F. PARDEE.

COAL BREAKER

APPLICATION FILED OCT. 4, 1917.

1,356,465. **Patented Oct. 19, 1920.**

6 SHEETS—SHEET 1.

Fig. 1a.

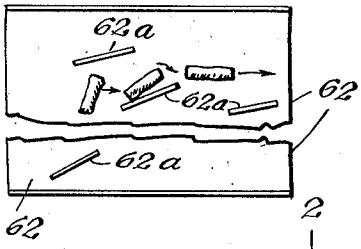
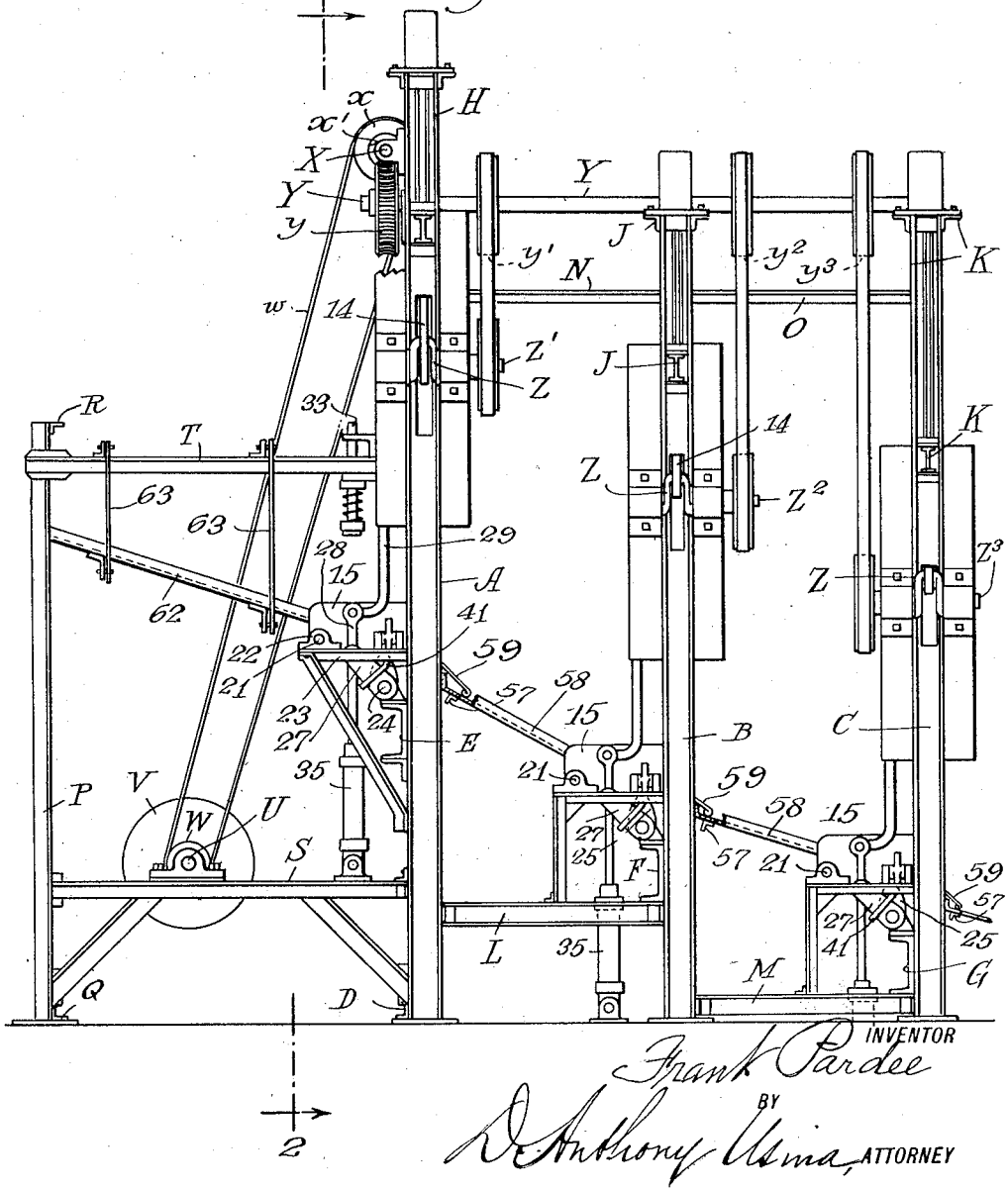


