H. LEHMANN.

MOLDING APPARATUS.

APPLICATION FILED MAR. 22, 1913.

1,166,842.

Patented Jan. 4, 1916.

3 SHEETS—SHEET 1.

FIG. 1.

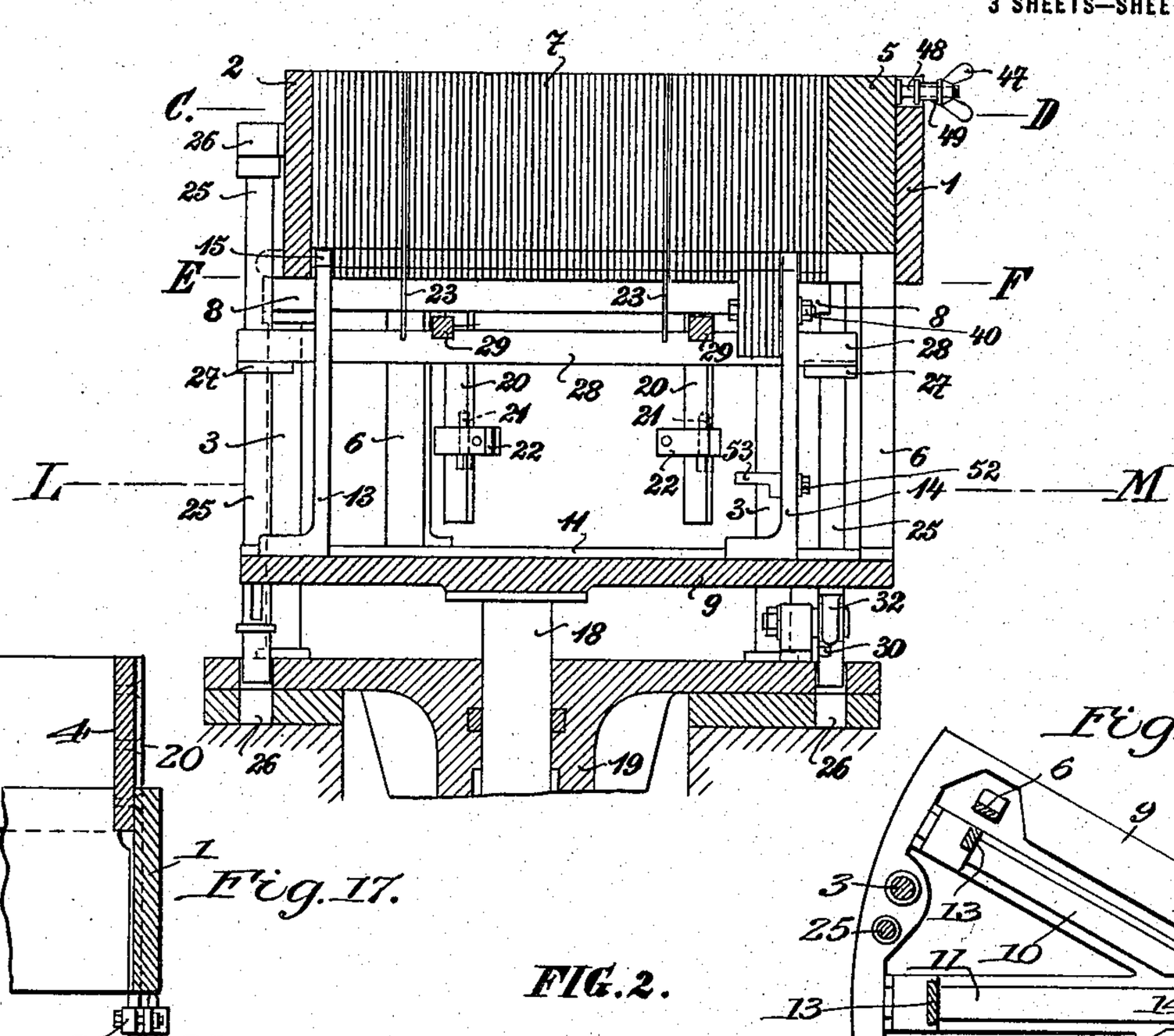


Fig. 17.

Fig. 16

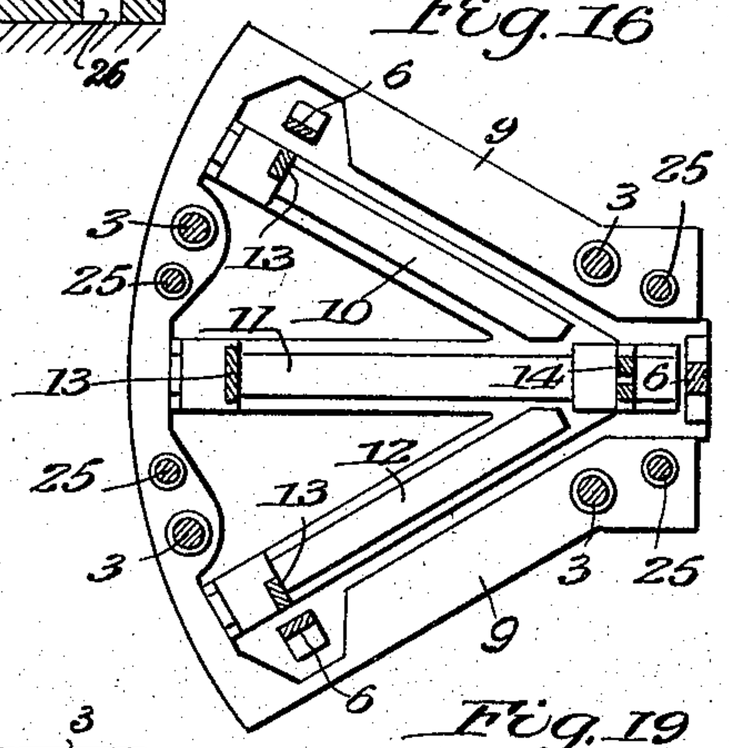


FIG. 2.

