Dec. 24, 1957 H. L. PHILLIPS ET AL 2,817,273

CARTON BLANK FORMING DIE AND METHOD

Filed Oct. 13, 1955 3 Sheets-Sheet 1

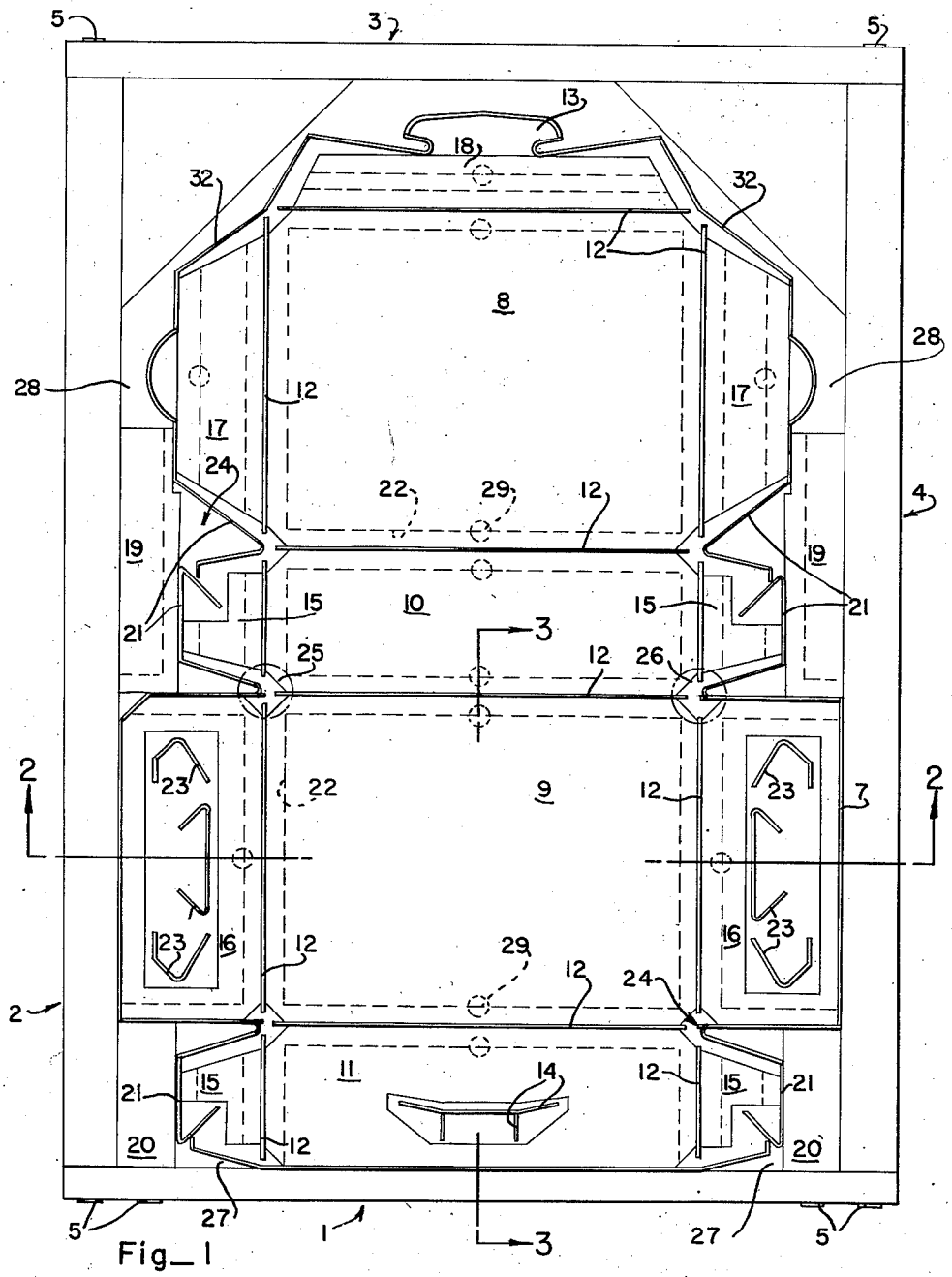


Fig_1

INVENTORS
HARRY L. PHILLIPS
LYTTON S. FAIN

BY Bayken, Mahler & Wood
ATTORNEYS

Dec. 24, 1957 H. L. PHILLIPS ET AL 2,817,273

CARTON BLANK FORMING DIE AND METHOD

