July 17, 1962 W. MAY 3,044,719

HAMMER CRUSHER

Filed July 14, 1958 2 Sheets-Sheet 1

Fig. 1

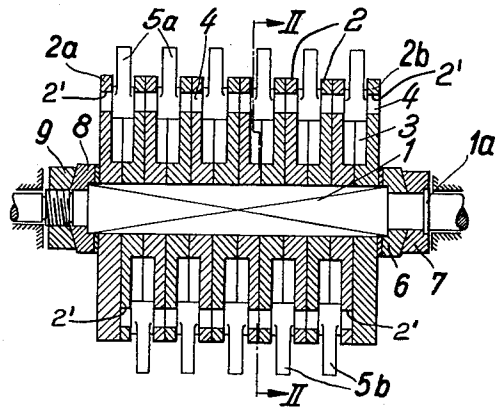


Fig. 2

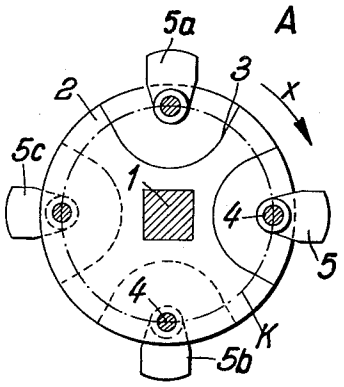
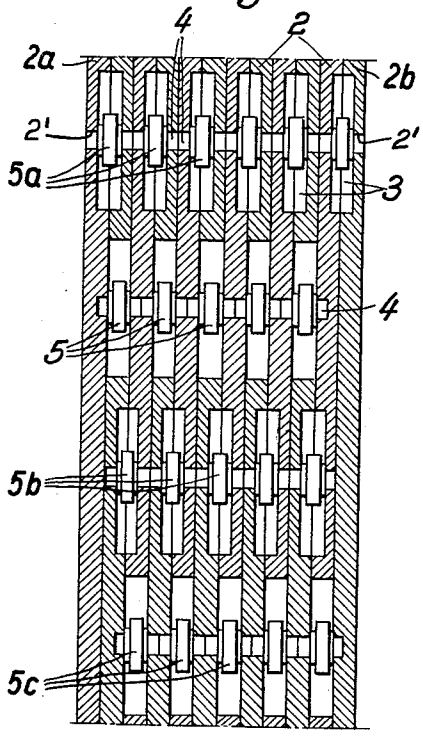


