

March 6, 1951

F. J. DOFSEN ET AL
PROCESS OF FORMING AN ARTICLE
FROM AT LEAST TWO PLASTICS

2,544,140

Filed Dec. 9, 1947

2 Sheets-Sheet 2

Fig. 10.

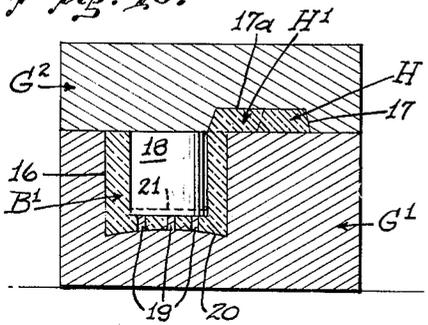


Fig. 11.

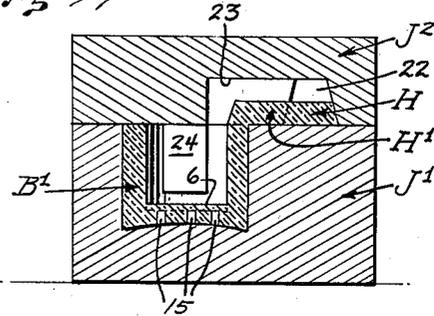


Fig. 12.

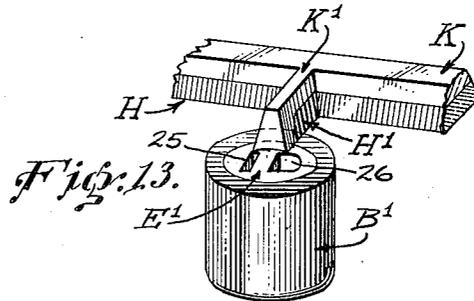
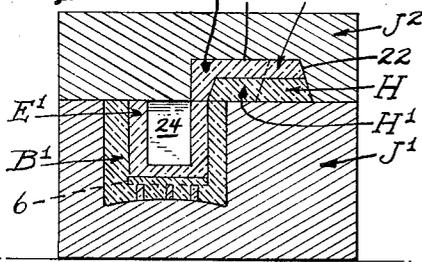
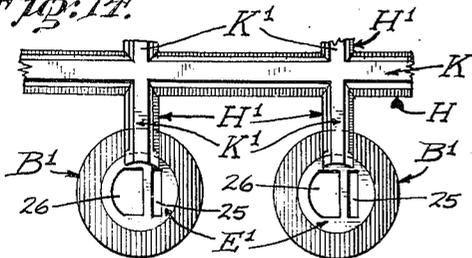


Fig. 14.



INVENTOR.
FLOYD U. DOFSEN &
BY ELMER L. DANIELSON.
Munn, Liddy & Glacum
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,544,140

PROCESS OF FORMING AN ARTICLE FROM AT LEAST TWO PLASTICS

Floyd J. Dofsen, Millbrae, and Elmer L.
Danielson, Oakland, Calif.

Application December 9, 1947, Serial No. 790,676

3 Claims. (Cl. 18—59)

1

The present invention relates to a process for forming an article from at least two plastics. It consists of the steps of the process hereinafter described and claimed.

An object of our invention is to provide a process for forming an article from at least two plastics, which embody improvements over the form of the invention shown in our copending application on a Process and Apparatus for Bonding Thermoplastic Materials, Serial No. 761,128, filed July 15, 1947, now Patent No. 2,492,973. In the copending application, one part of the article is cast in a mold so that a plurality of these parts will be interconnected to each other by a runner, and branch runners will extend from the main runner to the individual parts. The runner and its branches interconnect all of the parts as a unit at the completion of the first casting operation and then the device is removed from the first mold and placed over a plurality of cavities in a second mold corresponding in number to the number of parts, the parts being positioned above the cavities. The parts then are severed from their branch runners and drop into their respective cavities by gravity. The second mold then is closed and a second plastic forced into the cavities to combine with the cast articles already disposed therein and produce a completed article comprising two different plastics.

