

March 29, 1932.

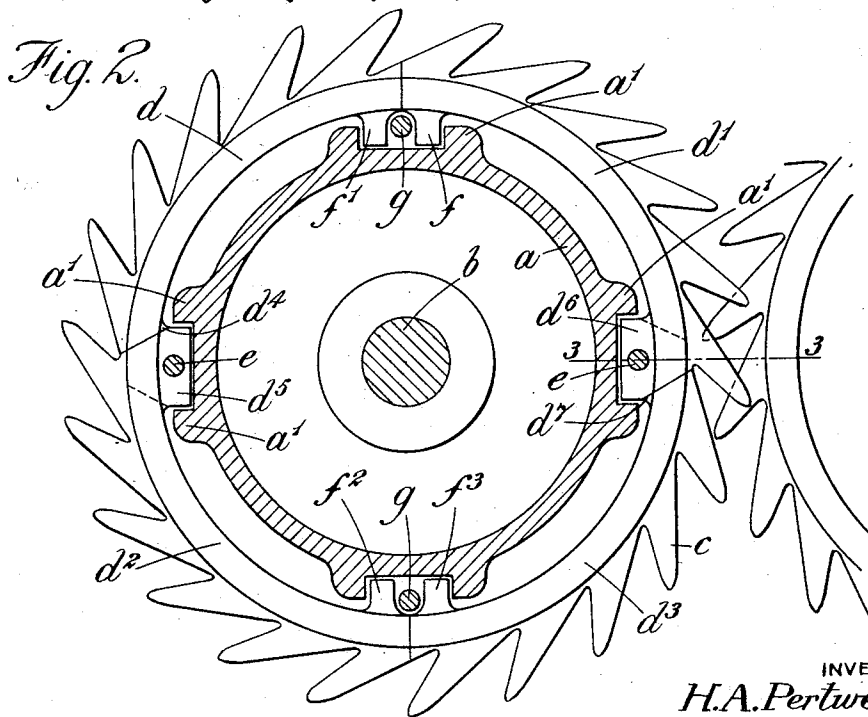
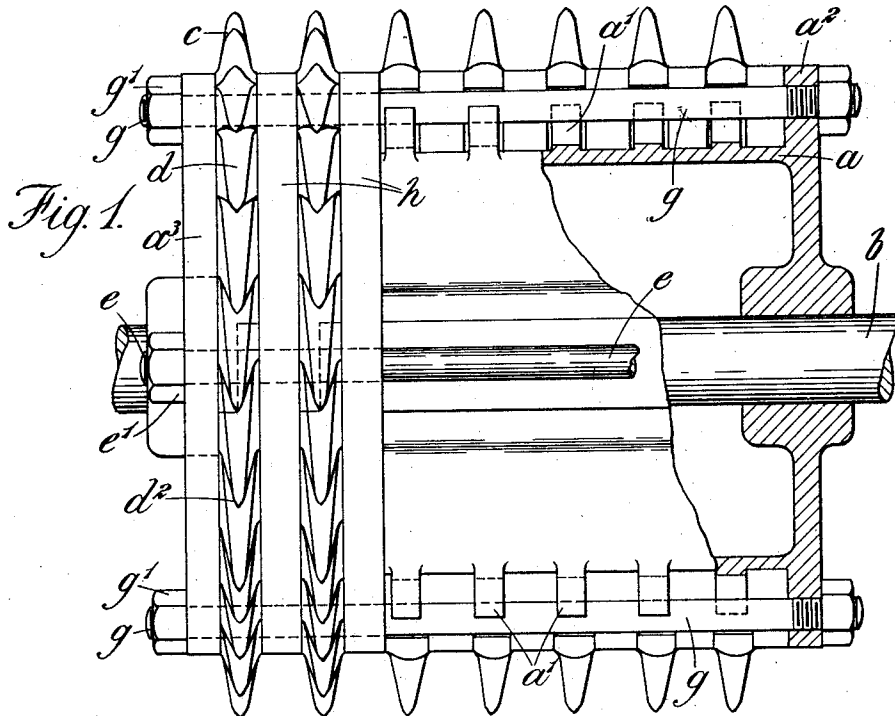
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MEANS FOR DISINTEGRATING SOLID MATERIALS

