Oct. 29, 1929. H. R. MacMICHAEL 1,733,352

SCOTCH HEARTH RABBLING MECHANISM

Filed June 22, 1927 3 Sheets-Sheet 1

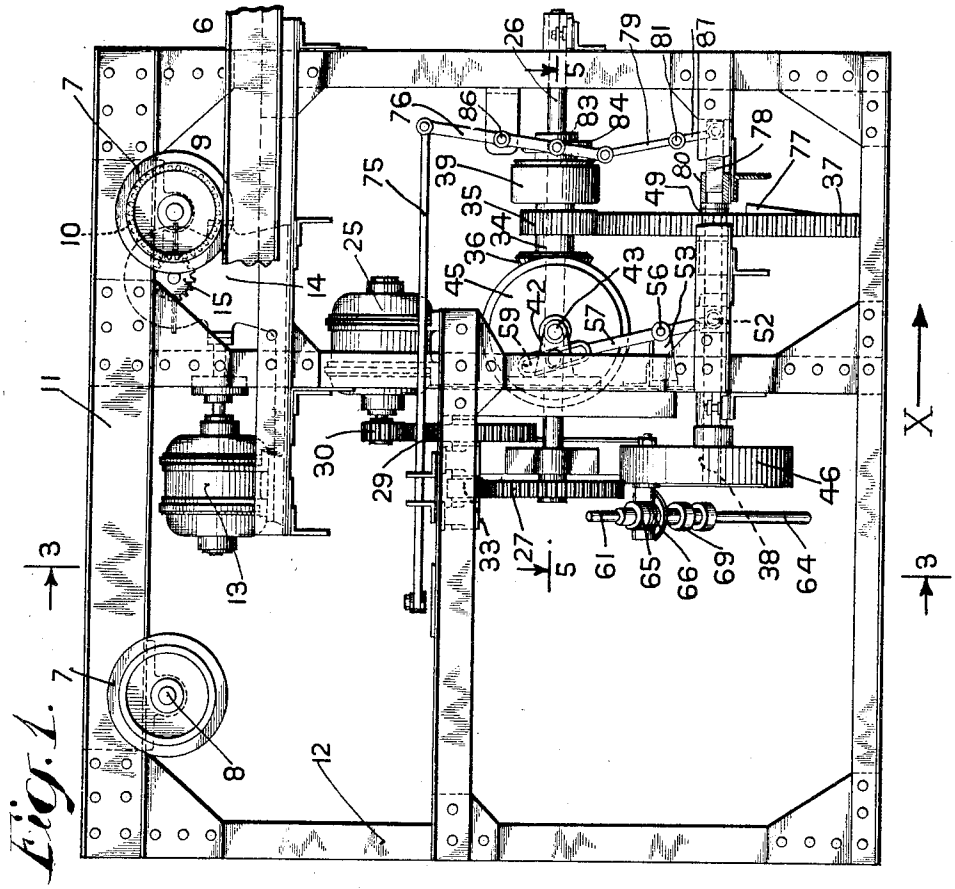


Fig. 1.

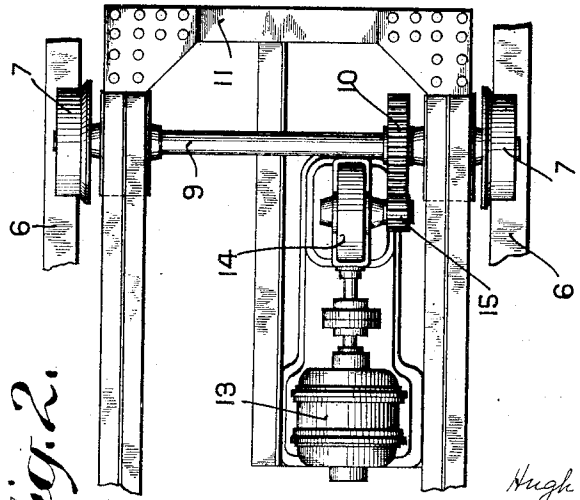


Fig. 2.