Filed Oct. 13, 1955 3 Sheets-Sheet 2

Fig_2

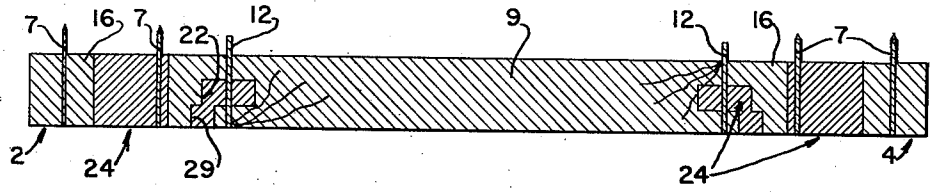


Fig_3

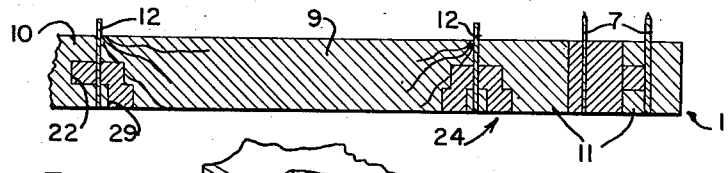


Fig_7

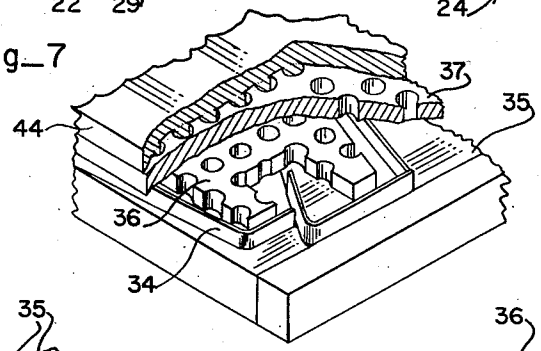


Fig_4

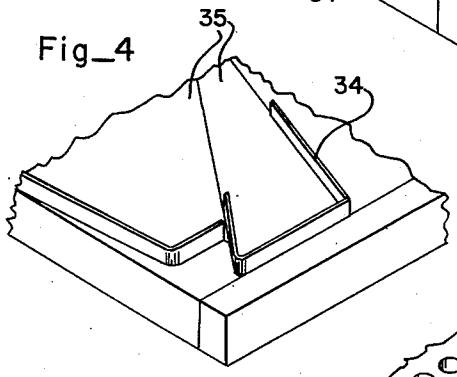


Fig_5

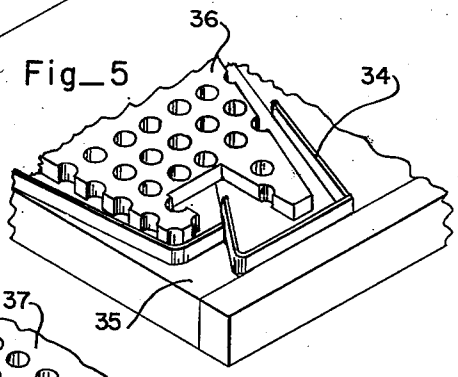
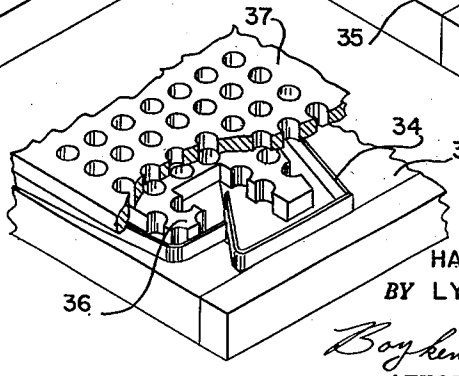