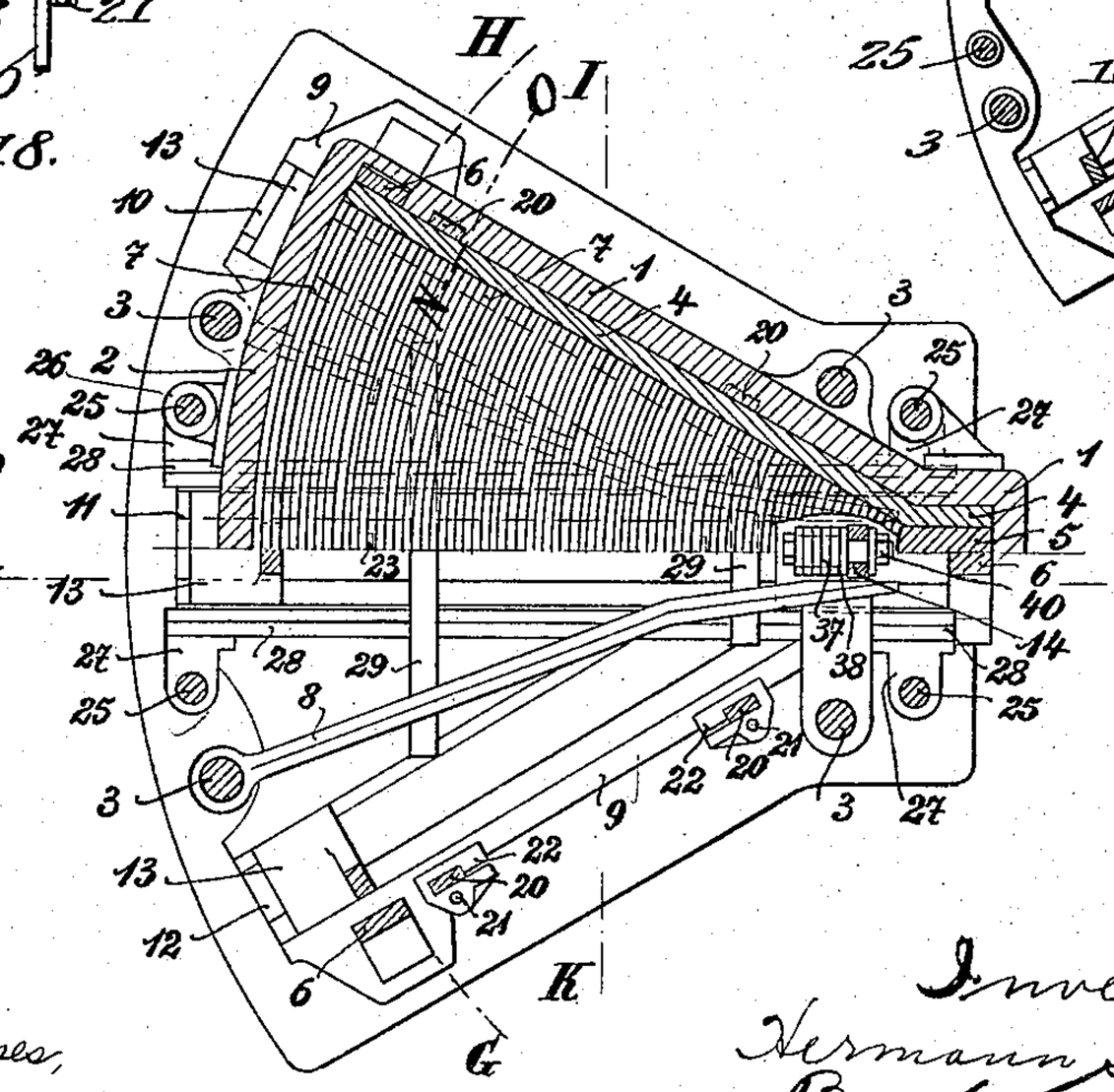


Fig. 18.

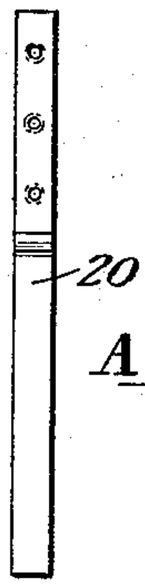
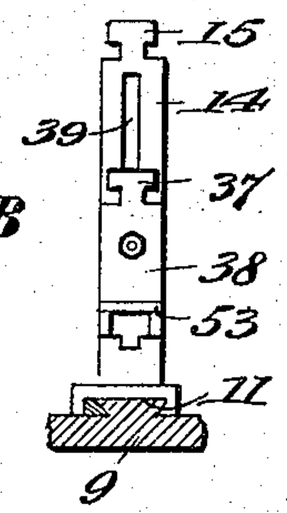


Fig. 19



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3 SHEETS—SHEET 2.

FIG. 3.

