C. E. HALL.

STONE AND ORE CRUSHERS.

No. 187,375. Patented Feb. 13, 1877.

FIG. 1

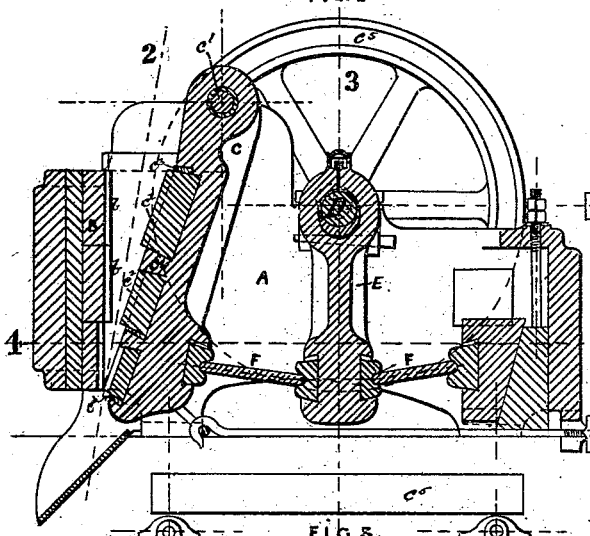


FIG. 2.

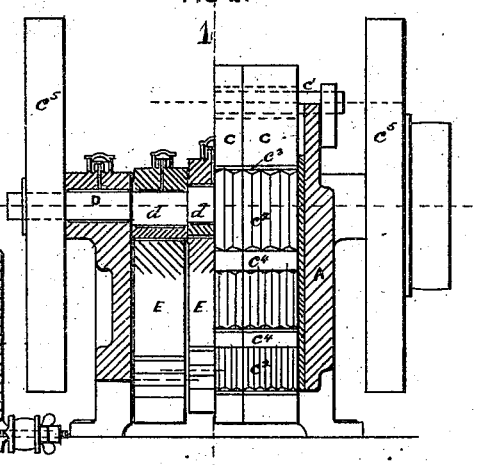


FIG. 3.

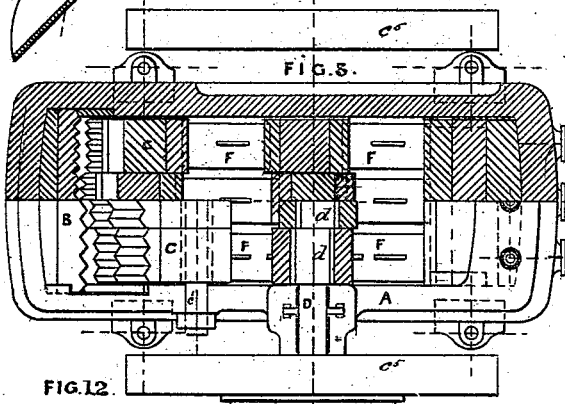


FIG. 4.

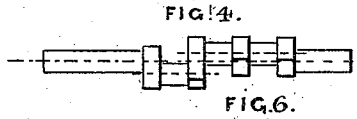


FIG. 5.

FIG. 6.

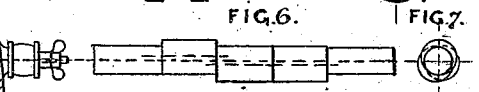


FIG. 7.

FIG. 8.

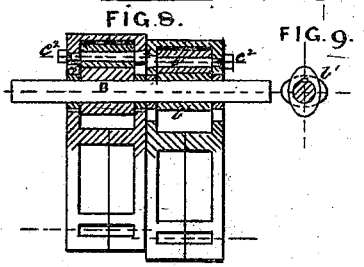


FIG. 9.

FIG. 12.

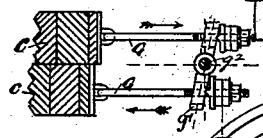


FIG. 10.