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2 Sheets-Sheet 1



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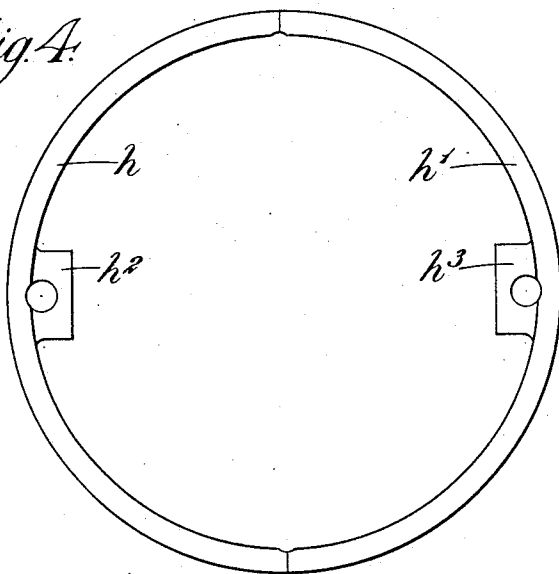
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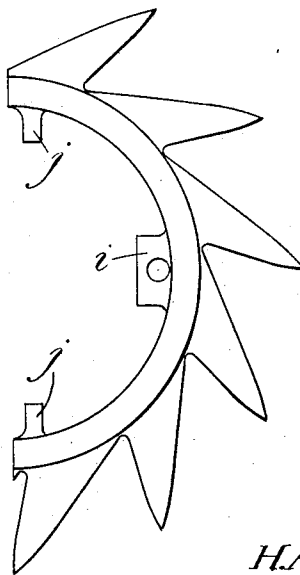
*Fig. 3.*



*Fig. 4.*



*Fig. 5.*



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## UNITED STATES PATENT OFFICE

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## MEANS FOR DISINTEGRATING SOLID MATERIALS

Application filed November 7, 1929, Serial No. 405,406, and in Great Britain November 22, 1923.

This invention relates to means for disintegrating solid materials, and, while particularly intended for breaking coke and coal, is of general application to the breaking or crushing of other solid materials, such as ice, salt, soda or the like.

The invention particularly relates to machines of the known kind comprising a pair of parallel shafts adapted to be rotated in opposite directions and carrying pointed arms or fingers arranged so that when the shafts are rotated, the arms or fingers carried by one of the shafts extend between the arms or fingers carried by the other shaft.

In my prior British Specification No. 218,230 I have described an ice crusher wherein the pointed arms or fingers are integrally provided upon circular discs which are keyed upon the shaft. This construction has the disadvantage that replacement of a broken or worn arm or finger necessitates the complete dismantling of the discs carried upon the shaft.

The present invention has among its objects to provide an improved construction of disintegrating apparatus of the kind referred to, whereby broken or worn arms or fingers may be readily replaced without disturbing the remainder of the breaking or crushing elements, while, at the same time, the construction according to the invention permits economy in the use of manganese, chrome, or other hard or high speed steel.

According to the present invention, the breaking or crushing elements are constructed in the form of segmental or interrupted rings provided on their periphery with outwardly extending arms or fingers, and adapted to be fixed upon a supporting drum, preferably with the interposition of spacing rings and advantageously by means of bolts or the like extending parallel with the axis of the shaft upon which the drum is mounted. For small machines the rings may consist of two semi-circular parts each of which is provided in a middle position in its circumference with an inwardly extending lug having a hole for the reception of the fixing bolt or the like, while, at its ends, it may be provided, if desired, with lugs adapted to co-operate with addi-

tional clamping bolts and/or recesses or the equivalent in the drum so as to position the parts of the ring concentrically with respect to the drum. For larger machines the rings may consist of a plurality of segments, conveniently four in number, each segment having at one end an inwardly extending lug provided with a hole for the reception of the respective fixing bolt or the like, and provided at the other end with means such as a lug for positioning the segment concentrically with respect to the drum. The segments may be arranged in pairs with the ends provided with the lugs referred to adjacent, the adjacent ends being stepped or otherwise formed so that the holes in the respective lugs may be disposed in alignment for the reception of the respective fixing bolt. The free ends of one pair of segments may co-operate with the free ends of the other pair of segments and may be provided with inwardly extending projections or the like adapted to engage with additional clamping bolts or the like and/or with recesses or the equivalent in the drum so that the segments are positioned concentrically with the drum. In either case, by removing the fixing bolt which extends through the lug in a segment which it is desired to replace, and by slacking off the additional clamping bolt or bolts cooperating with the respective segment, the latter may be withdrawn and replaced without disturbing the remaining segments.