Fig_6



INVENTORS
HARRY L. PHILLIPS
BY LYTTON S. FAIN

Boyken, Mahler & Wood
ATTORNEYS

Dec. 24, 1957 H. L. PHILLIPS ET AL 2,817,273

CARTON BLANK FORMING DIE AND METHOD

Filed Oct. 13, 1955 3 Sheets-Sheet 3

Fig_8

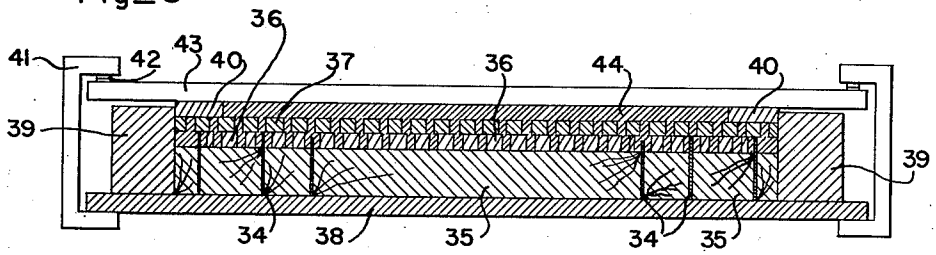


Fig_10

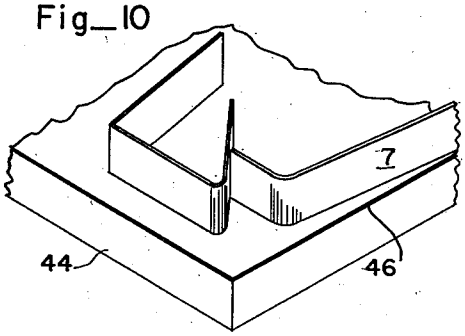


Fig_9

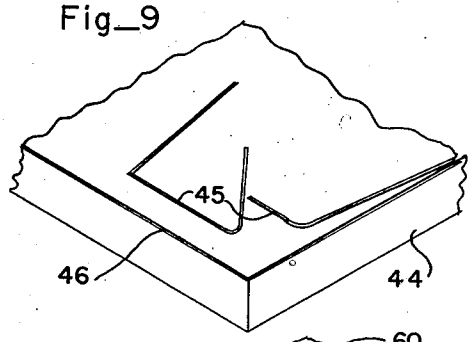


Fig_11

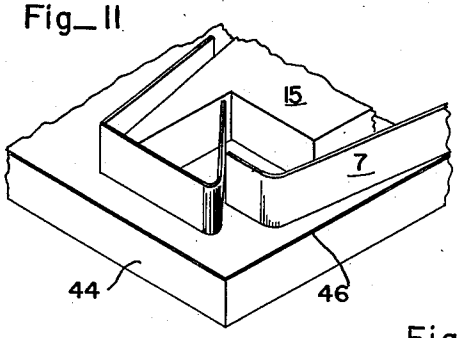


Fig_12

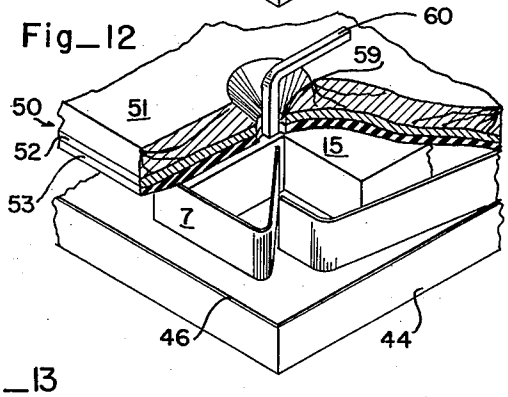
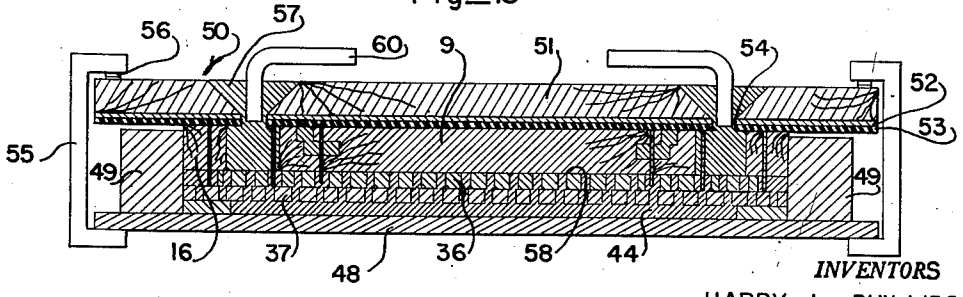


Fig_13



INVENTORS

HARRY L. PHILLIPS

BY LYTTON S. FAIN

Boyken, Mahler & Wood

ATTORNEYS

United States Patent Office

2,817,273

Patented Dec. 24, 1957

2,817,273

CARTON BLANK FORMING DIE AND METHOD

Harry L. Phillips, Piedmont, and Lytton S. Fain, San Leandro, Calif., assignors to Floseal Corporation

Application October 13, 1955, Serial No. 540,209

11 Claims. (Cl. 93—58)

This invention relates to a die structure as is used for forming carton blanks from cardboard and the like and to a method of making said die.

