2 Sheets—Sheet 1.

# A. K. RIDER.

## SAND-MOLDING APPARATUS FOR CASTING METAL ARTICLES

No. 195,843. Patented Oct. 2, 1877

Fig. 1.

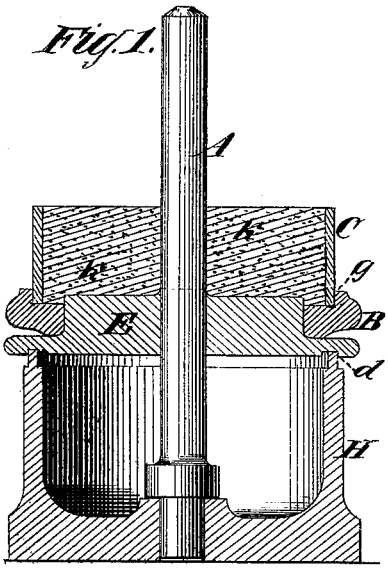



Fig. 4.

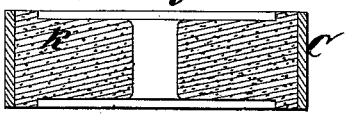



Fig. 6.

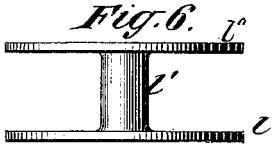



Fig. 5.

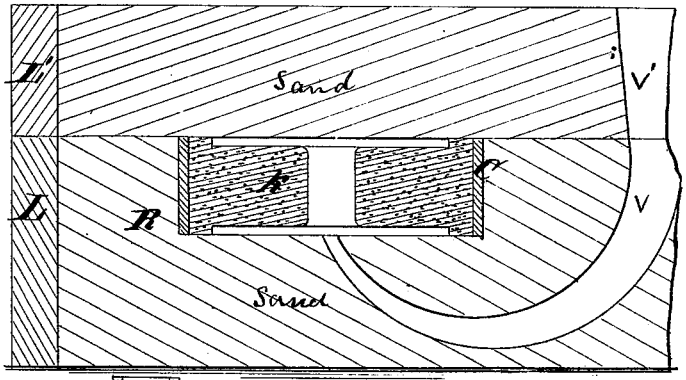



Fig. 2.

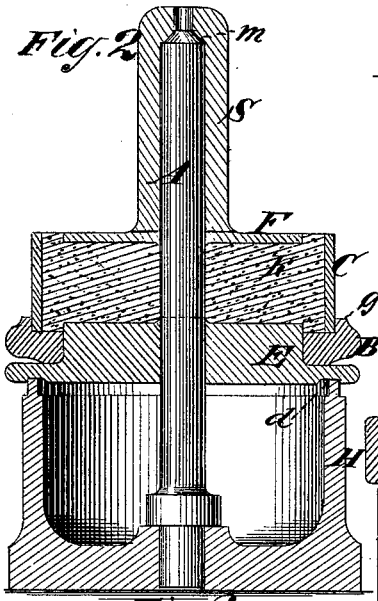



Fig. 7.

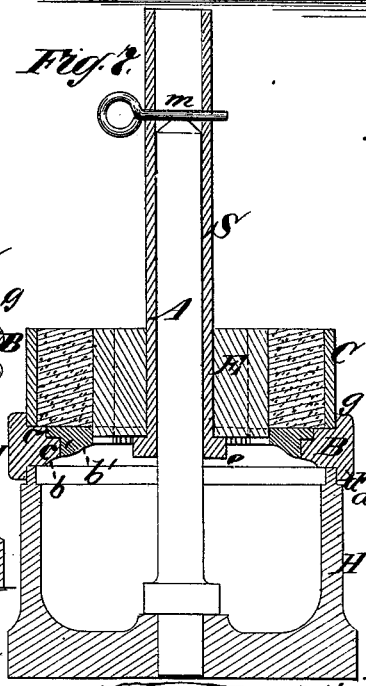



Fig. 9.

