May 19, 1925. 1,538,831

G. P. LUCAS

CENTRIFUGAL HAMMER

Filed Aug. 19, 1922. 3 Sheets-Sheet 1

Fig1

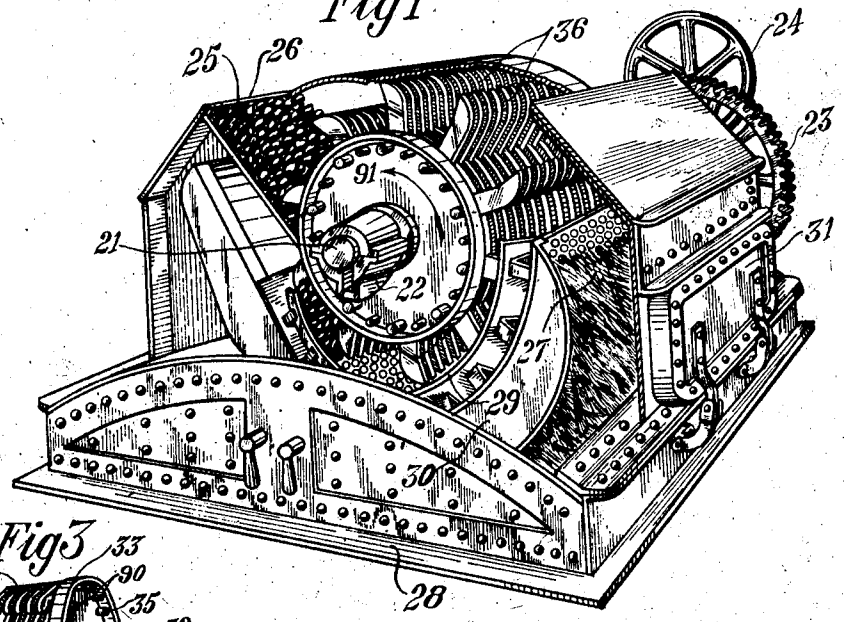


Fig3

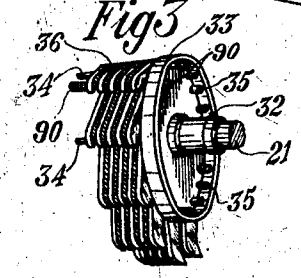
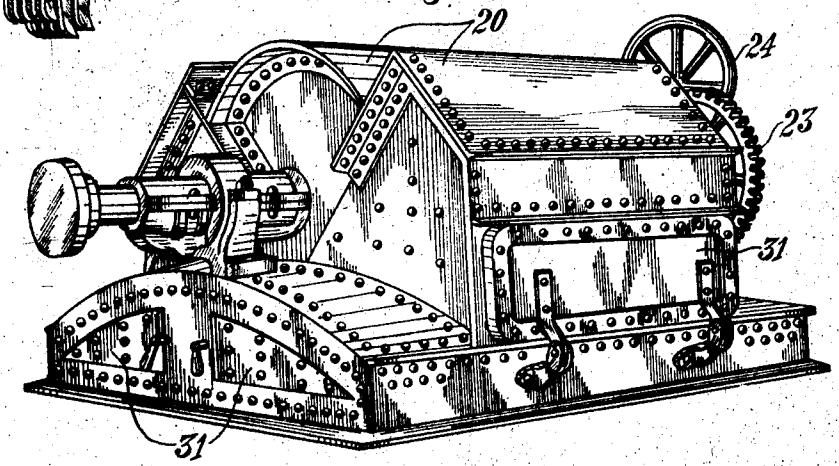


Fig2



Inventor,
George P. Lucas,
By his Attorney,
Henry J. Lucke.

May 19, 1925.