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Fig. 3.

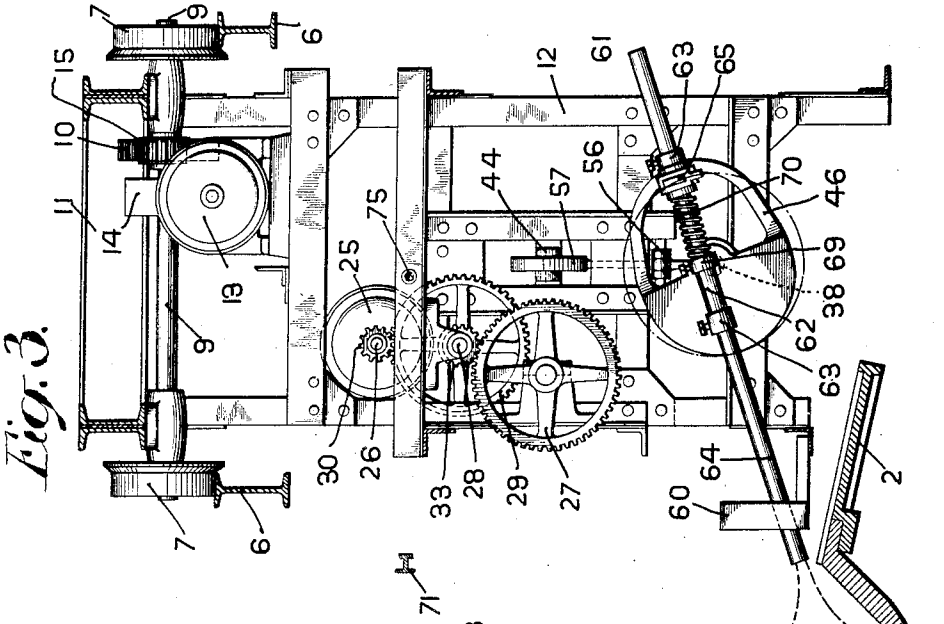
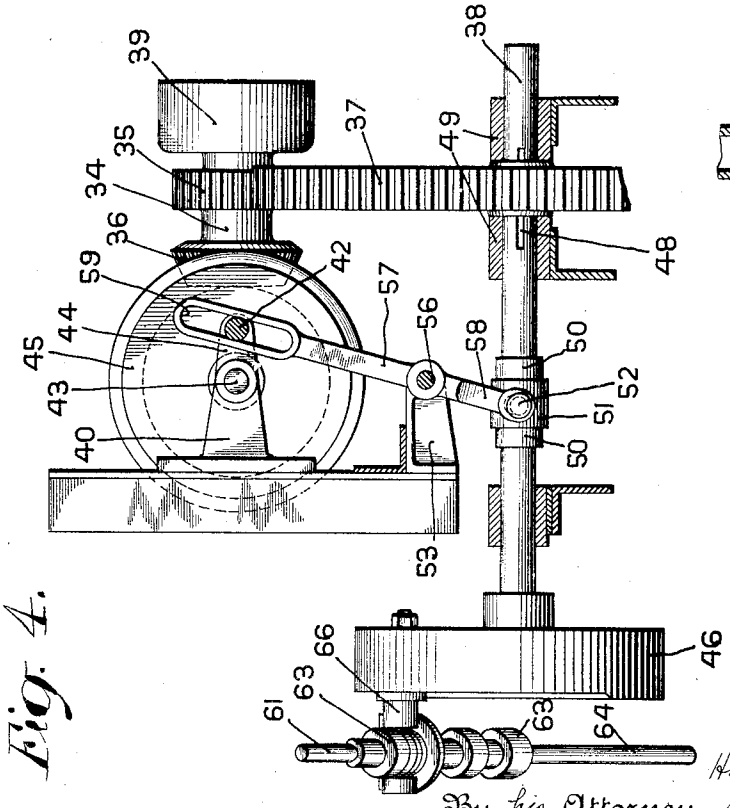


Fig. 4.