Heretofore, carton blank dies of the type herein described have been formed of flat pieces of wood having particular contours for holding steel strips called cutting and creasing rules on edge between the edges of such wood pieces when they are coplanar. The rules project from the upper side of the wood pieces and a piece of cardboard pressed against the projecting rule edges is cut and creased to the desired form thereby.

This conventional practice works well enough where the cuts and creases in the carton blank are along straight, regularly arranged lines. However, in the formation of blanks requiring intricate cutouts for interlocking flaps, pouring spouts, and other irregular patterns, it is practically impossible to achieve accurate, uniform results using the conventional practices described above. The tolerances required by such intricate patterns is often of the order of one sixty-fourth of an inch and such tolerances cannot be met by known methods of die manufacture except at great cost.

Since it is most economical to use multiple dies to form several duplicate blanks at one time, the problem of duplicating a single die to form such a multiple die is acute. Here again conventional die structures and practices fall short of the mark and many intricate carton structures have not been commercially feasible for this reason.

It is therefore an object of this invention to provide a die for forming carton blanks which may be economically built to close tolerances, and which die is light in weight.

Another object of this invention is the provision of a novel method for making a carton blank forming die.

Still another object of this invention is the provision of a carton blank forming die which is particularly rugged and resists deformation under repeated usage.

It is a further object of this invention to provide a carton blank forming die and a method of making the same that results in easy duplication and formation of accurate multiple dies.

Yet another object of this invention is the provision of a carton blank forming die that enables the accurate forming of intricate carton blanks.

Other objects and advantages will be apparent from the following description taken in connection with the accompanying drawings in which:

Fig. 1 is a top plan view of an example of a completed carton blank forming die of the present invention;

Fig. 2 is a cross sectional view taken along line 2—2 of Fig. 1;

Fig. 3 is a cross sectional view taken along line 3—3 of Fig. 1;

Figs. 4–7 are enlarged isometric views of a conventional die used as a pattern and related to the lower right corner portion of the die of Fig. 1, showing successive steps in the method of construction of the die mold;

Fig. 8 is a cross sectional view taken through the die pattern in a frame after completion of the step of casting the mold;

Figs. 9–12 are enlarged isometric views of substantially the same portion of the mold related to the pattern shown in Figs. 4–7, showing the successive steps in the construction of the die; and,

Fig. 13 is a cross sectional view taken through the assembled die mold and die showing the cast matrix poured in place.

In detail, as seen in Figs. 1, 2, 3, the die of this invention comprises frame members **1**, **2**, **3**, **4**, formed to provide a perimetrically bounding frame with the die components arranged therein. As seen in Fig. 1, the frame of the illustrated die is formed to enclose a rectangular space with frame member **1** oppositely spaced from and parallel to frame **3** and with frame member **2** oppositely spaced from and parallel to frame member **4**. Said frame members may be held in this relationship by fastening means **5** such as nails or screws.

The die illustrated is made up of a plurality of vertically projecting, horizontally extending steel strips or rules against which cardboard or the like is adapted to be pressed. The arrangement of the rules is predetermined for cutting or creasing the cardboard for forming the desired shape of carton blank therefrom.

The inwardly facing surfaces of frame members **1**, **2**, **3**, **4** are flat and vertical thus providing surfaces against which outer boundary cutting rules **7** may be positioned.

The cutting rules **7** have sharpened, exposed or projecting edges while the creasing rules **12** have blunt exposed edges for forming creases in cardboard pressed thereagainst. The cutting rules also project further from the main body of the die for assuring that they cut through the cardboard (Figs. 2, 3). In addition to the above mentioned rules, perforating rules may be used to form lines of weakness if desired. Any of these types of rules may be arranged as desired without necessitating structural changes in the die of this present invention.

In the illustrated die of Fig. 1, it is seen that individual rectangular wood blocks **8**, **9** form the two largest regular portions of the die inside of frame members **1**, **2**, **3**, **4**, and that block **10**, interposed between blocks **8**, **9**, and lower block **11** form the next largest portions of the die. Straight creasing rules **12** are positioned against the flat vertical sides of said blocks and in some cases positioned between and against said sides, such as between blocks **8** and **10**, **10** and **9**, and **10** and **11**.

Wherever the carton blank is to be formed to a regular, rectangular pattern, the above described system of sandwiching the rules between individual, regular blocks may be employed and will result in accurate blank formation. However, due to the complexity of many cartons, some of the rules, usually cutting rules, must be formed to irregular shapes. In the case of the frozen food carton blank die illustrated and many other complicated blanks, provision must be made for interengaging flaps or pouring spouts or the like. In these cases, accurate registration of various parts of the blanks is essential to correct functioning of the assembled carton.

