June 28, 1960 T. A. DEAKINS ET AL 2,942,312

COPE-TO-DRAG CLAMPING FACILITIES FOR MOLD ASSEMBLING INSTALLATION

Filed June 9, 1958 5 Sheets-Sheet 1

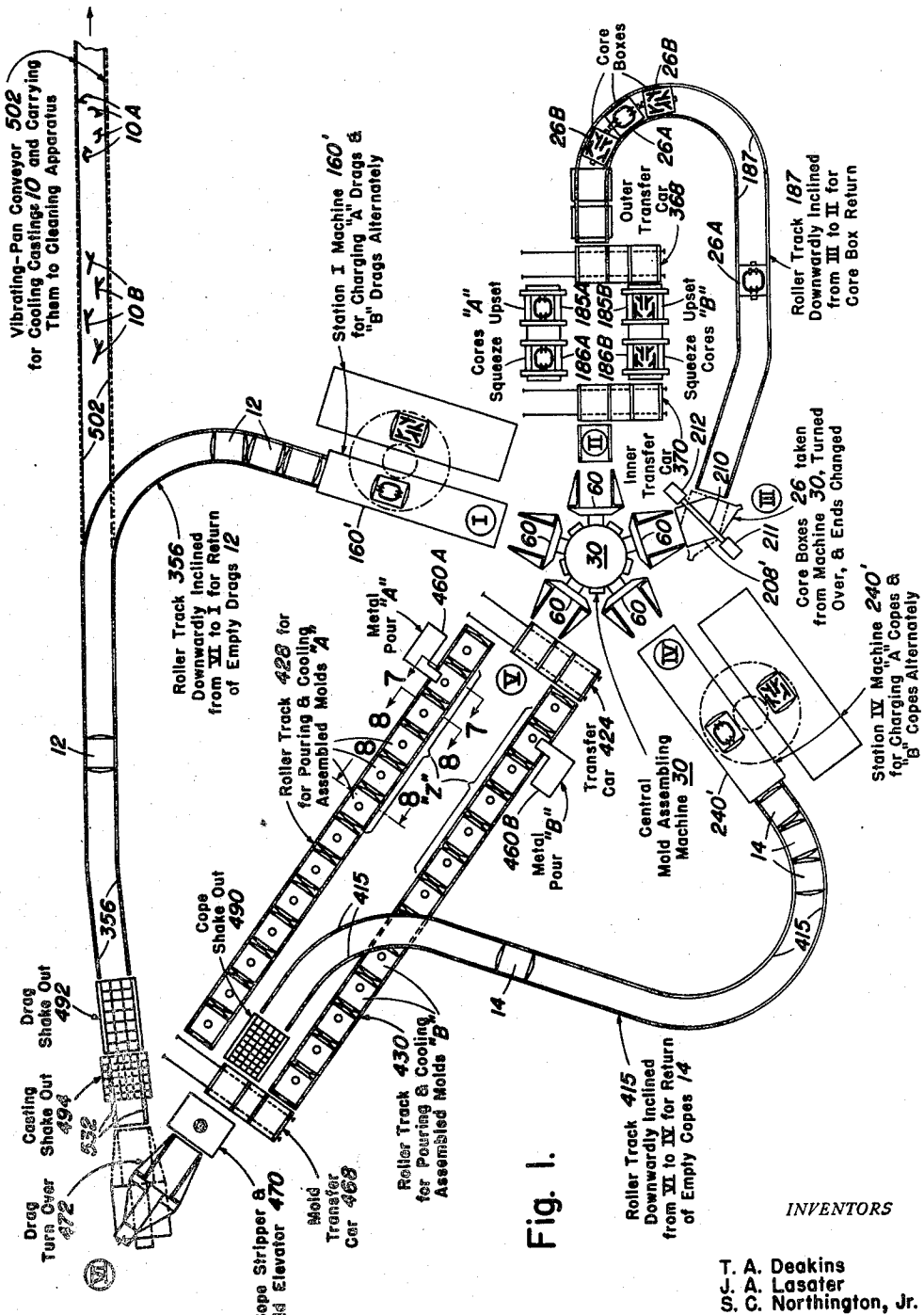


Fig. 1.

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COPE-TO-DRAG CLAMPING FACILITIES FOR MOLD ASSEMBLING INSTALLATION

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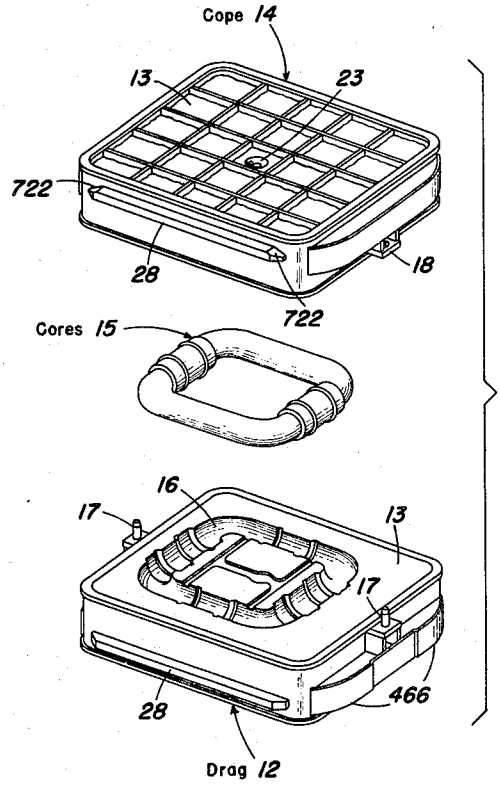


Fig. 2.

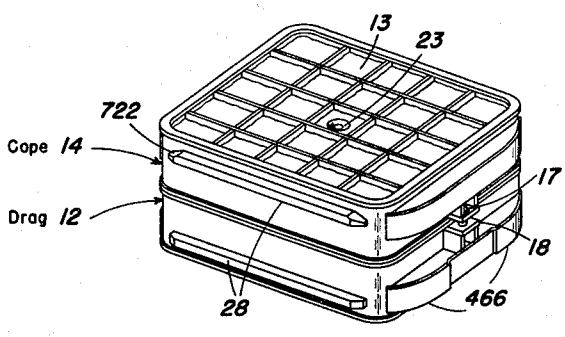


Fig. 3.