1,538,831

G. P. LUCAS

CENTRIFUGAL HAMMER

Filed Aug. 19, 1922

3 Sheets-Sheet 2

Fig 4

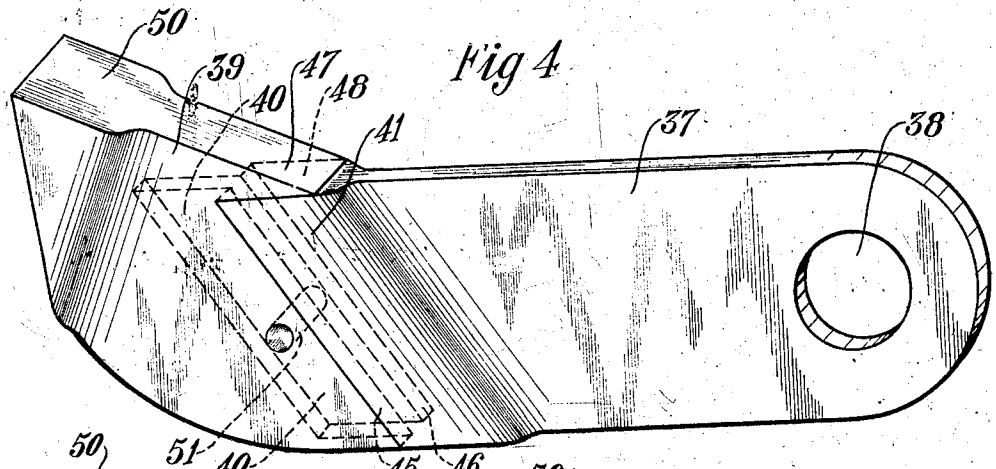


Fig 5

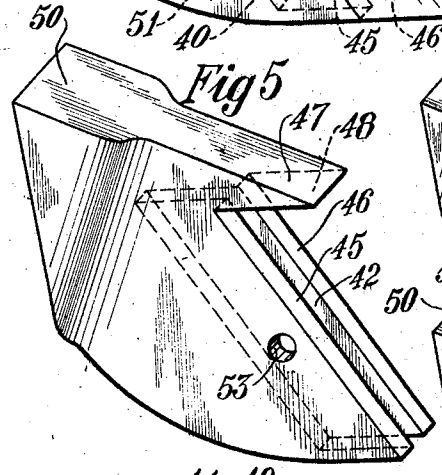


Fig 7

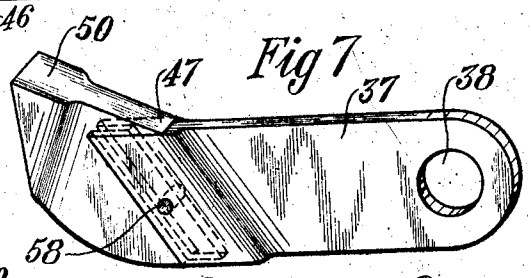


Fig 8

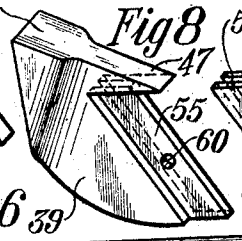


Fig 9

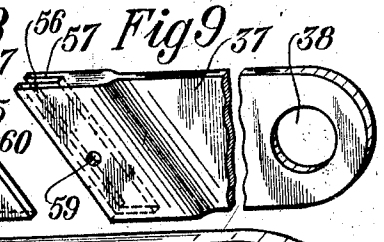
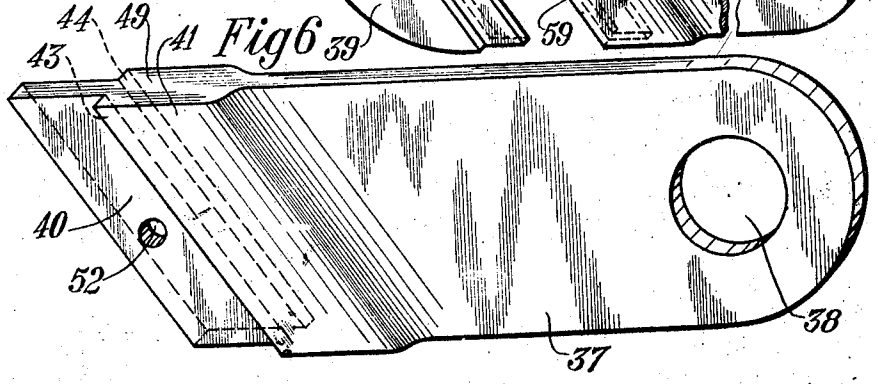


Fig 6



Inventor,
George P. Lucas,
By his Attorneys,
Henry J. Lucke.

May 19, 1925.