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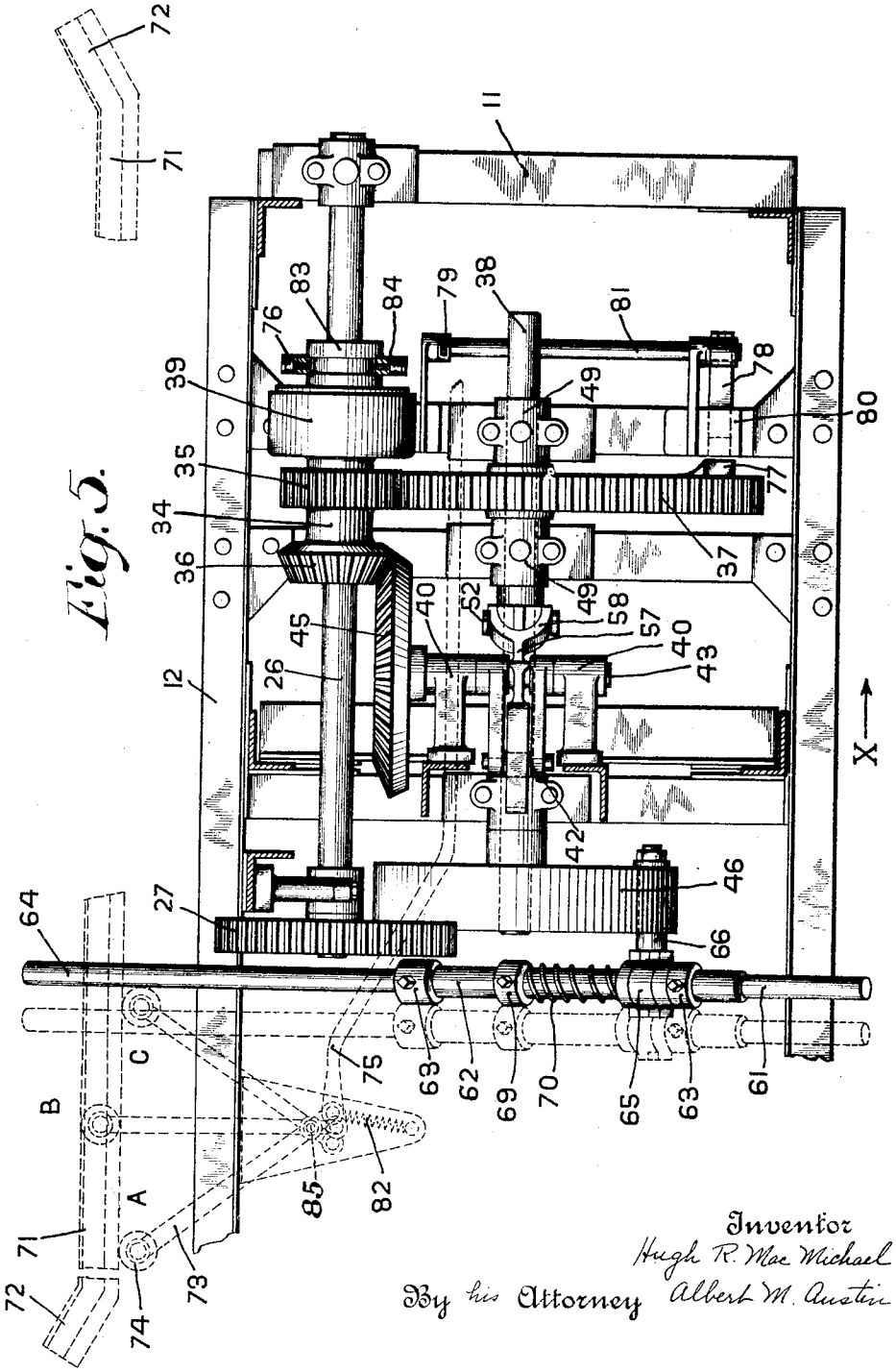


Fig. 5.