For example, the blank to be formed by the die of Fig. 1 must be provided with a flap, as at **13**, and cuts at **14**, to be engaged by such flap, for locking the carton top in a closed position. The irregular shapes of the cutting rules at **21**, **23** for cutting the end flaps and the cuts for receiving the same will also be noted. The use of conventional practices of jigsawing and shimming individual wood blocks to support these irregular rules has been found to be unworkable because of the difficulty of accurately and rigidly supporting the rules in the required places. Such practices also do not lend themselves to the formation of multiple dies, known in the trade as six-

on, eight-on dies, etc., and even single dies so formed become inaccurate after repeated usage. Hence the die of this invention supports only the straight, regular rules with wood blocks accurately cut to fit the spaces therebetween.

Disposed outwardly of creasing rules **12**, in the above described rule engaging relationship, are a series of other blocks that are adapted to be fitted within the spaced formed between the cutting rules **7** and creasing rules **12**. Said other blocks are formed more or less complementary to the space in which they are to be fitted and may be of such shapes as blocks **15**, blocks **16** (with a rectangular hole formed therein), and trapezoidal blocks **17** and **18**. Further filler blocks such as **19**, **20** may be positioned adjacent the inner edges of the frame members to provide, in effect, flat vertical extensions of said frame to bear upon the cutting rules **7** of the reduced width portion of the die. As seen in Fig. 1, the flat vertical edges of blocks **15**, **16**, **17**, **18** bear against the straight rules positioned longitudinally and transversely of the die while the edges of the same blocks that are adjacent the oblique and irregular rules such as those at **13** and **21** are spaced therefrom. It is also noted that the irregular rules at **14** and **23** are spaced from the edges of the holes in blocks **11** and **16**, respectively.

In order to support these irregular rules the aforementioned spaces are filled with a meltable solid which is cast in place as will be later explained. Any such solid may be employed for this purpose which will solidify to a solid mass for rigidly supporting the rules. It has been found that a relatively low melting point metal alloy is suitable for this purpose.

It will be noted that the corners of blocks **8**, **9**, **10**, **11**, **16** are cut off obliquely to allow the ends of the creasing rules **12** to extend freely therefrom. As seen in Figs. 2, 3, and by dotted lines in Fig. 1, grooves **22** are formed in the edges of blocks **8**, **9**, **10**, **11**, **15**, **16**, **17**, **18**, and **19** that are in engagement with cutting rules **7** or creasing rules **12** of the die.

The purpose of grooves **22** is to provide passageways for the molten metal, of a low melting temperature, to travel therethrough to all parts of the die, which forms a unitary matrix interlocking all component parts of said die upon the solidification of said metal. The matrix or cast material, generally designated **24**, completely fills grooves **22** and the spaces between the rules **13**, **14**, **21**, **23** and all aforementioned blocks. It is obvious that by pouring simultaneously from two positions such as **25**, **26** indicated by dot-dash circles on Fig. 1, the matrix forming metal can travel to all parts of the die except the rectangular holes in blocks **16** and the hole formed in block **11**; these may be poured separately. To enable the metal to reach the otherwise blocked off portions of the die, such as at **27**, **28**, risers may be provided in the cope part of the die pouring mold.

To further key the matrix to the remaining parts of the die and prevent possible horizontal shifting of the same, a plurality of holes **29** are formed at intervals in said blocks adjacent the vertical edges thereof to communicate with grooves **22**. Holes **29** are directed vertically upwardly from the bottom surface of the die (Figs. 2, 3) to communicate with grooves **22**, and it is not necessary for them to extend therepast to the upper surface of the die as this would only create the likelihood of a possible protrudance interfering with the cutting and creasing action of the die.

As seen by the above description the various blocks and rules comprising the die of this invention are entirely keyed together by a continuous matrix or casting that forms said blocks and rules into a unitary piece with no possibility of movement of one component with respect to another.

The matrix material, preferably metallic, must be of a low enough melting temperature so it will not cause the hardened steel rules to be annealed when the said matrix

is poured. It has been found in actual practice that a lead-tin alloy of about 83% lead and 17% tin is quite satisfactory for the matrix material as it has the desired low melting temperature and the ability to readily flow throughout the passageways without requiring excessive superheating.