Fig. 1



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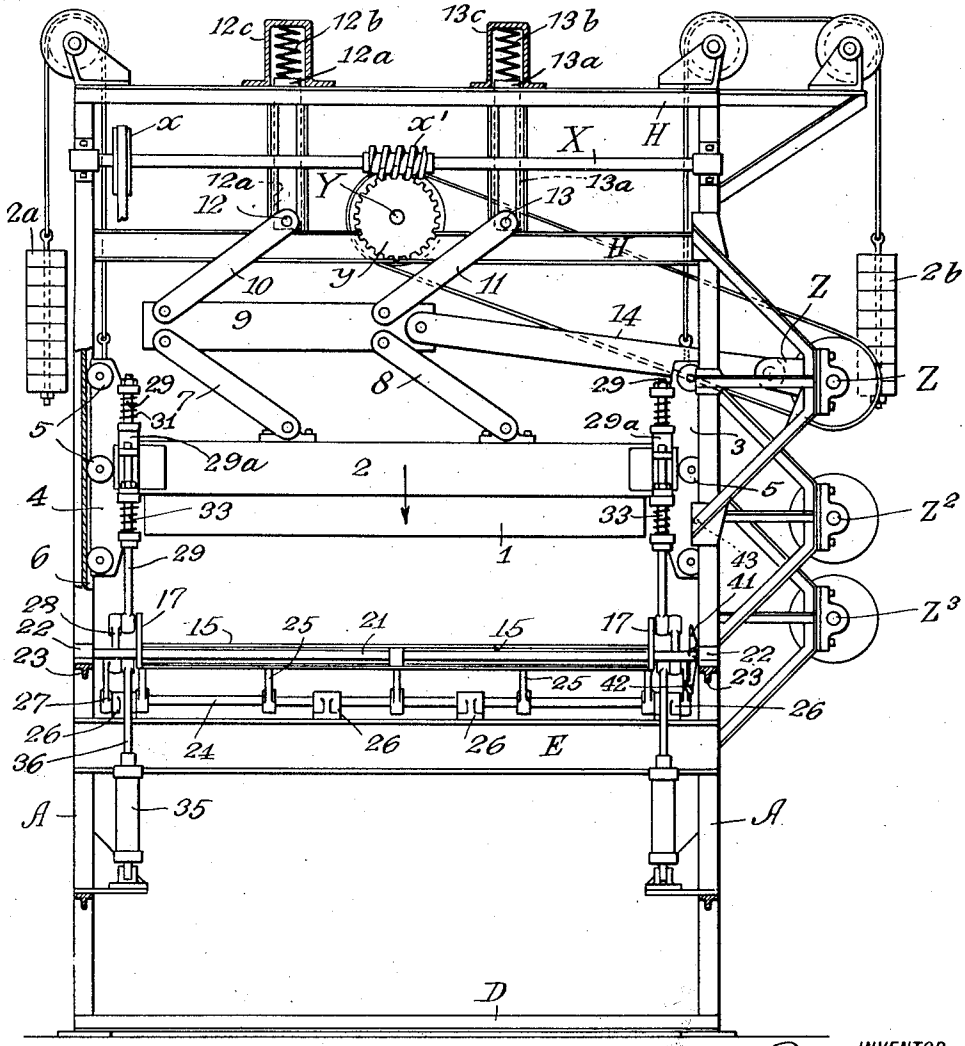
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6 SHEETS—SHEET 2.

Fig. 2.



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6 SHEETS—SHEET 3.

Fig. 3.