Fig. 3



Inventor:
Wilhelm May
By Walter Becker
Patent Agent

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Fig. 4

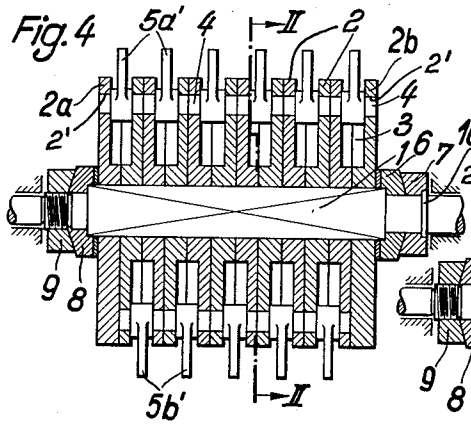


Fig. 6

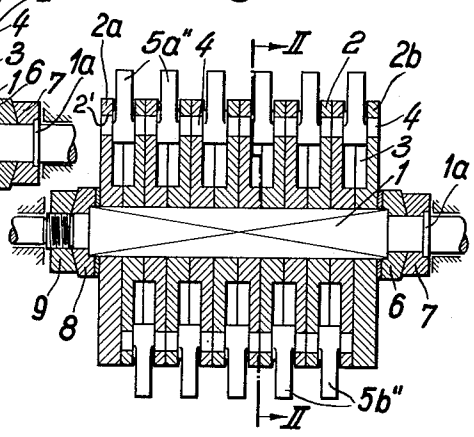


Fig. 5

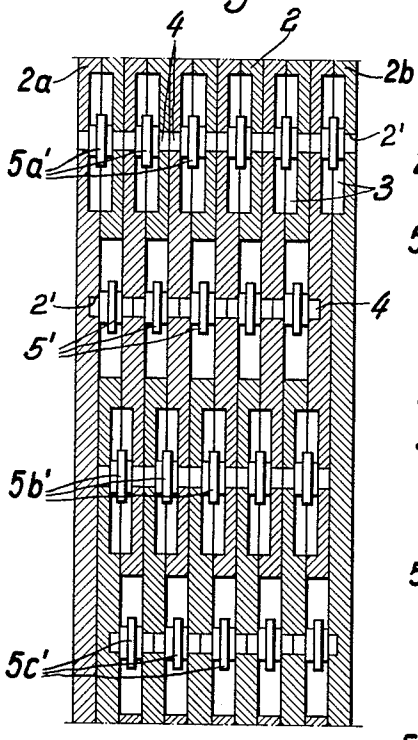
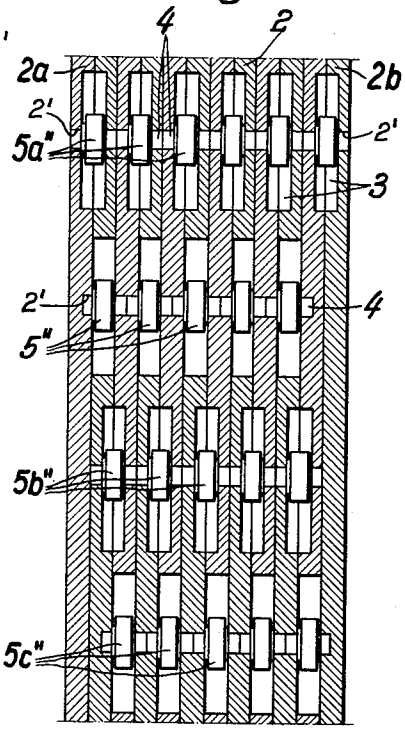


Fig. 7



Inventor:
Wilhelm May
By
Patent Agent

United States Patent Office 3,044,719 Patented July 17, 1962

3,044,719

HAMMER CRUSHER

Wilhelm May, Rheinhausen, Germany, assignor, by mesne assignments, to Beteiligungs- und Patentverwaltungsgesellschaft mit beschränkter Haftung, Essen, Germany

Filed July 14, 1958, Ser. No. 748,536
Claims priority, application Germany July 20, 1957
12 Claims. (Cl. 241—194)

The present invention relates to hammer crushers for crushing, for instance ores, coal and the like.

With hammer crushers, the hammers are generally mounted on a rotor in a plurality of planes located adjacent each other and transverse to the axis of rotation of the rotor in such a way that the hammers of the group located in the same plane will describe the same circular hammer path. The effective range of the rotor is, therefore, a cylindrical path in which, according to the annular spacing between the hammer groups, annular zones remain which are not affected by the hammers. As a result thereof, a crushing will be effected over a portion only of the width of the rotor, while dead annular spaces remain between the circular hammer paths, in which spaces the material to be crushed may accumulate and get stuck. Crushed material may also get stuck in the gaps of the discharge grate located opposite the dead spaces or chambers, inasmuch as here no crushed material is pushed forward by hammers whereby the gaps would be continuously scooped out and be freed for succeeding material.

It is, therefore, an object of the present invention to provide a hammer crusher which will overcome the above mentioned drawbacks.

It is another object of this invention to provide a hammer crusher which will be substantially free from dead spaces in which crushed material may accumulate or get stuck.

It is also an object of this invention to provide a hammer crusher for crushing ore, coal and other breakable material of the type involved, in which the material to be crushed is pushed forward by the hammers continuously so that no undue accumulation of crushed material will occur in the discharge grate adjacent the hammer crusher.

It is also an object of this invention to provide a hammer crusher which will perform crushing and scooping work over a major portion of its width.

These and other objects and advantages of the invention will appear more clearly from the following specification in connection with the accompanying drawings, in which:

FIG. 1 illustrates a longitudinal section through a hammer crusher according to the present invention.

FIG. 2 represents a section along the line II—II of FIG. 1 while showing the hammers in a state of operation.

FIG. 3 illustrates a development of the hammer crusher of FIG. 1 as effected in the direction of the arrow *x* of FIG. 2 along the circular line K of FIG. 2.

FIG. 4 represents a longitudinal section through a hammer crusher somewhat modified over FIG. 1 inasmuch as the hammers of FIG. 4 are narrower than the hammers of FIG. 1 so that the hammer paths are not as close to each other as in FIG. 1.

FIG. 5 is a development of the hammer crusher of FIG. 4.

FIG. 6 represents a section through still another modification of a hammer crusher according to the invention, which differs from that of FIG. 1 primarily in that the hammers are somewhat thicker than those of FIG. 1 so that the hammer paths partly overlap.

