(No Model.) 4 Sheets—Sheet 1.

A. E. HAMMER.

MACHINE FOR MAKING CORES FOR CASTING PIPE-TEES, &c.

No. 506,228. Patented Oct. 10, 1893.

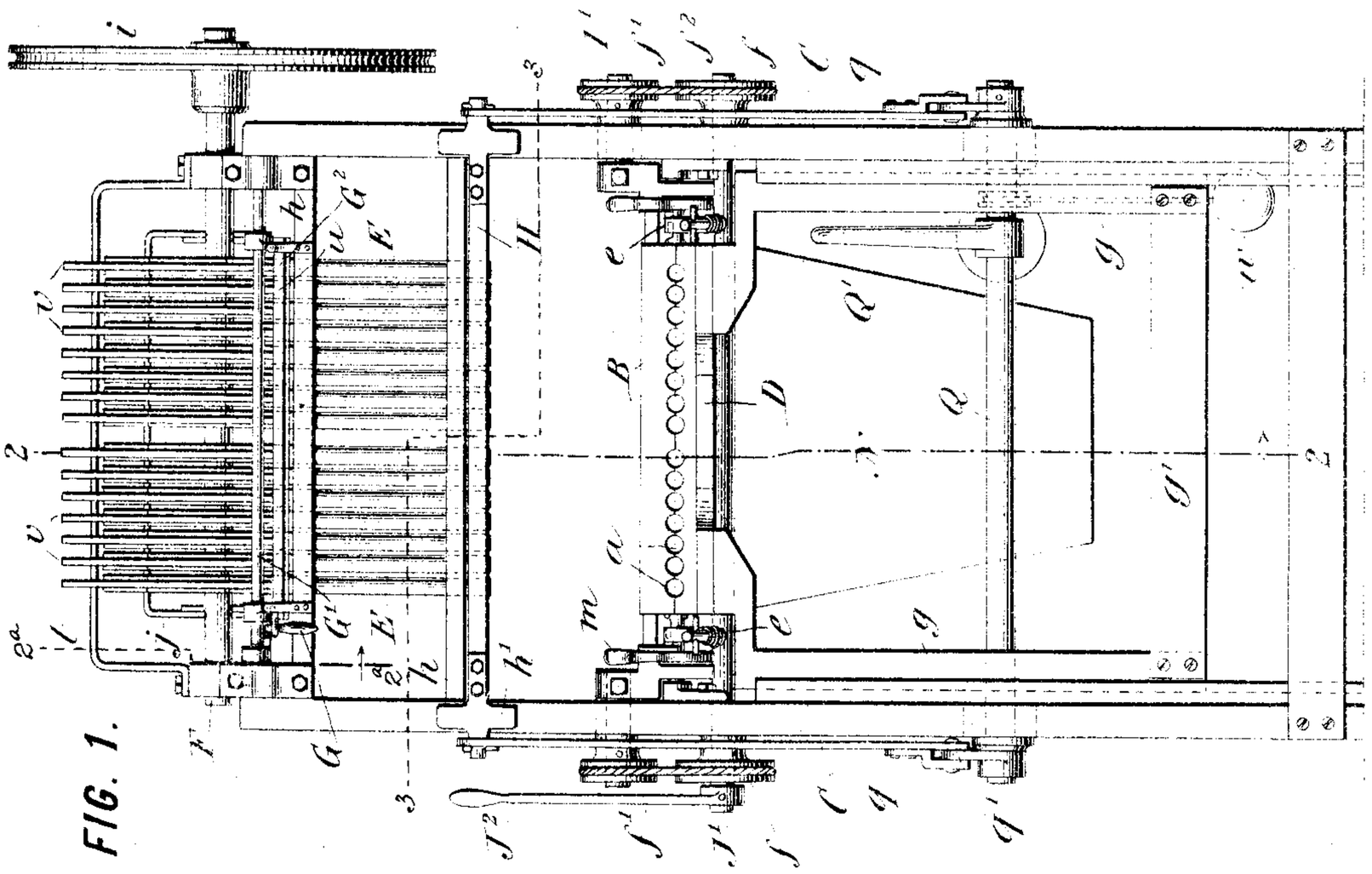

FIG. 1.

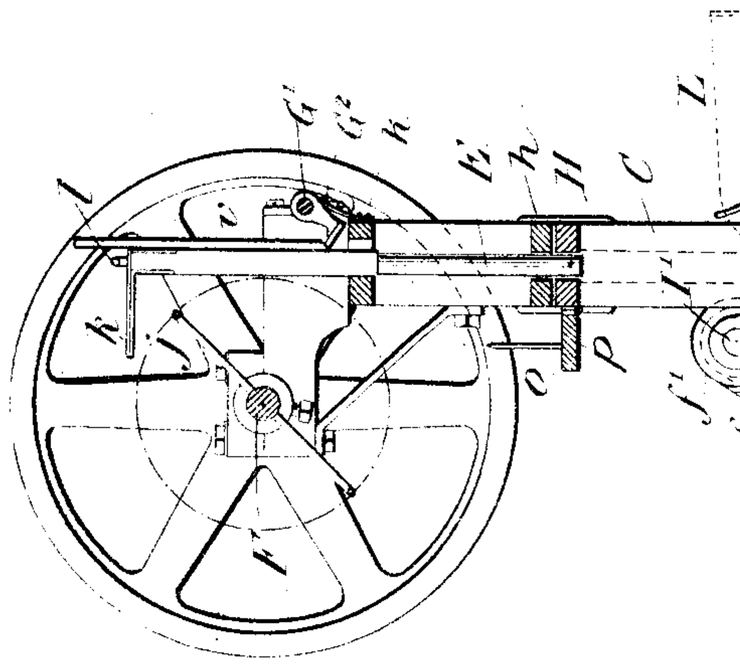

FIG. 2.

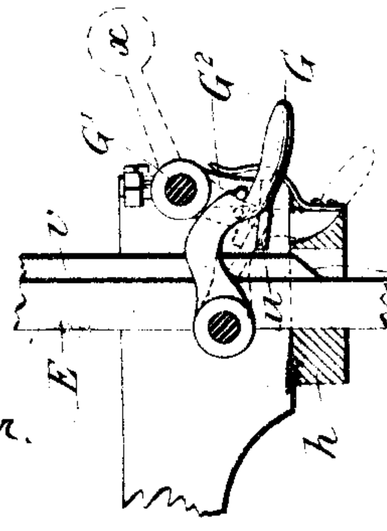

FIG. 2a.

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(No Model.) 4 Sheets—Sheet 2.

A. E. HAMMER.

MACHINE FOR MAKING CORES FOR CASTING PIPE-TEES, &c.

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FIG. 3.