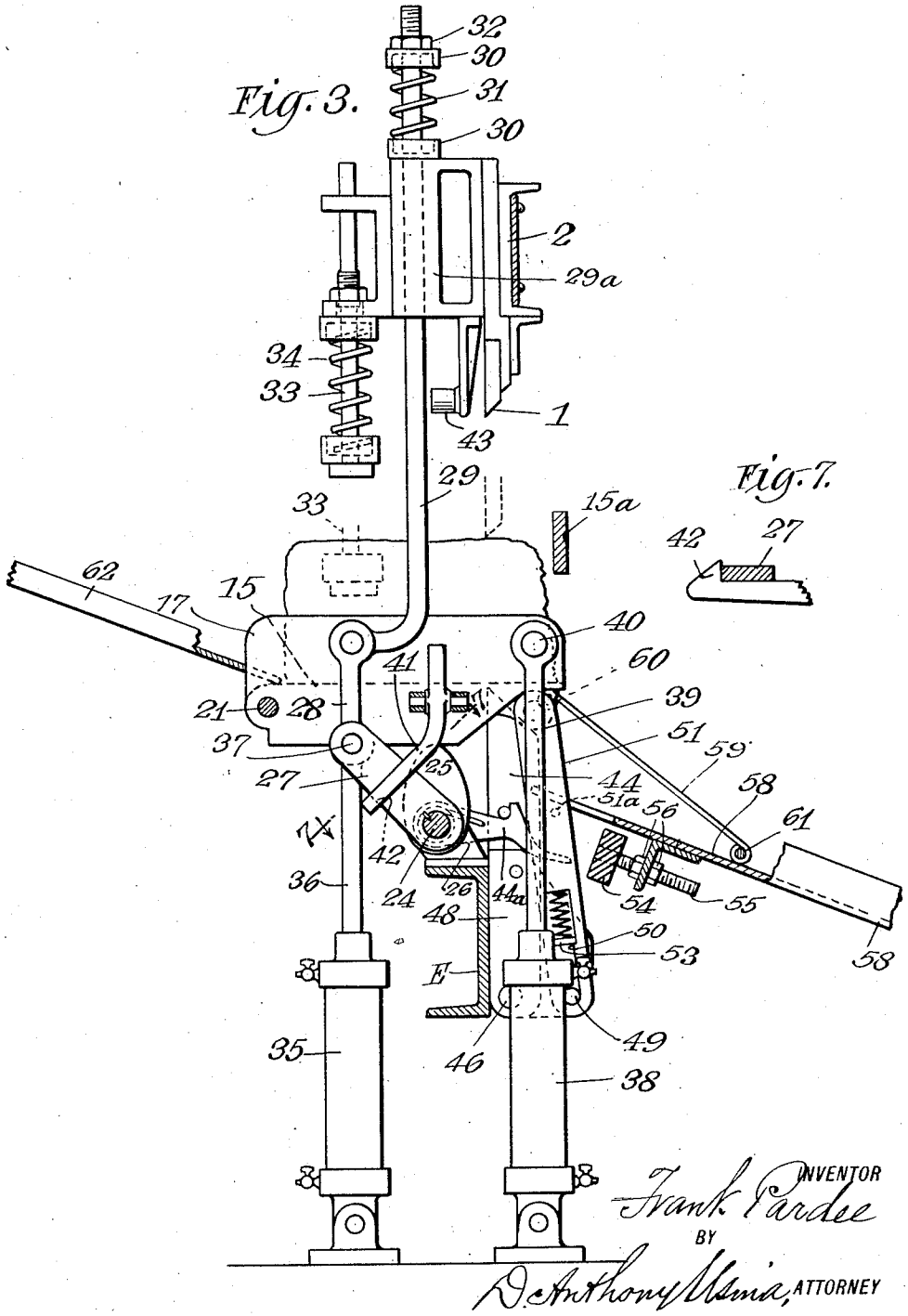


Fig. 7.

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6 SHEETS—SHEET 4.

Fig. 6.

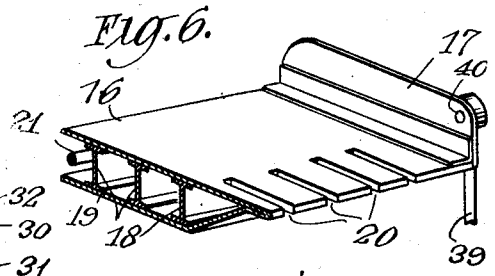


Fig. 8.

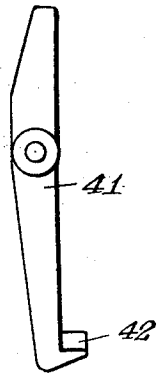


Fig. 4

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6 SHEETS—SHEET 5.