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UNITED STATES PATENT OFFICE

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SCOTCH-HEARTH RABBLING MECHANISM

Application filed June 22, 1927. Serial No. 200,523.

The invention relates to apparatus for metal smelting, and more particularly, to a mechanical poker or rabbler arrangement for poking or rabbling the charge of a Scotch hearth type furnace.

According to the invention, a carriage is provided which is adapted to move back and forth along the front of a Scotch hearth, the movement on its operating trip preferably being continuous. A suitable mechanical poker is provided on the carriage which is given a power driven mechanical poking movement into the hearth, the poker also being given a compensating movement to compensate for the movement of the carriage, so that when the poker is in the hearth there is no substantial movement thereof in the direction of the carriage travel.

The carriage may be reversed by suitable reversing mechanism at the end of its operating trip to travel backwards, preferably at an increased speed, to the starting point. Suitable mechanical shoveling mechanism and suitable mechanical feeding mechanism may also be provided on the carriage, or, if desired, either or both the shoveling and feeding may be done by hand.

The arrangement may be such that, as the carriage travels the length of the hearth on its operating trip, the poker may operate on the hearth to level the charge and throw part of it on the apron. The shovel may follow, pushing the charge back up against the back of the hearth forming a bank having desired characteristics. The feeder may follow to feed and distribute the charge which is preferably a mixture of crushed ore and fuel.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings.

The invention also consists in certain new and original features of construction and combinations of parts hereinafter set forth and claimed.

In the accompanying drawings there is shown, for purposes of illustration, one form of a device embodying the invention, in which—

Fig. 1 is a side elevation of the carriage and poking mechanism looking toward the back of the hearth;

Fig. 2 is a top plan view of a detail;

Fig. 3 is a section on the line 3—3 of Fig. 1;

Figs. 4 and 5 are enlarged details of the mechanism for giving the compensating movement to the poker;

Like reference characters denote like parts in the several figures of the drawings.

In the following description and in the claims parts will be identified by specific names for convenience, but they are intended to be as generic in their application to similar parts as the art will permit.

Referring now to the drawing, and more particularly to Fig. 3, so much of a Scotch hearth as is necessary to an understanding of this invention will be described. The Scotch hearth may comprise the usual basin or trough 1, the trough being comparatively narrow and relatively long, as is well understood. At the front edge of the trough, an apron 2 is provided extending the length of the trough, the apron sloping forward and slightly downwardly. At the back side of the trough and extending the length thereof is a back made up of a block 3 having a suitable water space 4 therein for cooling, underneath which are suitable tuyères 5 for supplying draft to the furnace, as is well understood in the art. This construction is well known and no further description is deemed necessary.

Extending along in front of the furnace is a pair of overhead tracks 6 upon which rides a carriage 11 comprising a suitable structural framework denoted generally by 12 depending from four flanged wheels 7 which are mounted on suitable axles 8 and 9. It will be understood that the carriage is adapted to move longitudinally of the hearth back and forth. The carriage may be supplied with suitable operating mechanism, such as a mechanical feeding device (not shown), a mechanical shoveling device (not shown), and a mechanical poker mechanism which is described in detail hereinafter.

Driving means for the carriage is shown

best in Figs. 1 and 2. One axle 9 may be journaled to rotate in the carriage frame and have fixed thereon the wheels 7 and also a spur gear 10. A suitable small electric motor 13 may be provided having operative connection with the spur gear 10 through a suitable worm and worm wheel reduction unit located within the housing 14, this reduction unit driving a small pinion 15 which meshes the spur gear 10. The motor 13 may be of the type which is capable of running forward at a certain speed and running backwards at a different speed.

A suitable reversing switch (not shown) may be provided on the carriage so that, when the carriage reaches the end of its operating trip, the switch will be operated to reverse the motor and drive it backwards at an increased speed to its starting point where the switch will be again operated to reverse the motor and cause it to drive the carriage on its operating trip at a reduced speed.

