May 30, 1961 R. W. STEVENSON 2,986,347

MATERIAL REDUCING APPARATUS

Filed Dec. 2, 1958

Fig. 1

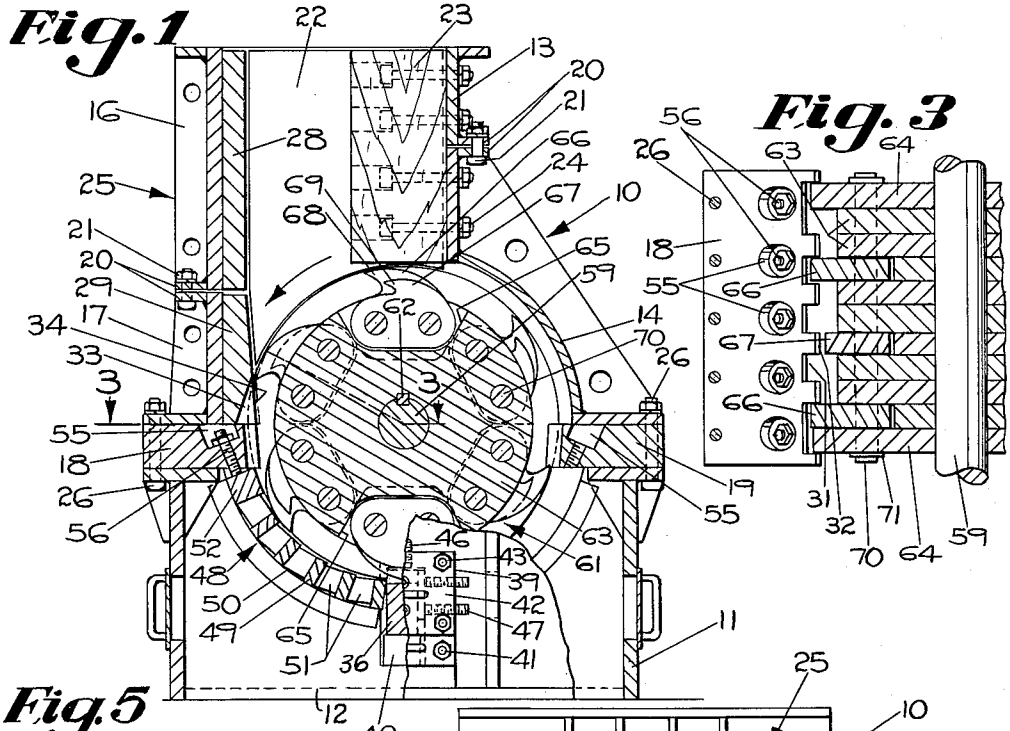


Fig. 3

Fig. 5

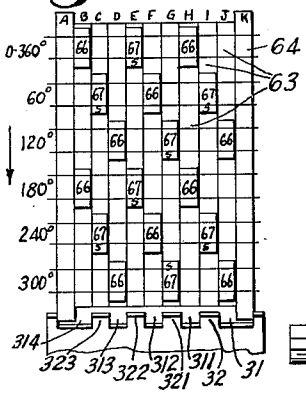


Fig. 4

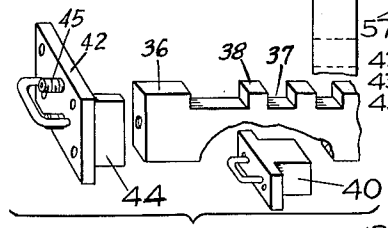
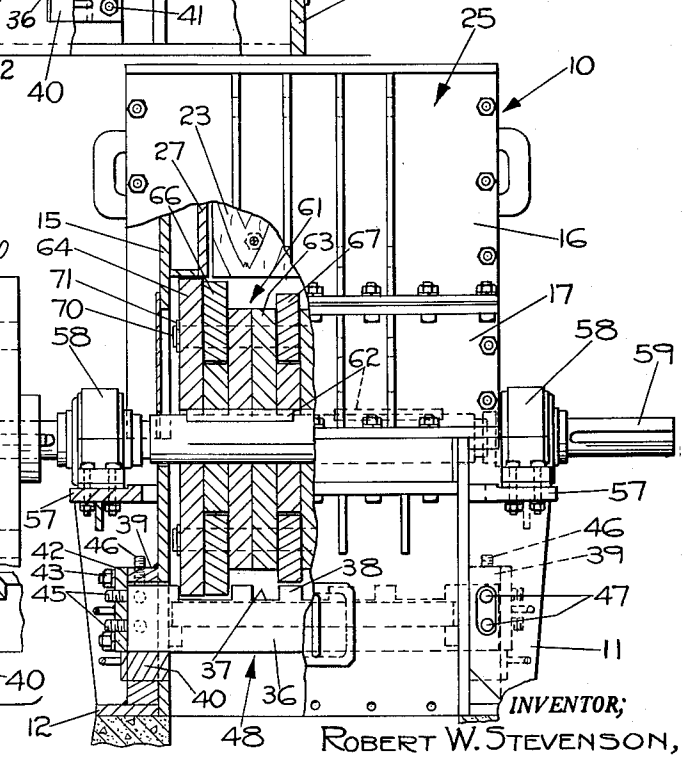