The principal object of our invention is to do away with the necessity of severing the parts from the branch runners after the first casting and dropping them into the cavities of the second mold. We have found it possible to manufacture the two-plastic articles by casting a plurality of the article bodies in one mold, these bodies being connected to each other as a unit by the main and branch runners. The bodies can be lifted from the first mold as a unit and transferred to a second mold having a plurality of cavities for receiving the precast bodies and also having grooves for receiving the precast main and branch runners. The second mold is provided with an additional groove and branch grooves paralleling the grooves receiving the precast runner and its branches. The additional grooves in the second mold have their outer faces closed by the precast runners when the second mold is closed. The injection of a second plastic into the second mold will form the other part of the plastic article; and then upon opening the second mold, the completed two-plastic articles can be removed with their integral two runners and their branch runners as a single unit. The articles then may be separated from their branch runners, thus

2

completing the manufacture of the two-plastic articles.

In the forming of the bodies in the first operation, the mold may form recesses in the outer surface of the bodies and these recesses will be filled with the second plastic during the second molding operation.

The present invention is also an improvement over the invention shown in another copending application on a method and apparatus for severing sprues from a molded part and simultaneously molding a second plastic to the part. That application was filed August 26, 1947, and the serial number is 770,594 and is now Patent No. 2,510,091. In that application the several plastic parts going to make up a plurality of articles are cast simultaneously and are inter-connected by a runner and branch runners. These precast parts then are transferred to a second mold having a groove and branch grooves for receiving the precast runner and its branches. The closing of the two parts of the second mold prior to the injection of the second plastic, severs the branch runners from their parts. At the completion of the second molding operation, the branch runners formed during the second injection of plastic must be severed from the completed articles. This requires two distinct steps of severing branch runners from plastic articles at two separate time intervals; the first being accomplished upon the closing of the second mold, and the second being carried out after the articles are removed from the second mold. In the present invention, a single severing of both branch runners, one to each plastic, at the same time is accomplished after the two-plastic articles and their runners are removed from the second mold.

Another advantage of holding the precast bodies of the articles to a main runner while transposing them from one mold to a second mold lies in the fact that all of the bodies are retained in a particular position with respect to each other while being transferred and, therefore, the addition of the second plastic to the articles will cause it to form bores in the proper position with respect to the bodies. In the case of making keys, for example, where the characters on the keys are initially formed as slots in the bodies during the first casting operation, the subsequent addition of the second plastic to fill the slots and also to fill a portion of the key interiors can be made with the keys in their same relative positions and, therefore, the provision of key shank-receiving bores in the keys can be ar-

3

ranged in proper relation with respect to the characters.

Other objects and advantages will appear in the following specification, and the novel features of the device will be particularly pointed out in the appended claims.

Our invention is illustrated in the accompanying drawings forming a part of this application, in which:

Figure 1 is a transverse section through our first mold showing the casting of the plastic body of the article;

Figure 2 is a transverse section through a second mold and illustrates the placing of the precast body and its main and branch runners in position ready for the second molding operation;

Figure 3 is a transverse section through the second mold and shows the completion of the second molding operation;

Figure 4 is a bottom plan view of the completed article, looking in the direction of the arrows IV—IV in Figure 3, the article shown attached to the two branch runners and removed from the mold;

Figure 5 is a perspective view of the top of an article as it appears after the first casting operation;

Figure 6 is a top plan view of a plurality of the articles interconnected by the runners and branch runners formed of the two plastics;

Figure 7 is a transverse section taken along the line VII—VII of Figure 3, and shows the completed article when removed from the second mold and freed from its branch runners;

Figure 8 is a top perspective view of the completed two-plastic article;

Figure 9 is a bottom perspective view of the same article;

Figure 10 is a transverse section of a mold used in making the first part of a modified form of the article;

Figure 11 is a transverse section through a second mold and shows the precast article from the modified first mold placed therein;

Figure 12 is a view similar to Figure 11 and illustrates the complete two-plastic article at the end of the second molding operation;

Figure 13 is a perspective view of the bottom side of the completed modified article still attached by two branch runners to the two main runners; and

Figure 14 is a bottom plan view of two of the completed modified articles interconnected to each other by the branch and main runners.