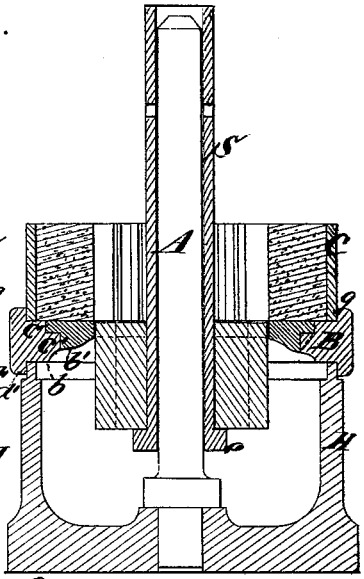



Fig. 3.

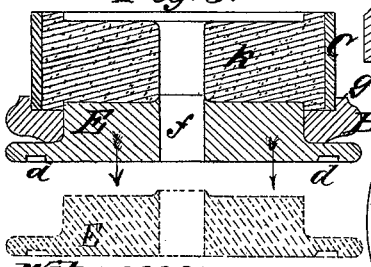



Fig. 8.

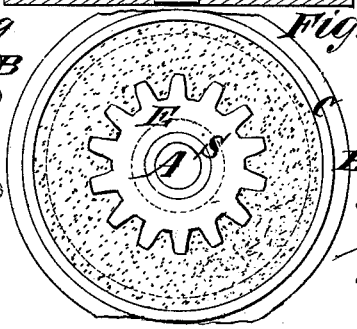



Fig. 10.