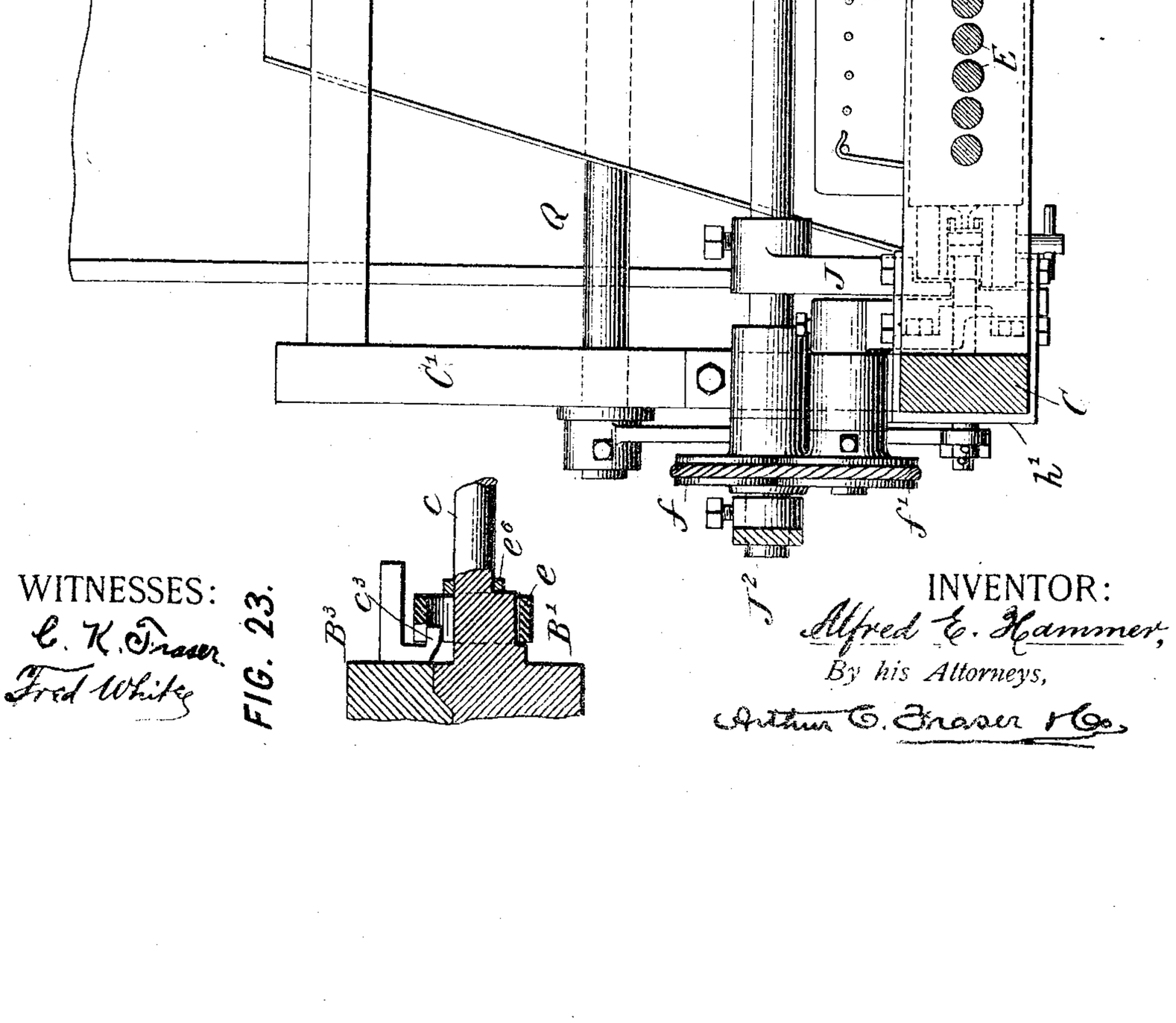

FIG. 23.

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(No Model.)

4 Sheets—Sheet 3.

A. E. HAMMER.

MACHINE FOR MAKING CORES FOR CASTING PIPE-TEES, &c.

No. 506,228. Patented Oct. 10, 1893.

FIG. 5.

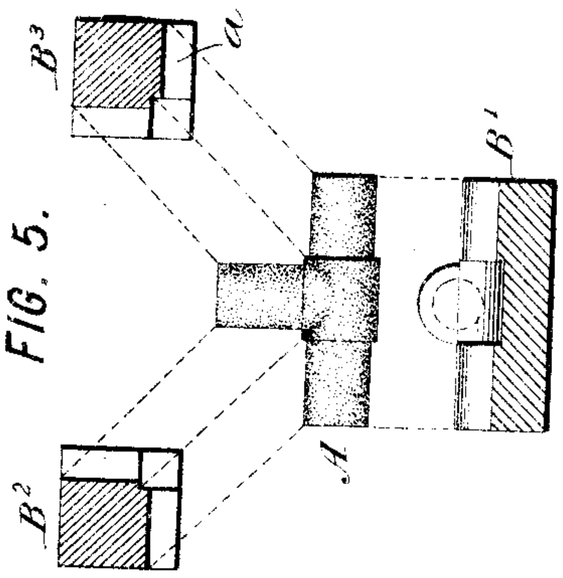


FIG. 6.

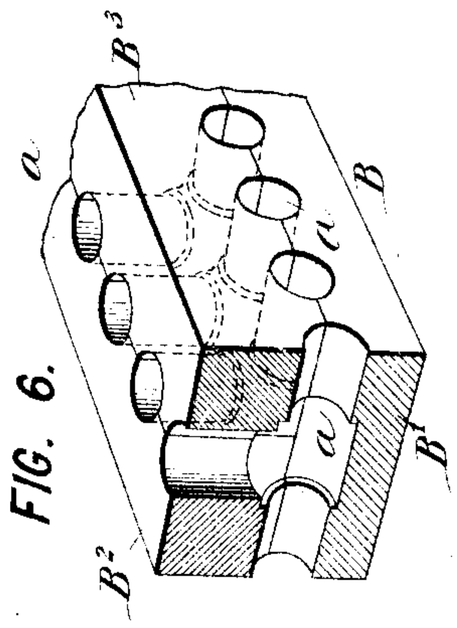


FIG. 20.