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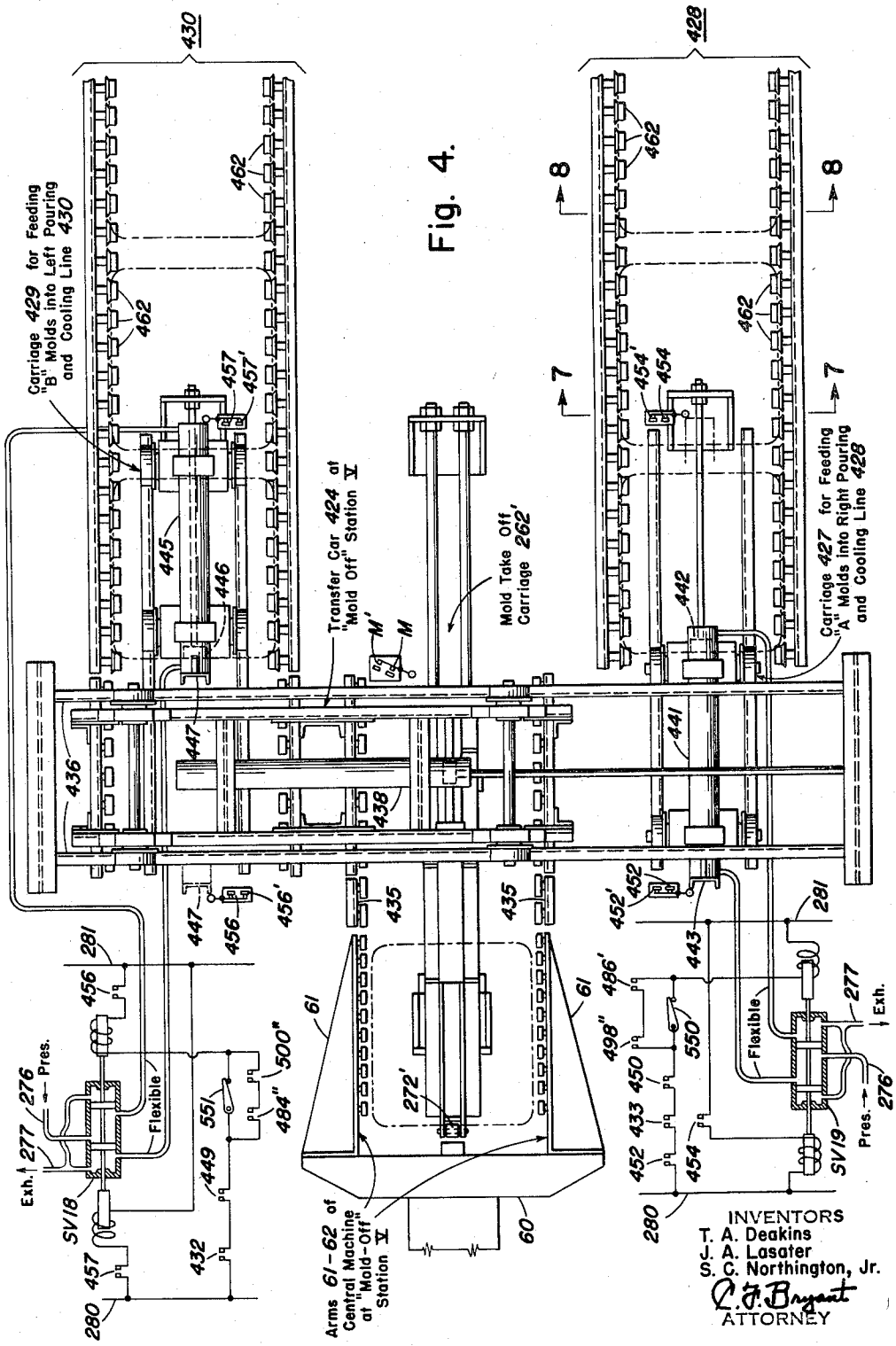
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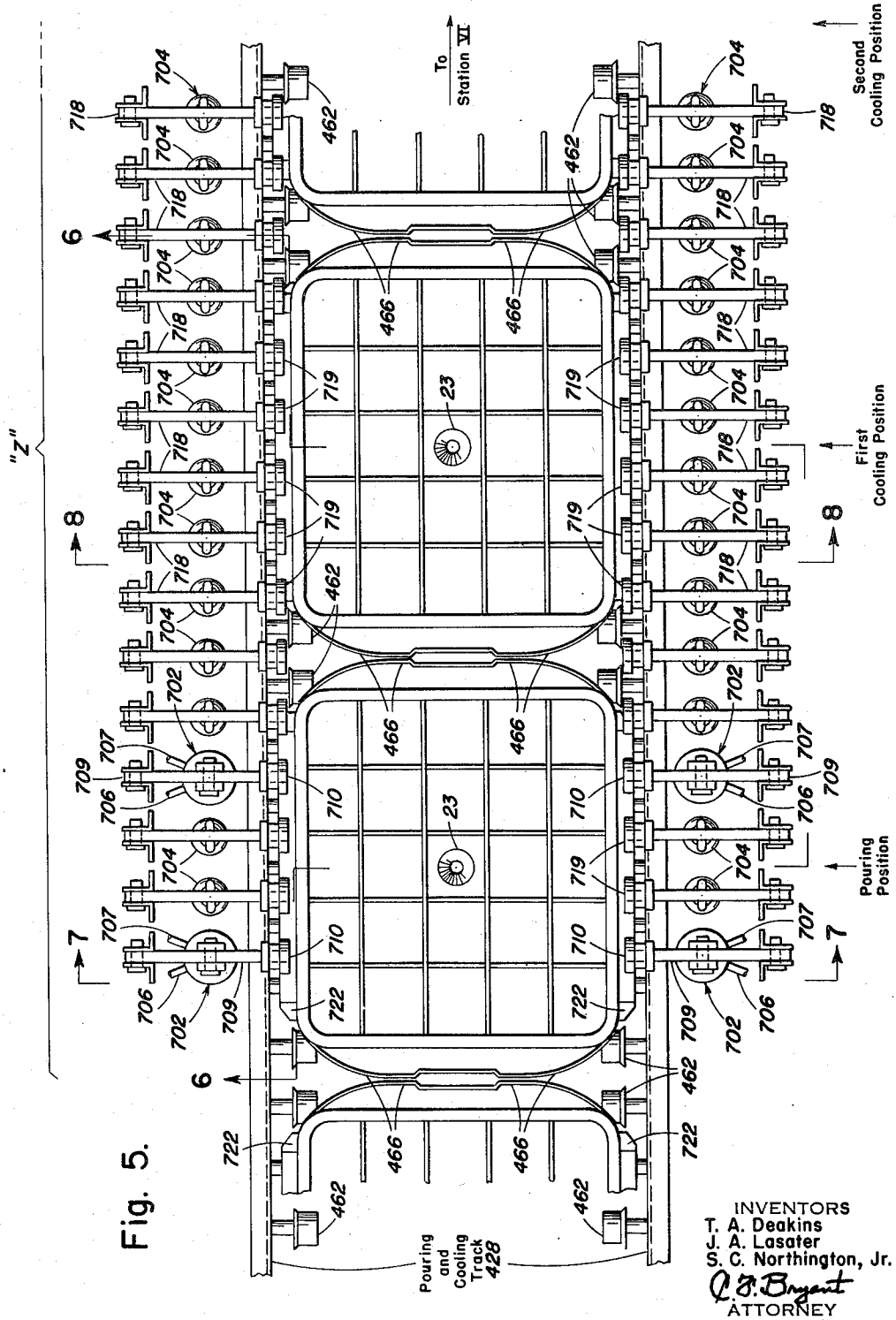