1,538,831

G. P. LUCAS

CENTRIFUGAL HAMMER

Filed Aug. 19, 1922

3 Sheets-Sheet 3

Fig 10

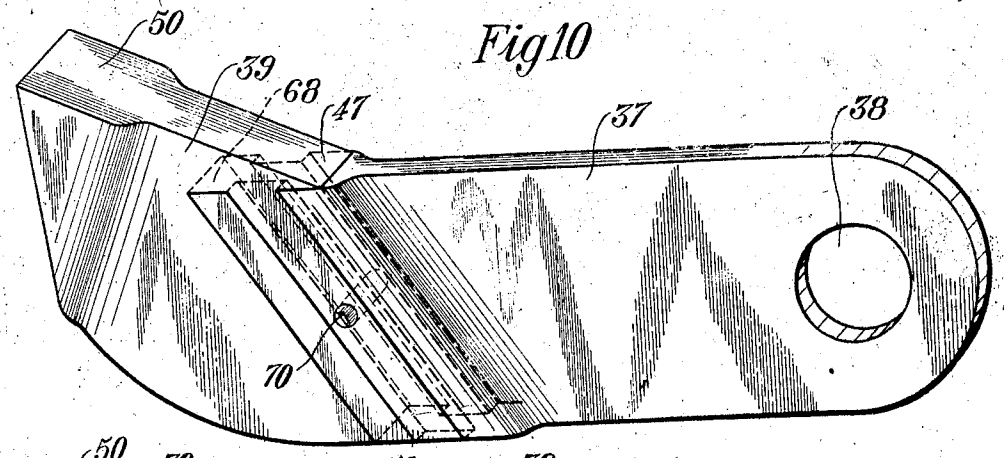


Fig 11

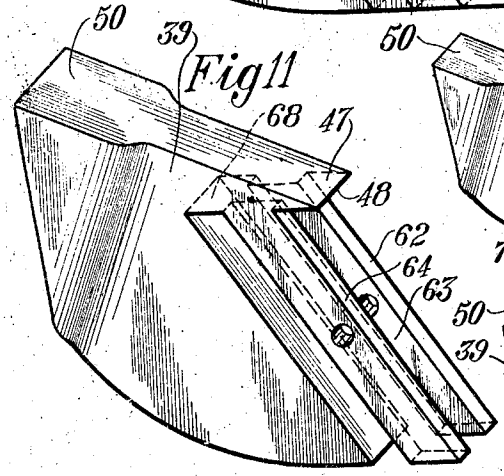


Fig 13

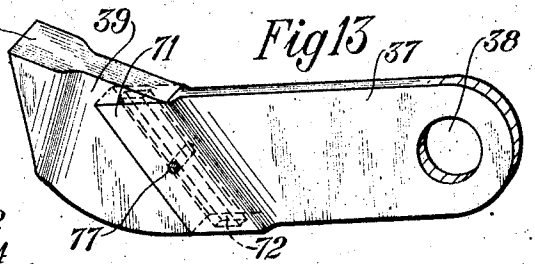


Fig 14

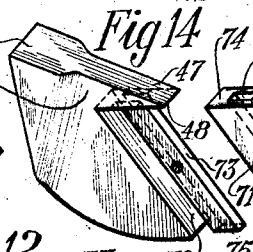


Fig 15

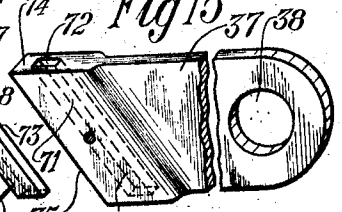
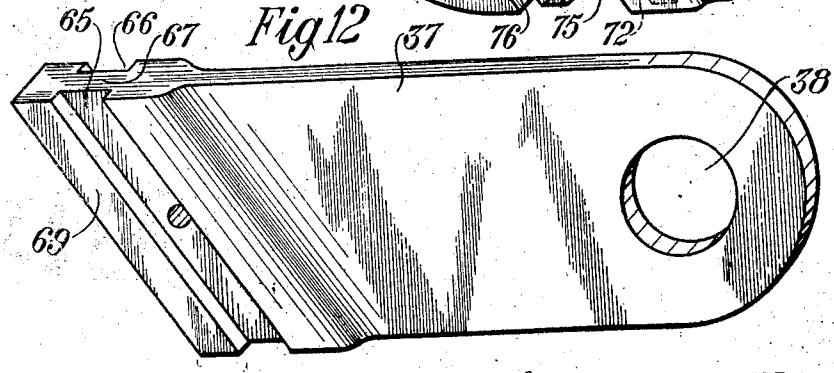


Fig 12



INVENTOR,
George P. Lucas,
BY
Harry J. Lucke
ATTORNEY.