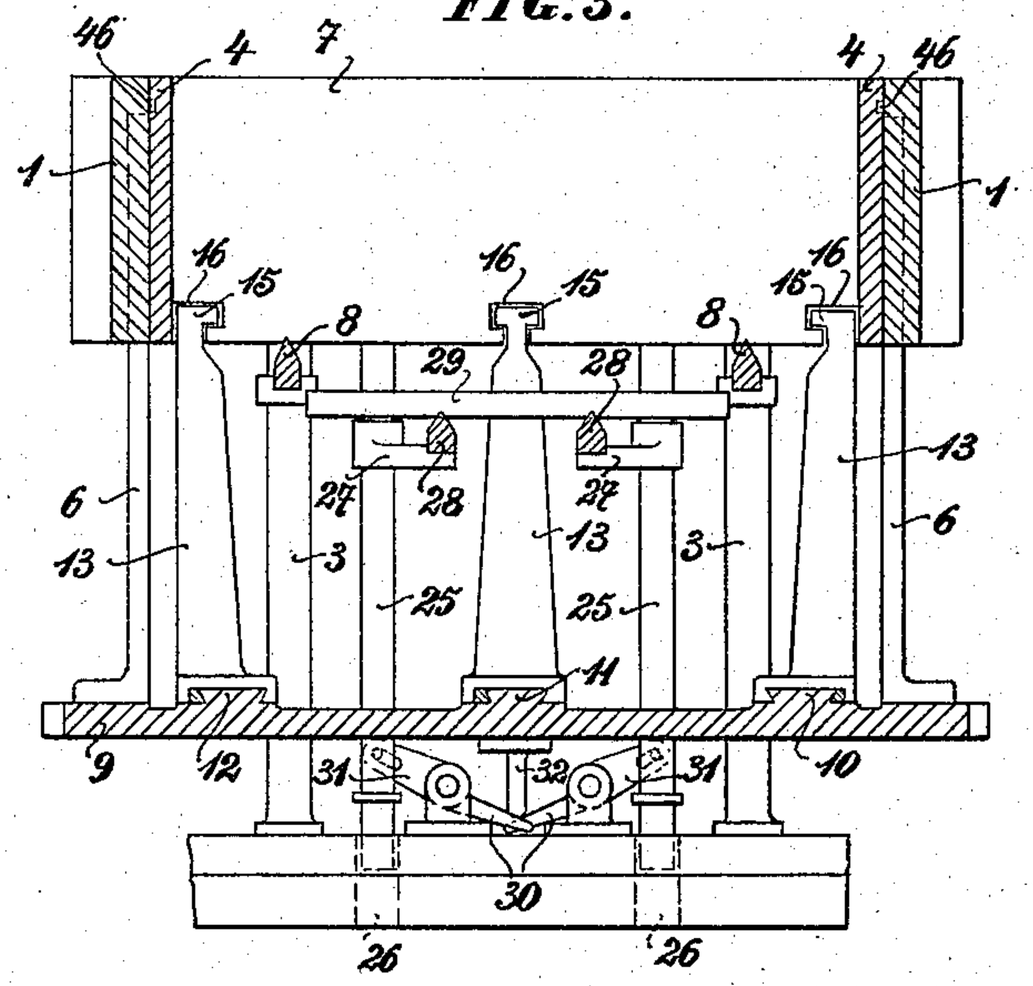


FIG. 4.

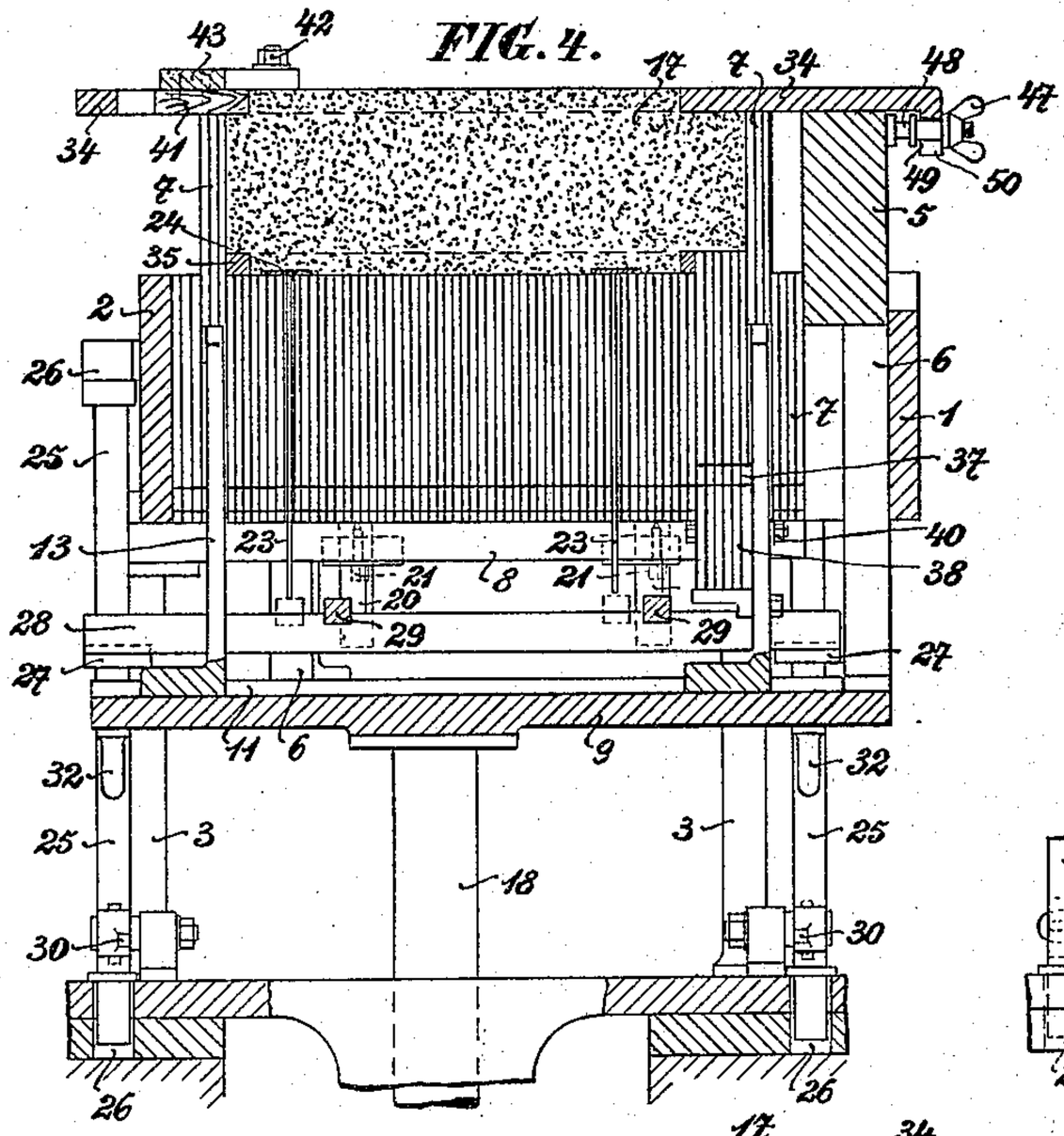
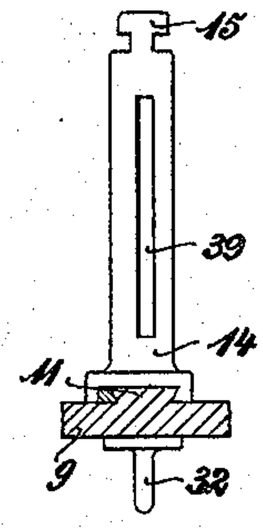


FIG. 5.