Fig. 2



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MATERIAL REDUCING APPARATUS

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The instant invention relates to material reducing apparatus, and more particularly to such an apparatus that is adapted to tear and rip material apart in reducing it to a smaller size.

It is the prime object of the instant invention to provide an improved material reducing apparatus for tearing and ripping material in reducing it to a smaller size.

It is a further object of the instant invention to provide an improved material reducing apparatus including a rotor having material reducing hammers of different lengths formed with tearing and ripping teeth for reducing the material.

It is another object of the instant invention to provide an improved material reducing apparatus including a rotor comprising a plurality of adjacent rotor segments each formed with at least one socket for the reception of a material reducing hammer which projects radially from the rotor with the hammers on adjacent rotor segments being circumferentially spaced from each other.

A still further object of the instant invention is to provide an improved material reducing apparatus including a rotor having material reducing hammers of different lengths projecting radially from the rotor and arranged in axially aligned rows, with the long and short hammers being alternated in the respective axial rows of hammers.

A still further object of the instant invention is to provide an improved material reducing apparatus including a rotor having material reducing hammers formed with tearing and ripping teeth for reducing the material, the hammers being arranged on the rotor in axial rows with the teeth of the short hammers being disposed behind the teeth of the long hammers in each axial row of hammers in the direction of rotation of the rotor.

It is also an object of the instant invention to provide an improved material reducing apparatus including a rotor having a plurality of radially projecting material reducing hammers which are adapted to interfit and cooperate with a comb mounted in the apparatus housing in reducing material.

It is still another object of the instant invention to provide an improved material reducing apparatus including a rotor having a plurality of radially projecting material reducing hammers, and the apparatus housing comprising two circumferentially spaced combs adapted to cooperate with the hammers in reducing material with a bar screen being disposed between said combs and secured in place in the housing by the combs.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claims.

In the accompanying drawings:

Fig. 1 is a side elevational view in section of the material reducing apparatus of this invention;

Fig. 2 is a front elevational view, partially in section, of the material reducing apparatus of this invention;

Fig. 3 is a sectional view of a portion of the rotor and one comb taken on the line 3—3 in Fig. 1;

Fig. 4 is a perspective view of the lower comb, the comb cover and the comb support block; and

Fig. 5 is a plan development of the peripheral surface of the rotor and one associated comb.

The material reducing apparatus of this invention comprises a massive rotor formed of a plurality of adjacent rotor segments, each of which includes a socket for the reception of at least one material reducing hammer which projects radially from the rotor. Each of the hammers is formed with a relatively sharp tooth, generally known as a hawk bill tooth, which projects forwardly in the direction of rotation of the rotor, and is particularly adapted to rip and tear the material which is delivered to the material reducing apparatus. There are provided long and short hammers projecting radially to different lengths from the rotor, with the teeth of the short hammers being disposed behind the teeth of the long hammers relatively to the direction of rotation to achieve the desired tearing and ripping action on the material to be reduced. The material reducing apparatus further includes several combs with which the hammers interfit and cooperate in reducing the material, and there is also provided a bar screen over which the reduced material is carried for further reduction and through which it is discharged from the material reducing apparatus.