Patented May 19, 1925. 1,538,831

UNITED STATES PATENT OFFICE.

GEORGE P. LUCAS, OF JERSEY CITY, NEW JERSEY.

CENTRIFUGAL HAMMER.

Application filed August 19, 1922. Serial No. 582,887.

To all whom it may concern:

Be it known that I, GEORGE P. LUCAS, a citizen of the United States of America, residing at Jersey City, county of Hudson, State of New Jersey, have invented certain new and useful Improvements in Centrifugal Hammers, of which the following is a specification.

This invention relates to centrifugal hammers.

More particularly, an object of this invention is to provide an improved form of hammer for mills and crushing machines of the centrifugal type whereby superior results are obtained in the stability of the hammer and increased life in use.

A further object of the invention is to provide the hammer with a head removably and preferably relatively rigidly connected to the arm of the hammer and arranged to effect improved crushing action on the coal or like material with which the mill or crushing machine is charged.

A further object of the invention is to provide an improved form of joint between the removable head and the arm whereby the rebounding and reaction forces arising upon encountering the material to be crushed are at an angle to the plane of the connecting joint of the head with the arm, and thereby obviate the serious difficulty arising upon the heads of the hammer "flying" off.

With the above stated objects and other objects in view, an approved form of my invention, usually utilized in a crushing mill embodying a compartment into which coal or other material is subjected to crushing action, comprising crushing means mounted on a suitable centrifugal device, such crushing means comprising a plurality of hammers each of which embodies an arm pivotally mounted at its one end to the centrifugal device and carrying at its other end a head having a weighted end portion constructed to directly impact the lumps or particles of coal and is jointed to the arm by a connection, the flanges of which extend in directions at an angle to the directions of the forces of reaction and of rebound whereby the absence of shearing forces substantially in the directions of the extension of the joints is effected.

Further objects and features of the invention will be more fully understood from the following detail description and the accompanying drawings, in which—

Fig. 1 is a side elevational perspective view of a preferred form of crushing machine embodying my invention with certain of the forward portions of the machine shown as removed to reveal hidden parts;

Fig. 2 is a side elevational perspective view of Fig. 1, on a somewhat reduced scale;

Fig. 3 is a detail perspective view of a portion of the centrifugal mounting means and showing a number of the hammers thereon in passive position;

Fig. 4 is a perspective view of one form of hammer having a longitudinal tongue and groove connection forming the joints, disposed in predetermined relation to the hammer head; Figs. 5 and 6 are perspective views respectively of the head and the arm shown in Fig. 4;

Fig. 7 is a perspective view of a modified form of hammer, similar to Fig. 4, on a reduced scale; Figs. 8 and 9 are perspective views respectively of the head and of the arm of the hammer shown in Fig. 7;

Fig. 10 is a perspective view of a further modified form of hammer, having its head and arm jointed by lateral tongue and grooved connection; Figs. 11 and 12 are perspective views respectively of the head and of the arm of the hammer shown in Fig. 10;

Fig. 13 is a side elevation of a further modified form of hammer, similar to that shown in Fig. 10 but on a reduced scale; and

Figs. 14 and 15 are perspective views of the head and arm of the hammer shown in Fig. 13.

Referring to Figs. 1, 2 and 3, the crushing machine illustrated herein is generally of any approved type suitable for crushing coal and other material and provided with an outer casing 20 of appropriate construction to enclose substantially on all sides the movable parts of the machine.

Suitably mounted in the machine for cen-

trifugal propulsion, there is provided the main shaft 21 mounted in opposite bearings 22, suitably driven by a train of gearing 23 actuated from the pulley 24, connected by a belt or otherwise to an engine, motor, shafting or the like.

Generally, in such types of crushing machines, the coal 25, see Fig. 1, is charged from above through the chute opening 26 located at the top and at one side of the main shaft 21, and the coal 25 is fed downwardly on the curved screen 27 toward the hammers, more particularly described hereinafter. Such screen 27 may be stationary or subjected to agitation, and the portions of the material crushed upon being reduced to suitable fineness, drop through the screen and are discharged from the crushing machine, usually through a chute extending from the bottom 28 of the machine and through to a lower floor.

The oppositely disposed, upper baffles 28 and lower baffles 29 are of the usual construction.