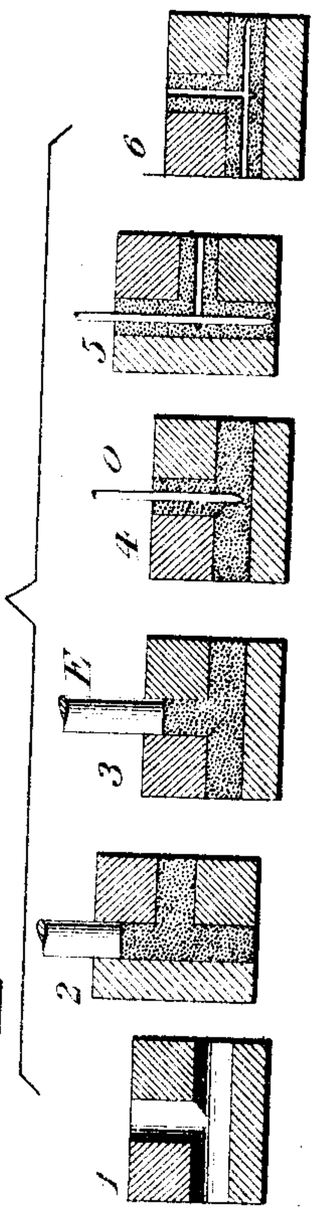


FIG. 4.

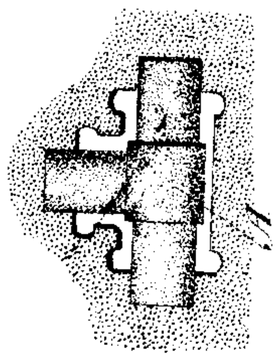


FIG. 7.

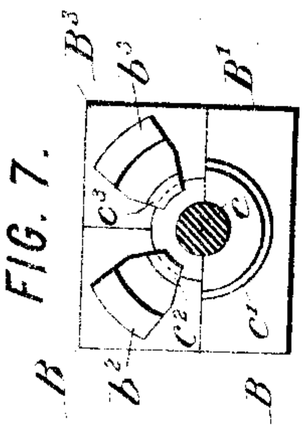


FIG. 8.

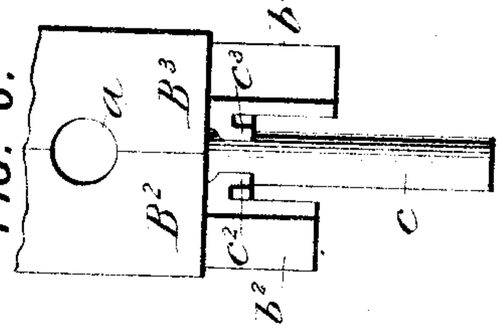


FIG. 10.

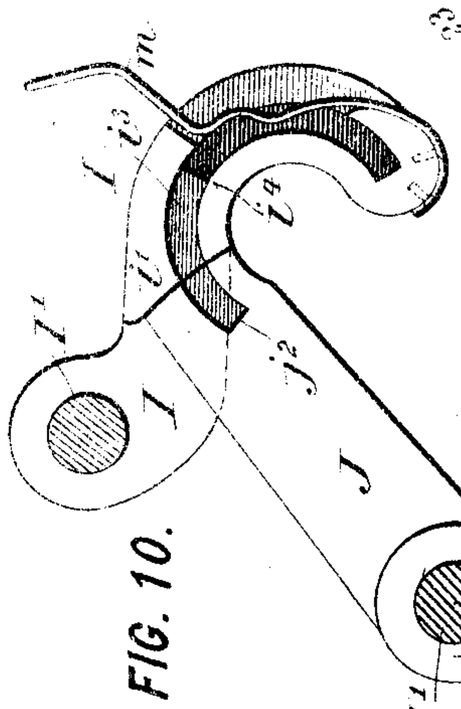


FIG. 9.

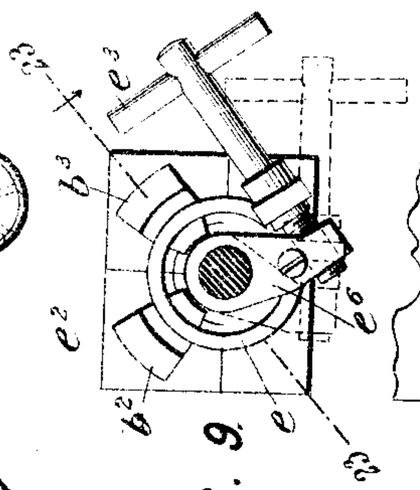


FIG. 11.

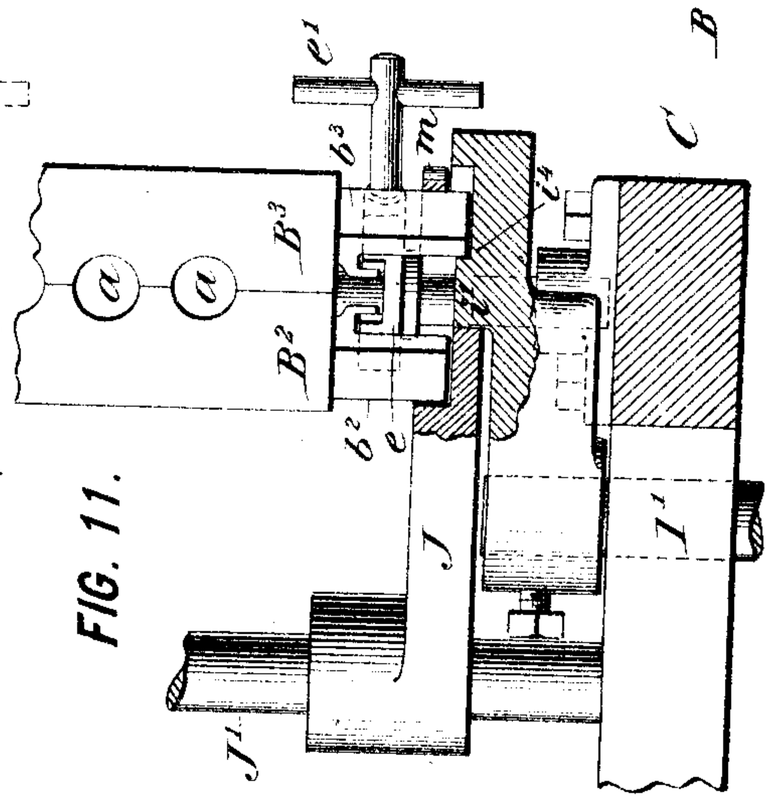
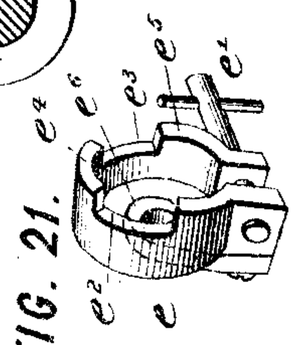


FIG. 21.



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(No Model.) 4 Sheets—Sheet 4.

A. E. HAMMER.

MACHINE FOR MAKING CORES FOR CASTING PIPE-TEES, &c.

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FIG. 22.

