Dec. 30, 1924.

1,521,292

J. S. HARRISON

MOLDING APPARATUS

Filed May 1, 1924

2 Sheets-Sheet 1.

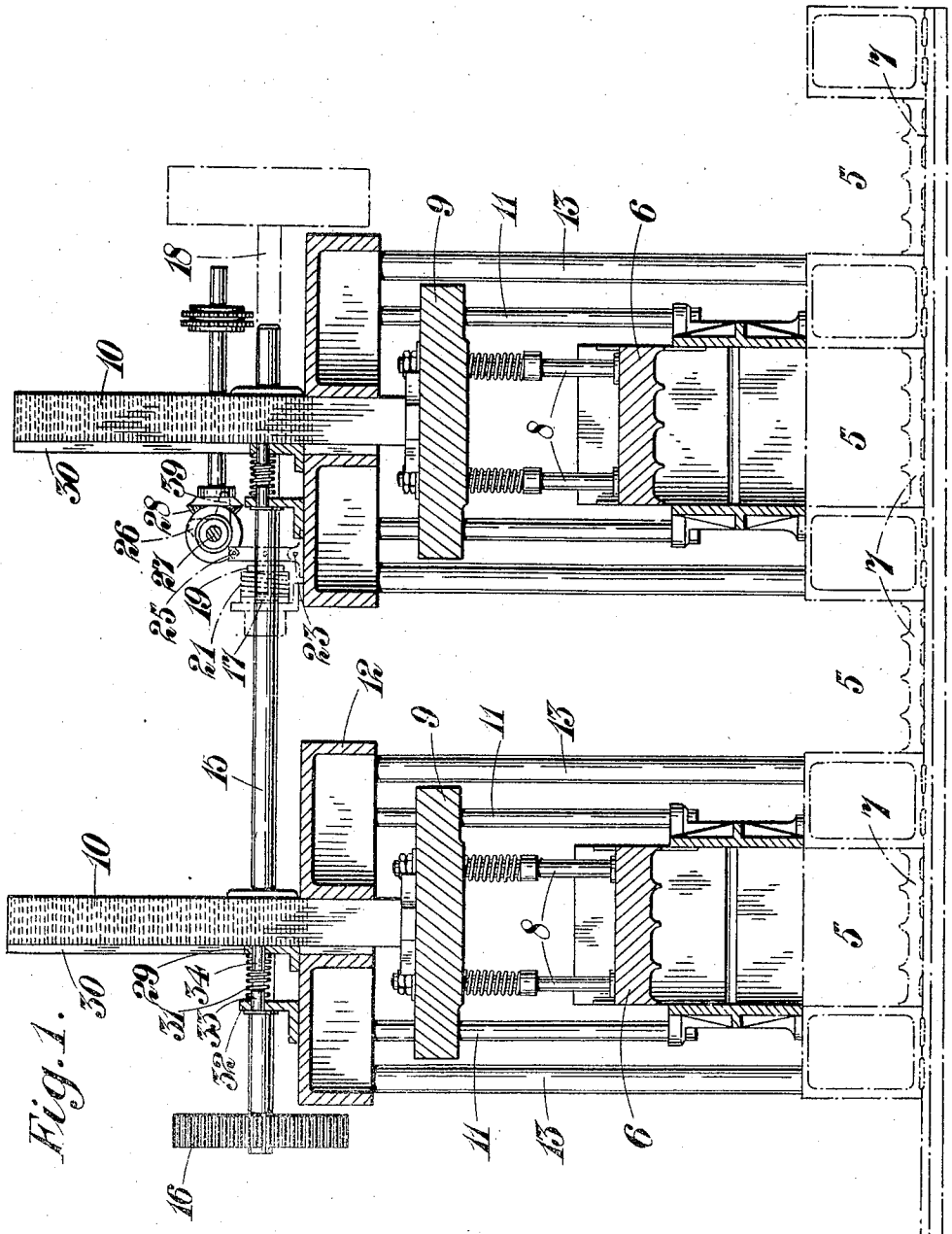


Fig. 1.

INVENTOR

John Stanley Harrison

By Byron, Stebbins & Bramble

His Attys

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Fig. 2.