Preferably, the drum is provided with longitudinally extending ribs or the like adapted to co-operate with the inwardly extending lugs or projections on the ring segments in such manner as positively to prevent relative rotation of the rings with respect to the drum. In order to enable any segment to be removed and replaced without disturbing adjacent segments, the longitudinal ribs on the drum are slotted circumferentially or may comprise projections spaced apart at suitable distances, the slots or intervening spaces coinciding with, but being of greater width than, the spacing rings between the segmental rings carrying the arms or fingers, and the spacing rings are similarly constructed in two semi-circular parts, or in a number of segments so

that when the respective bolt has been withdrawn, the respective segment carrying the arms or fingers may be removed by first withdrawing the respective segment of the adjacent spacing ring and then moving the segment carrying the arms or fingers laterally so that the inwardly extending lugs or projections thereon are disposed in alignment with the slots or spaces in the longitudinal ribs referred to, whereupon the segment may be freely withdrawn.

Conveniently, the drum is provided at one end with an outwardly extending flange against which the series of segmental rings with intervening spacing rings are drawn by means of the fixing and clamping bolts, the other end of the drum being preferably provided with a loose clamping flange.

The invention is hereinafter described by way of example with reference to the accompanying diagrammatic drawings, in which:—

Figure 1 is a part sectional elevation showing breaking or crushing elements according to the invention mounted upon the supporting drum;

Figure 2 is a cross-section corresponding to Figure 1, and showing the manner in which the respective drums co-operate with one another;

Figure 3 is a part section on the line 3—3, Figure 2;

Figure 4 is an end elevation of one of the spacing rings shown in Figure 1; and

Figure 5 is an end elevation illustrating a construction of semi-circular ring segment suitable for small machines.

In carrying the invention into effect according to one construction, and with reference to Figures 1 to 4 of the accompanying diagrammatic drawings, each of the breaking or crushing elements of a disintegrating machine of the kind referred to may comprise a cylindrical drum *a* fixedly mounted upon a shaft *b* and having longitudinal series of outwardly extending projections *a'* forming interrupted or slotted ribs. The pointed arms or fingers *c* are provided integrally upon the exterior periphery of segmental rings each consisting of four parts *d*, *d'*, *d<sup>2</sup>*, *d<sup>3</sup>*. The adjacent pairs of segments *d*, *d<sup>2</sup>* and *d'*, *d<sup>3</sup>* are stepped one into the other, as shown in Figure 3, and are provided with coincident inwardly extending lugs *d<sup>4</sup>*, *d<sup>5</sup>*, *d<sup>6</sup>*, *d<sup>7</sup>* respectively, having coincident holes therethrough for the reception of fixing bolts *e* extending parallel with the axis of the shaft *b*. The series of projections *a'* are arranged in four symmetrically disposed pairs between two of which the respective pairs of coincident lugs *d<sup>4</sup>*, *d<sup>5</sup>*, and *d<sup>6</sup>*, *d<sup>7</sup>* are adapted to extend so as thereby to prevent possibility of relative rotation between the segmental rings and the drum *a*. The adjacent free ends of the segments *d*, *d'* and *d<sup>2</sup>*, *d<sup>3</sup>* are provided with inwardly extending projec-

tions *f*, *f'*, *f<sup>2</sup>*, *f<sup>3</sup>* respectively, which are adapted to extend between the remaining pairs of series of projections *a'*, as shown in Figure 2. The adjacent faces of the respective pairs of projections *f*, *f'* and *f<sup>2</sup>*, *f<sup>3</sup>* preferably are curved to accommodate longitudinally extending clamping bolts *g*.

The rings comprising the segments *d*, *d'*, *d<sup>2</sup>*, *d<sup>3</sup>* are mounted upon the drum *a* with the interposition of spacing rings, each of the latter being constructed of two semi-circular parts *h*, *h'* (Fig. 4) having inwardly directed lugs *h<sup>2</sup>*, *h<sup>3</sup>* respectively, provided with holes for the reception of the bolts *e*. The assembly terminates at one end with pricker segments, and the outer end with a spacing ring so that a pair of similar drums respectively reversed end for end will intermesh in the manner referred to.