Fig. 5.

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COPE-TO-DRAG CLAMPING FACILITIES FOR MOLD ASSEMBLING INSTALLATION

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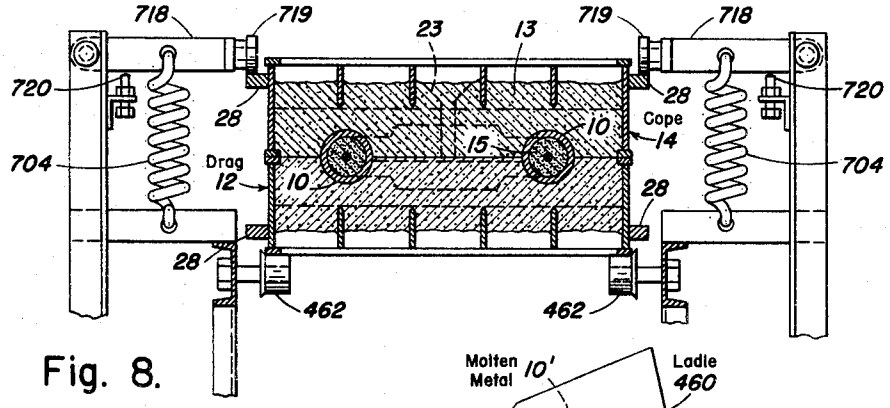


Fig. 8.

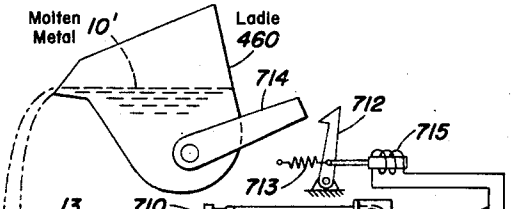
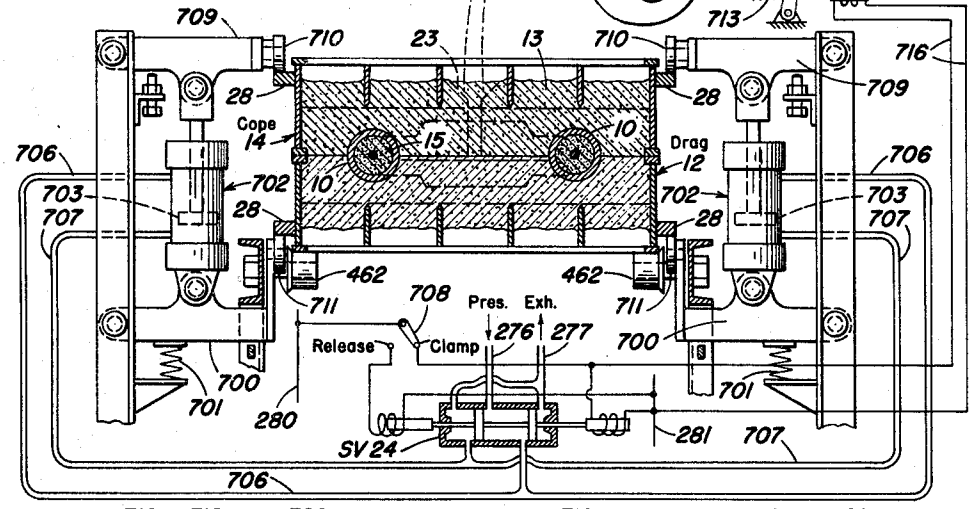


Fig. 7.



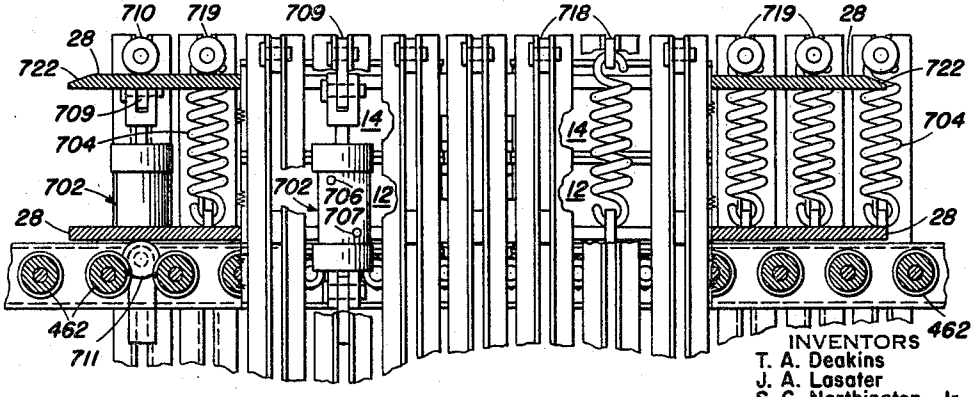


Fig. 6.