Witnesses
John Becker.
Fred Haynes

A. K. Rider
by his Attorneys
Brown & Allen.

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

2 Sheets—Sheet 2.

# A. K. RIDER.

## SAND-MOLDING APPARATUS FOR CASTING METAL ARTICLES.

No. 195,843. Patented Oct. 2, 1877

*Fig. 11.*

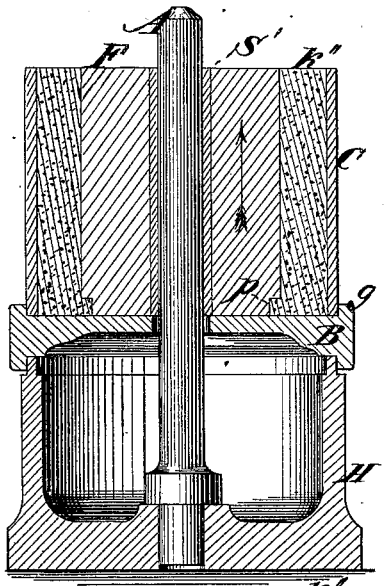



*Fig. 13.*

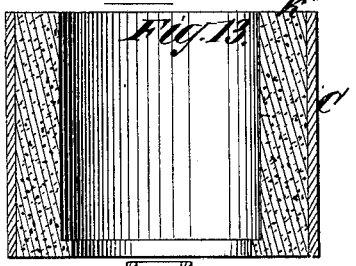



*Fig. 14.*

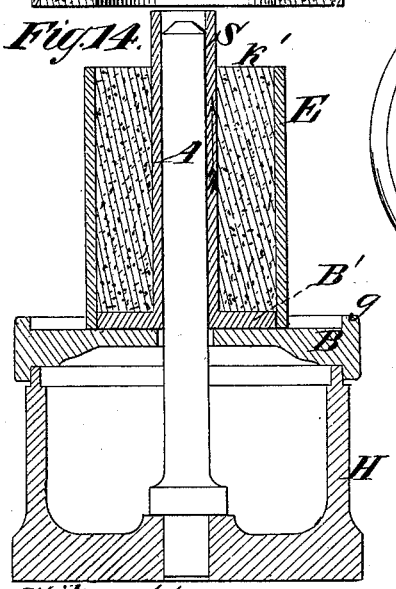



*Fig. 17.*

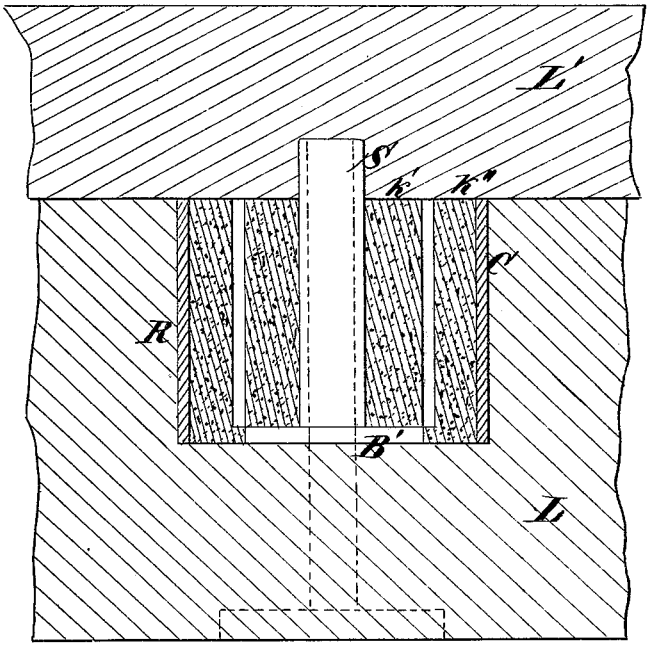



*Fig. 12.*

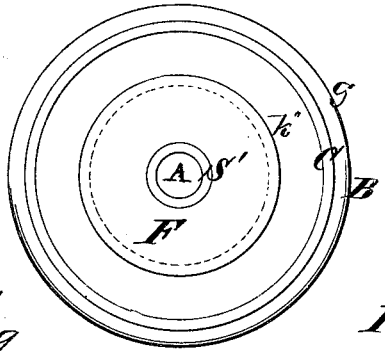



*Fig. 15.*

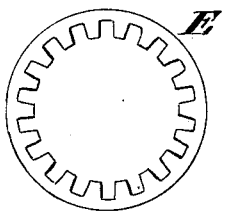
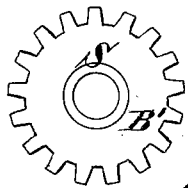



*Fig. 16.*




Witnesses
John Becker
Fred. Haynes

A. K. Rider
by his Attorneys
Brown & Allen

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

# UNITED STATES PATENT OFFICE.

ALEXANDER K. RIDER, OF WALDEN, NEW YORK,

## IMPROVEMENT IN SAND-MOLDING APPARATUS FOR CASTING METAL ARTICLES.

Specification forming part of Letters Patent No. **195,843**, dated October 2, 1877; application filed May 2, 1877.

*To all whom it may concern:*

Be it known that I, ALEXANDER K. RIDER, of Walden, in the county of Orange and State of New York, have invented an Improved Process and Apparatus for Making Sand-Molds and Casting Metallic Articles; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification.

The objects of my invention are to secure greater perfection in casting, and greatly cheapen the production of certain forms of castings.

My invention more particularly relates to castings of moderate size, to such as are usually molded with full patterns, and to certain forms of castings, in the manufacture of which the invention is found specially advantageous, some of which are as follows: Double-tread or spool-like wheels, (similar to those described in the specification of Letters Patent allowed to me January 13, 1877, entitled "Roller for sliding doors,") grooved pulleys and sheaves, external gear-wheels, internal gear-wheels, cylindrical tubes and pipes, and straight-rimmed pulleys; but the invention is also applicable to other forms of castings besides those mentioned.

The distinctive features of the apparatus forming part of my invention are simple and efficient means for preventing the breaking or displacement of sand in withdrawing the pattern from the mold, thus permitting exactly parallel-sided forms and forms of difficult conformation to be made with facility, and also convenient means for the accurate setting or placing in position of the interior portion of such molds as have an interior surface, such as interior wheels, tubes, &c.

The invention consists in various combinations of parts in the apparatus employed, chiefly comprising a guiding-stud, a guide-sleeve fitted to said stud, a protection-plate arranged in a novel manner, a transfer-ring, and an appropriate construction of patterns for use in connection with the said devices in forming the molds, and in transferring said molds or portions thereof to, and placing them in relation with, other molds or parts of molds in flasks, for casting molten metal therein, as hereinafter fully set forth.