For driving the poker mechanism a separate electric motor 25 is provided mounted on a suitable supporting part of the frame. A counter shaft 26 is provided suitably journalled in the frame, the counter shaft having a large gear 27 mounted on one end thereof. An intermediate shaft 28 is mounted in suitable bearings between the motor 25 and the counter shaft 26, this intermediate shaft having a large gear 29 meshing with the small gear 30 on the motor shaft, and also having a small gear 33 driving the large gear 27 on the counter shaft to give the necessary desired speed reduction to the counter shaft.

The counter shaft may have loosely mounted thereon a composite gear 34 made up of a spur gear 35 and bevel gear 36 fixedly secured to each other. The spur gear 35 drives a larger gear 37 located on the rabble shaft 38. A suitable clutch mechanism 39 may be provided for selectively connecting and disconnecting the composite gear 34 to the counter shaft 26. The mechanism for controlling the clutch will be described hereinafter more in detail.

Mounted in a pair of suitable bearings 40 supported by the frame is a crank shaft 43 having a pair of crank arms 44 and a crank pin 42 therebetween, and an overhung bevel gear 45 meshing with the bevel gear 36 on the counter shaft.

Located below the counter shaft is the rabble shaft 38, the rabble shaft being supported in suitable bearings on the framework. In overhung relation on the end of the rabble shaft is a crank 46 for driving the poker device. Also mounted on the rabble shaft is a large gear 37 having a feather keyway engagement 48 with the rabble shaft 38, as shown best in Fig. 4, the gear 37 being fixed longitudinally between suitable bearings 49. Also mounted on the rabble shaft is a pair of spaced collars 50 between which is loosely mounted a sleeve 51 having trunnions 52 projecting therefrom.

Between the crank shaft 43 and the counter shaft 26 is a fulcrum bracket 53 having a pivot pin 56 on which is pivoted a lever 57, the lower end 58 of the lever being forked to engage the trunnions 52, the upper end of the lever 57 being provided with a slot 59 in which the crank pin 42 works.

Supported by the carriage frame and near the front edge of the trough 1 is a support or fulcrum point 60 for the poker 61, this support allowing the poker 61 a motion bodily in the direction of carriage travel. The poker 61 is made up of a sleeve 62 having collars 63 at the ends, the poker rod 64 being fixed within the sleeve 62 by means of set screws. The sleeve 62 is held by means of a suitable buckle or clamp 65 having a projecting crank pin 66 which is journalled in the crank 46, the crank being provided with a suitable counter weight to counter balance the weight of the poker. The sleeve 62 is provided with a collar 69 fixed thereto by means of a set screw and between this collar and the clamp 65 a suitable spring 70 is provided.

The control mechanism will now be described. Extending along the length of the furnace and throughout substantially the extent of the carriage travel, is a control rail 71, the ends 72 thereof being inclined away from the carriage. Suitably mounted on a frame of the carriage is a chain of control links, the chain being made up of a control lever 73 having a roller 74 at its end which rolls along on the control rail. The control lever 73 operating through the link 75 and clutch lever 76 operates to hold the clutch 39 in engaged position so as to drive the poker mechanism when the roller 74 is rolling along the straight part of the control rail 71.

The clutch 39 will be provided with a grooved collar 83 on which is disposed a collar 84 having pivoted connection with the clutch link 76. The control lever 73 is suitably pivoted to the frame at 85 and the clutch lever 76 is pivoted to the frame at 86.

The control lever 73 also operates a suitable stop device for insuring that when the poker stops operating, it stops out of the hearth.

The stop device comprises a projection 77 projecting from the gear 37 and a suitable stop bar 78 slidable in a guide 80 into and out of the path of the projection 77. The lever 79 is rigidly connected to pivot rod 81 suitably journaled in the frame and is pivoted to the clutch lever 76. Lever 87 is rigidly connected to pivot rod 81 and is pivoted to stop bar 78, the guide 80 being such as to allow a slight tilting of the stop bar 78 due to the arc of swing of the lever 87.