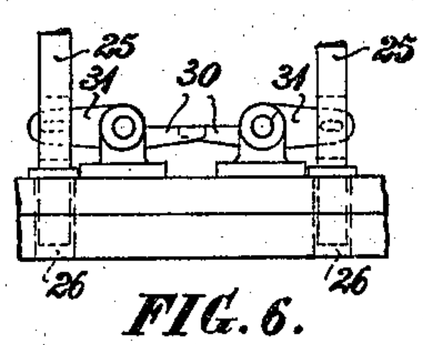
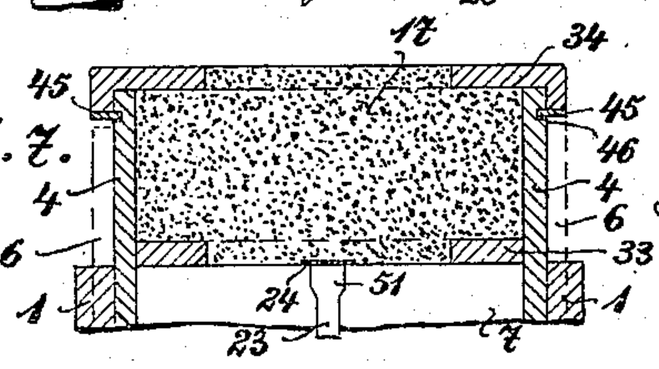


FIG. 6.

FIG. 7.



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3 SHEETS—SHEET 3.

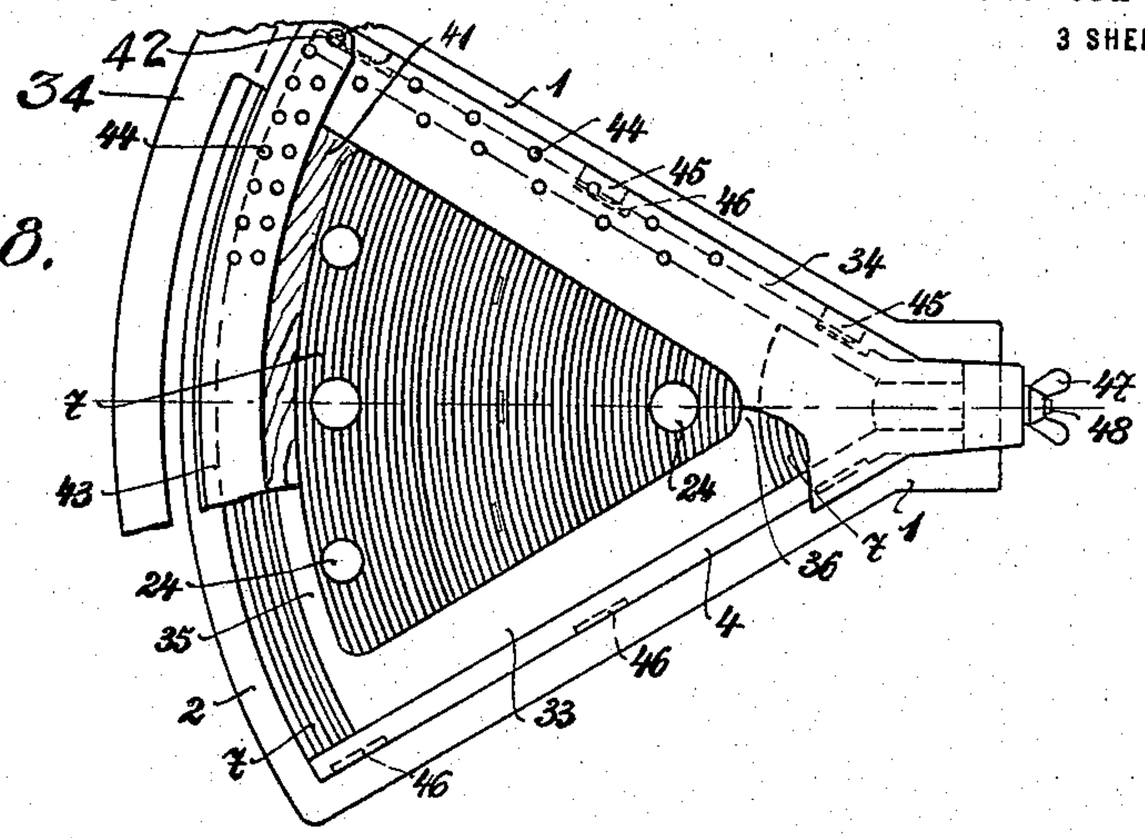


FIG. 8.

FIG. 9.

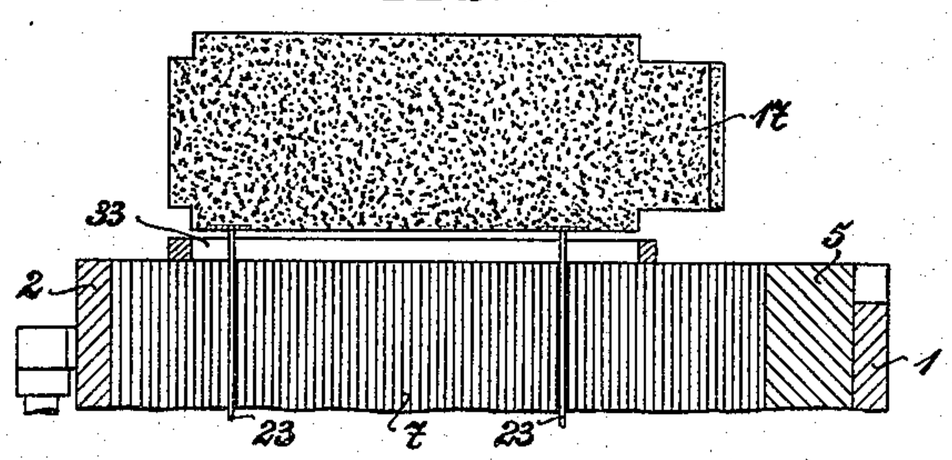


FIG. 10.