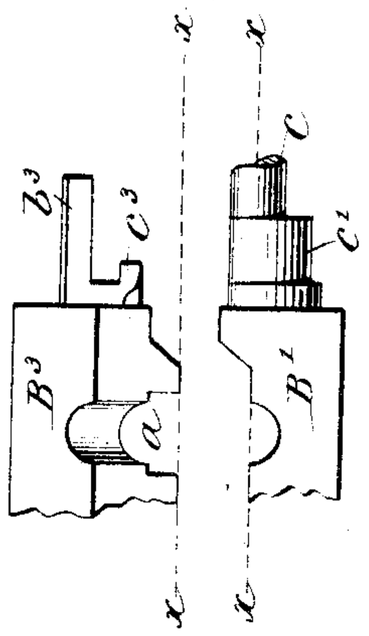

FIG. 16.

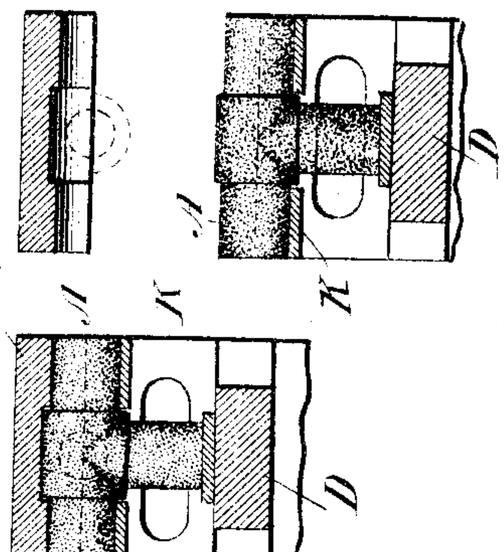

FIG. 19.

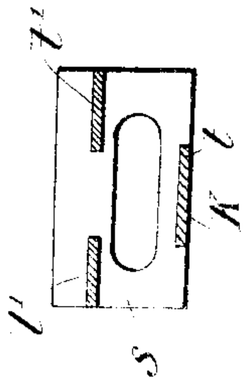

FIG. 15.

FIG. 14.

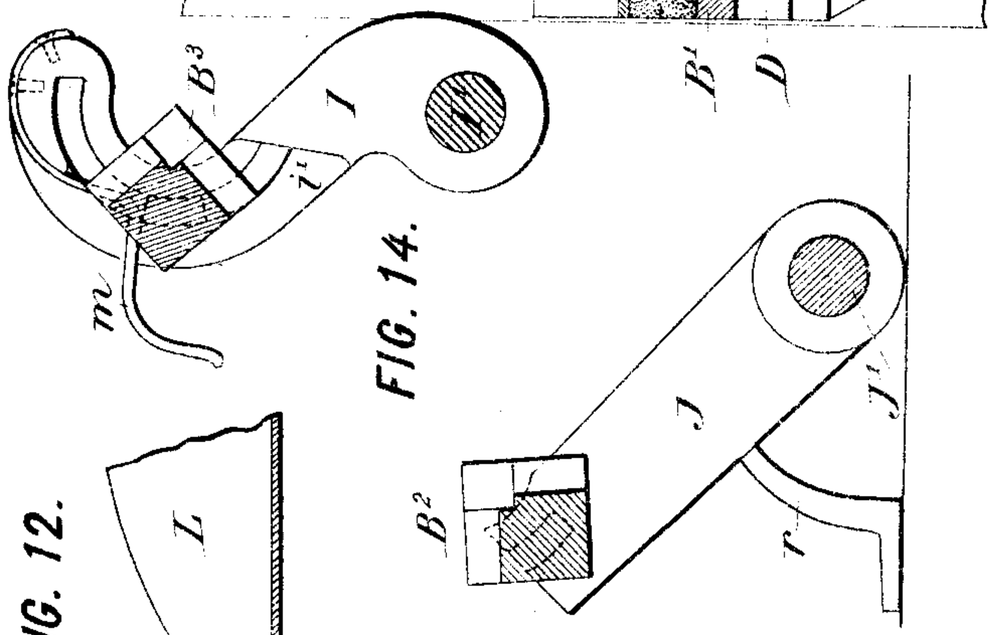

FIG. 17.

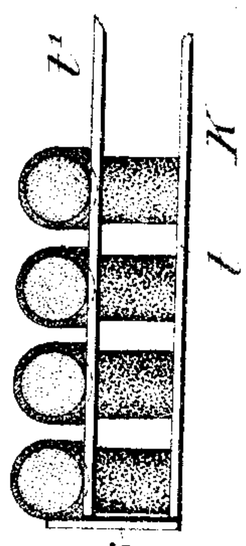

FIG. 18.

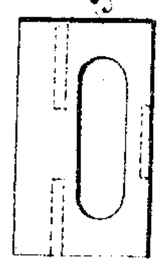

FIG. 12.

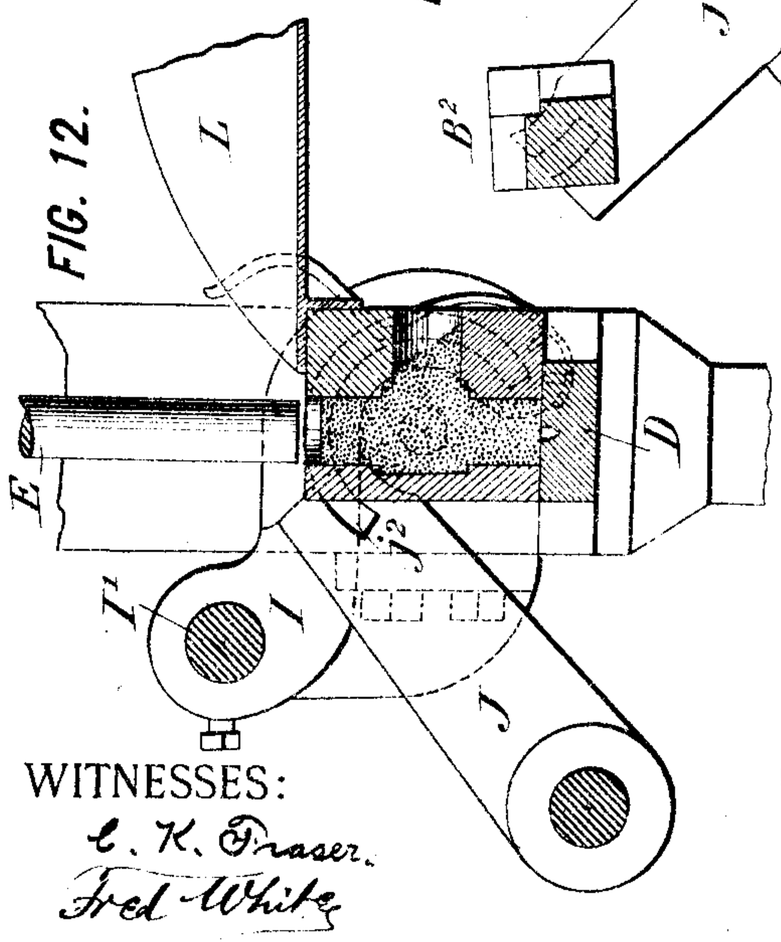

FIG. 13.

