

PATENT SPECIFICATION

(11)

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(21) Application No. 31153/71 (22) Filed 2 July 1971 (19)

(23) Complete Specification filed 5 June 1972

(44) Complete Specification published 23 Oct. 1974

(51) International Classification B29F 1/00

(52) Index at acceptance

B5A 1R20 2E4A 3D2 3DX

B8P 19 7C 8J

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(54) IMPROVEMENTS IN OR RELATING TO CONTAINERS

(71) We, GPG HOLDINGS LIMITED, of Cranford, Blackdown, Leamington Spa, Warwickshire, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a container, in particular to a plastics injection moulded container having a base and side walls extending upwardly from the base, for example as in the conventional design of a rectangular (usually oblong) bottle crate having an open framework base and four side walls extending upwardly from the base.

It is well known to provide the side walls of a container with upstanding and integral ribs which reinforce the side walls against vertical loading as, for example, is encountered in the stacking of several bottle crates one on another. Although these ribs are primarily intended to reinforce the side walls, their location is of considerable importance in container design since their presence can influence to a considerable extent the aesthetic properties of the container as well as its storage and stacking capabilities. It has hitherto been proposed to locate the reinforcing ribs which are integral with the side walls internally of the container, this not only permits the external surface of the side walls to be plain but allows several containers having side walls with plain and flat external surfaces to be positioned in layers in substantially face-to-face contact with each other, thereby permitting efficient utilisation of storage space. With this in mind, the present invention is especially concerned with a plastics injection moulded container of the kind (hereinafter referred to as "the kind specified") comprising a base, side walls extending upwardly from the base to an open top and at least one of said side walls having integral therewith at least one reinforcing side rib which extends up-

wardly from the base and is located internally of the container.

Conventionally a container of the kind specified is injection moulded in a die comprising co-operating male and female sections of which the male section usually defines the internal profile of the container while the female section usually defines the external profile of the container. The moulding of an internal side rib in a container of the kind specified, in particular when such side rib extends upwardly on its respective side wall from the base to an internal flange part which is spaced from the base on that side wall (for example, such flange part may provide a rim around the open top of the container), generally requires the use of a complicated and multi-part male section. It is clearly essential that the male section of the die can be withdrawn relative to the female section after injection moulding without damage to the moulded container. If the internal side rib partly defines what may be considered as an internal recess or recesses in a side wall of the container, as far as we are aware, it has hitherto been necessary to provide the male section with retractable parts which can be manoeuvred individually so that these parts, when retracted, can clear the internal recess or recesses to permit the safe withdrawal of the male section from the moulding. The provision of these retractable parts on a male section considerably increases the manufacturing cost of such section and also necessitates the container being of such design that sufficient clearance is provided within it to allow for retraction of these parts.

According to the present invention there is provided a method of injection moulding a plastics container of the kind specified in a die having male and female sections and which comprises, during closing of the die, inserting into a female section which is to partly define the exterior profile of the moulded container at least two spigots of a

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male section so that the spigots extend through the space in the die defining the eventual base of the container and partly define, together with the female section, a space or spaces which correspond to an eventual internal side rib or ribs and to at least part of the side wall or walls of the container which such side rib or ribs reinforce; injecting plastics material into the die to mould the container; and, during opening of the die, relatively withdrawing the spigots of the male section directly through the base of the container thus moulded, so as to expose the internal side rib or ribs which extend upwardly from the base and at least two apertures in the base, the or each internal side rib being located adjacent to and between two said apertures which are positioned adjacent to the side wall which that side rib reinforces and correspond to the positions of the two spigots which partly define that side rib in the die during moulding.

The invention further provides a container of the type specified when moulded in accordance with the method as stated in the immediately preceding paragraph.

Still further according to the present invention there is provided a container of the kind specified in which at least two apertures are provided in the base at positions adjacent to the or each internal side rib, the or each such side rib being disposed between and partly defining the two or more apertures associated therewith; said apertures being located adjacent to the side wall which that or each side rib associated therewith reinforces and corresponding to the positions at which two or more spigots of a male section in the die in which the container was moulded were located in a female section of the die to partly define that side rib and part of the side wall which that or each side rib reinforces, and through which apertures the two or more spigots were relatively withdrawn during opening of the said die.

One embodiment of the present invention and a modification thereof will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:—

Figure 1 is a perspective view of a container moulded and constructed in accordance with the invention, the container being shown in part section to illustrate parts of the internal side ribs adjacent to the base and apertures in the base respectively associated with such side ribs;

Figure 2 is a perspective view of part of a male section for a die in which the container shown in Figure 1 is moulded, the male section having an array of spigots for forming internal ribs in the moulded container;

Figure 3 is a section through part of a closed die in which the container shown in Figure 1 is moulded, the section corresponding to the line B—B of Figure 1;

Figure 4 is a further section through part of the closed die in which the container shown in Figure 1 is moulded, the section corresponding to the line A—A of Figure 1, and

Figure 5 illustrates a modification to the container shown in Figure 1.