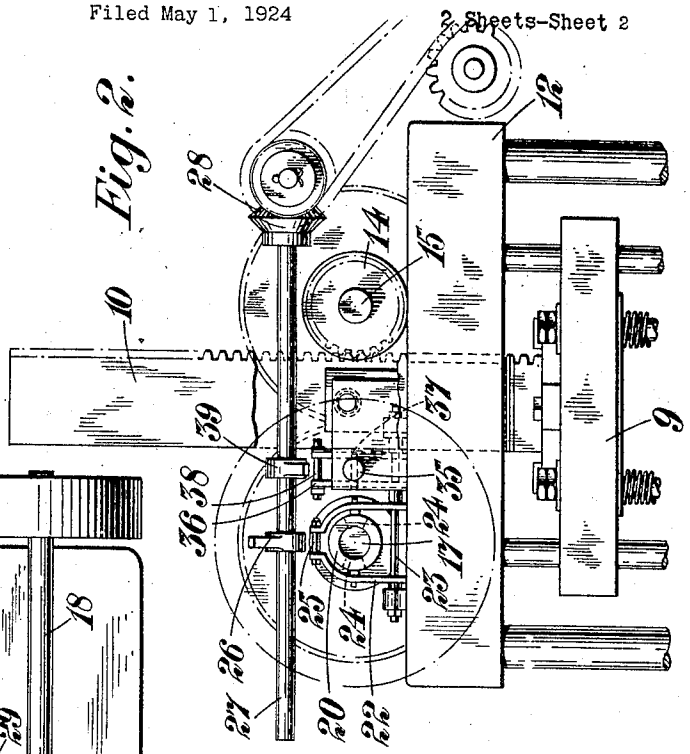
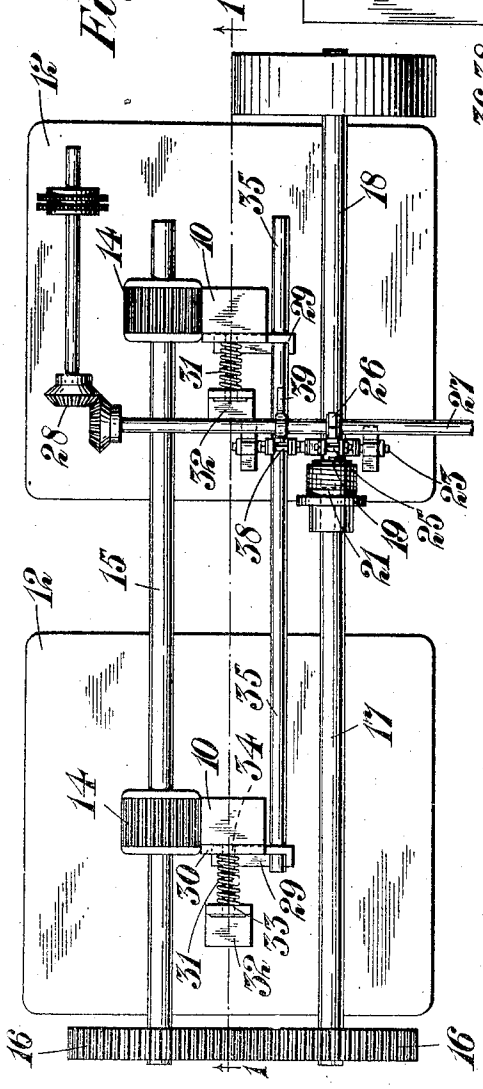


Fig. 3.



INVENTOR

John Stanley Harrison

By Bygrave, Stibbins & Parnell

His Attys

Patented Dec. 30, 1924. 1,521,292

UNITED STATES PATENT OFFICE.

JOHN STANLEY HARRISON, OF LONDON, ENGLAND, ASSIGNOR TO MACNAB STRATIFIED COAL LIMITED, OF LONDON, ENGLAND, A BRITISH COMPANY.

MOLDING APPARATUS.

Application filed May 1, 1924. Serial No. 710,255.

To all whom it may concern:

Be it known that I, JOHN STANLEY HARRISON, a subject of the King of England, residing in London, England, have invented certain new and useful Improvements in Molding Apparatus, of which the following is a specification.

This invention relates to molding apparatus for consolidating powdered or plastic material into block form. In a machine of the type to which this invention refers top-pressure is applied to the material in the mould by a weighted plunger and in the formation of successive blocks mechanical means operate alternately to raise the plunger clear of the mould when consolidation of a block is completed and then to release it when the next block is to be formed.

The main object of the present invention is to provide means for accurately timing the lift and release of the pressure-plunger.

The present invention provides in molding apparatus of the type specified above, the combination of two mechanisms operated in step one being an elevator which is actuated periodically to lift the pressure-plunger to a certain height and then to release it, and the other being a holding mechanism operative to engage the plunger when freed by the elevator, to support it for a predetermined time in its raised position and then to release it.