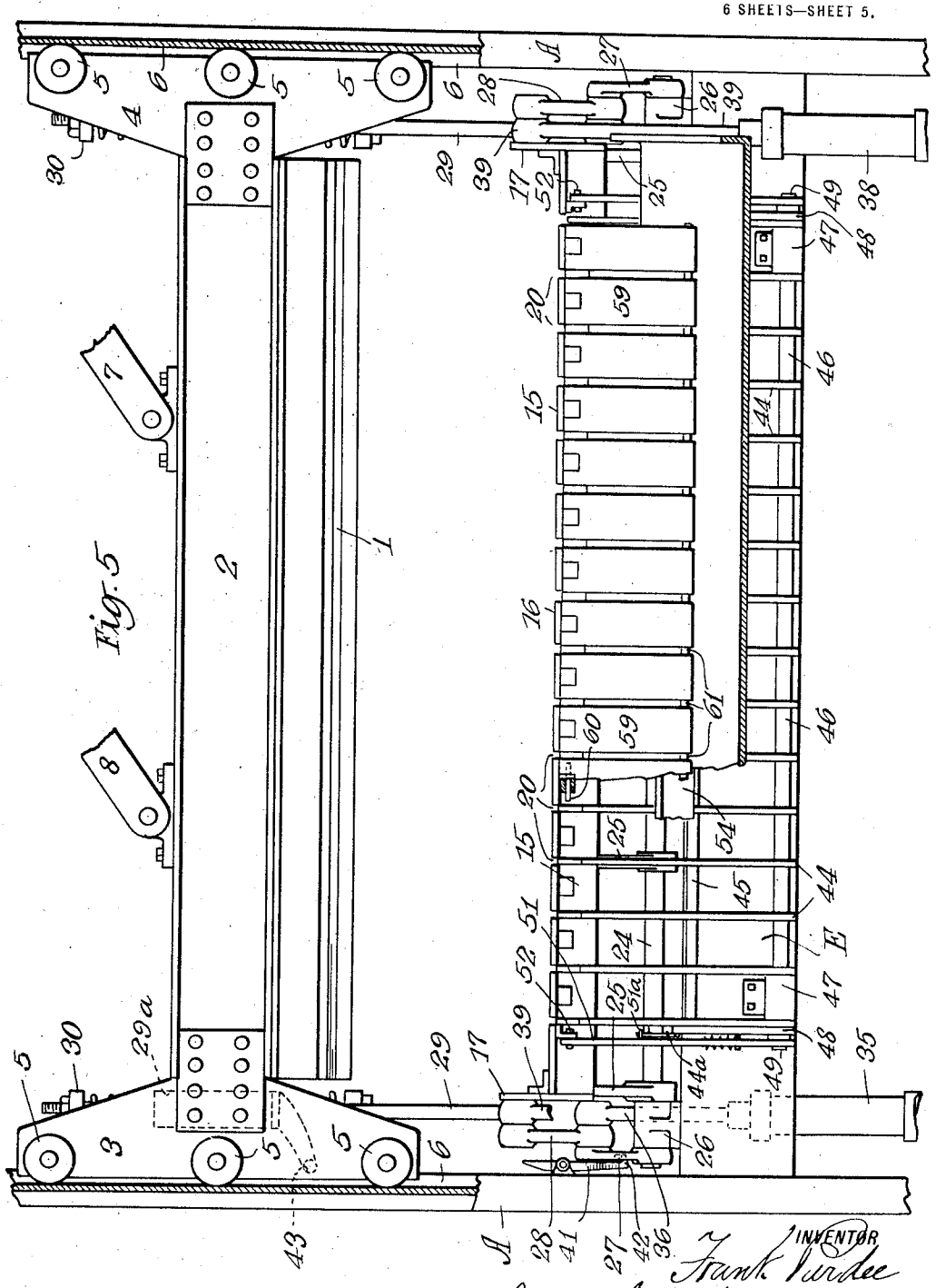


Fig. 5

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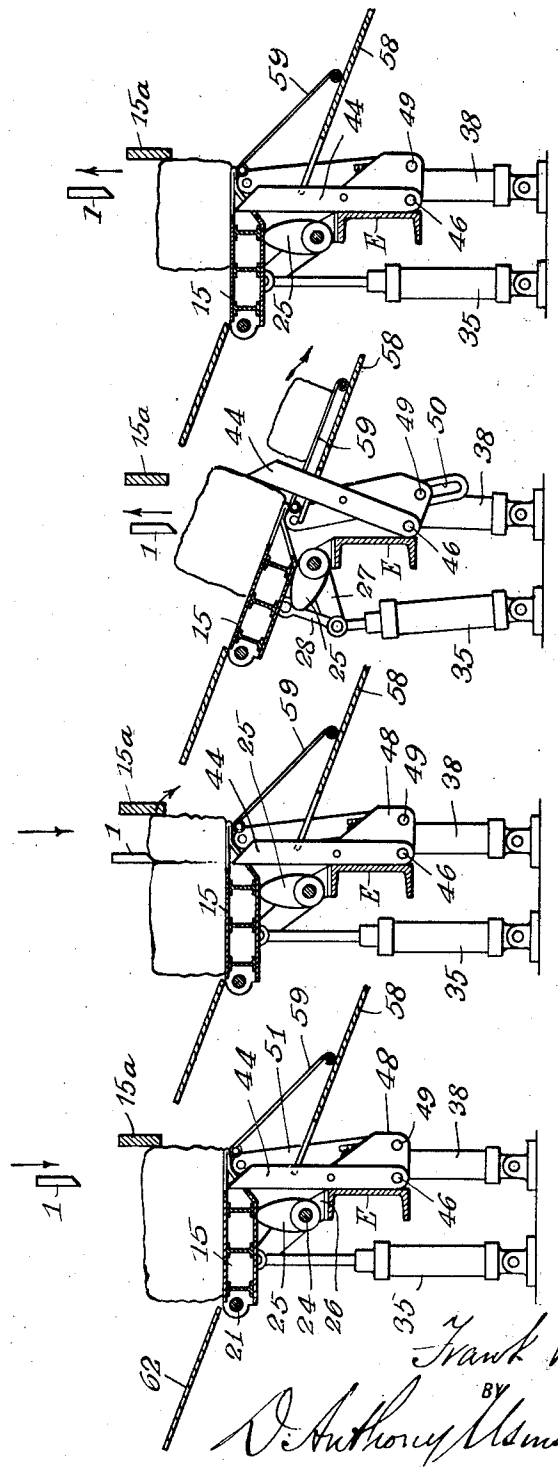
COAL BREAKER