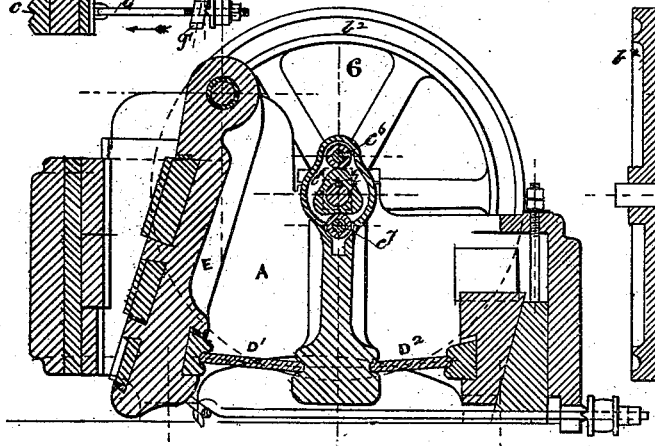
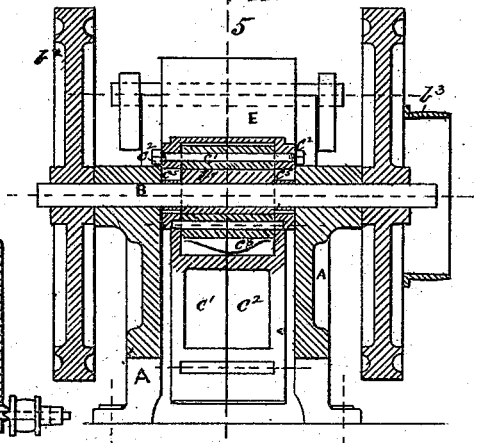


FIG. 11.



John William Campbell.
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Charles Edward Hall

UNITED STATES PATENT OFFICE

CHARLES EDWARD HALL, OF LEEDS, ENGLAND.

IMPROVEMENT IN STONE AND ORE CRUSHERS.

Specification forming part of Letters Patent No. **187,375**, dated February 13, 1877; application filed August 30, 1876.

To all whom it may concern:

Be it known that I, CHARLES EDWARD HALL, of Leeds, in the county of York, England, engineer, have invented new and useful Improvements in Stone and Ore Crushers, which improvements are fully set forth in the following specification, reference being had to the accompanying drawings.

My invention consists, first, of the improvements hereinafter described in actuating the vibrating jaws of stone breaking and crushing machines by means of cranks, eccentrics, or cams formed on or affixed to the driving shaft of such machines, so as to produce a multiple action.

My said invention further consists of the improvements hereinafter described in the faces of the vibrating jaw or jaws thereto, and of connecting the jaws together, so that the motion of the advancing jaw is utilized to bring back the receding jaw.

In applying my improvements to such stone breaking or crushing machines as have several vibrating jaws hung side by side on the same shaft or fulcrum, I form on, or affix to, the driving-shaft of the machine cranks, eccentrics, or cams, one for each vibrating jaw; and I mount on the said cranks, eccentrics, or cams connecting rods, the lower ends of which, on one side, are connected by toggles to the vibrating jaws. The cranks, eccentrics, or cams are formed on, or affixed to, their shafts at equal radial angles, so as to balance the momentum of the moving parts of the machine, and successively actuate the vibrating jaws. Thus some of the said jaws will be advancing to, while others are receding from, the fixed jaw, so that while the advancing jaws are operating on the stones to be broken, the receding jaws leave a passage for the stones which have been broken. The strain on the machine is thus greatly diminished, and it can, consequently, be made lighter than machines of the ordinary construction.

In some cases I dispense with the india-rubber springs usually employed for drawing back the swinging jaws, and I couple the said jaws together in pairs by rods and a lever of the first order, the said lever being capable of vibratory motion in a horizontal plane. The advance of one of the coupled jaws is thus caused to effect the withdrawal of the other.

Figures 1 and 2 of the accompanying drawings represent vertical sections of a stone breaking or crushing machine to which my improvements are applied—the section Fig. 1 being taken on the line 1, Fig. 2, and the section Fig. 2 being taken on the lines 2 3, Fig. 1. Fig. 3 is a half-plan, half-section, of the said machine, the section being taken on the line 4, Fig. 1. Figs. 4, 5, 6, 7, 8, and 9 are details of the said machine.

The same letters of reference indicate the same parts in both figures.

A A is the frame of the machine. B is the fixed jaw. C C are the vibrating jaws, and c^1 is the fulcrum on which they vibrate. D is the driving-shaft, and *d d* are the eccentrics, on which are mounted the connecting-rods E E. F F are toggles, which transmit motion from the connecting-rods to the jaws C C. *b b* are the teeth on the fixed jaw, and c^2 c^2 are the teeth on the swing-jaws. The upper sets of teeth are of coarser pitch than the lower, the bottom of the teeth being flush with the top of the teeth in each succeeding face. The teeth c^2 c^2 are fixed to the jaw by means of wedges c^3 c^3, driven in sidewise between the said faces and lugs or projections c^4 c^4 on the jaws.