It will be appreciated that between each application of pressure an interval is required for the ejection of the finished block and for the next filling operation. This interval and also the necessary dwell of the plunger in its lower or operative position cannot satisfactorily be controlled by a single mechanism, but by the provision according to this invention of two mechanisms as above described any desired dwell of the plunger in both upper and lower positions can readily be obtained.

In one form of the invention the elevator mechanism for the pressure-plunger is operatively connected through a clutch with a continuously-running driving member and means actuated by or in step with said driving member operate in succession to engage the clutch, maintain it engaged for a time sufficient to enable the elevator to lift the plunger to the desired extent, and then to free the clutch. The holding mechanism for the plunger may take the form of a spring-pressed detent arranged automatically to engage a stop on the plunger when the latter is in its raised position combined with a trip device actuated in step with the aforesaid clutch-control means for the elevator to free the detent from engagement with the plunger-stop after a predetermined interval.

Conveniently the detent-releasing device and the clutch-control means are actuated by cams carried on the same shaft, which shaft is driven from the continuously-running member which provides the elevator drive.

An example of the invention will now be described with reference to the accompanying drawings, in which—

Figure 1 is a front (part sectional) elevation of the upper part of a molding machine to which the invention is applied;

Figure 2 is an end view of the upper portion of Figure 1, parts being broken away in order to show clearly the mechanism which controls the lift and release of the pressure-plunger, and

Figure 3 is a top plan view (largely diagrammatic) of the machine shown in Figure 1.

Like reference numerals indicate like parts in the several figures.

The apparatus illustrated is a two-unit machine designed for the manufacture of fuel briquettes. The moulds 5 are arranged in pairs, one pair operating in conjunction with each pressure-plunger 6, and the two mould-pairs are coupled together and movable laterally as a single unit. When one mould of each pair is under the corresponding plunger the companion mould is in a side-stepped position. Ejecting devices are arranged to operate in conjunction with the side-stepped moulds to eject the finished blocks therefrom. The bottom of each mould is formed as a movable pallet 7 to which a rapid reciprocatory movement in a vertical direction and of comparatively short throw, is imparted while the mould is under the plunger. The consolidation of the material in the moulds is effected partly by the application of top-pressure thereto by the dead-weight plungers 6 and partly by the tamping or jigging action of the bottom pallets.

The general sequence of operations is as follows:—

The material to be consolidated (*e. g.*, coal-dust mixed with a binding medium such as bitumen) is fed in measured charges into the moulds under the plungers, the reciprocating bottom pallets are set in motion, and top-pressure is applied by the plungers. After a predetermined interval the plungers are raised, the reciprocation of the bottom pallets is stopped and the moulds are moved laterally thus bringing the previously side-stepped moulds (which are empty) under the plungers. The next filling operatiou proceeds on the fresh moulds while the finished blocks are ejected from the side-stepped ones. The plungers 5 are again allowed to fall and the same sequence of operations is repeated.

The general features of the apparatus so far described do not form part of the present invention, but they are mentioned in order that the necessity for the accurate timing and release of the pressure-plungers (with which this invention particularly deals) in a continuously-operating machine of this kind may be appreciated.

Each plunger 6 is connected by spring-pressed bolts 8 to an upper dead-weight 9 which in turn carries a vertical rack-bar 10. The spring connection between the plunger 6 and weight 9 provides a more resilient top-pressure than could be obtained with a simple gravity-controlled plunger. The weights 9 are guided for vertical movement by upright rods 11 and the rack-bars pass upwardly through apertures in frame-members 12 which are supported by columns 13 from the base of the machine. Pinions 14 mesh with the teeth of the rack-bars and are fast on a shaft 15 driven by gearing 16 from a parallel shaft 17. In line with the shaft 17 and forming a virtual continuation thereof is a constantly rotating shaft 18 which is driven from the base of the machine by another shaft (not shown) constituting the continuously-running driving member hereinbefore referred to. Connection between the shafts 17 and 18 is made by means of a clutch 19, the throwing in and out of which is controlled by a sliding collar 20 (see Figure 2) which is movable against the action of a spring 21 to engage the clutch and moved in the opposite direction by said spring to disengage it. Movement of the sliding collar is in turn controlled by a forked lever 22 pivoted at its lower end for swiging movement about a fulcrum rod 23 extending at right-angles to the axis of the clutch shaft 17. Extending inwardly from the arms of the lever 22 are cod-pieces 24 which engage in a circumferential channel in the collar 20. The upper end of the lever 22 carries a roller 25 co-operating with which is a cam 26 mounted on a cam-shaft 27 which extends parallel with and above the fulcrum rod 23 and is constantly rotated through bevel gearing 28 from the continuously-running driving member hereinbefore referred to. On each revolution of the cam-shaft the cam 26 engages the lever 22 and swings it over in a direction (to the left in Figure 1) such that the clutch is brought into engagement. When the cam moves clear of the lever, the clutch spring 21 re-asserts itself, throwing out the clutch and returning the lever to its original position.