Figure 1 in the drawings represents a central vertical section of a portion of the apparatus arranged to mold the aforementioned double-tread wheel at one stage in the process of molding the same. Fig. 2 is a similar section, with a sectional view of another portion of the apparatus as arranged at a subsequent stage of the process. Fig. 3 is a sectional view, illustrating parts of the apparatus and the contained mold completely formed and ready for transfer to the flask. Fig. 4 is a sectional view, showing the mold detached from all other parts of the apparatus, except the transfer-ring, in which said mold is lifted and transferred to the flask where the casting is to be made. Fig. 5 is a vertical section through the body of such flask, its cope, the contained mold, and transfer-ring, as finally arranged for the reception of the molten metal for the casting. Fig. 6 is an edgewise view of the double-tread or spool-shaped wheel after the same has been cast. Fig. 7 is a central vertical section of portions of the apparatus arranged for molding an exterior gear-wheel. Fig. 8 is a top view of the same. Fig. 9 is a central vertical section of the same apparatus, showing the position of parts as seen in another stage of the process. Fig. 10 is a vertical section through the transfer-ring and the therein-contained mold for an external gear when ready for transfer to the flask for casting. Fig. 11 is a central vertical section of the apparatus arranged as in one stage of the process of molding the exterior mold for an interior gear-wheel, a tube, or a pipe. Fig. 12 is a top view of the same. Fig. 13 is a vertical section through the transfer-ring containing the exterior mold for a tube. Fig. 14 is a central vertical section through the apparatus as arranged for molding the interior mold for an internal gear, a tube, or a pipe. Fig. 15 represents a top view of a pattern for molding an internal gear; and Fig. 16, a top view of the protection-plate used in molding such a gear, and the guide-sleeve thereunto attached. Fig. 17 represents a flask with exterior and interior molds for a tube arranged therein for casting.

H, Figs. 1, 2, 7, 9, 11, and 14, is the base or pedestal, of circular or other shape, upon which other parts of the apparatus are arranged in molding and sometimes in casting, as hereinafter described. Said base is preferably cylin-

drical and hollow, and has attached to it a central vertical guiding-stud, A. Said pedestal is provided with a raised edge, on which other parts of the apparatus rest in molding, and is preferably turned on said edge and its periphery, to receive and hold concentrically a pattern-plate, E, or protection-plate B, hereinafter described.

The guiding-stud A is preferably made of iron turned true and cylindrical for the greater part of its length, and, when used for molding a double-tread wheel, it should have a diameter equal to the diameter of the hub of such wheel, for which hub a portion of said stud forms the pattern, as hereinafter described; but the diameter of said stud may be varied to adapt it to different molds.

In arranging the apparatus for molding a double-tread wheel, I place on the base H the pattern E, Figs. 1, 2, and 3, for that part of said wheel marked *l* in Fig. 6, said pattern having a central hole, *f*, Fig. 3, fitted accurately to said stud, and being slipped down over said stud onto the said pedestal H in placing the parts in proper relation. Said pattern has also formed on its under side a concentric annular groove, *d*, the outer margin of which is accurately fitted to the truly-turned upper and outer part of the pedestal H, by which means it is very firmly held in true square and concentric relation with said base and the guiding-stud.

The central portion of the pattern E projects upwardly, and is of the same diameter as the diameter of that part of the double-tread wheel it is intended to represent in the finished mold. Upon and around the upwardly-projecting central part of the said pattern E is fitted the annular protection-plate B, its bottom resting upon the upper side of the broader part of said pattern.

Said protection-plate is turned true on its upper and lower sides, and has its central opening accurately fitted to the part of the pattern E which projects upwardly through the protection-plate, the part so projecting above said plate representing in form the part *l*, Fig. 6, of the double-tread wheel to be cast. Said plate B also has a snap or upward annular projection, *g*, formed on its upper side. Accurately, but easily, fitted to the interior of said snap *g* is placed, upon the said protection-plate, the transfer-ring C, Figs. 1, 2, 3, 4, and 5, all the parts so arranged being held firmly in true and square relation with each other, and with the sand-mold to be formed therein. The said transfer-ring is simply a stout hoop.