The doors 31 afford inspection of the interior of the machine.

The centrifugal member 32, see Figs. 1 and 3, comprises usually spaced plates 33 respectively fixed on the main shaft 21 by keys or the like, and secured to and extending between the plates 33 are the series of rods 34 passing through a set of circularly disposed, uniformly spaced openings in the respective plates 33. The rods 34 are removably locked to the plates 33 by means of nuts 35 or the like.

On each rod 34 see Fig. 1, are freely pivotally mounted a series of hammers 36, such as of the type shown in Fig. 4; each hammer comprises an arm portion 37, see Fig. 4, having the opening 38 at one end through which extends a rod 34. At the opposite end of the arm 37 is provided the hammer head 39 of a construction more particularly set forth hereinafter.

In the type of hammer shown in Fig. 4, and illustrated in detail in Figs. 5 and 6, the connection between the hammer head 39 and its arm 37 is formed of the tongue 40 extending longitudinally at the end portion 41 of the arm 37 and substantially centrally thereof, which tongue 40 coacts with the groove 42 extending longitudinally within the hammer head 39. Preferably, the end portion 41 of the arm 37 is thickened adjacent the edges of the flat surfaces 43, 44, see Fig. 6, on opposite sides of the tongue 40, which flat surfaces 43, 44 when the head 39 is jointed with its arm 37, respectively make a snug fit with the flat surfaces 45, 46, see Fig. 5 of the hammer head 39.

Such connection further comprises the joint indicated at 47 formed by a portion of the hammer 39 extending transversely to the surfaces 45, 46, preferably at right angles thereto and having the exposed flat surfaces 48, see Fig. 5 for engagement with the flat surface 49 of the thickened portion 41 of the arm 47.

Noting that the hammer head 39 is rotated clockwise as viewed in Fig. 4, by reason of its arm 37 being mounted on a rod 34 of the centrifugal mechanism, which rod passes through the opening 38, the components of the forces of impact sustained by the head upon encountering lumps of coal or other material, are transmitted in direction substantially at right angles to the faces 48—49 and 43—45 and 44—46, thereby eliminating substantially all tendency of shear in respect to the tongue 43 of the arm 37 and the material of the head 39 disposed on opposite sides of the groove 42.

It will further be noted that by reason of the extension of the terminal portion 50, see Figs. 4 and 5, of the hammer head proper 39, laterally of the direction of length of its arm 37, the effective leverage of the hammer head is increased without substantial longitudinal extension of the hammer as a whole.

If desired, as shown in Fig. 4, the tongue 40 of the arm 37 is locked with the sides of the groove 42 of the head 39 by means of a pin 51 passing through the opening 52, see Fig. 6, in the tongue 40 and also through the oppositely disposed openings 53, see Fig. 5 (one only shown) of the sides of the groove portion 42 of the head 39.

In the modification shown in Figs. 7, 8 and 9, the tongue of the joint connection is located on the head and the groove in the arm; as is shown in these figures, the head 39 is provided with the tongue portion 55 located substantially centrally at the joint portion of the head and the arm 37 is provided with the grooved portion 56, the groove 57 of which is arranged to receive the tongue 55. A pin 58, see Fig. 7, extends through the oppositely disposed openings 59, see Fig. 9, (one only being shown) in the groove portion 56 of the arm 37 and also through the opening 60, see Fig. 8, of the tongue 57 of the head 39. Otherwise, the portions of the hammer shown in Figs. 7, 8 and 9 correspond to similar portions of the hammer shown in Figs. 4, 5 and 6 and like reference numbers are employed to indicate like parts.

The hammer shown in Figs. 10, 11 and 12 is the general formation and construction similar to the modifications hereinabove described; however, the arm 37 is jointed with the head 39 by a lateral tongue and groove connection. In the form of the modification shown in these figures, the tongues are arranged in pairs 62, 63, see Fig. 11, and arranged on opposite sides of the slot 64; the groove connection is correspondingly arranged as a pair of grooves 65, 66, see Fig.

12, on opposite sides of the integral portion 67. Below the slot 64 is also provided the enlarged slot 68, see Fig. 11, for reception of the enlarged end portion 69, see Fig. 12, of the arm 37. As will appear in Fig. 10, upon jointing the arm 37 with the head 39, the joints of the tongue 62, 63 are made with the respective slots 65, 66 and as well of the enlarged slot 68. This modification conforms otherwise similarly to the modifications hereinabove described and like parts are designated by like reference numbers. The pin 70 bonds the arm 37 to the head 39.