FIG. 7 is a development of the hammer crusher according to FIG. 6.

A hammer crusher according to the present invention is characterized primarily in that the hammers are mounted in staggered or offset arrangement with regard to each other in the direction of rotation of the rotor supporting said hammers. In this way, an individual circular path will be obtained for each hammer which path does not coincide with the circular path of other hammers and overlaps with the latter only partly, or is only slightly spaced from the adjacent hammer path or adjoins the circular path of other hammers when looking in axial direction. With the last mentioned arrangement which has proved particularly advantageous, the circular paths of all hammers will be adjacent each other without the formation of intermediate spaces or chambers. With the arrangement of the hammers in conformity with the present invention, the hammers can carry out a crushing and scooping operation over the entire width of the rotor.

Especially with hammer crushers having the rotor composed of discs replacing a pre-grate and having hammers journalled between said discs, expediently according to one embodiment of the invention, each of said discs has its circumferential portion alternately on one side of the disc provided with a recess for a hammer the central axis of which is located approximately in the dividing plane between two discs, while inside this said recess there is provided a bore, preferably continuous, for a stud on which the hammer is journalled. Further, each of the discs of which the rotor is composed is provided with a recess extending all the way through for a hammer journalled in the two adjacent discs. Still further, each of the discs is provided with a bore for a stud on which is journalled a hammer located in the plane of an adjacent disc or a bore extending all the way through may be provided for two studs on which hammers are journalled which are located in the planes of two adjacent discs.

Referring now to the drawings in detail, the hammer crusher illustrated in FIGS. 1 to 3 comprise a rotor composed of a square shaft **1** and discs **2**, **2***a*, **2***b* arranged alongside each other and connected to shaft **1** in any convenient manner. Preferably, shaft **1** is provided at one end thereof with a flange **1***a* against which one end disc **2***b* abuts by means of discs **6**, **7**. The discs **2** are then clamped by means of the other end disc **2***a* and a disc **8** and a nut **9** against the end disc **2***b* so that all of the discs are firmly connected to shaft **1** for rotation therewith.

The hammer crusher furthermore comprises hammers **5**, **5***a*, **5***b*, **5***c* rotatable in recesses **3** and provided with studs or trunnions **4** arranged on and connected to opposite sides thereof. The said studs or trunnions are rotatably journalled in bores **2'** provided in the respective adjacent discs **2**, **2***a*, **2***b*.

As will be evident from FIG. 3 hammers **5** are offset in axial direction against hammers **5***a* whilst hammers **5***b* are offset in axial direction against hammers **5**. In the same manner hammers **5***c* are offset in axial direction against hammers **5***b*. By this arrangement of hammers **5**, **5***a*, **5***b*, and **5***c* the hammer paths of the hammers **5** touch the hammer paths of hammer **5***a*. In the same manner the hammer paths of the hammers **5***b* touch the hammer paths of the hammers **5** and so on.

The operation of the crusher described so far will be as follows: The material to be crushed is charged into the rotor at the point A in FIG. 2. While the rotor rotates in the direction of the arrow *x*, the hammers **5** will swing outwardly about the shafts **4** and will crush the material. If the material when hit by the hammers **5** does not break rightaway, the hammer **5** will oscillate back into the recesses **3**.

It will thus be clear that all charged material will be safely moved into one of the circular hammer paths, and all gaps of the discharge grate (not shown in the drawing) will be raked by hammers which, due to their pushing

effect, will continuously scoop out the gaps of the grate. A smearing or clogging up at any portion of the crusher cannot occur any longer so that the output of the crusher is considerably increased.

The hammer crusher of FIGS. 4 and 5 is generally designed similar to that of FIGS. 1 to 3, i.e. is likewise composed of a rotor built up of a plurality of discs 2, 2*a*, 2*b* rotatably connected to a shaft 1. The hammer crusher of FIGS. 4 and 5 differs, however, from that of FIGS. 1 to 3 in that the hammers 5', 5*a*', 5*b*', 5*c*' are narrower than the hammers 5–5*c* of FIGS. 1 to 3 so that the hammer paths are slightly spaced from each other.

The hammer structure of FIGS. 6 and 7 likewise comprises a rotor composed of discs similar to the hammer crusher of FIGS. 1 to 3. However, the hammers 5'', 5*a*'', 5*b*'', 5*c*'' of the hammer crusher of FIGS. 6 and 7 are wider than the hammers 5–5*c* of FIGS. 1 to 3 so that the paths of the hammers 5''–5*c*'' partly overlap each other. This is particularly clearly shown in FIG. 7.