It will be apparent that, as the carriage travels on its operating trip in the direction indicated by the arrow in Fig. 1, the clutch 39 will be in engaged position and the motor

25 will cause the poker to have a movement transverse to the carriage travel to cause the end of the poker to travel somewhat on a line 90 as indicated in Fig. 3. The poker spring 70 takes up any shock which would be caused by the poker striking a hard lump, and also allows the poker to strike the back of the trough 1 to scrape any slag or crust which may adhere thereto. The poker rod may be adjusted within the sleeve 62 for wear.

At the same time the poker is given the movement above described, the entire poker is given a compensating movement in a direction opposite to that of the carriage travel to compensate for the carriage movement, to cause the poker to have substantially no movement in the direction of the carriage travel when it is in the hearth. This mechanism moves the entire rabble shaft 38 and the entire poker bodily in the direction of carriage travel. The parts and kinematic value may be so adjusted that the poker pokes the charge every few inches, this depending upon operating conditions.

When the carriage is moving on its operating trip in the direction indicated by the arrow X in Figs. 1 and 5, the control lever 73 is in the position indicated by A in Fig. 5 and holds the clutch 39 in engagement against the clutch spring and, if necessary, an auxiliary spring 82. The control lever also holds the stop bar 78 out of engagement with the projection 77 allowing the gear to rotate freely.

When the carriage reaches the end of its operating trip, the control lever 73 runs off of the inclined end of the control rail 71 and assumes a neutral position as shown by B in Fig. 5, due to the action of the clutch spring and spring 82. This disconnects the clutch and throws the stop bar 78 into a position to be engaged by the projection 77, this causing the gear to stop in such a position that the poker is out of the hearth.

When the reversing device causes the carriage to travel on its back trip, the inclined end 72 of the control rail 71 engages the control lever 73 and moves it to an opposite position indicated by C in Fig. 5. This has no effect on the engagement of the clutch and merely causes the stop bar 78 to move a little further, the projection 77 being large enough to allow this additional movement.

When the carriage reaches its starting point, the control lever 73 runs off the control rail 71 and again assumes a neutral position due to the action of the clutch spring and spring 82. When the reversing mechanism starts the carriage on its operating trip, the control lever 73 is thrown into the position shown by A against the tension of the clutch spring and of the spring 82, the clutch being placed in engaged position and the stop bar 78 moved free of the projection 77. This movement causes the poker to operate again.

It will thus be seen that a mechanical poker or rabbler mechanism has been provided which is comparatively simple in construction and effective in operation. The parts may be made rugged thereby insuring long life and low maintenance. The continuous movement of the carriage on its operating trip together with the compensating movement of the poker, has operating advantages as well as structural advantages. The provision of a continuously moving carriage not only simplifies the mechanism necessary for moving the carriage but also allows the use of other operating mechanism, such as an automatic feeder device, with which it may be desirable to have continuous carriage movement. The compensating movement given the poker causes the poker to have substantially no motion in the direction of carriage travel while it is in the hearth, this poker operating upon the charge in the most desirable and efficient manner. The provision of the stop mechanism operated by the control mechanism which controls the poker, positively causes the poker to stop clear to the hearth, so that there is no possibility of ruining the fire when the carriage makes its back trip, by the poker engaging the charge.

While certain novel features of the invention have been shown and described and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes in the forms and details of the device illustrated and in its operation may be made by those skilled in the art without departing from the spirit of the invention.