APPLICATION FILED OCT. 4, 1917.

1,356,465.

Patented Oct. 19, 1920.

6 SHEETS—SHEET 6.



UNITED STATES PATENT OFFICE.

FRANK PARDEE, OF HAZLETON, PENNSYLVANIA.

COAL-BREAKER.

1,356,465. Specification of Letters Patent. Patented Oct. 19, 1920.

Application filed October 4, 1917. Serial No. 194,688.

To all whom it may concern:

Be it known that I, FRANK PARDEE, a citizen of the United States, residing in Hazleton, Pennsylvania, have invented certain new and useful Improvements in Coal-Breakers, of which the following is a specification.

In my Patent No. 1,218,693 dated March 13th, 1917, I have described a method and apparatus for breaking larger lumps of coal into a smaller determined size with minimum production of particles finer than said determined size by subjecting the lumps to opposed pressures along practically continuous lines extending across the lumps as distinguished from a number of breaks radiating from a focal point. The machine shown in said patent contains two directly opposed blades between which the individual lumps of coal are broken or cut into the smaller sizes desired. The present application covers other features of the machine and shows another type of machine working on the same general principle, such machine being illustrated in the accompanying drawings.

Figure 1 is a side elevation;

Fig. 1ª is a detail plan of the shaking chute;

Fig. 2 is a front elevation of the first breaking unit being a view on the line 2—2 of Fig. 1;

Figs. 3 and 4 are transverse sections of the same showing the parts in different positions;

Fig. 5 is a partial rear elevation on an enlarged scale of one of the breaking units, parts being broken away in the interest of clearness;

Fig. 6 is a sectional perspective view of the supporting table;

Fig. 7 is a section on the line 7—7 of Fig. 3;

Fig. 8 is a detail of the latch for holding the table in position during the breaking operation;

Figs. 9, 10, 11 and 12 are diagrammatic views illustrating different stages in the cycle of operation of one of the breaking units.

Referring to the embodiment of the invention illustrated, the complete machine comprises three successive units. In the first, the large lumps of coal are broken into smaller lumps. These in turn are fed to the second unit which breaks them into still smaller lumps. And these in turn are fed to the third unit and again broken into the size finally desired. According to the size of the original lumps we may use a single breaking unit or any desired number of such units in succession.

The frame of the machine comprises three main pairs of uprights A, B and C connected by cross-beams D at their lower ends; by cross-beams E, F and G respectively at intermediate points, which serve also to support the table and adjacent parts hereinafter referred to; and by framed girders H, J and K at their upper ends. The lower portions of the uprights are connected also near their lower ends by longitudinal beams L and M and at their upper ends by longitudinal beams N and O. A supplementary frame for supporting the chute which feeds to the first unit and for supporting other parts is located in front of the first set of uprights and comprises a pair of uprights P connected together by cross-beams Q and R at the lower and upper ends respectively and connected to the first unit by longitudinal beams S and T.

The longitudinal beams S of the supplemental frame carry suitable bearings for the main drive shaft U on which is mounted the pulley V driven by a suitable prime mover, and a driving pulley W connected by a belt w with the pulley x on the worm shaft X.

A countershaft Y mounted in suitable bearings carried by the girders H, J and K, has a worm gear y secured thereto adapted to be driven by a worm x' on the shaft X. Pulleys, y', y^2 and y^3 secured to the shaft Y serve to drive the crank shafts Z', Z^2 and Z^3 by means of suitable belting as shown. Cranks Z, carried by said shafts drive the coal breaking toggle mechanism to be presently described.

In the embodiment of the invention illustrated there are shown three sets of breaker units, which are practically identical in construction and operation, the only distinction between them being that the travel of the ejector-fingers in each unit is so adjusted that the lumps of coal broken off by each breaker are smaller than the lumps previously broken. It is, therefore, deemed sufficient to only describe in detail one of the breaking units.