To make the mold, properly-tempered sand *k*, in sufficient quantity, is now put within and over the transfer-ring, upon packing which, as hereinafter described, that part of the pattern E which rises above the protection-plate B forms the impression in the sand for that part of the double-tread wheel marked *l* in Fig. 6, and that part of the guide-stud A which passes through the sand-mold forms the impression for the hub of said wheel, (marked *l'* in Fig. 6.)

I next slip over the guiding-stud A the guide-sleeve S, Fig. 2, said guide-sleeve having formed upon its lower end or having separately formed and attached thereto the pattern F, Fig. 2, arranged concentrically with the said guiding-stud and guide-sleeve. The said guide-sleeve S has formed in its interior, near the upper end, a stop, *m*, which limits the descent of said sleeve and its attached pattern F, which, being pressed downward as far as it will go, forms the impression for the upper part of the double-tread wheel, (marked *l''* in Fig. 6,) and completes the compaction of the mold *k*. When so pressed downward into the sand till the stop *m* in the said guide-sleeve rests upon the top of the said guiding-stud, the top of the pattern F is on a level with the top of the transfer-ring, and its lower side is parallel with the upper side of the pattern E. The sand is then struck off from the top of the mold *k*, which completes said mold.

The mold has now to be removed from portions of the apparatus and placed in the flask L L' for casting, as shown in Fig. 5.

The said flask is prepared for the reception of the mold *k* by filling the body of the flask with compacted sand, having formed therein a blank cylindrical mold equal in diameter and height to the diameter and height of the transfer-ring C, and a gate, *v*, for pouring the molten metal. The cope L' is filled with compacted sand struck off flat on its under side, and a corresponding gate, *v'*, formed in it.

The mold *k* is now removed from the apparatus in which it is formed by first sliding the guide-sleeve S and its attached pattern F off from the guiding-stud A, then lifting the pattern E, the protection-plate B, the transfer-ring C, and the contained mold *k* together off from the pedestal H, the guiding-stud A guiding the lifting, and the parts so lifted off being kept unchanged in their relative positions, as shown in Fig. 3. The pattern E is then withdrawn downward from the protection-plate B, as indicated in dotted outline in Fig. 3, said protection-plate protecting the lower internal edges of the mold *k* from breaking or damage, (which is its chief function,) and insuring the straight withdrawal of the pattern. The transfer-ring, which perfectly sustains the mold, is then, with its contained mold *k*, withdrawn upward from the protection-plate B, the relative position of said ring and mold being shown in Fig. 4. The transfer-ring and the contained mold are then placed in the aforementioned blank cylindrical mold R, Fig. 5, in the flask L L', and the filled cope placed thereon and clamped, in the usual manner, ready to receive the molten metal for casting the double-tread wheel, as shown in Fig. 6, the said blank mold in the flask forming the upper and lower surfaces of said wheel.

This mode of casting is the same, in all essentials, as that for sheaves and grooved pulleys, which are made in precisely the same manner.

Although in this case the guiding-stud forms

a part of the pattern for the double-tread wheel, its main use, as will be seen in further exemplification of the use of the apparatus, is to provide a rectilinear path for the whole or a part of the pattern while withdrawing such pattern from the sand. It also furnishes the means for accurately setting in position the inner parts of such molds as have interior surfaces. These functions will be more fully illustrated in the description of the processes of molding an external gear, a tube, and an internal gear, which follows.

In molding an external gear, the operation is much simpler than molding the double-tread wheel, as hereinbefore described, the pattern E, Figs. 7 and 8, being only in one piece. The guide-sleeve S projects upward through the pattern, in concentric relation therewith, the said pattern being preferably removable from said sleeve, in order that various patterns may be used on the same sleeve.