What is claimed is:

1. In combination with a hearth, mechanical poker mechanism comprising a carriage, a path along said hearth for said carriage, means for imparting a continuous movement to said carriage on its operating trip, a counter shaft, means for rotating said counter shaft, a composite bevel and spur gear on said counter shaft, a clutch for connecting said composite gear and counter shaft, a second bevel gear meshing said first bevel gear and having a crankpin, a rabble shaft having an axially fixed spur gear having feather keyway engagement therewith, said spur gears having meshing relation, said rabble shaft having a crank, a lever fulcrumed in said carriage, means for connecting said lever to said pin and said rabble shaft so that movement of said pin causes axial movement of said rabble shaft, a rest on said carriage, a poker on said rest, and means for pivotally connecting said poker to said crank.

2. In combination, a hearth, a support, means for moving said support and hearth relatively, an operating member on said support, a shaft, means connecting said member to said shaft to cause said member to enter and operate upon said hearth, means for rotating said shaft, and means for imparting

a movement to said shaft in the direction of relative movement to compensate therefor.

3. In combination with a hearth, a support, means for moving said support and hearth relatively, an operating member on said support, an operating shaft, means connecting said member and shaft to cause said member to enter and operate upon said hearth, a counter shaft, a bevel gear on said counter shaft, a second bevel gear meshing said first bevel gear and having a crank pin, a lever pivoted to said support and engaging said crank pin and operating shaft, and means for rotating said counter and operating shafts.

4. In combination with a hearth, mechanical poker mechanism comprising a carriage, a path along said hearth for said carriage, means for imparting a continuous movement to said carriage on its operating trip, a counter shaft, means for rotating said counter shaft, a composite bevel and spur gear on said counter shaft, a clutch for connecting said composite gear and counter shaft, a second bevel gear meshing said first bevel gear and having a crankpin, a rabble shaft having an axially fixed spur gear having feather keyway engagement therewith, said spur gears having meshing relation, said rabble shaft having spaced collars and a crank, a lever fulcrumed in said carriage and having a slotted end engaging said pin, a member engaging between said collars, the other end of said lever being pivoted to said member, a rest on said carriage near the front edge of said trough, a poker on said rest and having upper and lower abutments, a buckle holding said poker and having a crank pin journalled in said crank, a spring between said lower abutment and said buckle.

5. In combination with a Scotch hearth having a longitudinally extending trough, mechanical poker mechanism comprising a carriage adapted to move along in front of said hearth, means including a separate motor for imparting a continuous movement to said carriage on its operating trip, a second motor on said carriage, a counter shaft below said second motor, reduction gearing connecting said second motor and counter shaft, a composite bevel and spur gear on said counter shaft, a clutch for connecting said composite gear and counter shaft, a second bevel gear meshing said first bevel gear and having a crank pin, a rabble shaft below said counter shaft, said rabble shaft having an axially fixed spur gear having feather keyway engagement therewith, said spur gears having meshing relation, said rabble shaft having spaced collars and a crank, a lever fulcrumed in said carriage and having a slotted upper end engaging said pin, a member engaging between said collars, the lower end of said lever being pivoted to said member, a rest on said carriage near the front edge of said trough, a poker on said rest and having upper and lower abutments, a buckle holding said poker and having a crank pin journalled in said crank, a spring between said lower abutment and said buckle.

6. In combination with a hearth having a longitudinally extending trough, mechanical poker mechanism comprising a carriage adapted to move along in front of said hearth, means including a separate motor for imparting a continuous movement to said carriage on its operating trip, a second motor on said carriage, a counter shaft operatively connected to said second motor, a composite bevel and spur gear on said counter shaft, a clutch for connecting said composite gear and counter shaft, a second bevel gear meshing said first bevel gear and having a crank pin, a rabble shaft, said rabble shaft having an axially fixed spur gear having feather keyway engagement therewith, said spur gears having meshing relation, a lever fulcrumed in said carriage, means connecting said lever to said pin and to said rabble shaft so that the movement of said pin causes an axial movement of said rabble shaft, a rest on said carriage near the front edge of said trough, a poker having upper and lower abutments, a buckle holding said poker and having pivotal connection with said crank, a spring between said lower abutment and said buckle.