Referring to the drawings, there is illustrated therein the material reducing apparatus **10** of the instant invention comprising a lower frame **11** in which the bottom **12** is open to permit the discharge of the reduced material therethrough. The top of the material reducing apparatus **10** is formed with an upper back frame **13** and a middle back frame **14** disposed directly below the upper back frame **13**. At each side of the material reducing apparatus there is a side frame **15**. At the front of the material reducing apparatus **10** there is an upper breaker plate **16** and a lower breaker plate **17** disposed one directly above the other. Between the lower breaker plate **17** and the lower frame **11** there is provided a front horizontal comb **18**, and at the rear of the material reducing apparatus **10** between the middle back frame **14** and the lower frame **11** there is a rear horizontal comb **19**, which is similar in all respects to the front horizontal comb **18**. The several frame members **11, 13, 14, 15**, and the upper and lower breaker plates **16, 17** include laterally extending flanges **20** for securing the various elements in assembly by use of suitable bolts **21**, to form a housing **25**. The combs **18, 19** are secured in the assembly as part of the housing **25** by bolts **26**.

The upper and middle back frames **13, 14**, the side frames **15**, and the upper and lower breaker plates **16, 17** form a delivery chute **22** at the top of the housing **25** through which material is delivered for reduction. A closing block **23**, which may be formed of wood, is secured to the upper and middle back frames **13, 14** by a plurality of bolts **24** to restrict the opening in the delivery chute **22**, the size of the opening in the delivery chute **22** being governed by the nature of the material fed into the material reducing apparatus **10** for reduction.

Each of the side frames **15** has secured thereto a side liner **27**, and the upper breaker plate **16** has secured to it a breaker plate liner **28**. The lower breaker plate **17** has secured to it a breaker plate comb **29**. The several liners **27, 28** and the breaker plate comb **29** are removably secured to the respective housing elements in any suitable manner, so that they may be replaced when they are damaged or worn as the result of the operation of the material reducing apparatus **10**.

As seen by reference to Fig. 3 of the drawings the front horizontal comb **18** is formed with a plurality of slots one of which is designated **31**. Intermediate the slots the comb **18** is formed with solid bridging portions one of which is designated **32**, the comb **18** being adapted to

cooperate with the rotor hammers 66, 67 in the reduction of material, as will be described in greater detail hereinafter. The breaker plate comb 29 is similarly formed with a plurality of slots one of which is designated 33 and bridging portions one of which is designated 34, which are aligned with the corresponding portions of the horizontal comb 18. By reference particularly to Fig. 5 of the drawings, which constitutes a development of the peripheral surface of the rotor, it will be seen that the comb 18 (and this is true of combs 19 and 36), as viewed from left to right includes successively slot 31 of the width of two discs of said rotor, then bridging portion 32 which is the width of one rotor disc, then slot 311 which is the width of one rotor disc, then bridging portion 321, slot 312, bridging portion 322, slot 313, and bridging portion 323, all of which have the width of one disc, after which there is slot 314 which has the width of two rotor discs.

In the bottom of the lower frame 11 there is provided a lower comb 36, which is also formed with a plurality of slots 37 and intermediate solid bridging portions 38, corresponding to the slots 31 etc. and the bridging portions 32 etc., respectively, in the front horizontal comb 18. At each side of the lower frame 11 there is a laterally projecting housing 39 through which the lower comb 36 may be inserted into the lower frame 11. The lower comb 36 is supported at each side of the lower frame 11 by a support block 40 which is inserted into each housing 39 below the comb 36. The support block 40 is secured to the lower frame 11 by a plurality of bolts 41. A comb cover 42 closes the open end of each housing 39 and is secured thereto by a plurality of bolts 43. The comb cover 42 includes a spacer block 44 which fits between the lower comb 36 and the housing 39. Each comb cover 42 includes a pair of set screws 45 which abut the ends of the lower comb 36 and permit the adjustment thereof transversely of the lower frame 11, and also secure the comb 36 in adjusted position. Each housing 39 includes a top set screw 46, and at each side of each housing 39 there is provided a pair of lateral set screws 47. The set screws 46 are adapted to abut the top of the lower comb 36, and the lateral set screws 47 are adapted to abut either the lower comb 36 or the spacer block 44 for the purpose of further adjusting and securing the lower comb 36 in the bottom of the lower frame 11. It will be understood that by use of the set screws 46, 47 the position of the lower comb 36 may be adjusted for proper alignment thereof with the rotor hammers 66, 67 as will appear hereinafter in greater detail.