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UNITED STATES PATENT OFFICE.

ALFRED E. HAMMER, OF BRANFORD, CONNECTICUT.

MACHINE FOR MAKING CORES FOR CASTING PIPE-TEES, &c.

SPECIFICATION forming part of Letters Patent No. 506,228, dated October 10, 1893.

Application filed April 14, 1893. Serial No. 470,320. (No model.)

To all whom it may concern:

Be it known that I, ALFRED E. HAMMER, a citizen of the United States, residing in Branford, in the county of New Haven and State of Connecticut, have invented certain new and useful Improvements in Machines for Making Cores for Casting Pipe-Tees, &c., of which the following is a specification.

This invention provides an improved machine for molding cores having three branches, such for example as those used in casting pipe-tees or other similar pipe fittings.

According to my invention the cores are molded in a multiple core-box divided into three parts, which I will designate as a drag and two copes. The core-box is elongated, and is formed with a row of successive core-matrices arranged with their three branches emerging on three sides of the core-box. The box is divided in planes coincident with the axes of the respective branches of these matrices. For convenience in handling the box, it is pivoted upon trunnions at its opposite ends, the rotative axis of these trunnions being coincident with the intersections of the axes of the three branches of the core-matrices throughout the box, in order that the box may be turned to two or three different positions in order to bring two or three different rows of matrix openings into line with a series of rammers which are mounted and constructed to enter the matrices and ram down the material for the cores. In order to facilitate the separation of the core-box to enable the cores to be removed, my invention provides a coping-off mechanism consisting essentially of moving parts engaging the respective copes and adapted to lift them off in directions initially at right angles or approximately so to each other, and at angles of forty-five degrees or approximately so to the drag. These moving parts consist in the preferred construction of swinging arms pivoted on suitably located oscillating shafts so arranged and connected together as to simultaneously lift off the two copes, swinging the one up and back and the other forwardly and then backwardly, so that both have their meeting faces presented toward and accessible from the same side, whereby their cleaning is facilitated.

In carrying my invention into practice, I employ by preference certain mechanism described and claimed by me in an application for patent for improvements in core machines which I have executed, filed January 17, 1893, Serial No. 458,653. The mechanism referred to comprises a series of rammers movable toward and from the core-box, and adapted each to enter one of the core-matrices therein, with mechanism for repeatedly lifting and releasing these rammers to permit them to fall and ram the cores, and means for arresting their operation at will; also a vertically movable table arranged beneath the pivoted core-box and normally pressed up against it to hold it in position; also means for operating a series of vent wires to cause them to penetrate the branches of the core matrices to form vent openings in the cores; and also in general terms a tray constructed and adapted to the drag of the core-box to receive the cores therefrom, and on which they may be carried to the drying oven.

The improvements introduced by my invention are illustrated in their preferred form in the accompanying drawings.

Figure 1 is a front elevation of the machine. Fig. 2 is a side view thereof in vertical mid-section. Fig. 2^a is a fragmentary enlarged section. Fig. 3 is a horizontal section in two planes indicated by the line 3—3 in Fig. 1. Fig. 4 is a plan view showing one half of a molder's flask with the mold for casting the pipe-T and the core therefor laid in place. Fig. 5 is an elevation of the core and a transverse section of the core-box, its sections being separated to illustrate the directions of their movements relatively to the core in drawing. Fig. 6 is a fragmentary sectional perspective view of the core-box. Fig. 7 is an elevation of one end thereof. Fig. 8 is a plan of one end thereof. Fig. 9 is an elevation similar to Fig. 7, but showing a clamp applied thereto to hold the three sections together. Fig. 10 is an elevation of the two farther coping-off arms, being those on the right-hand side of the machine. Fig. 11 is a plan partly in section of the coping-off arms on the left hand side of the machine, together with the adjacent parts. Fig. 12 is a fragmentary vertical section showing the core-box and its accessories during the operation of ramming. Fig. 13 is a similar view showing it during

the operation of venting. Fig. 14 is a similar section showing the position of the parts after coping off. Fig. 15 is a transverse section of the drag and drying tray. Fig. 16 is a similar section showing the removal of the cores on the tray. Fig. 17 is a fragmentary side elevation of the tray showing the cores in place. Fig. 18 is an end elevation of the tray; and Fig. 19 a cross-section thereof. Fig. 20 includes a series of cross-sections of the core-box showing the different operations performed in making the cores. Fig. 21 is a perspective view of the clamp for holding the sections of the core-box together. Fig. 22 is an elevation of two of the parts of the core-box slightly separated. Fig. 23 is a fragmentary section cut obliquely on the line 23—23 in Fig. 9, and showing the clamp applied to hold the sections of core-box together.

The apparatus shown is designed to make cores of the shape shown at A in Figs. 4 and 5, or of any other similar or analogous shape, that is to say, any core having three branches, or any core of such shape as to require the division of the core-box into three parts or sections. For molding these cores I provide a core-box B of the general construction shown in Fig. 6, this core-box being formed with a succession of core-matrices *a a*, one of which is shown in section in Fig. 6, these matrices being arranged in a row parallel with and in line with one another, and with their branches opening at different sides of the core-box. To enable the cores to be removed, the core-box is divided into three sections, the planes of division intersecting the axes of the three branches of the core-matrices. The bottom section B′ I will designate the drag, and the two upper or quarter sections B^2 B^3 I will designate copes. In parting the core-box, the copes are moved off at an angle of approximately forty-five degrees to the drag, as shown in Fig. 5, which indicates the directions of draw of the core from the core-box. The copes require to be started off at the angle stated, or at some other angle not too greatly divergent therefrom, but after being moved off sufficiently to disengage them from the core, they may then be moved in some different direction, it being desirable to carry them to such positions as will take them out of the way and present their meeting surfaces and matrices where the attendant can conveniently clean them. A multiple core-box thus constructed, being preferably made of metal, is somewhat heavy, and in order to provide for conveniently handling it, I mount it pivotally so that it may be turned to different positions, the pivotal axis being concentric with the junction of the angles of the copes B^2 and B^3 with the drag B′, or in other words coincident with the line of intersections of the axes of the matrix branches. I preferably form trunnions *c c* projecting from the opposite ends of the core-box, preferably from the drag B′ thereof, these trunnions turning in bearings attached to upright frames C C, as shown in Figs. 1, 2 and 3. In order to hold the core-box sections together some suitable form of clamp is provided, the clamp *e* shown best in Fig. 21 being suitable. This clamp consists of an open or split ring having a screw *e′* for drawing it together, and formed on the side toward the core-box with two notches e^2 e^3 leaving uninterrupted portions e^1 e^5. The drag B′ is formed with a half-hub or collar *c′* (Figs. 7 and 22) over which the ring portion of the clamp fits, being held centrally thereon by an arm e^6 formed with an eye embracing the trunnion *c*. The copes B^2 B^3 are provided respectively with end projections c^2 c^3 to be engaged by the clamp. When the clamp is dropped to the position shown in dotted lines in Fig. 3, its notches e^2 e^3 coincide with the respective projections c^2 c^3 so that the copes may be lifted off. The clamp occupies this same position when closing the core-box, and after its sections are together the clamp is turned by the screw *e′* to the position shown in full lines in Fig. 9, thereby bringing the uninterrupted portions e^1 e^5 of the clamp to stand over the projections c^2 c^3 on the copes. By then turning the screw *e′* the clamp is contracted so as to tightly draw these projections toward the hub *c′* and consequently to bind the several sections of the core box firmly together. A clamp thus constructed is very simple and effective, while being very quick and easy to operate. The construction of the clamp might be greatly varied, as many different ways are admissible for holding the several sections together during the manipulations of the core-box.