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2,942,312

COPE-TO-DRAG CLAMPING FACILITIES FOR MOLD ASSEMBLING INSTALLATION

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Filed June 9, 1958, Ser. No. 740,792

6 Claims. (Cl. 22—31)

This invention relates to new and improved means for clamping firmly together the cope and drag flasks of assembled foundry molds while and after molten metal is being poured into the casting cavities of those molds; and the subject matter of the present application is in part disclosed by and has in part been reproduced from an earlier application Serial No. 731,426 which was filed April 28, 1958 in the names of Thomas A Deakins and John A. Lasater and Samuel C. Northington, Jr. and which is entitled "Mechanized Facilities for Producing and Assembling Foundry Molds of Alternately Differing Types" and of which this present application is a continuation-in-part.

Broadly stated, the object of this invention is to provide improved cope-to-drag clamping means which are novelly organized to function in and uniquely coordinate with mold assembling systems such as are disclosed and claimed by the aforesaid earlier application Serial 731,426 and also by a still earlier application Serial 200,899 which was filed December 15, 1950, now abandoned, in the names of Samuel C. Northington Jr. and John A. Lasater and which on May 31, 1955 was replaced by a continuation application Serial 511,941 then filed on the same subject matter under title of "Apparatus and Method for Assembling Foundry Molds" and which continuation application issued on September 9, 1958 as U.S. Patent No. 2,850,775.

A more specific object is to equip each pouring and cooling track of a mold assembling system such as application Serial 731,426 represents with cope-to-drag clamping facilities which apply holding force only upon those assembled molds along the track that are within a track length span which includes and follows the point at which the molds have molten metal poured thereinto.

Another object is to provide a cope-to-drag clamping organization which holds the mold flasks together during pouring and while the poured metal is solidifying but which thereafter leaves the cope full free for subsequent stripping from the drag.

Additional objects and advantages will become apparent as the disclosure and description hereof proceeds.

An illustrative embodiment of this invention is shown by the accompanying drawings wherein:

Fig. 1 is a diagrammatic showing in top plan view of the mold assembling installation which our earlier application Serial 731,426 discloses and claims and which includes mold pouring and cooling tracks equipped with the cope-to-drag clamping means of this invention;

Fig. 2 is an exploded view showing the drag flask and cope flask and core components of one of the molds which the Fig. 1 installation assembles and pours;

Fig. 3 indicates how the drag and cope and core of Fig. 2 appear after having been brought together by the central assembling machine of said installation to produce an assembled mold;

Fig. 4 illustrates the Station V apparatus of Fig. 1 in an enlarged top plan view that reproduces Fig. 39 of earlier application Serial 731,426 and that shows certain

details of the mold transfer car and of the cooperating right and left ejector carriages by which "A" molds and "B" molds from the assembling machine respectively are fed upon the right and left pouring and cooling tracks that extend from Station V to the associated Station VI of Fig. 1 where cope stripping and drag turn over take place;

Fig. 5 is an enlarged top plan view of the "A" mold pouring and cooling track 428 of Figs. 1 and 4 showing the cope-to-drag clamping means of this invention applied thereto in the length span portion thereof which Fig. 1 designates as "Z";

Fig. 6 is a side elevation on line 6—6 of Fig. 5 showing two of the four hydraulic cylinders utilized at the pouring apparatus location to clamp together the cope and drag flasks of each mold which said track delivers to that location for the purpose of having molten metal poured thereinto;

Fig. 7 is an end elevation, partly in section, on line 7—7 of Figs. 1, 4 and 5 showing how the left and right pairs of said four cylinders at such pour location serve to apply clamping force upon each mold which arrives at said location and which there receives molten metal from the Fig. 1 pouring means; and

Fig. 8 is an end elevation, also partly in section, on line 8—8 of Figs. 1, 4 and 5 which shows two of the fourteen tension springs utilized at each of the next four mold locations along the pouring and cooling track for the purpose of applying downward holding force upon the cope side bars of each poured mold that advances along the track into and through those succeeding four locations.

The mold components to be assembled

The previously mentioned earlier applications Serial 511,941 and Serial 731,426 each discloses mold components such as are shown by Figs. 2–3 hereof, and the specifications of those two earlier applications each describe illustrative productions of castings in static molds prepared and assembled from such component parts.

As represented by Figs. 2–3 hereof, said mold parts include a lower flask half 12 referred to as the "drag," an upper flask half 14 referred to as the "cope," suitable sand 13 or the like packed into both the drag and the cope for receiving cavity impressions 16 from the casting pattern (not shown), and cores 15 (sand or other) which are placed within the mold cavity to form a hollow interior for the castings to be produced.

In the mold 12—14 here illustrated the aforesaid casting pattern and the cooperating cores 15 are both shaped to provide for simultaneously casting four quarter bend soil pipe fittings in each such mold when the Fig. 2 parts thereof are assembled as represented by Fig. 3. Said assembled mold as here shown by these Figs. 2–3 will hereinafter be referred to as of the "A" type; and the aforementioned quarter bend elbows which are cast therein are shown by our earlier application Serial 731,426 in Fig. 2 thereof at 10A. When viewed externally this "A" type mold can be distinguished by the central positioning of its sprue openings 23; see, for example, the line of these assembled "A" type molds which Fig. 1 hereof represents on the right pouring and cooling track 428.

Another or "B" type of mold which also will be referred to at later points in the description hereof has its sprue opening 23 offset towards one end; and a line of assembled "B" type molds with such offset sprue openings is represented by Fig. 1 hereof on the left pouring and cooling track 430 of the Fig. 1 system. Such "B" type molds differ internally from the illustrative "A" type molds of Figs. 2–3 hereof in that the patterns (not shown)

over which the drags **12** and copes **14** thereof are charged with sand and the cooperating cores **15** (also not shown) are shaped for the production of some different form of casting, such as the Y fitting which our earlier application Serial 731,426 shows at 10B in Fig. 7 thereof.

Each drag flask **12** and each cope flask **14** both for the "A" type mold of Figs. 2–3 and for the "B" type mold referred to above is provided with left and right side support bars **28** that during assembly of the mold parts are utilized in the way which earlier applications Serial 511,941 and Serial 731,426 both show and explain.

The drag flasks **12** for these "A" and "B" type molds further are provided with end bumpers designated **466** in each of Figs. 2, 3 and 5 hereof. These bumpers **466** on the drag ends project lengthwise slightly beyond the corresponding end parts of the mating copes **14** which are assembled upon the drags; and this relationship assures that end-to-end pushing force in a line of assembled molds, as on the "A" track **428** or on the "B" track **430** of Fig. 1, all will be transmitted through the bottom drags **12** with none of it being applied to the top copes **14** when resting upon these drags in the way which Fig. 3 shows.