7. In combination with a hearth, mechanical poker mechanism comprising a carriage adapted to move back and forth along said hearth, a rabble shaft on said carriage having a drive gear and a crank, a poker pivotally connected to said crank, a fulcrum rest for said poker on said carriage, means for driving said drive gear including a clutch, a stop member, a cooperative device on said gear for engagement with said stop member, means whereby the movement of said carriage causes said clutch to disengage and said stop member and device to engage to cause said poker to stop clear of the hearth.

8. In combination with a hearth; mechanical poker mechanism comprising a carriage adapted to move back and forth along said hearth, a rabble shaft on said carriage having a drive gear and a crank, a poker pivotally connected to said crank, a fulcrum rest for said poker on said carriage, means for driving said drive gear including a clutch, said drive gear having a projection, a stop bar, a guide to allow said stop bar to slide into the path of said projection, a control lever, linkage connecting said lever with said clutch and stop bar, means whereby the movement of said carriage causes said control lever to operate to disengage said clutch and to move said stop bar in the path of said projection to cause said poker to stop clear of the hearth.

9. In combination with a hearth, operating mechanism comprising a carriage adapted to

move continuously along said hearth, an operating member on said carriage, means for imparting an operating movement to said member, and means for imparting a compensating movement to said member to compensate for movement of said carriage.

10. In combination with a hearth, operating mechanism comprising a carriage adapted to move continuously along said hearth, an operating member on said carriage, means for imparting an operating movement to said member transverse to the carriage movement, and means for imparting a compensatng movement to said member to cause said member to have substantially no carriage movement while operating on said hearth.

11. In combination, a hearth, a support, means for moving said hearth and support relatively and continuously, a poker on said support, means for causing said poker to enter and rabble the material on said hearth, and means for imparting a compensating movement to said poker to cause said poker to have substantially no movement in the direction of the relative movement between said hearth and support while rabbling said material.

12. In combination with a hearth, a path along said hearth, a carriage adapted to move back and forth on said path, means for causing said carriage to move continuously on its operating trip, an operating member on said carriage adapted to enter said hearth, means for imparting an operating movement to said member, means for imparting a compensating movement to said member to compensate for movement of said carriage, means for stopping said operating member at the end of said path, and devices operable by said stopping means for causing said operating member to stop clear of the hearth.

13. In combination, a hearth, a support, means for moving said hearth and support relatively, an operating member on said support adapted to enter said hearth, means for imparting an operating movement to said member, means for imparting a compensating movement to said member to compensate for said relative movement.

14. In combination, a Scotch hearth, a path along said hearth, a carriage adapted to move back and forth along said hearth, means for moving said carriage with a continuous movement on its operating trip, a poker on said carriage adapted to rabble the charge in said hearth, a rabble shaft on said carriage having a crank, a pivot connecting said crank and poker, a rest on said carriage for said poker, a counter shaft, a motor for rotating said counter shaft, means including a crank for causing said counter shaft to impart axial motion to said rabble shaft, and means for causing said counter shaft to impart a rotary motion to said rabble shaft.

15. In combination, a hearth, a path along said hearth, a carriage adapted to move back and forth along said hearth, means for moving said carriage with a continuous movement on its operating trip, a poker on said carriage adapted to enter and operate upon said hearth, a shaft on said carriage having a crank, a pivot connecting said crank and poker, means including a second crank for imparting an axial movement to said shaft to cause said poker to move bodily in a direction opposite to that of carriage travel while the poker is in the hearth, and means for rotating said shaft.

16. In combination with a metal smelting hearth comprising a longitudinally extending basin, a mechanical poker mechanism comprising a continuously moving carriage, a rabble shaft on said carriage having a crank, a poker pivoted to said crank, a fulcrum rest for said poker, means for rotating said rabble shaft to cause said poker to rabble the charge in said basin, and means for moving said shaft axially so that said poker partakes of substantially no movement of said carriage while rabbling the charge.

In testimony whereof I have hereunto set my hand.

HUGH R. MacMICHAEL.