The outer sides of the core-box are preferably made square and flat in planes perpendicular to the axes of the opposite core branches, and a vertically movable table D is provided mounted between the side frames C C and pressed up by a suitable tension device against the under side of the core-box, so that the flat top of this table resting against the flat under side of the core-box, will hold the latter against turning in whichever position the core-box be arranged. The table D is mounted on a sliding frame consisting of uprights *g g* on opposite sides and a cross-bar *g′* at the bottom, the uprights sliding between guides on the inner sides of the guide-frames C C, and the whole being pressed upwardly by the tension of a weight *w* acting through a cord *w′* passed over a sheave w^2, as shown in Fig. 2. The cross-bar *g′* serves as a convenient treadle by which the table D may be pressed down by the foot.

Above the core-box B is arranged a series of rammers E E, arranged preferably vertically and sliding through holes or ways formed in cross-frames *h h* fixed between the side frames C C. The rammers correspond to the respective core-matrices, each being shaped at its lower end so as to enter its matrix. Any suitable mechanism is provided for repeatedly lifting and dropping the rammers so

that they fall by their own weight each independently of the others, and strike blows against the core sand which is fed to the matrices, the blows being proportional to their weight and momentum. The mechanism shown consists of a revolving shaft F driven by a belt pulley *i* and carrying parallel rods *j* which as they revolve come under backwardly projecting arms *k* fixed to the several rammers so as to lift these arms and the rammers, and then pass out from under them, permitting the rammers to fall. To prevent the rammers being thrown up too high, a stop-rod *l* is extended across the top. To prevent the rotative displacement of the rammers, their upper portions are made square and work in square holes in the upper cross-bar *h*. To hold the rammers elevated when not performing the function of ramming, I provide some suitable device for locking them in their upper position, and preferably also for slightly lifting them to elevate their arms *k k* above the path of the operating bars *j* in order that as these bars rotate they shall not strike the arms. The proferable device for this purpose is that shown in Figs. 1, 2 and 2ª, and consists of a locking pawl pressed toward the rammers by a spring or otherwise, and having means for holding it out of action while the rammers are in operation. On a transverse shaft G′ is pivotally mounted a locking pawl or frame G^2 consisting of two arms connected by a bar or blade *u*, and pressed by springs or otherwise toward the rammers. The latter are provided with ribs *v*, the lower ends of which form inclined shoulders *v′* (Fig. 2ª). When in action the pawl G^2 is held away from the rammers by a notched cam-lever G engaging a pin projecting from the pawl, as shown in Fig. 2ª. Upon pulling down this lever the pawl is liberated and presses toward the ribs *v v* on the rammers. This pressure, however, is insufficient if the rammers are falling to arrest them, so that they will complete the stroke they are making, but when again fully lifted so that the blade *u* of the pawl passes under the shoulders *v′*, it will act against these shoulders, not merely to uphold the rammers, but by moving entirely beneath the shoulders to lift the rammers until their arms *k* are slightly above the path of the lifting rods *j*, whereby the rammers will be held out of action until the operator again pulls down the handle G. This construction of locking device for holding the rammers out of action has the advantage that to operate it requires no skill or dexterity on the part of the attendant, since he is not required to make its operation coincident with the completion of the upward movement of the rammers, but may operate it at any instant, and its operation will not take effect until the rammers complete their stroke and are again lifted to their uppermost position. This greatly facilitates the work of the attendant, whose attention is concentrated on the filling of the matrices in the core-box below. The construction of the locking device may be considerably modified, as for example by substituting weights for pressing the pawl against rammers instead of springs, this being indicated in dotted lines at *x* in Fig. 2ª. If weights are used the pawl can be thrown out of action by throwing it back until the weight is lifted beyond the vertical, so that the operating lever G may be omitted, but the construction shown in full lines is deemed preferable.

To provide for punching the vent holes in the cores after they are rammed, and while still held in the core-box, I provide a series of core-wires *o o* corresponding in number and position to the core box matrices, mounted on a hinged leaf or bar *p* hinged to a vertically sliding horizontal bar H extending beneath the lower bar *h*, formed with an opening through it through which the rammers may work, and having at its ends a sliding connection with the upright frame C, consisting in the construction shown of stirrup frames *h′* extended around the side frames and having pivoted to their outer ends links or connecting bars *q q*, which extend down the side frames and are jointed to arms *q′* fixed on a rock-shaft Q, to which is also fixed a counterweighted arm Q^2 projecting backwardly, and an operating lever-arm Q′ projecting forward. The weight Q^2 ordinarily holds the bar H elevated, but by first swinging the hinged leaf *p* under the bar H and then pressing down the lever Q′, the vent wires are caused to descend and punch vent holes in the cores, as shown in Fig. 13.