Accurate alignment of each top cope **14** with the bottom drag **12** upon which it is assembled is maintained, both in the "A" type molds and in the "B" type molds, by pins **17** which upstand from the drag ends as shown by Fig. 2 and over which mating brackets **18** on the cope ends fit as shown by Fig. 3.

In the foundry installation upon which the drawings hereof are based, the molds to be prepared and assembled and poured and otherwise handled are relatively large and comparatively heavy. Each assembled mold shown at **12—14** in Fig. 1 hereof thus weighs approximately 2000 pounds before pouring and about 2200 pounds after molted metal has been filled thereinto; and it has inside dimensions of 32 inches by 36 inches and is 18 inches tall (bottom of drag to top of cope). Weights and sizes of this magnitude rule out manual handling and make mechanized manipulation imperative.

The complete mold assembling system of Fig. 1

The novel cope-to-drag clamping facilities of the present invention relate primarily to that portion of the Fig. 1 system of mold assembly which lies between the Mold-Off Station V thereof and the Cope Stripper and Drag Turn Over Station VI thereof. By way of introduction it now will be pointed out that said complete system of Fig. 1 is built around the central mold assembling machine represented at **30** and is organized, as taught by our earlier application Serial 731,426, to accomplish the preparation and assembly and pouring and breaking up of foundry molds **12—14** (Fig. 3 hereof) which alternately are of the "A" type (represented on the right pouring and cooling track **428**) and of the "B" type (represented on the left pouring and cooling track **430**).

This central machine **30** is equipped with a turret which is rotatable about a vertical axis and which is provided with five arm heads **60** that are spaced circumferentially (72° apart) around the turret. Each of these five arm heads **60** is mounted for roll over about a horizontal axis radial to the turret center; and carried by each head **60** are upper and lower sets of flask receiving arms that extend outwardly from the head in radial relation to the turret. Such upper and lower arm sets on each of the five turret heads **60** are arranged to be moved towards and away from each other; and each of these ten arm sets (details not fully shown here) is adapted to have a drag flask **12** or a cope flask **14** or a core box (not here shown) with cores **15** therein inserted endwise into the arms and there supported via the aforementioned left and right side bars **28** (Figs. 2–3) on the inserted flask or box.

Provision is made for successively advancing this turret of central machine **30** through the angular distance (72°) between arm heads **60** whereby each set of upper and lower arms progressively occupies at-rest positions spaced around the turret periphery's rotative path at the station locations designated I—II—III—IV—V in Fig. 1.

At the first or "Drag-On" Station I of Fig. 1 use is made of a drag-charging machine **160'** and associated facilities that function to insert into the upper arms of the turret heads **60** there successively coming to rest sand charged drag flasks **12** (Fig. 2) which alternately are of the "A" mold type and of the "B" mold type and each of which has its pattern impression **16** facing down.

At the second or "Core-On" Station II of Fig. 1 there are provided two parallel sets of core forming machines **185A—186A** and **185B—186B** plus outer and inner cooperating transfer cars **368** and **370**; and these facilities function to insert into the lower arms of the turret heads **60** there successively coming to rest core boxes (designated **26** in Fig. 1) with finished cores **15** (Fig. 2) therein, which cores **15** are of the same alternate "A" mold type and "B" mold type as the mating drag flasks **12** in the upper arms of those receiving heads **60** and each of which faces up from its carrying box.

Following Station II is a third or "Core-Box-Off" Station shown at III in Fig. 1; and cooperating with the turret of central machine **30** are control means responsive to advancement by the turret of each arm head **60** from Station II to Station III for first moving the upper and lower arms on that head together thus bringing the cores **15** into the drag **12**'s pattern cavity **16** (Fig. 2) and then rolling said arms through 180° about the head axis thus placing the drag **12** on the bottom and the cores **15** on top thereof with the core box **26** above the cores and then moving the two arms away from each other thus lifting the core box **26** free both of the drag **12** and the cores **15** now resting in the drag's pattern cavity.

At the aforesaid "Core-Box-Off" Station III is mechanism **208'—210—211—212** for withdrawing the empty and now inverted core boxes **26** out of the upper arms of the turret heads **60** there successively coming to rest, for turning each withdrawn core box over and interchanging its two ends, and for returning those turned over boxes **26** to "Core-On" Station II via a gravity track **187** in the same alternate "A" type and "B" type order as the boxes come out of machine **30** at III.

At the fourth or "Cope-On" Station IV use is made of a cope-charging machine **240'** and associated facilities that function to insert into the now-empty upper arms of the turret heads **60** there successively coming to rest sand charged cope flasks **14** (Fig. 2) which are of the same alternate "A" mold type and "B" mold type as the mating drag flasks **12** in the lower arms of those receiving heads **60** and each of which has its pattern impression facing down.

Following Station IV is a fifth or "Mold-Off" Station shown at V in Fig. 1; and cooperating with the turret of central machine **30** are control means responsive to advancement by the turret of each arm head **60** from Station IV to Station V for moving the upper and lower arms of that head together thus bringing the cope **14** down upon the drag **12** with the cope's pattern cavity fitting over the cores **15** now supported by the drag.

At the aforesaid "Mold-Off" Station V is a transfer car **424** plus cooperating facilities for withdrawing from the two closed arms of each turret head **60** there coming to rest the now assembled mold made up of the drag **12** and cores **15** and cope **14** brought together as just described; and the molds **12—14** thus withdrawn upon transfer car **424** alternately are of the "A" type and the "B" type earlier discussed.

And cooperating with central machine **30**'s turret are further control means responsive to advancement by the turret of each arm head **60** from Station V to the first named "Drag-On" Station I for moving the upper and lower arms on that head away from each other preparatory to repeating the mold assembly cycle outlined above.

In the installation reproduced by Fig. 1 hereof from our earlier application Serial 731,426 the so assembled

"A" type and "B" type molds as alternately taken from machine **30** at Station V are delivered by the aforesaid transfer car **424** into respective register with the earlier mentioned right pouring and cooling track **428** for those "A" molds and with the companion left pouring and cooling track **430** for those "B" molds. Fig. 4 hereof reproduces Fig. 39 from said earlier application Serial 731,426 and shows the Station V apparatus by which the so-delivered "A" molds and "B" molds are fed from car **424** upon those two pouring and cooling tracks.