A bar screen 48 extends along an arc between the front horizontal comb 18 and the lower comb 36. The bar screen 48 comprises a plurality of individual screen bars 49, each of which is placed in an arcuate channel 50 on each side of the lower frame 11, with the individual screen bars 49 extending laterally across the lower frame 11. Each screen bar comprises several legs 51 extending transversely therefrom and abutting an adjacent screen bar 49, for the purpose of maintaining the several screen bars 49 in spaced relation with respect to each other. The lower end of the bar screen 48 abuts the lower comb 36, and at the upper end of the bar screen 48 there is provided a breaker bar 52. The front horizontal comb 18 is formed with a plurality of laterally aligned recesses 55, which are bored into the top thereof and in each of the recesses 55 there is a threaded bore extending from the bottom of the recess 55 through the bottom of the front horizontal comb 18, for the reception therein of a bolt 56. The bolts 56 bear against the breaker bar 52 and fixedly secure the bar screen 48 in the lower frame 11 between the horizontal comb 18 and the lower comb 36.

At each side of the lower frame 11 there is formed a supporting stand 57 to the top of which there is secured a pillow block 58. A transversely extending rotor shaft 59 is rotatably supported in the pillow blocks 58, and one end of the shaft 59 extending beyond a pillow block 58 has secured thereto a flywheel 60. The opposite end of the shaft 59, which also extends beyond a pillow block 58, may have secured thereto any suitable drive means for rotating the shaft.

A material reducing rotor 61 is fixedly secured to the shaft 59 by several keys 62. The rotor 61 is formed of a plurality of similar rotor segments 63, all having the same diameter and disposed adjacent each other, and which may be secured to each other by welding. At each end of the rotor 61 there is provided an end plate 64 which is of substantially larger diameter than the rotor segments 63, and is in the form of a solid disk fitting below the side frame liners 27 and serving to confine the material reducing action of the rotor 61 to the area between the opposite end plates 64. In Fig. 5 of the drawings wherein the rotor is shown developed it will be seen that the end plates 64 together with the segments 63 are shown in their relation to each other by the alphabetical designations A through K, the letters A and K constituting the end plates or discs 64 and the letters B through J designating the nine similar segments 63. Each rotor segment 63 is formed with a pair of diametrically opposite peripheral sockets 65 for the reception therein of a material reducing hammer 66, 67 that projects radially from the rotor 61. The adjacent rotor segments 63 are rotated relatively to each other so that the sockets 65 in adjacent rotor segments 63 will be spaced from each other in a circumferential direction and the material reducing hammers 66, 67 disposed in the sockets 65 of adjacent rotor segments 63 will not be axially aligned with each other.

The material reducing rotor 61 is provided with relatively long hammers 66 and relatively short hammers 67 which project to different distances in a radial direction from the rotor 61. The relatively long hammers 66 are each formed with a relatively sharp, pointed tooth 68 which is forwardly directed in the direction of rotation of the rotor 61, and the short hammers 67 are each similarly formed with a relatively sharp, pointed tooth 69 that is also directed forwardly in the direction of rotation of the rotor 61. The teeth 68, 69 are generally known as hawk bill teeth and are particularly adapted to rip and tear at the material delivered to the material reducing apparatus 10 for reduction.

The hammers 66, 67 are of the same width as the rotor segments 63 and a single hammer 66 or 67 will substantially fill the socket 65 within which it is placed. The hammers 66, 67 are secured to the rotor 61 within the sockets 65 by a plurality of hammer pins 70 which extend in an axial direction through the hammers 66, 67 and through the rotor segments 63, as well as through the end plates 64. A pair of hammer pins 70 is provided for each axial line of hammers 66, 67. The hammer pins 70 are secured to the rotor 61 in an axial direction by means of external snap rings 71 secured to the opposite ends of the hammer pins 70.

In the illustrated embodiment of the invention and as illustrated in Fig. 5 of the drawings, since each rotor segment 63 has a pair of hammers 66, 67, and the adjacent rotor segments 63 are rotated with respect to each other through an arc of 60°, the rotor 61 is thereby provided with six axial lines of hammers 66, 67 which are 60 degrees apart as illustrated by their angular positions designated in said Fig. 5 as 0°, 60°, 120°, 180°, 240°, 300° and 360°, respectively. In each axial line of hammers 66, 67 there are three hammers, two of which are relatively long hammers 66 and one of which is a relatively short hammer 67, or alternately, there is a pair of relatively short hammers 67 and one relatively long hammer 66.