I will now describe the preferred form of coping-off mechanism. Of course the copes B^2 B^3 might be lifted off by hand, but in a long multiple core-box made of metal they are too heavy to be conveniently handled in this way, and I therefore prefer to provide machinery for operating them. I therefore provide a pair of movable parts J J adapted to engage the opposite ends of the cope B^2 and move it off obliquely from the drag and from the other cope, and I also provide a pair of moving parts I I adapted to engage the opposite ends of the cope B^3 and lift it off obliquely to the drag and away from the other cope. These moving parts might be slides or be otherwise mounted, but I prefer to construct them as vibrating arms fixed on oscillatory shafts. The arms J J are both fixed on a transverse shaft J′ mounted in bearings on a frame C′ and provided with any suitable means for oscillating it, preferably a hand-lever J^3 shown in Fig. 1. The arms I I are fixed on short oscillatory shafts I′ I′ having bearings I^2 at opposite sides of the machine, and provided with any suitable means for oscillating them. The two shafts I′ must be oscillated synchronously, and it is preferable to oscillate them simultaneously with the oscillation of the shaft J′, in order that the arms J and I shall simultaneously lift off the two copes B^2 and B^3. To this end I prefer to drive

the shafts I' I' from the shaft J', which may be accomplished by connecting them together by gearing or links, or by other suitable mechanical connection, a suitable and simple construction being that shown, wherein pulleys *f f* are fixed on the opposite end portions of the shaft J', and pulleys *f' f'* on the opposite shafts I', the respective pulleys being connected together by any suitable belt, preferably a wire rope f^2, which to insure positive motion should at some suitable point be fastened to both pulleys.

The ends of the arms J I may be connected in numerous different ways to the respective copes, as by clamping, screwing, pinning, or otherwise. The construction shown however is considered preferable, and consists in forming the ends of the arms J I with grooves or slots adapted to receive and engage the opposite end projections b^2 b^3 of the respective copes. Each arm J is formed at its outer end and on its side toward the middle, with a groove j^2 shown best in Fig. 10. The end of the arm J fits against the portion i' of the arm I, which latter is also formed with a groove i^3 forming a continuation of the groove j^2. The grooves j^2 of the arms J J are adapted to engage the projections b^2 on opposite ends of the cope B^2. The grooves i^3 in the arms I I are adapted to engage the projections b^3 at opposite ends of the cope B^3. The grooves j^2 i^3 are extended for somewhat more than half the circumference of a circle, as shown in Fig. 10, in order to provide room for the free oscillatory movement of the projections b^2 b^3 as the core-box is oscillated from its normal position shown in Fig. 13 to its sidewise position shown in Fig. 12, during which oscillation the projection b^2 turns forward and occupies the position which in Fig. 7 is occupied by the projection b^3, and the latter advances to the position at the outer end of the groove i^3. At the end of the return oscillation, the projections b^2 abut against the ends of the slots j^2, while the projection b^3 which as shown in Fig. 8 are longer than the others, are stopped by abutting against shoulders i^4 in the slots i^3 (see Figs. 10 and 11). The grooved end portion of each arm I is partly cut away, and a spring catch *m* is applied thereto, as best shown in Figs. 10 and 11, being fastened at its end, entering obliquely into the slot i^3 in position to snap under the projection b^3 when it is in its normal position, and having its free end carried outward to form a handle by which to pull out and withdraw the spring catch. In the normal position of the core-box, as in Fig. 7, after its clamp *e* is disengaged and the arms J and I are thrust up, the core-box B^2 will be carried upwardly and backwardly by the engagement of the slots j^2 with the projections b^2; at the same time the cope B^3 will be carried obliquely forward and upwardly and then back, by the engagement with its end projections b^3 of the slots i^3 and spring catches *m*, which latter will prevent the end projections from sliding downward toward the outer ends of the slots i^3, while as the arms are thrown backward to the position shown in Fig. 14, the sliding of the projections in the opposite direction is prevented by their abutment against the shoulders i^4 of the slots. When the respective arms are carried back to the positions shown in Fig. 14, they are stopped by stops *n* against which they which the arms J abut.

The operation of molding T-cores according to my invention is as follows.—At starting, the core-box is open, its copes B^2 B^3 being thrown back to the position shown in Fig. 14. The attendant after wiping off the molding faces of the core-box sections pulls forward the lever J^3, thereby throwing down the copes B^2 B^3 into position on the drag B'. He then oscillates the clamps *e e* to cause their complete portions to overhang and lock the projections e^2 e^3 of the copes and screws the clamps tight. He then pulls out the spring-catches to disengage them from the projections b^3, and while depressing the table D with his foot oscillates the core-box from its initial position shown at 1 in Fig. 20, to its second position shown at 2 in Fig. 20, and releases the table, so that it shall press up against the core-box and hold it in this position. He then places against the top of the core-box a tray L, shown in dotted lines in Fig. 2, and in full lines in Fig. 12, containing a suitable quantity of core sand, that is, sand containing a small amount of adhesive material, or in lieu of core sand any other material from which cores may be molded. While holding this tray in place he pushes the sand from it with his hands or a suitable tool into the several core-matrices until they are substantially full of sand, whereupon he pulls down the locking lever G to free the rammers, and the shaft F being in rotation these commence their operation, repeatedly falling and entering the core-matrices and ramming down the sand therein. The operator continues to push new sand over the top of the core-box so that it may be rammed into the matrices, and when the latter are full he arrests the rammers, scrapes off the top of the core-box to level the ends of the cores, and removing the tray L, he turns back the core-box to its first position while lowering the table D with his foot. Then replacing the tray, he pushes fresh sand over the core-box and into the branches of the core-matrices that were projecting horizontally in the first position but which are now projecting vertically, as shown at 3 in Fig. 20. Again starting the rammers, these branches are rammed, after which the rammers are arrested and the surplus sand is scraped off. The sand thus scraped off may be pushed back onto the tray L, or scraped off the core-box and permitted to fall down a chute N into a box N'. The next operation is the venting of the cores, which is performed in the manner already described, first, while in the last described position as shown at 4 in Fig.

20, and more exactly in Fig. 13, and subsequently after oscillating the core-box, back to its second position as shown at 5 in Fig. 20. Thereupon the core-box is again oscillated to its original position, as shown at 6 in Fig. 20, its clamps *e e* are disengaged, and by throwing back the lever J^2 its copes are lifted off and thrown back to the positions shown in Fig. 14. The copes will usually require to be tapped to disengage them from the molded cores before being coped off. It then only remains to remove the cores from the drag and carry them away to be dried. To facilitate this operation, I provide a specially constructed tray K, shown best in Figs. 17, 18 and 19 consisting of upright end pieces *s s*, a bottom plate *t* and two top plates *t'* having a space between them sufficient to receive the middle leg of the cores. This tray is inverted upon the cores, as shown in Fig. 14, whereupon the table D is lowered and the drag B' turned upside down while holding the tray to it, the table D being then restored leaving the parts in the position shown in Fig. 15. Then by tapping the drag it is released from the molds, and by carefully lowering the table D the tray is lowered carrying the molds with it, as shown in Fig. 16. The tray is then lifted off from the table and carried away to the oven. The cores rest upon the tray, being supported by the ends of their middle branches and the sides of their end branches lying respectively on the plates *t* and *t' t'* of the tray, as shown.