The weights 9 and pressure-plungers 6 are supported in their raised positions (shown in Figure 1) by detents 29 formed by angle-section bars, the vertical flanges of which engage under projecting strips 30 secured to the sides of the rack-bars 10. The detents are resiliently pressed up to the racks by springs 31 bearing against fixed brackets 32 and located in position by pins 33, 34 secured to the brackets and detents respectively. The two detents are coupled together by a connecting rod 35 (see Figure 3) which extends parallel with the clutch shaft 17. Movement of the rod 35 to the left frees the detents from engagement with the strips 30 and, provided the clutch 19 is out, allows the racks, and with them the weights 9 and plungers 6 to descend. During the fall of the racks the pinions 14, gearing 16 and shaft 17 run free.

The release of the detents is controlled by a forked lever 36 mounted on the fulcrum rod 23 and coupled to the connecting rod 35 by a pin 37 which extends laterally at each side of the rod 35 and engages in slots in the lever arms. The upper end of the lever 36 carries a roller 38 co-operating with a cam 39 on the cam shaft 27 which controls the engagement and disengagement of the clutch 19. When the cam 39 engages the roller 38 it swings the lever and the rod 35 to the left and so frees the rack detents and allows the plungers to descend. When the cam moves past the roller the springs 31 press the detents against the sides of the strips 30 and when the racks are again raised the strips overrun the detents and the latter reassume their locking position.

The plunger lift and release apparatus described above operates in the following manner:—

Assuming the plungers to be in the raised position the cam 39 first comes into action to release the rack detents and the plungers fall. After a predetermined interval, depending upon the angular spacing between the cam 39 and the clutch-control cam 26, the latter engages and throws over the clutch lever 22 and the rack pinions are thereby coupled to the continuously drive shaft 18. The shape of the cam 26 is such that it maintains the clutch in engagement

just sufficiently long to enable the racks to be raised to the desired height, and then releases it. As the racks reach the upper limit of their travel the ends of the strips 30 ride past the detents 29 and the latter automatically spring into the locking position. Thus when the clutch is released the racks are taken in charge by the detents and prevented from falling. On the next revolution of the cam shaft the detent-release cam again comes into operation and the plungers descend into the moulds. The cams 26 and 39 are so angularly set and the speed of the cam shaft is such that the plungers are maintained in the raised position for a period sufficient to accommodate the side-stepping of the moulds, the filling of the empty moulds which are brought under the plungers, and any other operations which may be necessary between each descent of the pressure-plungers.

In the above example the period during which the clutch 19 is engaged depends upon the duration of engagement between the cam 26 and the clutch-control lever 22. In an alternative arrangement the release of the clutch may be timed by the engagement of the rack detents. That is to say while the cam 26 is arranged to throw the clutch into engagement, the disengagement of the latter may be effected by means interconnecting the detent rod 35 with the sliding collar of the clutch. The interconnecting means may conveniently take the form of a finger (not shown) projecting laterally from the connecting rod 35 so that when the rod is moved to the right (*i. e.*, when the detents are overrun by the rack stops 30) the finger will engage with the clutch collar or the control lever 22 or a part attached to either and so move the clutch collar into the free position. When the detents are next released the trip finger will be moved to the left thus allowing the clutch to be thrown in when the clutch cam 26 next comes into operation.

If desired the trip finger may be used as a safety device in conjunction with a clutch, the engagement or disengagement of which is normally effected solely under the control of the clutch cam. Thus in this case should the clutch spring such as 21, which is normally relied on to throw out the clutch, fail to act the trip finger will come into play and free the clutch.

It will be understood that the apparatus as described above may be modified in many ways without departing from the scope of the invention. For example any other convenient elevating mechanism may be employed in place of the rack-and-pinion mechanism used in the particular example illustrated. Again the holding mechanism which is operative to engage the plunger when freed by the elevator may take forms other than the spring-controlled detent described herein.

I claim:

1. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for said plunger, means periodically to actuate said elevator so as to lift the pressure-plunger to a certain height and then to release it, a holding mechanism to support the plunger in the raised position, means actuated in step with the operation of the elevator to engage said holding mechanism with the plunger when the latter is freed by the elevator, to maintain it engaged for a predetermined time and then to release it.

2. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for said plunger, a continuously-running driving member, a clutch movable to couple said driving member with the elevator, means operated in step with said driving member periodically to engage the clutch, maintain it engaged for a predetermined time sufficient for the elevator to lift the plunger and then to free the clutch, a holding mechanism to support the plunger in the raised position, and means actuated in step with the clutch-control means aforesaid to engage the holding mechanism with the plunger, when the latter is freed by the elevator, to support said plunger for a predetermined time in its raised position, and then to release it.

3. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for said plunger, a continuously-running driving member, a clutch movable to couple said driving member with the elevator, means operated in step with said driving member periodically to engage the clutch, maintain it engaged for a predetermined time sufficient for the elevator to lift the plunger and then to free the clutch, a resiliently-controlled detent automatically operative to engage the plunger when in the raised position and to hold it in said position, and a trip device actuated in step with the aforesaid clutch-control means to free the detent from engagement with the plunger after the latter has been in the raised position for a predetermined interval.

4. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator for said plunger, a continuously-running driving member, a clutch movable to couple said driving member with the elevator, a resiliently-controlled detent automatically operative to engage the plunger when the latter is raised and to support it in the raised position, a trip device movable to release the detent from engagement with the plunger, and cams rotated in step with the continuously-running

member and arranged to operate the clutch aforesaid and the detent trip device in such sequence and at such intervals as to provide a dwell of the plunger in both upper and lower positions.

5. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator for said plunger, a continuously-running driving member, a clutch movable to couple said driving member with the elevator, a cam operated from the continuously-running member aforesaid so as successively to engage the clutch, maintain it engaged for a predetermined time sufficient for the elevator to raise the plunger and then to free said clutch, a resiliently-controlled detent automatically operative to engage the plunger when in the raised position and to support it in this position, and a trip device cam-operated from the continuously-running member to free the detent from engagement with the plunger after a predetermined interval.

6. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for said plunger, a continuously-running driving member, a clutch movable to couple said driving member with the elevator, a resiliently-controlled detent automatically operative to engage the plunger when the latter is raised and to support it in the raised position, a trip-device movable to release the detent from engagement with the plunger and a cam-shaft driven from the continuously-running member aforesaid and carrying two cams one co-operating with a follower which is operatively connected to the detent trip-device and the other with a follower operatively connected to the clutch aforesaid, said cams being so spaced apart angularly as to operate on their respective followers in such sequence and at such intervals as to provide a dwell of the pressure-plunger in both upper and lower positions.

7. In molding apparatus of the type specified the combination with a pressure-plunger of a rack-and-pinion elevator mechanism for the said plunger whereof the rack is secured to the plunger, a continuously-running driving member, a clutch movable to couple said driving member with the rack pinion, means operated in step with said driving member periodically to engage the clutch, maintain it engaged for a predetermined time sufficient for the pinion to lift the rack and plunger, and then to free the clutch, a resiliently-controlled detent automatically operative to engage a stop on the rack when the latter is raised and to support the rack and plunger in the raised position, and a trip-device actuated in step with the continuously-running driving member aforesaid to free the detent from engagement with the rack-stop after the plunger has been in the raised position for a predetermined interval.

8. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for the plunger, a continuously-running driving member, a clutch movable to couple the elevator mechanism with said driving member, means actuated in step with the continuously-running member aforesaid periodically to throw in the clutch, a resiliently-controlled detent movable automatically into engagement with the plunger when the latter is raised and operative to support said plunger in the raised position, means interconnecting the detent with the clutch and operative on movement of the detent into engagement with the plunger to throw out the clutch, and means actuated in step with the continuously-running member to disengage the detent after the plunger has been in the raised position for a predetermined interval.

9. In molding apparatus of the type specified the combination with a pressure-plunger of an elevator mechanism for said plunger, a continuously-running driving member, a clutch movable to couple the elevator mechanism with said driving member, a resiliently-controlled detent automatically operative to engage the plunger when the latter is raised and to support it in the raised position, a trip device movable to release the detent from engagement with the plunger, a cam-shaft driven from the continuously-running member aforesaid, two levers one operatively connected with the detent trip device and the other with the clutch aforesaid and both fulcrumed for movement about axes parallel with that of the cam-shaft, and two cams carried on said cam-shaft, one co-operating with the detent-control lever and the other with the clutch-control lever, said cams being so spaced apart angularly as to operate on their respective levers in such sequence and at such intervals as to provide a dwell of the pressure-plunger in both upper and lower positions.

In testimony whereof I affix my signature.

JOHN STANLEY HARRISON.