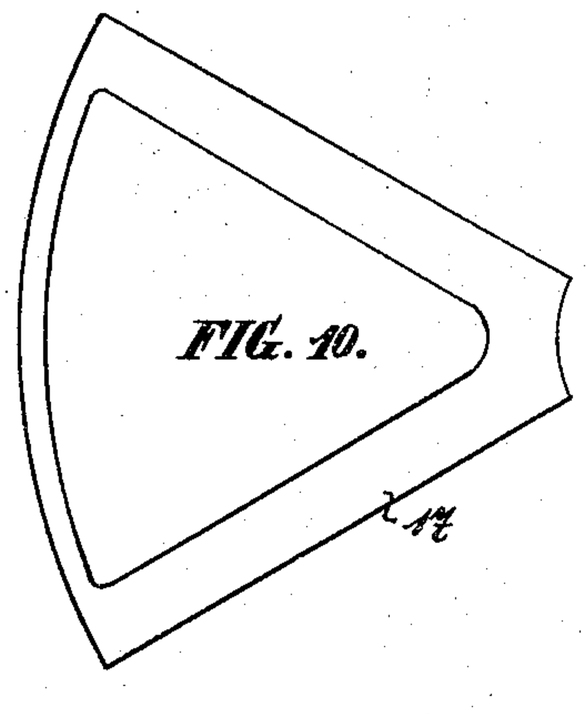


FIG. 11.

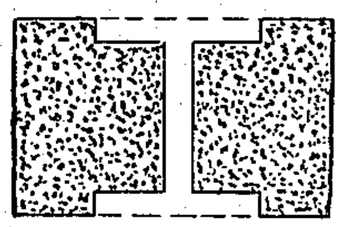


FIG. 12.

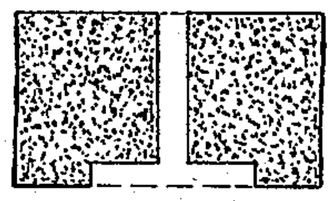


FIG. 13.

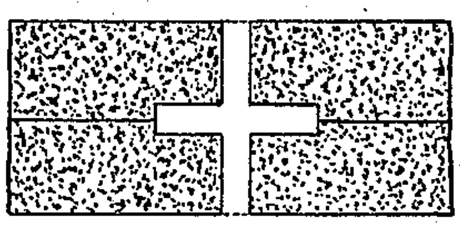


FIG. 14.

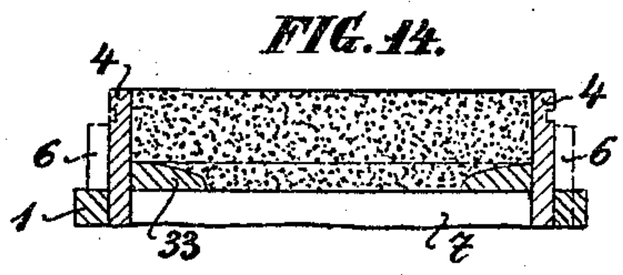
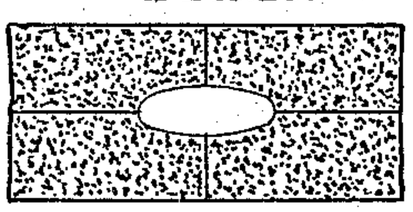


FIG. 15.



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MOLDING APPARATUS.

1,166,842. Specification of Letters Patent. **Patented Jan. 4, 1916.**

Application filed March 22, 1913. Serial No. 756,155.

To all whom it may concern:

Be it known that I, HERMANN LEHMANN, a subject of the King of Prussia, and resident of Magdeburg, German Empire, have invented certain new and useful Improvements in Molding Apparatus, of which the following is a specification.

This invention relates to an improved apparatus for molding arm cores for belt pulleys, gear wheels or the like. In belt pulley molding machines already known the rim or crown and the hub may be formed by means of concentric, separately displaceable rings. Sector-shaped frames for forming arm cores in which the diameter of the external sector is variable in accordance with the various wheel diameters have also been employed. In order to change the diameter of such frames, in addition to a displacement of the outer sector in the radial direction, a modification of the curvature is necessary; this is a difficult operation and does not give perfect results.

According to the present invention the principle of the belt pulley molding machine is utilized in a suitable manner for the formation of sector-shaped frames for the arm cores used in casting gear wheels and the like.

To form the side faces of the core four upright plates issue from the molding table. Of these plates two are at a fixed angle relatively to each other to form the radial faces. The other two plates are selected, according to the internal diameter of the rim and the external diameter of the hub, from a plurality of concentric arc shaped plates, and serve to shape the curved faces of the core forming the inner face of the wheel rim and the outer face of the hub. When the core has been rammed and smoothed off these four plates are lowered into the table and the core is lifted from the surface of the table by means of supports issuing from the table. For forming special forms of arm cross section specially profiled auxiliary pieces or frames joined to the casing are employed. The device for lifting the core can be arranged in such a manner that the core is positively lifted when the four plates forming the casing of the core are lowered.