Represented by Fig. 4 hereof are the take-off carriage **262'** which through latch **272'** pulls each assembled mold **12—14** from the Station V machine arms **61—62** and upon said transfer car **424**, all in the manner which earlier application Serial 731,426 explains by reference to its Fig. 41; the cylinder **438** which, when controlled as per Fig. 40 of earlier application Serial 731,426, drives car **424** back and forth between the entrance ends of the aforementioned right and left tracks **428** and **430**; the right carriage **427** with driving cylinder **441** which via upstanding member **443** (more fully shown by Fig. 42 of earlier appln. Serial 731,426) pushes each assembled "A" mold from car **424** upon said right pouring and cooling track **428**; and the left carriage **429** with driving cylinder **445** which via upstanding member **447** pushes each assembled "B" mold from car **424** upon said left pouring and cooling track **430**. These left and right feed cylinders **445** and **441** are governed by valves **SV18** and **SV19** and their associated control circuits, as our earlier application Serial 731,426 fully explains by reference to its Fig. 39.

During operation of the Fig. 1 mold assembling system, the above described Station V apparatus shown in Fig. 4 hereof alternately withdraws assembled "A" and "B" molds from the central machine **30** and at the same time feeds all such "A" molds successively upon the entrance end of right pouring and cooling track **428** and also feeds all such "B" molds successively upon the entrance end of the left pouring and cooling track **430**.

Once on its aforesaid track, each of these assembled molds **12—14** rides on left and right sets of side rollers which are shown at **462** in each of Figs. 4–5–6–7–8 as contacting and imparting support to the left and right bottom edges of the mold's drag flask **12**. All of these rollers preferably have the indicated outer side flanges by which said drag flask **12** of each carried mold is kept centralized on the track **428** or **430** (Figs. 1 and 4) along which it is proceeding.

The feeding of each additional mold upon the entrance end of each of these tracks **428** and **430** is accompanied by a pushing (via the aforementioned drag bumpers **466**) of all other assembled molds thereahead on that track along said track towards the exit end thereof; and during the time that each mold occupies the second position from its track entrance end, molten metal is poured into the mold's sprue opening **23** via suitable apparatus represented in Fig. 1 at **460A** for the "A" track **428** and at **460B** for the "B" track **460B**.

These right and left pouring and cooling tracks **428** and **430** are sufficiently long as to permit the castings **10** (see Figs. 7–8) in each of the "A" molds so poured at **460A** and the castings in each of the "B" molds so poured at **460B** fully to solidify and substantially to cool before the molds reach the Station VI apparatus at the track exit ends; and in the installation here illustrated each of said tracks accommodates the thirteen assembled molds which Fig. 1 shows thereon.

The aforesaid apparatus at Station VI is indicated by Fig. 1 as including a mold transfer car **468** plus a cope stripper and mold elevator **470** plus a drag turn over **472**. By this transfer car **468** and associated facilities the poured "A" and "B" molds arriving at Station VI via tracks **428** and **430** are fed into said cope stripper and mold elevator **470** successively and in alternate "A" and "B" order.

Each mold so received by said apparatus **470** first has its cope flask **14** stripped upwardly away from its drag flask **12** and castings **10**; the stripped cope **14** then is transferred (via facilities that our earlier application Serial 731,426 fully shows) from the elevator **470** upon a cope shake out which is shown at **490** in Fig. 1 and by which all sand is removed from such flask **14**; and this having been done the now-empty cope flask **14** passes from shakeout **490** upon a downwardly inclined gravity track **415** by which it is returned to the cope charging apparatus **240'** at Station IV.

The mold drag **12** and castings **10** from which the cope **14** has been stripped, as outlined above, now is transferred from the elevator **470** into the Station VI turn over device **472**. After receiving said drag **12** with castings, device **472** swings counterclockwise around a vertical axis to the dotted line position of Fig. 1 where it is in register with a track **532** which leads to a casting shakeout **494** and a drag shakeout **492**. Here the device **472** rotates around a horizontal axis through 180° and turns the drag flask **12** over with an accompanying dropping of the castings **10** out of the drag.

Said dropped out castings **10** next are pushed from device **472** upon the casting shakeout **494**; the turned over drag flask **12** likewise is advanced by way of track **532** upon the drag shakeout **492** where all sand is removed therefrom; and this having been done the now-empty drag flask **12** passes from shakeout **492** upon a downwardly inclined gravity track **356** by which it is returned to the drag charging apparatus **160'** at Station I.

Meanwhile the mold castings **10** as delivered from said turned over drag **12** upon the casting shakeout **494** in the manner aforesaid are there freed of all sand and thence passed upon a conveyor shown at **502** in Fig. 1. By this conveyor **502** said finished castings **10** are carried away from Station VI (to the right in Fig. 1) and delivered into suitable cleaning equipment (not shown) through which they pass in preparation for shipment.

In going through and being acted upon by our Station VI apparatus, each drag **12** of an "A" type mold yields the four solidified castings which Fig. 1 shows at **10A** on conveyor **502** at the extreme right thereof, while each drag **12** of a "B" type mold similarly yields the four solidified castings which Fig. 1 shows at **10B** closer to Station VI. Since the assembled and poured molds from Station V are fed into said Station VI apparatus in alternate "A" and "B" order, the sets of finished castings **10A** and **10B** from the turned over drags **12** thus also are delivered in the same alternate "A" and "B" sequence upon the castings conveyor **502**; and they there thus line themselves up in the alternate "A" and "B" groups which Fig. 1 represents.

The new cope-to-drag clamping means of our invention

Our new cope-to-drag clamping facilities of the present invention are installed in the just described assembling system of Fig. 1 along each of the pouring and cooling tracks **428** and **430** between Mold-Off Station V and Cope Stripper and Drag Turn Over Station VI; they function to hold the cope **14** of each mold in said "A" line **428** and the cope **14** of each mold in said "B" line **430** firmly against the mold drag **12** therebeneath while and after molten metal is being poured into the mold, as from the ladle **460** of Fig. 7; and they take the place of and do the same thing (but in a better way) as the conventional mold end clamps which earlier application Serial 511,941 shows at 19 in its Figs. 4–5.