Illustrated in the drawings and described in the above specification is what is generally known as a one-on or single die. However, this is merely for sake of description as the dies of this invention lend themselves especially well to the formation of the multiple cutting dies used commercially such as six-on, eight-on, etc. In the case of these latter dies the outermost cutting rules may be utilized as common cutting rules, when possible, between two adjacent carton blanking dies. Also it is evident that the frame members **1**, **2**, **3**, **4**, are then adapted to enclose the entire six-on or eight-on die instead of each individual carton blanking die.

As previously stated, one of the objects of this invention is the provision of a method of making duplicate dies all of which are made to the same accuracy and dimensional specifications as the original. For this above mentioned object to be economically feasible, it is necessary to have some sort of accurate pattern from which said dies can be made.

Referring to Fig. 4, there is shown a portion of a die, of the configuration of the die of Figs. 1, 2, 3, that is assembled according to conventional die making procedure, metal rules **34** being rigidly held in place between a plurality of complementarily formed individual wood blocks **35**. This above structure is typical of a common one-on die and has been also utilized as the basis for multiple dies. However, owing to the very nature of wood, that it cannot be consistently machined to close dimensional tolerances, the manufacture of multiple cutting dies that are perfect duplicates of one another is exceedingly difficult if not impossible. Furthermore, as has been previously explained, due to the close tolerances demanded for particular carton structures, it may be very expensive to produce even one die by this method, and such a die would have only a limited life before it became so deformed as to be useless. Therefore, the die structure shown in Fig. 4 is used, in this present method, only to form an accurate pattern from which a virtually indestructable production mold is made.

Starting with the conventional die structure illustrated in Fig. 4 perforated metal plates **36** (Fig. 5) formed more or less complementary to the space into which they are to be put, are positioned within the various spaces enclosed by rules **34** in such a manner as to provide clearance between said rules **34** and perforated plates **36**. The thickness of plates **36** is preferably less than the height to which rules **34** project above blocks **35**.

Upon placing perforated plates **36** in position, a larger perforated plate **37** (Fig. 6) that will completely cover the entire die pattern, is placed resting on top of the exposed edges of rules **34**. Plate **37** will serve as a rigid bearing surface in the production mold.

After the perforated plate **37** is in place as shown in Fig. 6, the die pattern is placed in a frame (Fig. 8) consisting of a bottom member **38**, side members **39**, which can be brought into tight engagement against the outer sides of the wooden pattern, and hold down members **40** that can be brought to bear against the upper surface of plate **37** such as by means of **C** clamps **41**, wedges **42** and hold down bar **43**.

The assembly thus formed is now ready for the pouring of a lead base alloy **44** (Fig. 7) which will pass through the perforations of plate **37** and shaped plate elements **36** to fill all the remaining interstices between such elements, rules **34**, and blocks **35**. Upon solidification the resultant casting is removed from the pattern and thus forms the production mold of the present invention. Besides adding to the overall strength and rigidity of the mold, plate elements **36** act as chills to facilitate the re-

moval of heat when the die is made from the mold as will be subsequently explained herein.

It is evident that the mold is cast upside down and upon being inverted it appears substantially as a flat relatively thick plate with impressions **45** formed therein (Fig. 9). Said impressions **45** are of course formed from the projecting portions of rules **34** in the pattern and are of the same depth as said rules **34** projected beyond the wood blocks **35** of the pattern.

The top surface of the mold **44** is now plated with a metallic coating **46** such as copper to prevent welding of the mold to the die as will be subsequently described.

The cutting rules **7** and creasing rules **12** of the final die are now inserted, operating edge down into the impressions **45** in the mold (Fig. 10). They are uniformly seated against the now submerged perforated plate **37** which prevents said rules from being overinserted resulting in uneven rule heights in the final die.

Into the resulting spaces between the rules are now placed the wooden, grooved block elements **8, 9, 10, 11, 15, 16, 17, 18, 19** and **20** (Fig. 11), previously described with regard to the die structure.

This above assembly is put into a frame (Fig. 13) consisting of a bottom member **48**, side members **49** which can be brought into tight engagement against the outer side of the mold and uncast die, and a hold down platen generally designated **50** consisting of a wooden backing **51** to which is secured a metal stiffening plate **52** on which is vulcanized a sheet of rubber **53**.

Through platen **50** are formed pouring sprues **54** and the necessary risers **59** (Fig. 12) to conduct the molten lead alloy **57** to all parts of the die. Sprues **54** are so located to communicate with positions **25, 26** of Fig. 1. The above described frame and assembly may be clamped together by conventional clamping means, such as C clamps **55** and wedges **56**.