A constructional form of machine embodying the invention is illustrated by way of example in the accompanying drawings, in which:—

Figure 1 is a vertical section of the machine on the radial line A—B of Fig. 2. Fig. 2 represents two horizontal half sections, its upper half being taken on the line C—D and its lower half on the line E—F of Fig. 1. Fig. 3 is a developed section on the arc line G—H of Fig. 2. Figs. 1 to 3 represent the machine prior to the commencement of operations while Fig. 4 is a section corresponding to Fig. 1, in which the core is already rammed. Figs. 5 and 6 illustrate constructional details. Fig. 7 is a section, similar to Fig. 3, of the upper part of the machine taken on the line I—K in Fig. 2, but in the position occupied by the machine in Fig. 4. Fig. 8 is a plan view of Fig. 4 with some parts broken away. Fig. 9 represents a section corresponding to Fig. 1, in which the machine elements resume the position shown in Figs. 1 to 3, that is to say, the core casing is again withdrawn; the core itself is represented in its raised position. Fig. 10 shows the finished core in plan view. Fig. 11 is a cross section of two arm core pieces formed in accordance with this embodiment of the invention and laid side by side, and Figs. 12 and 13 are similar views to Fig. 11 of core pieces for arms of T-shaped and cross-shaped transverse section. Fig. 14, a view similar to Fig. 7 but showing an auxiliary frame of different section and; Fig. 15 is a view similar to Fig. 11 of core pieces for arms of oval cross section. Fig. 16, is a horizontal section on line L—M of Fig. 1; Fig. 17 is a section on line N—O of Fig. 2; Fig. 18 is a left hand elevation of Fig. 17 with some parts removed, and Fig. 19 is an elevation of a detail.

The outer fixed casing corresponding to a segment of a circle is formed in the known manner by two radial lateral walls 1 and a sector shaped wall 2, and rests upon uprights 3. The radial lateral walls of the core casing proper are formed by plates 4 displaceable vertically and in the example here illustrated set at an angle of 60° to each other, as required for a six armed wheel. For any other number of arms a different angle and therefore a different machine is necessary. The plates 4 are connected by an upright 5 at the apex of the

angle see Figs. 2, 4, and 8. Between the radial walls and the sector shaped wall 2 are located a number of co-axial arc shaped plates 7 lying against one another but displaceable vertically independently of each other. In their lowest position, which corresponds to the inoperative condition of the machine (Figs. 1 to 3 and 9), these plates 7 rest upon a cross beam 8 secured to the uprights 3 of the machine casing. One of the plates 7 serves for forming the inner face of the wheel rim and another plate serves for forming the outer face of the hub. The following means is employed for displacing the arc shaped plates 7 and the plates 4 forming the radial walls of the core casing: Guide and supporting strips or ledges 6 are mounted on a platform 9 and engage the plates 4; guides 10, 11 and 12 are also provided upon each of which the lower end or foot of a rod 13 is slidable. These rods 13 serve for lifting the arc shaped plate forming the inner face of the wheel rim. The lower end or foot of a rod 14 is also slidably mounted on the middle guide 11 and serves for lifting the arc shaped plate which forms the outer face of the hub, compare Fig. 5. For this purpose, all the rods 13 and 14 engage by means of heads 15 in undercut notches 16 (Fig. 3) in the arc shaped plates 7. In the example here illustrated the upper ends of the rods 13 14 are so wide that they always lift three arc shaped plates simultaneously, the inner of these plates serving for forming and the other two for stiffening the first. The platform 9 can be lifted in any convenient manner. In the apparatus shown hydraulic lifting mechanism is used in which the platform is connected with a piston 18 capable of vertical displacement in a cylinder 19. To regulate and limit the movement of the platform 9 and consequently the vertical displacement of the plates 4 and 7 as desired, the plates 4, see Fig. 17 which are rigidly connected with the platform 9, are provided with bars or ledges 20 upon which the stops 22 are secured. These stops are provided with fine adjusting screws 21 which encounter the lower edge of the casing 1 if the platform 9 is raised, see Fig. 17. The screws 21 are secured in such a manner that they can be displaced and retained at any desired height. The core is lifted by means of rods 23 distributed in groups over the core casing (Fig. 8) and displaceably secured in the arc shaped plates 7 (Figs. 1, 4 8 and 9); their lower ends protrude from the arc shaped plates. If desired their upper ends can be covered with small plates 24 in order to prevent injury to the core. The following device is employed for lifting these rods 23:—

By means of arms 27 guide pieces 28 are fixed on uprights 25 which are capable of vertical displacement in guides 26 forming part of the fixed frame of the machine. Upon these guide pieces 28 supports 29 are displaceable; before the core is lifted these supports are inserted beneath the lower ends of the rods 23 (Fig. 4, position of the supports 29 shown in broken lines). The radius of the arm cores 17 determines below which of the groups of rods 23 the supports 29 are inserted. The uprights 25 with the arms 27, the guide pieces 28 and the supports 29 can be lifted in any convenient manner. In the example here illustrated this is effected positively upon the downward movement of the platform 9 carrying the plates 4 and the raised arc shaped plates 7. With this object in view two levers are mounted on the fixed machine frame each lever having two opposing arms 30, 31. The inner arm 30 of each of these double levers interengages and coöperates with a tappet 32 arranged upon the under side of the platform 9 (Figs. 3, 5 and 6), the outer lever arms 31 engaging with the uprights 25 (Figs. 3 and 6).

For molding special arm cross sections, such as I-shaped, ⊥-shaped oval, and so forth, auxiliary frames 33, 34 are employed. It is only in forming arms of I cross section such as are commonly used for gear wheels and are selected by way of example in Figs. 4 and 7 to 11, that both frames are used simultaneously (Figs. 4, 7 and 8). In the case of other cross sections one frame is sufficient, as for example with oval and ✣ shaped cross sections of the core as hereinafter described and illustrated in Figs. 13 to 15, in which the cores are formed of two superposed parts.