It is, of course, to be understood that the present invention is, by no means, limited to the particular constructions shown in the drawings but also comprises any modifications within the scope of the appended claims.

What I claim is:

1. In combination in a hammer crusher: a rotatable shaft, a plurality of disc-shaped members having substantially uniform radius and being supported by and connected to said shaft for rotation therewith, said disc-shaped members being in lateral engagement with each other by surfaces of contact extending to circles of substantially the same radius as said disc-shaped members, each one of said disc-shaped members being provided with a cut-away portion forming with the respective two adjacent disc-shaped members on opposite sides thereof a hammer chamber, said hammer chambers being subdivided into a plurality of groups of axially aligned chambers, said groups of hammer chambers being circularly spaced from each other, each two adjacent disc-shaped members which with one of said cut-away portions therebetween confine one of said hammer chambers respectively being provided with axially aligned apertures, and a plurality of groups of hammers respectively rotatable in said groups of hammer chambers, said hammers having lateral extensions in form of studs pivotally journalled in said apertures of the respective adjacent disc-shaped members, the axes of said studs of all hammers being substantially evenly spaced from the axis of said shaft, each of said chambers being so dimensioned as to allow the respective hammers therein to rotate by 360°, the hammers of each group being substantially in alignment with each other in a direction substantially parallel to the axis of rotation of said shaft while being offset with regard to the hammers of an adjacent group of hammers in the paths of movement thereof, the outer radius of said disc-shaped members being greater than the distance between the axes of the studs and the axis of the shaft to at least such an extent that said hammers when occupying their inward position do not protrude beyond the circumference of said disc-shaped members.

2. A hammer crusher according to claim 9, which includes groups of hammers having each hammer thereof located in a chamber formed by a recess in only one disc-shaped member and by wall portions of two disc-shaped members spaced from each other by and in lateral engagement with said last mentioned disc-shaped member, said wall portions being respectively provided with bores arranged in axial alignment with each other and serving as bearing means for the respective hammers located in said last mentioned chambers.

3. In combination in a hammer crusher: a rotatable shaft, a plurality of disc-shaped members having substantially uniform radius and being supported by and connected to said shaft for rotation therewith, said disc-shaped members being in lateral engagement with each other by surfaces of contact extending to circles of substantially the same radius as said disc-shaped members, said surfaces of contact being interrupted by chambers formed by recesses in said disc-shaped members, each two adjacent disc-shaped members confining one of said chambers therebetween and being respectively provided with axially aligned bores, and a plurality of groups of hammers spaced from each other in circumferential direction of said disc-shaped members, said hammers having lateral extensions in form of studs pivotally journalled in the bores of the respective adjacent disc-shaped members, the axes of said studs of all hammers being substantially evenly spaced from the axis of said shaft, each of said chambers being so dimensioned as to allow the respective hammers therein to rotate by 360°, the hammers of each group being substantially in alignment with each other in a direction substantially parallel to the axis of rotation of said shaft while being offset with regard to the hammers of an adjacent group of hammers in the path of movement thereof, the outer radius of said disc-shaped members being greater than the distance between the axes of said studs and the axis of said shaft to at least such an extent that the hammers when occupying their inward position do not protrude beyond the circumference of said disc-shaped members.

4. In combination in a hammer crusher: a rotatable shaft, a plurality of disc-shaped members having substantially uniform radius and being supported by and connected to said shaft for rotation therewith, said disc-shaped members being in lateral engagement with each other by surfaces of contact extending to circles of substantially the same radius as said disc-shaped members, each one of said disc-shaped members being provided with a bore forming with the respective two adjacent disc-shaped members on opposite sides thereof a first group of hammer chambers, each one of said disc-shaped members also being provided with recesses in such a way that the recesses of each two adjacent disc-shaped members face each other and with each other confine a hammer chamber of a second group of hammer chambers, said first and second group of hammer chambers respectively being subdivided into a plurality of groups of axially aligned chambers, said first and second groups of hammer chambers being respectively subdivided into a plurality of groups of axially aligned chambers, said first and second groups of hammer chambers being circularly spaced from each other, each two adjacent disc-shaped members forming part of hammer chambers respectively being provided with axially aligned apertures, and a plurality of groups of hammers respectively rotatable in said first and second groups of hammer chambers, said hammers having lateral extensions in form of studs pivotally journalled in said apertures, the axes of said studs of all hammers being substantially evenly spaced from the axis of said shaft, each of said chambers of said first and second groups of hammer chambers being so dimensioned as to allow the respective hammers therein to rotate by 360°, the hammers of each group being substantially in alignment with each other in a direction substantially parallel to the axis of rotation of said shaft while being offset with regard to the hammers of an adjacent group of hammers in the path of movement thereof, the outer radius of said disc-shaped members being greater than the distance between the axes of said studs and the axis of said shaft to at least such an extent that said hammers when occupying their inward position do not protrude beyond the circumference of said disc-shaped members.