The rubber sheet **53** is in tight engagement along the inverted bottom surface of the blocks and the bottom rule edges to prevent the overflowing of the lead alloy **57** around said blocks and rules.

The frame is now ready to receive the molten lead alloy **57** which is conducted through grooves **22** to form, when solidified, the continuous matrix **24** keying the entire die together into a unitary piece. Line **58** (Fig. 13) defines the copper plated surface of the mold which now becomes the parting line between the mold and the die upon the solidification of alloy **57**. As hereinbefore mentioned the plating is to prevent the possible welding of alloy **57** to the lead alloy **44** of the mold. Also now the perforated plate elements **36** act as chills to more rapidly conduct the heat away from the die and accelerate the solidification around the rules **7, 12**.

Upon solidification of alloy **57** the mold is loosened from around the resultant casting and the poured die and platen **50** are lifted free of the mold.

Platen **50** may then be separated from the die by twisting the handle portion of the metal keys **60** that have been previously inserted into the conical entrance of sprues **54** and risers **59**. This causes the lead alloy **57** to break at the narrow neck portion of said risers and sprues in platen **50**.

The die is now ready to have frame elements **1, 2, 3, 4** placed therearound thus completing the manufacture of the die of this invention.

Although this invention has been described and illustrated in detail, such is not to be taken as restrictive thereof as it is obvious that modifications could be made therein without departing from the spirit and scope of the invention.

We claim:

1. A die for forming a carton blank from a sheet of cardboard, which blank is to have regular and irregular cuts and creases, said die comprising: a first set of regularly arranged straight cutting and creasing rules, individual, straight-sided blocks arranged between the rules of said first set for holding them in a spaced and predetermined relation for forming said regular cuts and creases, a second set of irregularly shaped and arranged rules, a casting extending between and around the rules of said second set and between said second set and the said blocks adjacent thereto, the material of said casting being in firm cast engagement with the opposite sides of the rules of said second set and with said adjacent blocks for holding said second set in a predetermined relation to said blocks and said first set and for firmly holding the rules of said second set against displacement relative to each other.

2. A die for forming a carton blank from a sheet of cardboard, which blank is to have regular and irregular cuts and creases, said die comprising: a first set of regularly arranged straight cutting and creasing rules, individual, straight-sided blocks arranged between the rules of said first set for holding them in a spaced and predetermined relation for forming said regular cuts and creases, a second set of irregularly shaped and arranged rules, a casting extending between and around the rules of said second set and between said second set and the said blocks adjacent thereto, the material of said casting being in firm cast engagement with the opposite sides of the rules of said second set and with said adjacent blocks for holding said second set in a predetermined relation to said blocks and said first set and for firmly holding the rules of said second set against displacement relative to each other, the rules of said first and second sets having one of their edges coplanar and said blocks and said casting having one of their sides flat and coplanar with said last-mentioned edges.

3. A die for forming a carton blank from a sheet of cardboard comprising a plurality of spaced cutting and creasing rules arranged with one of their edges in cutting and creasing relation with a cardboard sheet adapted to be engaged thereby for forming a carton blank from said sheet, a plurality of individual blocks interposed between the sides of said rules, some of said blocks being in tight engagement with the sides of some of said rules and others of said blocks being spaced from other of said rules, and a casting cast into the space between said other blocks and the sides of said other rules, the material of said casting being in firm cast engagement with the sides of said other rules.

4. A die for forming a carton blank from a sheet of cardboard comprising a plurality of spaced cutting and creasing rules arranged with one of their edges in cutting and creasing relation with a cardboard sheet adapted to be engaged thereby for forming a carton blank from said sheet, a plurality of individual blocks interposed between the sides of said rules, some of said blocks being in tight engagement with the sides of some of said rules and others of said blocks being spaced from other of said rules, and a casting cast into the space between said other blocks and the sides of said other rules, the material of said casting being in firm cast engagement with the sides of said other rules, passageways through said blocks connecting said spaces, and said casting including portions filling said passageways for interlocking said blocks and said rules together against relative displacement.

5. A die for forming a carton blank from a sheet of cardboard comprising a plurality of spaced cutting and creasing rules arranged with one of their edges in cutting and creasing relation with a cardboard sheet adapted to be engaged thereby for forming a carton blank from said sheet, a plurality of individual blocks interposed between the sides of said rules, some of said blocks being in tight engagement with the sides of some of said rules and others of said blocks being spaced from other of said rules, and a casting cast into the spaces between said other blocks and the sides of said other rules, the material of said casting being in firm cast engagement with the sides of said other rules, passageways through said blocks

generally parallel to the plane of said die connecting said spaces, and holes in said blocks transversely of said passageways and communicating therewith, said casting including portions filling said passageways and said holes for interlocking said blocks and said rules together against relative displacement.