The auxiliary frames 33, 34 correspond externally and internally to a circular segment. The radial portions of the frames serve, together with the plates 4, for molding the arm cross section and the arc shaped portions, together with the raised arc shaped plates 7, for molding the inner face of the rim and outer face of the hub respectively, with the rim and hub extensions. One of the frames 33 is intended to be placed upon the molding table and the bottom of the core casing formed by the surface of the arc shape plates 7 which are located in their lowest position. The frame 33 is connected through an outer arc 35 with the arc shaped plate 7 serving to mold the inner face of the rim (Figs. 4 and 8), a different frame 33 being necessary for each internal rim diameter. On the other hand a single frame 33 can be employed for various hub diameters. With this object the diameter of the inner arc 36 of the frame 33 is made considerably larger than that of the innermost of the arc shaped plates 7, leaving in many cases a space between the arc 36 and the arc shaped plate serving for molding the outer face of the hub. This space is filled by lift-

ing the intermediate plates 7 to an extent corresponding to the height of the frame (Fig. 4). This is effected by plates 38 see Fig. 19 corresponding in thickness to that of the plates 7 and having heads 37 of the same form as the heads 15 of the rods 13, 14, which heads 37 engage in the middle undercut slot 16 in the plates 7. They are inserted in the slot 16 from below in the manner of a bayonet joint. A number of these plates corresponding to the number of arc shaped plates required for filling the interstice referred to above are inserted in the middle slot 16 and held together and in contact with the rod 14 by a screw 40 passing through a slot 39 in said rod. A stop 53 adjustable to different heights upon the rod 14 by means of a screw 52 serves for lifting the plates 38. With this object the screw 52 passes through the slot 39 in the rod 14.

The other auxiliary frame 34 is fitted upon the core casing (Figs. 4 and 7). An arc shaped member 41 is used to form the rim extension and is secured in such a manner as to be readily detachable upon a stirrup 43 connected with the frame 34 by means of screws 42. A different member 41 is used for each rim diameter. On the other hand the stirrups corresponding to the various rim diameters can be secured upon the frame in different positions by means of the holes 44, or their adjustment may of course be effected in any other convenient manner. The frame 34 is temporarily fixed upon the core casing when the core is being rammed, by means of hook-shaped projections 45 which engage in undercut recesses 46 in the plates 4. With this object the frame 34 is mounted upon the core casing so that the projections 45 are external and on outward displacement of the frame the projections 45 are caused to engage with the recesses 46. The frame is secured in this position by a nut 47 on a bolt 48 rigidly attached upon the connecting member 5 of the plates 4 (Fig. 4). The nut has an annular groove 49 in which a fork-shaped projection 50 from the frame 34 engages so that the forked projection 50 together with the frame 34 partakes in any outward or inward displacement of the nut. By screwing up the nut 47 the frame is pressed radially outward, that is toward the left of Figs. 4 and 8 while when the nut is turned back the frame is drawn radially inward.

The operation of the machine will now be described first in connection with the molding of a wheel with arms of I-shaped cross section. Before the work begins the machine occupies the position illustrated in Figs. 1 and 3. In the first place the rods 13, 14 are adjusted on their guides 10, 11, 12 in such a manner that they come beneath the arc shaped plates 7 which correspond to the diameter of the rim and hub respectively, and the stops 22 are adjusted on the bars 20 in correspondence with the required height of the core casing. The auxiliary frame 33 corresponding to the desired cross section is then placed upon the arc shaped plates 7. If a space should remain between the arc shaped plate which molds the outer face of the hub and the inner arc shaped portion 36 of the auxiliary frame, such space is filled by further plates 7, as many plates 38 as the number of plates 7 that are required being inserted in the manner hereinbefore described, in the middle undercut slot 16 and then passed to the rod 14. The plates 38 are then suspended by their heads 37 in the middle slot of the plates 7 that they are to lift. To retain them in this position, the screw 40 is passed through them and the slot 39 in the rod 14 and tightened to such an extent that the plates 38 are held together and in loose contact with the rod 14. Thereupon the stop 53 is secured upon the rod 14 by means of the screw 52 at such a height that the arc shaped plates that are intended for filling the aforesaid space are raised as far as the upper edge of the auxiliary frame 33 when the platform 9 ascends. The platform 9 is then raised by means of the piston 18 until the stops 22 encounter the lower edge of the casing walls 1 see Fig. 17. The arc shaped plates 7 which form the core casing and the plates 4 rise with the platform 9.

In the first place the plates 38 remain stationary as owing to their loose connection with the rod 14 the slot 39 in the latter slides over the screw 40. It is only in the latter part of the upward movement of the platform 9 that the stop 53 strikes against the plates 38 from below and lifts them and with them the arc shaped plates located above them to such an extent that the upper edge of the latter comes flush with the upper edge of the frame 33. The small plates 24 are then placed upon those of the rods 23 that are subsequently to lift the core. The core is rammed in the usual manner up to the upper edge of the core casing. The upper auxiliary frame 34 is then placed upon the core casing, the fork-shaped projection 50 engaged with the annular groove 49 in the nut 47 and then, by screwing up the nut 47, the auxiliary frame 34 is displaced radially outward. By this means its hook-shaped projections 45 engage in the recesses 46 in the plates 4. The arc shaped part 41 corresponding to the internal rim diameter in question is fixed upon the stirrup 43 and the latter secured in the proper position on the auxiliary frame 34. The core piece is finally rammed and smoothed off when the parts assume the position shown in Figs. 4 and 7.

In order to withdraw the core, in the first place the stirrup 43 is detached from the

auxiliary frame 34 and removed together with the arc shaped part 41. By screwing back the nut 47 the frame 34 is displaced radially inward so that the projections 45 are disengaged from the recesses 46, whereupon the frame 34 is removed. The supports 29 are then inserted beneath the rods 23 to be lifted (position indicated in broken lines in Fig. 4) and the platform, and with it the plates 4 previously raised, and the rods 13, 14 are lowered. The T-shaped heads 15 of the rods 13, 14 inserted in the undercut slots 16 draw down the arc shaped plates previously raised when these rods descend.