It must not be inferred from the circumstantial description which I have given of the details of the apparatus that my invention is necessarily limited to all the details of construction shown. My invention is in fact susceptible of considerable modification without departing from its essential features. For molding cores of different shapes, the three-part core-box will necessarily be changed in shape or in the position of its partings to correspond with the shape of the cores. It is not essential that the core-box be trunnioned on the drag B', although this is the preferable construction. In coping-off, the core-box might be inverted and the drag lifted off first, or one of the copes might be lifted off first and then the core-box be inverted or nearly so, and the drag lifted off leaving the cores supported on the other cope. The construction of the coping-off mechanism might be considerably modified in respect of the devices by which the lifting parts are engaged to the respective sections of the core-box.

Those features of the machine which pertain to the construction of the rammers, multiple vent-wires, vertically movable table, &c., which are claimed in my aforesaid application, are not essentially or necessarily used with my present invention, but are here illustrated because they are believed to be the best mechanical devices for performing their respective functions of any known to me.

I make no claim herein to anything claimed in my said application Serial No. 458,653, nor to anything claimed in another application filed on the same date, Serial No. 458,654.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices and divided into three sections in planes intersecting the axes of the three branches of the matrices.

2. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices, the three branches of which open at three sides of the box, and the box divided into three sections in planes intersecting the axes of the three branches of the matrices.

3. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices and divided into three sections in planes intersecting the axes of the three branches of the matrices, combined with fastenings for holding the three sections together, and pivotal trunnions on which the box is hung, whereby it may be oscillated to different positions.

4. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices the three branches of which open at three sides of the box, and the box divided into three sections in planes intersecting the axes of the three branches of the matrices, combined with fastenings for holding the three sections together, pivotal trunnions on which the box is hung, arranged on an axis in line with the intersections of the axes of the three branches of the matrices, and a series of rammers adapted to enter either of said branches in either of the positions of the box.

5. The combination of a core-box hung on trunnions, having a series of matrices and divided into three sections, a movable table mounted to rise and fall beneath said core-box and adapted by fitting against it to hold it in either position to which it is designed to be turned, and a series of rammers adapted to enter the matrices in either of said positions.

6. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices and divided into a drag and two copes in planes intersecting the axes of the three branches of the matrices, combined with a coping-off mechanism consisting of moving parts adapted to engage the two copes respectively, and constructed in lifting off the copes from the drag to move in directions initially at approximately right angles to each other and oblique to the drag.

7. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices and divided into a drag and two copes in planes intersecting the axes of the three branches of the matrices, combined with a coping-off mechanism consisting of moving

parts adapted to engage the two copes respectively, said parts connected together to move simultaneously, and constructed in lifting off the copes from the drag to move the copes in directions at approximately right angles to each other and oblique to the drag.

8. A multiple core-box for molding T cores and the like, formed with a row of parallel matrices and divided into a drag and two copes in planes intersecting the axes of the three branches of the matrices, combined with a coping-off mechanism consisting of pivoted arms engaging one cope and mounted to lift it obliquely from the drag and swing it back, and pivoted arms engaging the other cope and mounted to lift it obliquely in the contrary direction and swing it forwardly, upward and back, whereby the meeting faces of the two copes are exposed and accessible from the same side.

9. The combination with core-box B divided into drag B′ and copes B^2 B^3, of coping-off arms J J constructed to engage the cope B^2, rock-shaft J′ carrying said arms, arms I I constructed to engage the cope B^3, and means for vibrating said arms.

10. The combination with core-box B divided into drag B′ and copes B^2 B^3, of coping-off arms J J constructed to engage the cope B^2, rock-shaft J′ carrying said arms, arms I I constructed to engage the cope B^3, rock-shafts I′ I′ carrying said arms, and mechanical connections between shaft J′ and shafts I′ I′ to transmit rocking motion from the former to the latter.

11. The combination with core-box B hung on trunnions c c and divided into drag B′ and and copes B^2 B^3 of coping-off arms J I, and interengaging projections b^2 b^3 on the copes and slots j^2 i^3 in the arms.

12. The combination with core-box B hung on trunnions c c and divided into drag B′ and copes B^2 B^3 having end projections b^2 b^3 respectively, of coping-off arms J I having arc-shaped coinciding slots j^2 i^3 engaging said projections and in which they may slide as the core-box is oscillated upon its trunnions.

13. The combination with core-box B hung on trunnions c c and divided into drag B′ and copes B^2 B^3 having end projections b^2 b^3 respectively, of coping-off arms J J having slots j^3 receiving said projections b^3, arms I I having slots i^2 adapted to receive the projections b^3, and catches n carried by arms I for engaging the projections b^3 and limiting their movement in the slots.

14. The combination with a core-box hung upon trunnions and divided into three sections having end projections, of a clamp for holding the sections together consisting of a contractile ring movable to overhang and confine said projections, and having means for contracting it to draw the projections together.

15. The combination with a core-box divided into three sections, a drag B′ and copes B^2 B^3, the drag formed with trunnions c and bosses c' at its ends, and the copes with end projections c^2 c^3, of clamps for holding the sections together consisting of rings e engaging said bosses and each having notches which in one position coincide with said end projections to permit of the removal of the copes, while in another position they are out of coincidence therewith so that the end projections are confined by the rings.

16. The combination with a multiple core-box divided into three sections, of a drying tray adapted to be fitted to the row of cores exposed on one section after the coping-off of the other two, and by being inverted with said section to receive the cores therefrom, being formed with extended surfaces to support said cores.

17. The combination with a multiple core-box divided into a drag and two copes, the drag pivoted so as to oscillate, of a drying tray adapted to be fitted to the row of cores exposed on the drag after the lifting off of the copes, and by being inverted with the drag to receive the cores therefrom, being formed with extended surfaces to support said cores.

18. A drying tray K consisting of end-pieces s s, longitudinal bar t adapted to support the ends of the middle branches of a row of T cores, and longitudinal bars t' t' adapted to support the sides of the opposed branches thereof.

19. A multiple core-box, sliding rammers for entering the matrices thereof, and mechanism for lifting and dropping the rammers, combined with means for holding the rammers out of action consisting of inclined shoulders on the rammers and an elongated pawl mounted to press upwardly toward the rammers and adapted to engage beneath inclined shoulders thereon when the rammers are fully lifted, whereby the pawl acts to lift them slightly above their normal stroke.

20. A multiple core-box, rammers for entering their matrices, and mechanism for lifting and dropping the rammers, combined with means for holding the rammers out of action consisting of a pivoted pawl G^2 normally pressed toward the rammers and adapted to engage the faces thereof and to enter under shoulders thereon when the rammers are fully lifted, and an operating handle G having a cam-face engaging said pawl for throwing it out of action.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

ALFRED E. HAMMER.

Witnesses:
LESTER J. NICHOLS,
HERBERT E. THATCHER.