The drum *a* is preferably provided at one end with an integral outwardly extending flange *a<sup>2</sup>* against which the elements are drawn by means of the bolts *e* and *g*, a loose flange *a<sup>3</sup>*, with which the tightening nuts *e'*, *g'* of the bolts engage, preferably being provided at the other end of the drum *a*. The projections *a'* are so arranged upon the drum that the spaces between them coincide substantially with, but are of greater width than, the spacing rings *h*, as shown in Fig. 1. By this construction it is possible to remove and to replace any one segment *d*, *d'*, *d<sup>2</sup>* or *d<sup>3</sup>* without disturbing the remaining segments. Thus if, for example, it is desired to remove the segment *d*, the respective bolt *e* is withdrawn and the respective clamping nut *g'* is slackened off. The segment *h* of the adjacent spacing ring is pulled out and the segment *d* is then moved laterally into the position previously occupied by the segment of the spacing ring so that the lug *d<sup>4</sup>* and the projection *f'* on the segment *d* come into alignment with the spaces between the respective circumferential series of projections *a'*, the segment *d* being then freely removable. The replacement of the segment is effected in a similar manner.

According to a modification, more particularly adapted for small disintegrating machines, the rings carrying the pointed arms or fingers may be constructed in two semi-circular parts, as shown in Figure 5, each part being equivalent to a pair of the segments, such as *d*, *d<sup>2</sup>* or *d'*, *d<sup>3</sup>* shown in Figure 2. Inwardly extending lugs *i* and projections *j* are provided which are similar in form to the respective lugs and projections provided in the construction of Figure 2. The removal and replacement of the rings is effected in the manner before described with reference to Figures 1 to 4.

In machines of the character described, it is desirable, owing to the hard wear to which the machines are subjected, that the pointed arms or fingers should be constructed of a

hard steel, such as manganese or chrome steel or other suitable steel alloy. Such steels are relatively expensive and it will be appreciated that, in the construction according to the invention, only a comparatively small part of the machine, that is, the segments  $d$ ,  $d'$ ,  $d''$ ,  $d'''$ , together with the pointed arms or fingers, need be constructed of such material. The segments may be constructed of cast steel or chilled cast iron, and the bolts are preferably made of rustless steel.

It will be understood that the invention is not limited to the details of construction hereinbefore described. For example, the rings provided with the pointed arms or fingers may be constructed of more than four segmental parts.

What I claim is:—

1. Apparatus of the kind referred to for disintegrating solid material, wherein the breaking or crushing elements are constructed in the form of segmental or interrupted rings provided on their periphery with outwardly extending arms or fingers and adapted to be fixedly mounted upon a supporting drum; the rings carrying the pointed arms or fingers each being constructed of four segments, opposite pairs of which are stepped into one another, for the purpose and substantially as described.

2. Apparatus of the kind referred to for disintegrating solid material, wherein the breaking or crushing elements are constructed in the form of segmental or interrupted rings provided on their periphery with outwardly extending arms or fingers and adapted to be fixedly mounted upon a supporting drum; said segments being substantially semi-circular; said drum and said segments having interlocking members; and spacer rings secured between adjacent rings having the fingers and composed of segments of greater width than the rings having the fingers, said spacer segments being disposed between the interlocking members on the drum and being individually removable from the drum whereby a single segment having the fingers may be moved laterally into the space left by the spacer segment and removed from the drum without disturbing any other segment.

3. A disintegrator comprising, in combination, a substantially cylindrical drum having a series of radial, spaced projections extending longitudinally and parallel with the axis; a series of segmental rings having pointed fingers on their peripheries and mounted on the drum, each ring segment having means abutting one of said projections so that relative rotation of the rings and drum is prevented; bolts extending longitudinally of the drum interiorly of and engaging the ring segments and the drum to hold the rings on the drum; and segmental spacing rings between the several rings with the pointed fingers, said bolts also engaging with the spacing rings

to hold them clamped upon the drum; the width of said spacing rings being less than the distance between the projections on each side of them and each spacing ring, except the one at the end of the drum, being drawn up tight by the bolts against the two segmental rings on opposite sides; and the segments of said spacing rings being so arranged as to be disengaged by said bolts to permit radial removal of any disengaged spacer segment and subsequent removal of an adjacent fingered segment.

4. A disintegrator comprising, in combination, a drum; a series of segmental rings having pointed fingers mounted on the drum; a series of segmental spacing rings also on the drum, between the rings with the pointed fingers; interlocking means on the drum and the fingered segments to prevent relative rotation, the interlocking means on the drum being spaced longitudinally on its periphery to accommodate the spacing rings; and clamping members for holding all of the segments assembled on the drum, the construction and arrangement being such that any spacing segment may be removed radially to permit removal of an adjacent fingered segment by first displacing it laterally into the vacant space left by the spacing segment and without disturbing any other ring.

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