While we have shown only the preferred forms of our invention, it should be understood that various changes or modifications may be made within the scope of the appended claims without departing from the spirit and scope of the invention.

In carrying out our invention, we provide a mold in Figure 1 comprising a lower half A1 and an upper half A2. The lower mold half has a plurality of cavities 1 provided therein, although we show only one cavity in Figure 1. Any type of plastic article can be formed and we have shown the cavity shaped to form the body B of a key. The key may have any desired character on its concave face and, therefore, we show the bottom of the cavity as being made convex at 2 and provided with a projection 3 to form the desired character. The character chosen to be represented is the number "8" and a cross section through the mold will show the projection 3 as composed

4

of three portions representing the top, middle and bottom of the number "8."

The upper mold half A2 has a longitudinally-extending groove 4 therein that has inclined sides so that any thermoplastic which sets in the groove may be readily removed therefrom due to the draft or inclination of the sides. The groove 4 has branch grooves 4a extending laterally therefrom at an angle and these branch grooves communicate with the cavities 1 in the lower mold half A1 as indicated in Figure 1. When the two halves of the mold are closed and the plastic is injected from one end of the mold into the groove 4, it will flow along the groove and then into the branch grooves 4a and finally into the cavities 1 to form the bodies B of the keys.

The upper mold half A2 carries depending cores 5 that enter the cavities 1 and cause the plastic to form hollow bodies. Each body will have a slot in its outer concave surface corresponding to the shape of the character formed by the projection 3 and extending up to the end of the core 5. In the forming of an entirely enclosed circular character, such as the number "8," a bridge 6 must be formed, see Figure 5, so as to support the central portions 7 of the number. The lower end of the core 5, therefore is provided with a groove 5a and the plastic in the first molding operation will fill this groove to form the bridge 6. The top portion of the key body is indicated at B in Figure 5 and the bridge 6 is clearly shown connecting and supporting the central portions 7 of the number "8" to the body.

The injection of the plastic at one end of the mold will cause a runner C to be formed in the groove 4 and branch runners C1 or sprues to be formed in the branch grooves 4a. The branch runners will be integral with the key body B. When the plastic has set, the mold is opened and the runner C will lie on top of the lower mold half A1 where it may be readily removed from the mold and will carry with it the bodies B. Figure 6 illustrates how branch runners or sprues C1 project from both sides of the main runner C so key bodies B can be cast on both sides of the main runner.

In Figure 2, we show a second mold comprising a lower half D1 and an upper half D2. The lower half has cavities 8 therein for receiving the precast plastic bodies B and the upper mold half has a groove 9 therein for receiving the runner C and branch grooves 9a for receiving the branch runners or sprues C1. In addition, the lower mold half D1 has a groove 10 paralleling the groove 9 when the two halves of the second mold are closed and the groove 10 is substantially the same in cross sectional dimensions and shape as the groove 9. The arrangement is such that when the second mold is closed the outer face of the runner C will close the top of the groove 10. Figure 2 represents the second mold with the key body B and its runner in position just prior to the injection of the second plastic.

In Figure 3 we show the same mold as in Figure 2 and further illustrate the completed injection of the second plastic. It will be noted from Figures 2 and 3 that a branch groove 10a extends from the groove 10 and this groove communicates with a second branch groove 11 that parallels the branch groove 9a and is arranged along its side. If desired, the branch groove 11 may be of less depth than the groove 9a and this is indicated in Figure 3. This arrangement allows the branch runners or sprues C1 to project into the branched grooves 9a above the tops of

5

the branch grooves 11, thus holding the branch runners C1 relating to the mold half D2. The branch groove 11 extends to the cavity 8 at a point where the second plastic may be injected into the interior of the key body B.