5. In combination in a hammer crusher: a rotatable shaft, a plurality of disc-shaped members having substantially uniform radius and being supported by and connected to said shaft for rotation therewith, said disc-shaped members being in lateral engagement with each other by surfaces of contact extending to circles of substantially the same radius as said disc-shaped members, said disc-shaped members having cut-away portions and together with the latter confining therebetween groups

of hammer chambers, and a plurality of groups of hammers spaced from each other in circumferential direction of said disc-shaped members, said hammers respectively being rotatable in said hammer chambers by 360° and having lateral extensions in form of studs pivotally journalled in the respective adjacent disc-shaped members, the axes of said studs of all hammers being substantially evenly spaced from the axis of said shaft, the hammers of each group being substantially in alignment with each other in a direction substantially parallel to the axis of rotation of said shaft while being offset with regard to the hammers of an adjacent group of hammers, the outer radius of said disc-shaped members being greater than the distance between the axes of said studs and the axis of said shaft to at least such an extent that said hammers when occupying their inward position do not protrude beyond the circumference of said disc-shaped members.

6. A hammer crusher according to claim 1, in which the spacing and offset arrangement of said hammers in circumferential direction of said disc-shaped members is such that the paths of movement of said hammers about the axis of rotation of said rotatable shaft only slightly overlap each other in axial direction of said shaft.

7. A hammer crusher according to claim 1, in which the spacing and offset arrangement of said hammers in circumferential direction of said disc-shaped members is such that the paths of movement of said hammers about the axis of rotation of said rotatable shaft are slightly spaced from each other in axial direction of said shaft.

8. A hammer crusher according to claim 1, in which the spacing and offset arrangement of said hammers in circumferential direction of said disc-shaped members is such that the paths of movement of said hammers about the axis of rotation of said rotatable shaft substantially adjoin each other in axial direction of said shaft.

9. In combination in a hammer crusher: a rotatable shaft; a plurality of groups of hammers; a plurality of pairs of disc-shaped members arranged adjacent each other in axial direction on said shaft; each disc-shaped member of each pair of disc-shaped members with the exception of the outermost disc-shaped members having recesses on opposite faces thereof; each pair of recesses pertaining to adjacent disc-shaped members and facing each other forming with each other a chamber; each two adjacent disc-shaped members the recesses of which together with each other form a chamber being provided with a pair of bores; each of said hammers being provided with two oppositely located lateral extensions respectively pivotally journalled in the bores of the respective adjacent disc-shaped members for rotation of the respective hammer in the chamber formed by the respective recesses of the adjacent disc-shaped members; each of said chambers being dimensioned so as to allow the respective hammer therein to rotate by 360°; the hammers of each group being substantially in alignment with each other in a direction substantially parallel to the axis of rotation of said shaft while being offset with regard to the hammers of an adjacent group of hammers in the paths of movement thereof; the outer diameter of said disc-shaped members being such that said hammers when occupying their inward position do not protrude beyond the circumference of said disc-shaped members.

10. A hammer crusher according to claim 9, in which the disc-shaped members pertaining to each pair of disc-shaped members engage each other along a plane transverse to the axis of rotation of said shaft and substantially forming the plane of symmetry of the respective hammer confined by said respective pair of disc-shaped members.

11. A hammer crusher according to claim 9, in which each hammer is mounted on a shaft forming the lateral extensions thereof journalled in said bores.

12. A hammer crusher according to claim 9, in which said bores are axially aligned and with the exception of the bores in the outermost disc-shaped members extend all the way through wall portions of said disc-shaped members.

References Cited in the file of this patent

UNITED STATES PATENTS

1,728,392	Clement	Sept. 17, 1929
1,803,148	Sheppard	Apr. 28, 1931
1,893,030	Kingsley	Jan. 3, 1933
2,026,790	Mankoff	Jan. 7, 1936
2,185,331	Conway	Jan. 2, 1940

FOREIGN PATENTS

369,997	Italy	Apr. 4, 1939