The arc shaped plates raised as far as the upper edge of the auxiliary frame 33 first of all remain stationary, as the slot 39 in the rod 14 slides over the screw 40. In the latter part of the descent of the platform 9 the upper limiting edge of the slot 39 in the rod 14 strikes against the screw 40 and draws it and the plates 38 downward. By means of their T-shaped heads 37, which are inserted in the undercut slots 16, these plates draw the plates 7 downward. Furthermore, in the latter part of the descent of the platform 9 the tappet 32 strikes the lever arms 30 and depresses them, by which means the lever arms 31 are raised, as are also the rods 23 by means of the parts 25, 27, 28 and 29. By the intermediary of the small plates 24 these rods lift the core from the casing. The parts then assume the position shown in Fig. 9.

If it be desired to clean the machine before preparing the next core, the supports 29 are displaced to such an extent that the rods 23 can descend past them. The rods 23 slide downward under the influence of gravity or they can be depressed by hand. This displacement is limited by enlargements 51 on the rods 23, see Fig. 7 in such a manner that the upper edge of the rods 23 when occupying their lowest position are level with the upper edge of the plates 7.

If it be desired to use the same lower auxiliary frame not only for various hub diameters, but also for various rim diameters, or if it be desired to strengthen the rim extension by prolonging it toward the center of the wheel, a lower auxiliary frame 33 is inserted in which the outer diameter of the outer arc shaped part 35 is smaller than the internal diameter of the arc shaped plate which molds the inner face of the rim. The space that then remains between this outermost of the raised plates 7 and the arc shaped part 35, is filled by slightly lifting further plates 7 in the manner already described in connection with the part 36 and the inner raised plate 7. In this case one or more of the rods 13 must be slotted in the same manner as the rod 14 and also provided with plates 38 and stops 53 see Fig. 4.

If it be desired to produce core pieces for wheels T-shaped in cross section, one of the auxiliary frames is omitted. Arms of ✣ shaped cross section are formed by molding the core in two parts of half height and placing their lower faces in contact as shown in Fig. 13. Core pieces for wheels with arms of oval cross section are manufactured in a similar manner; see Figs. 14 and 15. Any arm cross section used in practice can be produced by suitably constructing the auxiliary frames.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core.

2. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core.

3. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table.

4. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for lifting the finished core from the table after the plates have been lowered.

5. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; an auxiliary frame to be used in conjunction with said plates for molding complex shaped cores.

6. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores.

7. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores, said lower auxiliary frame being shorter than the distance between the two raised curved plates, the inner and outer face of said lower frame being concentrically curved; means for partly raising a plurality of said arcuate plates to form fillers when needed between said lower frame and the two raised arcuate plates.

8. In an apparatus for molding cores of sector-shape, two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores; means for partly raising a plurality of said curved plates to form fillers when needed between the inner face of said lower frame and the curved plate of smaller radius.

9. In an apparatus for molding cores of sector-shape, two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, togther forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex-shaped cores; means for partly rasing a plurality of said curved plates to form fillers when needed between the inner face of said lower frame and the curved plate of smaller radius; said last named means comprising a projection adjustable relative to, and actuated by said first named raising means, an extension plate suspended from each of said plates to be partially raised, said extension plates positioned to be engaged by said projection.

10. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores, said lower frame bear-

ing against the inner surface of the curved plates of the greater radius, the inner face of said lower frame being arcuate to correspond with a hub of a fixed comparatively large diameter.

11. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side face of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores; said lower frame bearing against the inner surface of the curved plate of the greater radius, the inner face of said lower frame being arcuate to correspond with a hub of a fixed comparatively large diameter; means for partly raising a plurality of said curved plates to form fillers when needed between the inner face of said lower frame and the curved plate of smaller radius.

12. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores; said lower frame bearing against the inner surface of the curved plate of the greater radius, the inner face of said lower frame being arcuate to correspond with a hub of a fixed comparatively large diameter; means for partly raising a plurality of said curved plates to form fillers when needed between the inner face of said lower frame and the curved plate of smaller radius; said last named means comprising a projection adjustable relative to, and actuated by said first named raising means, an extension plate suspended from each of said plates to be partially raised, said extension plates positioned to be engaged by said projection.

13. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores, said lower auxiliary frame being shorter than the distance between the two raised curved plates, the inner face of said lower frame bearing against the raised curved plate of the smaller radius.

14. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores, said lower auxiliary frame being shorter than the distance between the two raised curved plates, the inner face of said lower frame bearing against the raised curved plate of the smaller radius; means for partly raising a plurality of said curved plates to form fillers when needed between the exterior face of said lower frame and the curved plate of greater radius.

15. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle; a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of dif-

erent radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores, said lower auxiliary frame being shorter than the distance between the two raised curved plates, the inner face of said lower frame bearing against the raised curved plate of the smaller radius; means for partly raising a plurality of said curved plates to form fillers when needed between the exterior face of said lower frame and the curved plate of greater radius; said last-named means comprising a projection adjustable relative to, and actuated by said first-named raising means, an extension plate suspended from each of said plates to be partially raised, said extension plates positioned to be engaged by said projection.

16. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores; said upper auxiliary frame having an adjustable stirrup, an arc shaped member detachably mounted on said stirrup and forming a rim extension.

17. In an apparatus for molding cores of sector-shape; two radial plates rigidly connected and situated at a permanent angle, a plurality of concentrically curved plates fitting between said radial plates, each of said curved plates constructed to be lowered into the molding table; and adjustable stops for said curved plates limiting the vertical position of the curved plates according to the thickness of the core; said radial plates and a selected pair of said curved plates of different radii, together forming the side faces of the core; and means for raising the four plates together with said stops relatively to the molding table; a lower auxiliary sector-shaped frame inserted in said radial plates and an upper auxiliary sector-shaped frame placed on top thereof for the purpose of molding complex shaped cores; interengaging members on said upper auxiliary frame and said radial plates, the upper auxiliary frame being radially displaceable for engaging and disengaging said members.

The foregoing specification signed at Madgeburg, this 8th day of March, 1913.

HERMANN LEHMANN.

In presence of—
HERMANN STEPHANI,
OSCAR MARKISCH.