This arrangement admits of the faces being unfixed, and turned upside down and refixed, so as to bring their least-worn edges into wear, or of removing the said faces when worn and fixing others in their place. The repairing and maintenance of the machine are thus facilitated.

Although I prefer this mode of affixing the faces, I do not limit myself thereto, as the said faces may be fixed in any other suitable way.

c^5 c^5 are fly-wheels, and c^6 is the driving-pulley.

The parts not described are of the ordinary construction.

The foregoing improvements are applicable both to machines constructed with vibrating and fixed jaws, and to machines in which a

lever is made to break or crush the stone against a fixed or moving jaw, between which and the said lever the stones are broken.

In applying my improvements to stone-breaking machines constructed with a single vibrating jaw, instead of a series of vibrating jaws mounted side by side, as hereinbefore described, I form on or affix to the driving-shaft a multiple-cam motion, from which is transmitted to the said jaw by a connecting-rod and toggles as heretofore, so that every revolution of the driving-shaft shall give two or more vibrations to the said jaw. The machine is thus caused to do more work, with a given speed of driving-shaft, than machines of the ordinary construction. Friction rollers or bars are interposed between the connecting-rod and the driving-shaft, the lower roller or bar being pressed upward by a spring so as to keep it tight against the cam. I prefer to make the said connecting-rod in two halves, of such form that when bolted together they constitute a case which incloses the principal wearing parts on or about the shaft, and protects them from dust and grit. Figs. 10 and 11 of the accompanying drawings represent vertical sections of a stone breaking or crushing machine of the class hereinbefore last described, and to which my improvements are applied, the section, Fig. 10, being taken on the line 5, Fig. 11, and the section, Fig. 11, being taken on the line 6, Fig. 10.

The same letters of reference indicate the same parts in both figures.

A A is the frame of the machine, and B is the driving-shaft, on which is formed or affixed the multiple cam b^1. C^1 C^2 are the halves of the connecting-rod, which are held together by the screwed spindle c^1 and nuts c^2 c^2, and the screwed bolt c^3 and nuts c^4 c^4. c^5 c^5 are slots formed in the connecting-rod, to allow of its moving up and down on the driving-shaft. c^6 is a friction-roller mounted on the spindle c^1, which roller bears on the cam b^1. c^7 is a friction bar or roller, which is pressed against the said cam by a spring, c^8, and keeps the parts to their work. D^1 D^2 are toggles, which communicate the motion of the connecting-rod to the vibrating jaw E. b^2 is a fly-wheel, and b^3 is the driving-pulley.

The parts not described are of the ordinary construction.

Fig. 12 of the accompanying drawings is a sectional plan of part of a stone-breaking machine, to which my arrangement for coupling the jaws thereof is applied. C C are the vibrating jaws or levers. G G are the rods, and g^1 is the lever by which the said jaws are coupled, the said lever g^1 being centered on the pin g^2. By this arrangement when one of the jaws is caused, by the action of the toggles, to advance, the jaws to which it is coupled are caused to recede.

Having now described the nature of my invention, and the manner in which the same is to be performed, I wish it to be understood that I do not limit myself to the precise details hereinbefore described, as they may be varied without departing from the nature of my said invention; but

I claim as my said invention—

1. The combination of the vibrating jaws and connecting-rods and toggles, one set for each jaw, with the driving-shaft of the machine, provided with cranks, eccentrics, or cams, one for each jaw, arranged successively to actuate the several vibrating jaws through their connecting-rods and toggles, substantially as set forth.

2. The combination, substantially as described, of the vibrating jaw or jaws and the connecting rod or rods, and toggles for the same, with the driving-shaft of the machine provided with a multiple cam or cams, formed and arranged to impart, through said connecting rods or rods and toggles, two or more vibrations to the said vibrating jaw or jaws for each revolution of said driving-shaft.

3. In a stone crushing or breaking machine, the combination of swinging jaws arranged side by side to act alternately in the same direction, and coupled substantially in the manner herein shown and described, so that the advancing movement of one swinging jaw shall cause the other jaw to recede.

CHARLES EDWARD HALL.

Witnesses:
JOHN WILLIAM CAMPBELL,
JOHN HUNTER.