The protection-plate B may be made in a single piece, and it has a central opening of the same contour as the horizontal cross-section of the pattern, into which opening the lower part of the pattern enters when the parts are adjusted in position to form the mold, and which prevents the pattern from turning on its vertical axis relatively to the said protection-plate in taking out the mold after forming the same; but the said protection-plate is preferably made in two concentric pieces, *b b'*, for the convenience of being more readily adapted to wheels of different diameters or pitch by the removal of the inner piece *b'* and the substitution therefor of other pieces, fitted on their exterior portions to the piece *b*, but having different central openings, corresponding to various patterns.

The inner piece *b'* has an exterior flange, *c*, which rests upon an interior ledge, *c'*, formed on the piece *b*. Said inner piece *b'* may be made of iron; but it is preferably made of Babbitt metal, type-metal, or other fusible metal or alloy, and it is preferably made by casting it in its position around the corresponding pattern, either when said pattern is adjusted upon the guiding-stud in due relation with the pedestal H and protection-plate B, or in any other convenient manner; or the said piece *b'* may be made in any other way, if desired, and may be fitted to the part *b* in any other manner to render it easily removable and convenient in use.

Whether the said protection-plate is made in a single piece or otherwise, it is provided with a "snap" or concentric downward annular projection, *d'*, accurately fitted to the exterior and upper part of the base or pedestal H, which holds it concentrically while casting the inner piece *b'*, and subsequently when forming the molds in the apparatus; and it also has a snap or concentric upward annular projection, *g*, formed on its upper border for the reception of the transfer-ring C.

The guide-sleeve S, projecting upwardly through the pattern E, as shown in Figs. 7 and 9, is provided with a stop, *m*, in this case, preferably, a pin inserted through the said sleeve.

An external gear-wheel is molded as follows: The protection-plate B is placed on the pedestal H, as shown in Figs. 7 and 9, and the transfer-ring C is placed on said plate within the snap *g*. The desired pattern E, corresponding to the protection-plate, is then placed upon the sleeve S, and held thereon by a collar, *e*, Figs. 7 and 9, formed upon the bottom of said sleeve. The said sleeve, carrying the pattern, is then put on the guiding-stud A, and slipped down till the lower part of the pattern enters the opening of similar contour in the said protection-plate, and the upper surface of said pattern is on a level with the upper edge of the transfer-ring, in which position it is held by inserting the pin-stop *m* through the sleeve S, said pin resting upon the top of the stud A.

The sand is next packed in the transfer-ring around the pattern, and the edge or joint struck off, which completes the mold.

The pin-stop *m* being now withdrawn, the pattern is pressed downward through the mold upon its sleeve S, which slides upon the guiding-stud A, insuring the parallelism of the movement of the pattern with the central vertical axis of the stud and the mold. The relative position of the parts when the pattern is thus pressed down out of the mold is shown in Fig. 9. The closely-fitting protection-plate B entirely prevents the interior lower angles of the mold from any crumbling or breaking, leaving them all formed clean and sharp. The transfer-ring is then transferred to a blank mold in a flask prepared to receive it for casting, as described for the double-tread wheel.

By these means the most perfect gear can be cast from an exactly parallel-sided pattern, no taper or "draft" being required, and the sand may be so tightly packed that an exact counterpart of the pattern may be produced.

The general arrangement of the apparatus for molding an internal gear, a tube, or a pipe is the same, the pattern and removable parts differing from each other only in size and contour for different articles to be cast.

The process of molding these articles will be sufficiently illustrated by the description of the molding of a tube.

In this instance the internal part of the mold is of the most importance, as it is in this portion that the greatest accuracy is necessary, and to secure such accuracy an interior protection-plate, B', Figs. 14 and 17, has its acting face directed outward instead of inward. The said protection-plate and the guide-sleeve S, to which it is attached, are in this instance preferably formed in one piece, as many of them, as well as of other removable parts, being provided as may be necessary for making the number of molds required preparatory to casting.