In the modification shown in Figs. 13, 14 and 15, the arm 37 is thickened at its end portion 71 which is provided with a slot 72 for receiving the tongue 73 secured to and projecting freely from the face 48 of the transverse joint portion 47. Upon assembly of the head 39 on the end of the arm 37, the face 74 of the thickened portion 71 is brought into close engagement with the face 48 of the joint portion 47 of the head 39 and the end face 75 of the thickened portion 71 of the arm 37 is brought into snug fit with the end face 76 of the head proper 39.

The pin 77 passing through suitable registering openings secures the tongue 73 in the slot 72 of the thickened end portion 71 of the arm 37.

As stated above, each individual hammer of any of the above described types is loosely pivotally mounted on a rod of the sets of rods 34 of the centrifugal mechanism comprising the spaced plates 32 fixed on the shaft 21. When the shaft 21 is quiescent, the hammers hang passively as is indicated in Fig. 2 and a set of rods 90 are provided and mounted similarly to and arranged alternately with the set of rods 34, to limit the passive position inwardly relatively to the shaft 21.

Upon rotation of the shaft 21 say in the direction of the arrow 91, see Fig. 1, the hammers swing out to greater and greater extent upon increased centrifugal speed and upon feeding coal in lumps or other lumped material to the centrifugal mechanism, the individual heads 39 of the hammers encounter the lumps, and upon impact with the same, break or crumble the material to the desired degree.

The forces of reaction to which the heads 39 and arms 37 are subjected are resolvable in directions at right angles to the planes of the joints of the connection between the head 39 of any hammer and its arm 37, thereby relieving the tongue and slot interconnecting parts of all shearing forces.

It will also be noted that the locating of the weighted end portion enhances the momentum of each hammer individually for any certain speed of rotation of the shaft 21 and its centrifugal mechanism.

From the above description of the constructions of the several types of hammers, it will be noted that the heads of the hammers are rigidly mounted on the respective arms but the rigid connections notwithstanding are protected from shearing strains. In use the wear is limited to the enlarged or contact faces of the hammers, thereby reducing the extent of effective wear and materially prolonging the average period of use of the hammers and accordingly extending the period of continuance of use of the machine as a whole, before the need of replacement or repair of the hammer heads arises.

Whereas, I have illustrated my invention by reference to several modifications thereof, it will be understood that many changes may be made and particularly as to the form of the joint connection, without departing from the scope of the invention as defined by the appended claims.

I claim.

1. A hammer for a centrifugal device comprising an arm provided adjacent one end thereof with an opening for pivotal suspension, said arm extending at one of its lateral faces substantially rectilinearly for its entire length, the opposite end of said arm having a projection, and a removable head formed of material of greater refractory character than the material of said arm, said head having at one end thereof a groove extending substantially the full length of said opposite end of said arm constructed to be received within said projection of said arm, said head further including a projection extending laterally of said arm when said head is assembled on said arm and in face to face engagement with said lateral longitudinally extending face of said arm.

2. A hammer for a centrifugal device comprising an arm provided adjacent one end thereof with an opening for pivotal suspension, said arm extending at one of its lateral faces substantially rectilinearly for its entire length, the opposite end of said arm having a projection, and a removable head formed of material of greater refractory character than the material of said arm, said head having at one end thereof a groove extending substantially the full length of said opposite end of said arm constructed to be received within said projection of said arm, said head further including a projection extending laterally of said arm when said head is assembled on said arm and in face to face engagement with said lateral longitudinally extending face of said arm, the free end of said head being enlarged and extending laterally and in advance of said rectilinear lateral face of said arm.

3. A hammer for a centrifugal device comprising an arm provided adjacent one end

thereof with an opening for pivotal suspension, said arm extending at one of its lateral faces substantially rectilinearly for its entire length, the opposite end of said arm having a projection, and a removable head formed of material of greater refractory character than the material of said arm, said head having at one end thereof a groove extending substantially the full length of said opposite end and constructed to be received within said projection of said arm, said head further including a projection extending laterally of said arm when said head is assembled on said arm and in face to face engagement with said lateral longitudinally extending face of said arm.

In testimony whereof I have signed this specification this 28th day of July 1922.

GEORGE P. LUCAS.