At the location on track **428** of "A" mold alignment with the Fig. 1 pouring apparatus **460A** and at the location on track **430** of "B" mold alignment with the Fig. 1 pouring apparatus **460B**, these clamping means utilize the four hydraulic cylinders (two on mold left plus two on mold right) which Figs. 5–6–7 show at **702**; and at each of the four immediately following mold locations on these two tracks **428** and **430** our flask holding means

utilize the fourteen tension springs which Figs. 5, 6 and 8 represent at **704**. Six such tension springs **704** also are shown by Fig. 5 as supplementing the four clamping cylinders **702** at the Fig. 7 pouring location there represented.

Figs. 1 and 5 each designate as "Z" the length of track span that includes the five mold positions which are so equipped with our cope-to-drag holding facilities. Such five-position length of this span "Z" is merely illustrative, because in an operating installation the particular length actually required will be governed both by how many poured molds per minute are advanced along the track away from the pouring location, and by how much mass of metal the castings **10** of those poured molds contain. As the speed of poured mold travel along the cooling track increases, more track length must be included in span "Z" if the poured metal is to solidify before each mold leaves that span; and the same is true as the thickness and mass of the molten metal in the poured castings is made greater and the time needed for solidification becomes correspondingly longer.

Looking first at the "pouring location" clamp devices **702** of Figs. 5–6–7, each of these four cylinders has upper and lower ports **706** and **707** which at proper times receive pressure fluid from a hydraulic control valve SV24 with which fluid pressure and exhaust lines **276** and **277** are connected in the manner shown by Fig. 7. The left and right windings of this valve are selectively energized over a switch **708** from electrical supply conductors **280** and **281**.

Switch **708** when in the represented right or "clamp" position energizes the right SV24 winding and by shifting the valve elements to the right causes pressure fluid from line **276** to flow via conduit **706** into the top ports of all four of the cylinders **702**. The resultant downward movement of all four pistons **703** pulls the four upper pivoted clamp arms **709** towards the four lower pivoted clamp arms **700** and in this way sets up clamping forces which rollers **710** on the upper arm ends exert downwardly upon the side bars **28** of the cope flask **14** and which rollers **711** on the lower arm ends exert upwardly upon the side bars **28** of the drag flask **12**. Such forces pull and hold that cope firmly against the mold drag **12** therebeneath; and the clamping force applied in this novel way is of the order of many hundred pounds.

The aforesaid switch **708** of Fig. 7 is moved to this right or "clamp" position each time that an assembled mold **12—14** arrives on track rollers **462** into said pouring position where the mold sprue opening **23** is in register with the spout of the Fig. 7 pouring ladle **460**; and the resultant clamping forces described above are applied and maintained during the entire time that molten metal **10'** is being poured into the mold.

If desired said pouring ladle **460** can be interlocked with the clamp cylinders **702** in such manner that movement of the ladle out of its untilted or level position is possible only when said switch **708** is in said "clamp" position. This may be done through the use of a latch **712** normally held by spring **713** over the end of ladle arm **714** when ladle **460** is level or untilted, but pulled to the right out of engagement with arm **714** when solenoid **715** is energized over conductors **716** and switch **708** in its right "clamp" position. Ladle **460** then and only then can be tilted to accomplish the pouring which Fig. 7 represents.

Following completion of such pouring, switch **708** is moved to its left or "release" position. This energizes the left winding of valve SV24 with accompanying shift of the valve elements to the left and resultant flow of pressure fluid from line **276** and via conduit **707** into the lower ports of all four cylinders **702**. All four pistons **703** accordingly now move upwardly thereby raising clamp arms and rollers **709—710** away from the side bars **28** on the mold cope **14** (see Fig. 7) while removing the upwardly acting clamping force from the lower rollers **711**. Compression springs **701** beneath the lower clamp arms **700** now continue to hold those arms in the generally horizontal position which Fig. 7 represents. Also, latch **712** now is moved by spring **713** (solenoid **715** being deenergized) to the left over the end of arm **714** thereby locking ladle **460** in the level or untilted position.

The thus poured mold now is free for movement out of the "pouring position" shown by Figs. 7 and 1 and so marked in Fig. 5. But while in that position before such movement the poured mold has its cope and drag held together by the several tension springs **704** which Fig. 5 shows between and beside the four clamp cylinders **702** and each of which is arranged as described below.

The mentioned movement of the mold out of said pouring position takes place when another assembled mold is pushed at Station V upon the entrance end of the pouring and cooling track; and this advances said just poured mold into the "first cooling position" that is so designated in Fig. 5. There the side bars **28** of the mold cope **14** continue under and are engaged by rollers **719** on the ends of pivoted arms **718**.

Each of these arms **718** throughout the entire track span "Z" is pulled downwardly by its earlier described tension spring **704**; and each of these springs **704** can if desired be provided with suitable means (not shown) for adjusting the tension. Stop bolts **720** limit downward movement of arms **718** to a point where the lower edge of each roller **719** stays slightly above the bottom face of each cope side bar **28** on the poured mold that is newly arriving. Provision of the taper which Figures 2, 3, 5 and 6 show at **722** on the ends of said cope side bars **28** enables those bars on said newly arriving mold to pass under said rollers **719**.

By raising the holding arms **718** against springs **704**, such passage builds up a suitably large holding force which acts downwardly upon these end-tapered side bars **28** of the mold cope **14** and thereby holds that cope firmly down upon the mold drag **12** therebeneath. That drag rests upon and is supported by the track rollers **462**; and said holding force continues to be applied to the cope side bars **28** as long as the mold remains in said "first cooling position" of Fig. 5.

In later moving along the track out of said first cooling position and into the next or "second cooling position" of Fig. 5, the poured mold has applied thereto while in the latter position a cope-to-drag holding force which again is produced by springs **704** in the same manner as just explained. And in thereafter moving further along the track into the third and then on into the fourth cooling position of Fig. 1, the very same cope-to-drag holding actions are repeated.

Still further movement by the mold beyond the span of track length designated "Z" in Fig. 1 is accompanied by a complete freeing of the mold from all of the clamping and loading forces which were applied thereto while the mold was in said track span "Z."

Upon later arrival at Station VI, at the exit ends of tracks **428** and **430**, the cope **14** of each of these molds in both the "A" line **428** and the "B" line **430** thus no longer is secured to its associated drag **12** and hence may freely be lifted therefrom without the need of the "unfastening" operation that is required when using mold end clamps of the conventional type which earlier application Serial 511,941 shows at 19 in its Figs. 4–5.