I use for molding a tube a pattern composed of a part, E, Fig. 14, for molding the interior form of said tube, and a part, F, Fig. 11, for

molding the exterior of the same. Said parts E and F together constitute one pattern; but, for convenience, they will be referred to as separate patterns in describing their use in molding.

The said patterns E and F are, of course, varied in contour for different articles. The pattern F is perforated centrically, and has, preferably, a metal bushing or guide-sleeve, S′, Figs. 11 and 12, fitted to slide snugly, but easily, on the guiding-stud A, to insure exact concentric position while said pattern is used in molding. It is also provided with a print, *p*, Fig. 11, at its lower end to receive the interior part of the mold when in position to be cast, and for this reason is somewhat longer than the intended casting.

To mold a tube with the said patterns I first place upon the pedestal H a protection-plate, B, similar to that already described, but having a smaller central opening, as shown in Figs. 11 and 14. I then place the internal pattern E on said plate, and place the interior protection-plate B′, Figs. 14 and 17, and its attached sleeve S, on the stud A, the said protection-plate exactly fitting the interior of the said pattern, and holding the same in true concentric position with the said stud, as shown in Fig. 14. The sand being now rammed in and struck off the interior mold *k′*, Fig. 14, the said interior mold is, with the protection-plate B′ and sleeve S, removed from the stud A, and the pattern F placed on said stud to form the mold for the exterior of the tube, as shown in Fig. 11. The transfer-ring C is next placed on the protection-plate B within the snap *g*, as shown in Fig. 11. The sand-mold *k″* for the exterior of the tube is then formed by packing sand between the said transfer-ring and pattern F, and striking off the top of the mold. The pattern F is then slid upwardly out of the mold *k″*, the stud A insuring its straight withdrawal without in any way injuring its sharply-defined impression in said mold. The interior mold E is then placed with its supporting protection-plate B′ and sleeve S upon the stud A, and slid down upon said stud till the protection-plate B′ reaches the protection-plate B, where it rests and is held in true concentric relation with the exterior mold F for casting.

The casting may, in this instance, be done either while the molds are held in proper relation upon the guide-stud and pedestal, as above described, or the molds may be transferred to a blank mold, R, Fig. 17, in a flask, and held therein by any suitable means in true relation in said flask, one method of holding them in true concentric relation being indicated in dotted outline in Fig. 17; but while I prefer the methods described for casting the articles named and other similar articles, I do not confine myself to the exact succession of operations described, as the methods may be varied without materially lessening the utility, or in any wise affecting the general principles of the process or the construction of the apparatus.

The molding and casting of an internal gear is similar to the molding of a tube, except that the interior pattern E, Fig. 15, must be internally toothed, and the interior protection-plate B′, Fig. 16, must be made to fit therein.

The various applications of the invention are sufficiently illustrated and explained by the examples given.

I claim—

1. The combination, with the base or pedestal H, for supporting patterns and molds or parts thereof, of a central cylindrical guiding-stud rigidly attached to said base or pedestal, for holding and guiding the patterns, molds, or parts of molds in rigid concentric relation, substantially as and for the purpose specified.

2. The guide-sleeve S or S′, in combination with the fixed guiding-stud A, and pattern or portions thereof, substantially as and for the purpose specified.

3. The protection-plate B or B′, in combination with the guiding-stud A, and pattern or portion thereof, substantially as and for the purpose described.

4. The combination of the pedestal H, the protection-plate B, fitted concentrically to the top of the said pedestal, and having formed thereon a concentric snap, *g*, and the transfer-ring C, fitted to said snap, and protection-plate for holding said ring also in concentric relation, substantially as and for the purpose specified.

5. The blank mold R, in combination with the transfer-ring C, and its contained mold or portion of a mold, placed within and inclosed by said blank mold, substantially as and for the purpose described.

6. The combination of the supporting base or pedestal H, guiding-stud A, guide-sleeve S or S′, protection-plate B or B′, and transfer-ring C, substantially as and for the purpose described.

ALEXR. K. RIDER.

Witnesses:
JAMES GOWER,
W. G. RUTHERFORD.