In general terms each breaking unit comprises a chute for conveying the coal to a

supporting table, a table for supporting the coal during the breaking operation, a blade for breaking the coal, mechanism for supporting and locking the table during the breaking operation, shock absorbing means and adjustable ejector mechanism for regulating the size of the lumps of coal to be broken off.

The breaking blade 1 is secured to a cross head 2 built up of structural beams and having members 3 and 4 secured to the ends thereof, which carry anti-friction rollers 5 adapted to travel in the guide-ways 6 of the uprights A, B and C.

The cross head is balanced by suitable counterweights 2^a and 2^b as shown in Fig. 2 and is reciprocated vertically by means of a toggle mechanism consisting of a pair of links 7 and 8 pivotally secured at one end to said cross head 2 and at their opposite ends to a floating bar 9; and a second pair of links 10 and 11 similarly secured at one end to the bar 9 and at their opposite ends to the pivots 12 and 13 carried by the sliding members 12^a and 13^a which impinge against powerful buffer springs 12^b and 13^b mounted in housings 12^c and 13^c carried by the frame of the machine.

These springs are designed to yield when material harder than coal, such as iron or rock is accidentally fed with the coal, thereby preventing the breakage of the blades.

The bar 9 is actuated by the crank Z and pitman 14. This toggle mechanism is so designed and arranged that the initial movement is rapid, to quickly bring the blade into cutting engagement with the coal, and the subsequent motion slow and powerful to exert a maximum breaking action.

Referring to Figs. 3, 1, 4 and 6, the supporting table 15 comprises a top plate 16, side plate 17 and supporting beams 18 suitably framed into said side plates, and a bottom plate 19. Slots 20 are cut in the supporting table to permit the ejector fingers hereinafter described to project beyond the surface of the top plate of the table.

A shaft 21 mounted in trunnions 22 secured to brackets 23 carried by the uprights of the machine, forms a pivotal support for the table.

Located below the table at a plane intermediate the shaft 21 and the free end of the table is a cam shaft 24, to which is keyed a plurality of cams 25 adapted to support the table against the breaking pressure of the blade 1 during its descent. Adjacent to the bearings 26 located near each end of the shaft 24 are keyed crank arms 27 which are connected by links 28 to the cam shaft operating rods 29 slidably mounted in guides 29^a carried on the ends of the cross head 2. At their upper ends the rods 29 are provided with adjusting nuts 32 and sleeves 30 between which are mounted springs 31. The lower ends of the rods 29 are bent forwardly for engagement with the yielding push rods 33 which are slidably mounted in the same guides 29^a and are provided with springs 34 and suitable adjusting means as shown. Double acting dash-pots 35 pivotally secured to the framing of the machine are connected by piston rods 36 and wrist pins 37 to the crank arms 27 and the links 28 to absorb shocks attendant upon the operation of the breaking mechanism. Similar dash-pots 28 are connected by piston rods 39 and pins 40 to the free end of the table 15, as shown.

Pivotally mounted to the framing of the machine is a latch 41 having a hooked end 42 adapted to engage the crank arm 27 as shown in Figs. 3 and 7, when the table is in position for the breaking operation, and to be tripped by a roller or stud 43 carried by a bracket on the cross head, upon the downward movement of the cross head.

A plurality of ejector fingers 44 joined together by an alining rod 45 are mounted on a rock shaft 46 mounted in suitable bearings 47 secured to the cross beam E of the frame of the machine.

Plates 48 are secured to the fingers which are located at each end of the shaft 46. Crank pins 49 carried by the plates 48 pass through slots 50 in links 51 which are pivoted at 52 to the underside of the supporting table.

Spring pressed shoes 53 are slidably mounted in the slots 50 to coact with the crank pins 49 in a manner to be presently described.

A stop 54 for limiting the movement of the ejector fingers away from the supporting table is adjustably mounted by bolts 55 and nuts 56 to the angle iron 57 which is secured to the underside of the stationary discharge chute. The several discharge chutes 58 are fixed by attachment at their rear ends to the uprights A, B and C and are slotted for the passage of the fingers 44.

To the underside of the table there is hinged a slotted extension 59 for conveying the broken coal from the table 15 to the stationary inclined discharge chute 58 leading to the next successive breaking unit.

The member 59 is composed of a plurality of narrow plates mounted adjacently on rods 60 and 61 (Fig. 5), the rods 60 being secured to the underside of the table in such a manner as to form the pintles of the hinge. The plates 59 are spaced sufficiently far apart to permit the ejector fingers 44 to pass between them as shown in Figs. 4 and 5.

