative to said floating frame for vibrating said jaws toward and away from each other.

5. A single stage rock crusher, comprising: a fixed base frame; a floating frame resiliently mounted on said base frame; a pair of opposed crusher jaws operatively mounted in said base frame and converging at their lower edges to define a throat therebetween; each of said jaws including a back plate, and a face plate; an outwardly extending flange fixed to the lower edge of each of said back plates, and a corresponding flange member fixed in said floating frame in alignment with each of said flanges; a plurality of support bars terminally attached to said flanges and flange members; clamp bars resiliently secured to said flanges and flange members and retaining said support bars thereon; a plurality of springs terminally secured at one end thereof to the upper portion of each of said back plates; the other ends of said springs being secured to said floating frame; a shaft rotatably and fixedly mounted on the upper portion of each of said back plates; each of said shafts having an eccentric weight fixed thereto; and driving means operatively connected to said shafts to rotate the shafts in opposite directions simultaneously causing said jaws to vibrate.

6. A single stage rock crusher, comprising: a supporting frame structure; a pair of opposed crusher jaws operatively mounted in said frame structure and converging at their lower edges to define a throat therebetween; resilient support means connecting said jaws to said frame structure; said resilient means constituting the sole means of support for said jaws; and means for vibrating said jaws toward and away from each other; said resilient support means comprising support bars resiliently connected to said frame structure adjacent one end of each bar, and said jaws being resiliently connected to said support bars.

7. Structure according to claim 6 wherein said support bars are secured to said jaws adjacent the lower ends of the jaws.

8. Structure according to claim 7 and including springs connecting upper end portions of the jaws to said support frame structure.

9. A rock crusher comprising: a supporting frame structure; a pair of opposed crusher jaws operatively mounted in said frame structure and converging toward their lower edges to define a throat therebetween; resilient means engaging said frame and said jaws as the sole means of maintaining said jaws opposed to one another for bodily floating and vibratory movement relative to said frame structure; rigid elements connected to said jaws in spaced relation to said resilient means; and means rotatably carried by said rigid elements on said jaws independently of said resilient means for directly effecting positive bodily movement of said jaws relative to said frame structure and vibrating said jaws toward and away from each other.

10. A crusher comprising: a supporting frame structure; a pair of opposed downwardly convergent crusher jaws defining therebetween a space for passage of material; means at the upper and lower ends of the respective jaws floatingly supporting said jaws in said frame for gyratory movement relative to one another; power means and means including portions mounted on said jaws directly connecting said power means to said jaws spaced

from and independent of said upper and lower supporting means for imparting gyratory motion to said jaws.

11. A crusher comprising: a supporting frame structure; a pair of opposed downwardly convergent crusher jaws defining therebetween a space for passage of material; means at the upper and lower ends of the respective jaws floatingly supporting said jaws in said frame for gyratory movement relative to one another; means separate from said upper and lower supporting means for imparting gyratory motion to at least one of said jaws; said latter means including rigid bearing supports directly connected to said jaw at a location spaced from said upper and lower supporting means thereof; and an eccentrically weighted shaft journalled in said bearing supports.

12. A crusher comprising: a supporting frame structure; a pair of opposed downwardly convergent crusher jaws defining therebetween a space for passage of material; means at the upper and lower ends of the respective jaws floatingly supporting said jaws in said frame for gyratory movement relative to one another; means separate from said upper and lower supporting means for imparting gyratory motion to said jaws; said latter means including rigid bearing supports directly connected to said jaws at locations spaced from said upper and lower supporting means; and eccentrically weighted shafts journalled in the respective bearing supports.

13. A crusher comprising: a base frame; a floating frame resiliently mounted on said base frame; a pair of opposed downwardly convergent crusher jaws defining therebetween a space for passage of material; means at the upper and lower ends of the respective jaws floatingly supporting said jaws in said floating frame for gyratory movement relative to one another; motion transmitting means connected to at least one of said jaws intermediate said upper and lower supporting means thereof for imparting gyratory motion thereto; and means for driving said motion transmitting means.

14. A crusher comprising: a base frame; a floating frame resiliently mounted on said base frame; a pair of opposed downwardly convergent crusher jaws defining therebetween a space for passage of material; means at the upper and lower ends of the respective jaws floatingly supporting said jaws in said floating frame for gyratory movement relative to one another; motion transmitting means connected to said jaws intermediate said upper and lower supporting means of the respective jaws for imparting gyratory motion to said jaws; and means for driving said motion transmitting means.

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