As seen in Fig. 1, in each axial line of hammers, the relatively short hammer 67 has its tooth 69 disposed completely behind the tooth 68 and also below the tooth 68 of the relatively long hammer 66. Thus, the teeth 68 of the long hammers 66 will first bite into the material to be reduced followed by the teeth 69 of the relatively short hammers 67. This action manifests itself in a progressive

tearing and ripping of the material when it is initially engaged by the hammers **66**, **67**. The relatively long hammers **66** are aligned with the slots **33**, **31**, **37** in the breaker plate comb **29**, the front horizontal comb **18** and the lower comb **36**, respectively, to carry the material through the slots **33**, **31**, **37**. The relatively short hammers **67** are aligned with the bridging portions **34**, **32**, **38** of the breaker plate comb **29** and the combs **18**, **36**, respectively, and carry the material over the bridging portions **34**, **32**, **38**. This cooperative action between the combs **29**, **18**, **36** and the hammers **66**, **67** further reduces the material which has been torn and ripped by initial engagement of the hammers **66**, **67** therewith. The hammers **66**, **67** carry the material beyond the breaker plate comb **29** and the front horizontal comb **18** over the bar screen **48** for discharge of the reduced material through the bar screen **48**. Any material that is not discharged through the bar screen **48** is carried through the comb **36** where it is further reduced and discharge through the open area beyond the comb **36**.

The material reducing apparatus **10** may include a second bar screen **48** disposed between the lower comb **36** and the rear horizontal comb **19**, with the second bar screen **48** being secured in place by a plurality of bolts **56** threaded through the comb **19** in the same manner as described in connection with the front horizontal comb **18**. The second bar screen **48** is used when it is desired to reduce the material to a smaller size than that provided through the use of only one bar screen **48**, it being understood that as the material is carried over the bar screens **48** by the hammers **66**, **67** there is a further reduction in the size of the material.

The material reducing apparatus of this invention comprises a massive rotor which is substantially solid, except for the peripheral sockets within which the hammers are received. Since the rotor, as constructed in accordance with the teachings of the instant invention, comprises a heavy mass there is a large momentum carrying the hammers into engagement with the material to tear and rip that material in reducing it to a smaller size. The material reducing apparatus of this invention is adapted to reduce a wide variety of materials such as rubber, tin cans, steel, aluminum, brass and copper cable, wood, scrap grill work, and others. The reducing action is substantially the same with any of these materials. The material to be reduced is delivered into the chute and it is first contacted by the long hammers followed by the shorter hammers, which progressively tear and rip the material and then carry the material through the several combs and over the bar screens, which action further reduces the material to the size desired for the final product.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claims hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

1. In a material reducing apparatus comprising a housing, a material reducing rotor disposed within the housing, a transversely extending shaft rotatably mounted on the housing, means mounting said rotor on the shaft for rotation therewith, said rotor comprising a plurality of rotor segments disposed adjacent each other on the shaft, each rotor segment including a socket for the reception of a hammer, a material reducing hammer disposed in each socket and projecting radially from the rotor, said hammers comprising a set of relatively short hammers and a set of relatively long hammers adapted to project radially beyond the short hammers, the relatively short hammers and the relatively long hammers being disposed in alternate rotor segments, the hammers in adjacent rotor segments being circumferentially spaced from each other, the hammers in said rotor segments being aligned in a plurality of axial lines with at least one short hammer and one long hammer in each line, each of said hammers comprising a tearing and ripping tooth directed forwardly in the direction of rotation of the rotor, and the tooth of a short hammer being disposed behind the tooth of a long hammer in each axially aligned row of short and long hammers.

2. In a material reducing apparatus comprising a housing, a material reducing rotor disposed within the housing, means rotatably mounting said rotor in the housing, said rotor comprising a plurality of material reducing hammers secured to the rotor and projecting radially therefrom, said hammers comprising a set of relatively short hammers and a set of relatively long hammers adapted to project radially beyond the short hammers, the relatively short hammers being disposed in circumferential rows and the relatively long hammers being disposed in circumferential rows alternated with the first said circumferential rows of short hammers, the hammers in adjacent circumferential rows being circumferentially spaced from each other, the hammers in said rotor segments being aligned in a plurality of axial lines with at least three hammers in each line of which at least one is a long hammer and at least one is a short hammer, each of said hammers comprising a tearing and ripping tooth directed forwardly in the direction of rotation of the rotor, and the tooth of a short hammer being disposed behind a tooth of a long hammer in each axially aligned row of short and long hammers.

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