In operation the large lumps or slabs of coal are fed onto the shaking inclined chute 62 which is hung from the frame T of the machine by links 63. The jogging of this chute spreads the coal one lump deep and causes the lumps to lie on their broadest

faces as they arrive at the breaker. The shaking chute is provided with suitable deflecting ribs 62ª so that elongated pieces of coal will be fed end-on to the breaking blade as shown in Fig. 1ª, and will feed the lumps onto the table 15, and the fingers 44 will approximately locate the lumps to be broken in the position shown in Fig. 11 and, as the blade rises and the table with it, the parts will assume the position of Fig. 9. Rotation of the crank shaft Z' will cause the cross head 2 and the blade 1 to move downward. When the cross head has moved down a sufficient distance to bring the blade 1 (as shown in dotted lines in Fig. 3) into engagement with the coal, the end of the push rod 33 will still be clear of the bent end of the rod 29.

As the blade continues its downward movement, cutting through the coal, the cams 25 will remain in the position shown in Figs. 3 and 9 with their major axes substantially vertical, supporting the table until the push rod 33 comes into contact with the lower bent end of the rod 29 and slightly compresses the spring 34, the arms 27 being held by the latches 41 and preventing movement of the links 28 downward. By this time the blade will have cut into the coal a sufficient distance to break off the portion between it and the end of the table (Fig. 10) and the latches 41 will be withdrawn. The springs 34 will then expand, causing a rocking movement of the cam shaft 24, through the bent end of rod 29, links 28 and crank arm 27. Further downward movement of the cross head will cause the cam shaft to be rocked until the cams reach approximately the position shown in Figs. 4 and 11, this downward movement being cushioned by the springs 34 and the dash pots 35 and 38.

The rotation of the cams 25 will permit the table 15 to rock on its shaft 21, and this initial rocking movement of the table will cause the ejector fingers 44 to project above the top surface of the table, to eject the broken lumps of coal from the table onto the hinged extension 59 which will convey the broken lumps to the inclined chute 58 leading to the next breaking unit.

Continued downward movement of the table accelerates the travel of the broken lumps, and will also tend to cause the unbroken slabs or lumps on the table to travel toward the inclined chute 59. The downward travel of the unbroken slabs or lumps will be arrested by the blade 1 upon the downward travel of said blade, and by the ejector fingers 44 when the blade is being retracted in a manner to be presently described.

During the initial movement of the table the ejector fingers remain practically stationary due to the fact that the crank pin 49 in the slot 50 of the link 51 will not be affected until the spring pressed shoe 53 strikes it, suitable spring pressed latches 44ª shown in Figs. 3 and 4 are employed to hold the fingers 44 in the vertical position until the pins 51ª carried by the link 51 trip said latches thereby permitting the shoes 53 carried by the link 51 to rock the fingers 44 until their travel is arrested by the adjustable stop bar 54.

As the blade 1 is retracted the unbroken lumps or slabs of coal on the table will be released by the blade and gravity will cause them to slide forward until their travel is arrested by the ejector fingers as shown by Fig. 11.

In some instances an additional gage or guard 15ª Figs. 3 and 4 is used to prevent the coal that is sliding down the inclined chutes from pushing the lumps off the table 15 when said table is in its horizontal position.

As the table moves upward the ejector fingers will remain in the position shown due to the lost motion between the crank pin 49 and the end of the slot 50 thus permitting the unbroken slab or lump to be retained and positioned on the table for the next operation of the blade.

Continued upward movement of the cross head 2 will cause same to strike the lower sleeve 30 on the rod 29 which will operate to rock the shaft 24 and cams 25 through link 28 and crank arm 27, thus re-setting the table to its initial or horizontal position as shown in Fig. 12. In this position the latch hook 42 will engage the crank arm 27 to securely lock the table in position for the subsequent breaking operation.

This latch remains in locking engagement with the crank arm 27 until the blade 1 has traveled a sufficient distance to break off the coal, after which it is tripped by the roller 43 engaging the cam surface thereon.

From the foregoing it will be clear that this invention provides a structure which will rigidly lock and support the table during the breaking operation, so that during this operation the force is taken by the staunch structural frame and the cushioning devices are provided to effectually absorb the shocks attendant upon the operation of the machine.

While the particular embodiment of my invention shown has been described in minute detail, I do not limit myself to the structure shown and described as it is obvious that changes may be made by those skilled in the art without departing from the spirit and scope of this invention.

What I claim is:—

1. A coal breaker including a movable supporting table, means for breaking lumps on said table and fingers actuated upon the movement of the table for ejecting the

broken portions of the lumps from the table and preventing the escape of the unbroken portions from the table.

2. A coal breaker comprising a series of inclined chutes and supporting tables, means for intermittently arresting the downward travel of the lumps on said tables and alining them in a row and subsequently breaking off a portion of the lumps so alined.