A bore 12, see Figure 9, for receiving a key shank, not shown, is formed in the key and this is accomplished by providing a core member 13 of the shape of the desired bore 12, this core member being carried by the upper mold half D2 and extending into the interior of the body B of the key. A second core, not shown, and carried by the upper mold half D2 may enter the interior of the key body to form a recess 14 that is arranged along the side of the bore 12. In making the second plastic injection, the two halves D1 and D2 of the second mold are closed and a second plastic, preferably of a different color from the first, is forced into the groove 10 of the lower mold half D1 and will flow along this groove to form a runner F and into the branch grooves 10a which communicate with the branch grooves 11 in the upper mold half D2. The second plastic in the branch grooves will form the branch runners or sprues F1. From the branch grooves 11, the second plastic will flow into the interior of the key body B and will form a key plug E or insert that will have the bore 12 and the recess 14 formed therein.

It will be seen from Figure 3 that a portion of the second plastic will fill the slot 15 formed by the projection 3 to form the character 15a on the key, such as the number "8." When the recess 15 is filled with plastic, the bridge 6 will be concealed with the result that the number "8" will appear on the top of the key and be of a different color than the key body. This number is shown at 15a in both Figures 6 and 8. As soon as the second plastic has set, the second mold may be opened and the completed keys with their runners C and F and branch runners C1 and F1 removed therefrom as a unit. The resulting article of manufacture is shown at Figure 6.

The flowing of the second plastic in the grooves 10 and branch grooves 10a and 11 will form the second runner F which will parallel the first runner C and will also form branch runners or sprues F1 which will parallel the branch runners C1. Figure 4 illustrates how the branch runners F1 are arranged along the sides of the branch runners C1, while Figure 3 illustrates how the runner F is positioned under the runner C. The completed two-plastic keys may be readily removed from the branch runners C1 and F1 by breaking the keys therefrom at the points where the branch runners or sprues join the keys. The finished keys are shown in Figures 7 to 9, inclusive.

One advantage of retaining the key bodies on the branch runners C1 is to maintain the recesses 15 forming the different characters on the keys in proper relation with respect to each other and the molds. When now the second plastic is injected into the second mold after the key bodies and their runners have been placed in the second mold, the formation of the bores 12 in the key plugs or inserts E will dispose the bores in their proper relation with respect to the characters 15a on the keys. The mounting of the keys on the key shanks, not shown, of the machine will dispose the key characters in their proper positions on the key board.

Another advantage of injecting the second plastic so that the runners and branch runners F and F1 will parallel the runners and branch

6

runners C and C1, lies in the fact that the keys may be severed from both branches C1 and F1 with substantially the same ease as if only one branch runner were being severed. The key bodies B act as the cavities for receiving the second plastic to form the inserts E.

In Figures 10 to 14, inclusive, we show a slightly modified form of the invention. The mold illustrated in Figure 10 consists of a lower half G1 and an upper half G2. The latter has a plurality of cavities 16 therein. These cavities are in the shape of the articles to be cast and we have indicated these articles as being key bodies B1. The upper half G2 has an elongated groove 17 with branch grooves 17a leading therefrom and communicating with the cavities 16. Cores 18 are carried by the upper mold half G2 and there are as many cores as there are cavities 16. The cores extend into the cavities as illustrated. The lower half G1 has a projection 19 in the shape of the desired key character, such as the number "8," and this projection extends above the convex bottom 20 of the cavity. The lower end of the core 18 has a diametrically-extending groove 21 for forming the bridge 6 shown in Figure 5.

The first operation is the injection of the plastic material under the desired pressure at the end of the mold and the material is directed into the groove 17, branch grooves 17a and cavities 16, to form an elongated runner H with branch runners or sprues H1. The branch runners or sprues are connected to the key bodies B1 so that opening of the mold will permit the exposed runner H to be removed and carry with it the key bodies connected thereto. This completes the first operation of forming the keys. The key bodies are hollow and will have slots or recesses 15 in their concave tops corresponding to the desired characters which are to be formed in the keys.