Our inventive improvements as here shown and described are therefore extensive in their application and hence are not to be limited to the specific form here disclosed by way of illustration.

What we claim is:

1. In an installation for assembling and pouring foundry molds, the combination of a pouring and cooling track, means for feeding assembled molds successively upon the entrance end of that track with accompanying pushing of other assembled molds thereahead on the

track along said track towards the exit end thereof, each of said assembled molds being made up of a drag flask which is equipped with left and right outer support bars extending along its left and right sides and which carries on its top a cope flask that likewise is provided with left and right outer support bars extending along its left and right sides, apparatus adjacent said track near said entrance end thereof for pouring molten metal into each of the said assembled molds which comes into register with that apparatus, and cope-to-drag holding means along each of the right and left sides of said track within a length span thereof which includes and follows the location of said pouring apparatus, said left-side-track means and said right-side-track means being operative respectively to engage and pull towards one another the said left side bars of the cope and drag and the said right side bars of the cope and drag with an accompanying forcing of the cope flask of each of the molds that is on said track within said length span firmly down upon the mold drag therebeneath whereby the cope and drag flasks of each of those molds are securely held together while and after said molten metal is being poured into the mold.

2. In a mold assembling installation which utilizes a pouring and cooling track plus means for feeding assembled molds successively upon the entrance end of that track with accompanying pushing of other assembled molds thereahead on the track along said track towards the exit end thereof, each of said assembled molds being made up of a drag flask which is equipped with left and right outer support bars extending along its left and right sides and which carries on its top a cope flask that likewise is provided with left and right outer support bars extending along its left and right sides, the combination of apparatus associated with said track near the said entrance end thereof for pouring molten metal into each of the said assembled molds which is advanced upon that track into a position of register with said apparatus, cope-to-drag clamping devices at said pouring position there disposed along each of the left and right sides of said track and being normally released but effective when activated to engage and pull towards one another the said left side bars of the cope and drag and the said right side bars of the cope and drag with an accompanying holding of the cope flask of each such registering mold firmly down upon the mold drag therebeneath, and means operative while said molten metal is being poured into each registering mold for activating said devices and causing them then to hold the cope and drag flasks of that mold securely together.

3. The combination defined by claim 2 wherein said cope-to-drag holding devices along the left and right track sides are in the form of hydraulic cylinders.

4. In a mold assembling system, the combination of a pouring and cooling track, means for feeding assembled molds successively upon the entrance end of that track with accompanying pushing of other assembled molds thereahead on the track along said track towards the exit end thereof, each of said assembled molds being made up of a drag flask which is equipped with left and right outer support bars extending along its left and right sides and which carries on its top a cope flask that likewise is provided with left and right outer support bars extending along its left and right sides, apparatus associated with said track near the said entrance end thereof for pouring molten metal into each of the said assembled molds which is advanced upon that track into a position of register with said apparatus, cope-to-drag clamping devices at said pouring position there disposed along each of the left and right sides of said track and being operative respectively to engage and pull towards one another the said left side bars of the cope and drag and the said right side bars of the cope and drag with an accompanying holding of the cope flask of each such registering mold firmly down upon the mold drag therebeneath during the period that molten metal is being received by the mold from said pouring apparatus, said clamping devices being released at other times whereby the track-carried molds are freely moveable into and are freely moveable out of the aforesaid pouring position, and other sets of cope-to-drag holding means disposed along said track at succeeding mold positions immediately following the said pouring position, each said other holding means set being effective to exert upon each poured mold coming into register therewith a force which continues to hold the cope and drag flasks of that mold together while cooling of the poured castings within the mold is in progress.

5. In a mold assembling installation, a pouring and cooling track, means for feeding assembled molds successively upon the entrance end of that track with accompanying pushing of other assembled molds thereahead on the track along said track towards the exit end thereof, each of said assembled molds being made up of a drag flask which is equipped with left and right outer support bars extending along its left and right sides and which carries on its top a cope flask that likewise is provided with left and right outer support bars extending along its left and right sides, apparatus associated with said track near the said entrance end thereof for pouring molten metal into each of the said assembled molds which is advanced upon that track into a position of register with said apparatus, cope-to-drag clamping devices at said pouring position there disposed along each of the left and right sides of said track and being operative respectively to engage and pull towards one another the said left cope and drag side bars and the said right cope and drag side bars with an accompanying holding of the cope flask of each such registering mold firmly down upon the mold drag therebeneath while molten metal is being received by the mold from said apparatus, and other sets of cope-to-drag holding means disposed along said track at succeeding mold positions immediately following the aforesaid pouring position and consisting of spring-loaded members on the two track sides arranged to exert upon the cope of each poured mold coming into register therewith a downward force which continues to hold that cope against the track-supported mold drag therebeneath while cooling of the poured castings within the mold is in progress.

6. In an installation for assembling and pouring foundry molds, the combination of a pouring and cooling track, means for feeding assembled molds successively upon the entrance end of that track with accompanying pushing of other assembled molds thereahead on the track along said track towards the exit end thereof, each of said assembled molds being made up of a drag flask which is equipped with left and right outer support bars extending along its left and right sides and which carries on its top a cope flask that likewise is provided with left and right outer support bars extending along its left and right sides, apparatus associated with said track near said entrance end thereof for pouring molten metal into each of the said assembled molds which is advanced upon that track into a position of register with said apparatus, cope-to-drag clamping devices at said pouring position there disposed along each of the left and right sides of said track and being effective when activated to engage and pull towards one another the said left side bars of the cope and drag and the said right side bars of the cope and drag with an accompanying holding of the cope flask of each such registering mold firmly down upon the mold drag therebeneath while molten metal is being received by the mold from said apparatus, and other cope-to-drag holding means disposed along said track throughout a limited cooling span thereof immediately following said pouring position and serving to exert upon the cope of each poured mold coming into register therewith a downward force which continues to hold that cope against its track-supported drag therebeneath while

cooling of the castings within the mold is in progress, said last mentioned holding force being applied to said poured molds only while they are within the aforementioned limited span of cooling track whereby each such poured mold with cooled castings therein later is delivered to the exit end of said track with the cope thereof fully free for subsequent stripping from the drag and the castings thereof.

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