3. A coal breaker including a plurality of blades and a line of pivoted tables extending below said blades on which the lumps may be broken into successively smaller portions by the successive blades and means for rocking said tables to eject the lumps therefrom.

4. A coal breaker including a plurality of blades and a line of pivoted tables extending below said blades, means for rocking said tables to eject the lumps therefrom and inclined chutes leading from each table to the next to convey the lumps to the successive tables and to cause them to be broken into successively smaller portions by the successive blades.

5. A coal breaker including a supporting table, means for breaking lumps on said table and means adapted to pass through the bottom of the table and eject the broken portions of the lumps.

6. A coal breaker including an oscillating supporting table, having a hinged extension, a blade for breaking the lumps on the table and means for lowering the hinged extension of the table to carry the broken off portions of the lumps while the blade prevents the escape of the remaining portions.

7. A coal breaker including an oscillating supporting table, a blade for breaking the lumps on said table, means for moving the blade into breaking engagement with the lumps on said table, and yielding means to oscillate said table.

8. A coal breaker including a supporting table, a blade for breaking the lumps on said table, auxiliary means for supporting the table against the breaking force of the blade, means for locking the table and said auxiliary supporting means in position for the breaking operation, and means for releasing the table after the breaking operation.

9. A coal breaker including a supporting table, a flat blade extending lengthwise of said table for breaking a row of lumps on said table, and means for ejecting the broken portions of said lumps and retaining the unbroken lumps for a subsequent breaking operation.

10. A coal breaker including a shaking chute having guiding fins for positioning the lumps traveling thereon, a plurality of oscillating supporting tables, means for feeding the lumps from said shaking chute to the first of said supporting tables, conveyers for feeding the lumps to the succeeding tables, means for moving said oscillating tables to transfer the lumps to said conveyers, blades for breaking the lumps on the tables and means for actuating said blades.

11. A coal breaker including a supporting table, a blade for breaking the lumps on said table, a reciprocating cross head for supporting said blade, means actuated by said cross head for supporting said table against the breaking pressure of said blade.

12. A coal breaker including an oscillating supporting table, a long flat blade for breaking the lumps on said table, a reciprocating cross head for supporting said blade, locking means for holding said table in position during the breaking operation and means for disengaging said locking means after the breaking operation.

13. A coal breaker including a supporting table, a blade for breaking the lumps on said table, a reciprocating cross head for supporting said blade, yielding means carried by said cross head, supporting means for said table actuated by said yielding means and locking means for said supporting means actuated by said cross head.

14. A coal breaker including a supporting table, a blade for breaking the lumps on said table, means actuated by said table for ejecting the broken lumps and retaining unbroken portions of the lumps.

15. A coal breaker including an oscillating table, a long blade for breaking a row of lumps on said table, a cross head supporting said blade, anti-friction guiding means for the cross head and means for reciprocating said cross head.

16. A coal breaker including a pivoted supporting table, a reciprocating cross head carrying a blade for breaking the lumps on said table, cams actuated by said cross head to support the table against the breaking action of said blade.

17. A coal breaker including a pivoted supporting table, a reciprocating cross head carrying a blade for breaking the lumps on said table, movable means for supporting said table against the breaking pressure of said blade, and yielding means for releasing the supporting means after the breaking operation.

18. A coal breaker including a supporting table, a blade for breaking the lumps on said table, fingers operated by the table for gaging the size of the portions to be broken from the lumps, and for ejecting the broken portions.

19. A coal breaker comprising a series of breaker units each including an oscillating supporting table, a blade for breaking the lumps on said table, fingers actuated by the movement of said tables for ejecting the

broken portions of the lumps therefrom, a chute leading to the next successive breaker unit and means carried by said table for conveying the broken lumps to said chute leading to the next successive breaker unit.

20. A coal breaker including a pivoted supporting table, a reciprocating cross head carrying a breaking blade, means operated by said cross head for rocking said table, a latch for locking said table in a substantially horizontal position, and means operated by said cross head for tripping said latch.

21. A coal breaker including a pivoted supporting table, a reciprocating cross head carrying a breaking blade, a plurality of cams carried by a cam shaft for supporting said table against the breaking force of said blade, and yielding means for rocking said cam shaft.

22. A coal breaker including a pivoted supporting table, a reciprocating cross head carrying a breaking blade, a plurality of cams carried by a cam shaft for supporting said table against the breaking force of said blade, and means carried by the cross head for storing energy to rock said cam shaft after the breaking blade has operated.

In witness whereof, I have hereunto set my hand and seal.

FRANK PARDEE.