Figure 11 shows the second mold comprising the lower half J1 and the upper half J2 in cross section. The runner H is received in a groove 22 formed in the upper half and the branch runners H1 are received in branch grooves 23. It will be noted that the elongated groove 22 is deeper than the thickness of the runner H; also, the branch grooves 23 are deeper than the thickness of the branch runners H1. This arrangement provides the groove 22 with an interior space for receiving the second plastic material and likewise the branch grooves 23 are made deep enough to have an interior space for receiving the second plastic material.

Figure 12 illustrates the completion of the second operation in flowing of the second plastic material under pressure into the portion of the groove 22 that has been left open by the runner H. The second material forms a runner K that overlies the runner H. The second plastic will flow into the portions of the branch grooves 23 not occupied by the branch runners H1 and will form branch runners or sprues K1 that are superimposed on the branch runners H1. The grooves 22 and 23 are formed in the upper mold section J2. This mold section carries core members 24 that project into the hollow interior of the key bodies B1. The second plastic will flow into the hollow key bodies and surround the core members 24. At the completion of the second molding operation, the mold may be opened and the completed keys with their runners removed as a unit.

The core members 24 will form the key shank-

7

receiving recesses 25 shown in Figure 14. The recess 25 is shaped so as to receive the key shank, not shown, of the machine using the keys. Other core members, not shown, will form the recesses 26 in the key plugs or inserts E1. In Figure 13, we show the runners H and K in perspective and the runner H has been shaded to indicate a different color from that of the runner K. The same figure also shows the branch runners H1 and K1 and it will be seen that the branch H1 is integral with the key body B1, while the branch K1 is integral with the key plug or insert E1. This form of the invention has all of the advantages enumerated for the form shown in Figures 1 to 9, inclusive.

The difference between the two forms lies in the fact that the two runners and their branch runners or sprues are superimposed one above the other in Figures 12 to 14, inclusive, while in the form shown in Figures 1 to 9, inclusive, the branch runners or sprues are arranged side by side. Furthermore, the two runners and their branches in the form shown in Figures 10 to 14, inclusive, are formed from grooves provided in the upper mold half G2, whereas in the first form of our invention, the second runner F is formed in the lower mold section. By arranging the branch runners one above the other as indicated in Figure 13, it is easier to break the completed keys from their branches than where the branch runners are arranged side by side.

We claim:

1. The herein described method of forming an article from more than one plastic consisting of placing a preformed plastic structure comprising a hollow body with a slot extending therethrough, a main sprue and a branch sprue connecting the body and main sprue into a mold having channels of greater size than said first mentioned sprues, with said sprues in said channels, of injecting a second plastic through the channels into said slot so that the sprues formed by the second plastic lie adjacent said preformed sprues.

8

2. The herein described method of forming an article from more than one plastic consisting of placing a preformed plastic structure comprising a hollow body with a slot extending therethrough, a main sprue and branch sprue connecting the body and main sprue into a mold having channels of greater size than said precast sprues with said sprues in said channels, of injecting a second plastic through the channels into said slot so that the sprues formed by the second plastic lie adjacent said preformed sprues and are coextensive therewith.

3. The herein described method of forming an article from more than one plastic consisting of placing a preformed plastic structure comprising a hollow body with a slot extending therethrough, a main sprue and a branch sprue connecting the body and main sprue into a mold having channels of greater size than said first mentioned sprues with said sprues in said channels, of injecting a second plastic through the channels into said slot so that the sprues formed by the second plastic will extend alongside the sprues of the first plastic in contacting relation therewith.

FLOYD J. DOFSEN.
ELMER L. DANIELSON.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,266,433	Morin et al.	Dec. 16, 1941
2,333,059	Tucker	Oct. 26, 1943
2,345,305	Thornton	Mar. 28, 1944

FOREIGN PATENTS

Number	Country	Date
198,417	Switzerland	Sept. 1, 1938