6. A die for forming a cardboard carton blank of the type having coacting, spaced, intricate cut portions and relatively large and simple portions adjacent to and between said cut portions comprising: spaced groups of tempered steel rules with the rules in each group arranged to conform to the contours of said cut portions for forming the latter in a cardboard blank, a casting for each of said groups in cast engagement with the rules in each group for holding said latter rules against shifting relative to each other and with their carton engaging edges substantially coplanar, other rules than those in said groups for forming said simple portions of said blank, means surrounding the casting of each group formed with flat sides in tight engagement with said other of said rules that are adjacent to said castings, and blocks coacting with said means and between said castings for supporting said other of said rules with their cutting and creasing edges coplanar with the carton engaging edges of the rules of said groups and holding said castings and the means enclosing the same against movement relative to each other.

7. A die for forming a cardboard carton blank of the type having coacting, spaced, intricate cut portions and relatively large and simple portions adjacent to and between said cut portions comprising: spaced groups of tempered steel rules with the rules in each group arranged to conform to the contours of said cut portions for forming the latter in a cardboard blank, a casting for each of said groups in cast engagement with the rules in each group for holding said latter rules against shifting relative to each other and with their carton engaging edges substantially coplanar, other rules than those in said groups for forming said simple portions of said blank, means surrounding the casting of each group formed with flat sides in tight engagement with said other of said rules that are adjacent to said castings, and blocks coacting with said means and between said castings for supporting said other of said rules with their cutting and creasing edges coplanar with the carton engaging edges of the rules of said groups and holding said castings and the means enclosing the same against movement relative to each other, said means and said blocks being of wood and said casting being of metal having a melting point below the annealing temperature of said tempered steel rules whereby the temper of said steel rules will be unimpaired by the casting of said metal about the rules of said groups.

8. A die for forming a cardboard carton blank of the type having coacting, spaced, intricate cut portions and relatively large and simple portions adjacent to and between said cut portions comprising: spaced groups of tempered steel rules with the rules in each group arranged to conform to the contours of said cut portions for forming the latter in a cardboard blank, a casting for each of

said groups in cast engagement with the rules in each group for holding said latter rules against shifting relative to each other and with their carton engaging edges substantially coplanar, other rules than those in said groups for forming said simple portions of said blank, means surrounding the casting of each group formed with flat sides in tight engagement with said other of said rules that are adjacent to said castings, and blocks coacting with said means and between said castings for supporting said other of said rules with their cutting and creasing edges coplanar with the carton engaging edges of the rules of said groups and holding said castings and the means enclosing the same against movement relative to each other, said means and said blocks being of wood and said casting being of metal having a melting point below the annealing temperature of said tempered steel rules whereby the temper of said steel rules will be unimpaired by the casting of said metal about the rules of said groups, and a casting rigidly connecting the castings of said groups with each other and with said blocks and said other rules.

9. A method of making a carton blank forming die comprising the steps of: supporting sets of straight, regularly arranged rules and irregularly shaped and arranged rules in a predetermined pattern of the configuration of the desired carton blank, interposing straight-edged individual blocks between the rules of said regular set in firm supporting relation thereto, and casting a material around and between the rules of said irregular set and between said irregular set and said blocks in firm cast engagement therewith.

10. A method for making a carton blank forming die comprising the steps of: supporting a plurality of cutting and creasing rules arranged corresponding to the desired cuts and creases in the blank, interposing between said rules a plurality of individual blocks, some of which exactly fit the space between some of said rules and others of which are spaced from other of said rules, and casting a material into the resulting spaces between said blocks and said rules for rigidly supporting said rules and said blocks as a unitary die upon solidification of said material.

11. A method for making a carton blank forming die comprising the steps of: fabricating an accurate pattern in the form of a conventional die having projecting edges of cutting and creasing rules, forming a mold to said pattern, said mold having impressions corresponding to said rules, inserting rules of the die to be made in said impressions, interposing between said rules a plurality of individual blocks, some of which exactly fit the spaces between some of said rules and others of which are spaced from other of said rules, and casting a material into the resulting spaces between said blocks and said rules for rigidly supporting said rules and said blocks as a unitary die upon solidification of said material.

No references cited.