The plastics container shown in Figure 1 has a flat base 1 which is substantially oblong-rectangular in plan. Four side walls 2 to 5 are integral with, and extend perpendicularly from, the base 1. A rim 6 is provided which projects inwards from the tops of the side walls 2 to 5. The container is symmetrically formed so that the side walls in each of the opposed pairs are the mirror image of each other.

Each of the side walls is provided with an elongated aperture 7 which, as a matter of convenience, provide hand holes for carrying the container.

Each of the opposed longer side walls 2 and 4 is provided with five internal side ribs 8 to 12 of which ribs 9 to 11 extend upwardly between the base 1 and a flange 13 which underlies the aperture 7 in its respective side wall and is inwardly projecting internally of the container. Side ribs 8 and 12 extend upwardly between the base 1 and a flange 14 which is located at the top rim 6 and is inwardly projecting internally of the container. In a similar manner, the opposed shorter side walls 3 and 5 are each provided with three internal side ribs 15 to 17 which extend upwardly between the base 1 and an inwardly projecting flange 18 which underlies the aperture 7 in its respective side wall. Each of the side ribs 8 to 12 and 15 to 17 is integral with the base and with the side wall which it respectively reinforces.

In addition to the side ribs 8 to 12 and 15 to 17, each of the corner portions of the container which extends between the adjacent side walls may be considered as comprising a reinforcing "corner" side rib 19. As a result the side walls of the container shown in Figure 1 may be considered as having twenty substantially rectangular and internal recesses, four recesses being provided in each of the shorter side walls 3 and 5 between the flange 18, ribs 15 to 17 and the respectively adjacent corner side ribs 19; and six recesses being provided in each of the longer side walls 2 and 4 between the flanges 13 and 14, side ribs 8 to 12 and the respectively adjacent corner side ribs 19.

Provided in the base 1 to extend between the adjacent side ribs in the array 15 to 17 and between the respectively adjacent side ribs 15 and 19 and 17 and 19 of each of the side walls 3 and 5 are four apertures 20 to

23. These apertures 20 to 23 are partly defined by their respectively adjacent side walls 3 and 5. Similarly provided in the base 1 to extend between the adjacent side ribs in the array 8 to 12 and between the respectively adjacent side ribs 8 and 19 and 12 and 19 of each of the side walls 2 and 4, are six apertures 24 to 29. The apertures 24 to 29 are partly defined by their respectively adjacent side walls 2 and 4. The flanges 18, 13 and 14 overlie apertures 21 and 22; 26 and 27; 20, 23 24 25, 28 and 29 respectively. In such a construction it will be apparent that each of the side ribs 8 to 12 and 15 to 17 is positioned between a pair of apertures in the base 1 as is each of the corner side ribs 19 (one corner side rib extending between apertures 23 and 24, a second between apertures 29 and 23, a third between apertures 20 and 29 and the fourth between apertures 24 and 20), said corner and side ribs serving partially to define the apertures to which each rib is adjacent.

In the present example the major part of the outer surface of each of the side walls 2 to 5 is substantially flat and plain. In fact only the portions of the side walls located above the apertures 7 are not substantially flat and plain, these portions are recessed and ribbed on the outer surface of the respective side walls (see Figure 4).

We will now consider the manufacture of the container shown in Figure 1 by injection moulding in a die, parts of which die are illustrated in Figures 2 to 4. The die comprises a female section shown generally at 30 which co-operates with, but is separable from, a first male section 31 and a further male section 32. The female section 30 has an array of movable elements three of which are shown at 33 to 35 which together provides a substantially rectangular cavity having an internal profile corresponding to the external profile of the side walls 2 to 5. In the parts of the die shown in Figures 3 and 4, inner surfaces of the movable elements 33 and 35 correspond to the outer surfaces of the side walls 4 and 5 respectively.

The male section 31 comprises a plate 36 from which extend an array of twenty spigots (only nine of which 37 to 45 are shown as a matter of convenience of illustration in Figure 2). The plate 36 is mounted in a complementary recess of a movable closure plate 46 so that the twenty spigots project into the cavity of the female section 30 and are located adjacent to, but spaced from, the inner surfaces of the movable elements (33 and 35) of the female section at positions which will respectively correspond to the apertures 20 to 29 associated with side walls 3 and 4 in the moulded container. For the parts of the die illustrated in Figures 2 to 4 the array of

spigots 37 to 40 are spaced from each other and from the inner surface of the adjacent movable element 33 to provide spaces which correspond to the eventually moulded side ribs 15 to 17 and part of the side wall 5. Similarly, the array of spigots 41 to 45 are spaced from each other and from the inner surface of the adjacent movable element 35 to provide spaces which correspond to the eventually moulded side ribs 9 to 12 and part of the side wall 4. The adjacent spigots 40 and 41 are spaced from each other and from their respectively adjacent inner surfaces of the movable elements 33 and 35 of the female section 30 to provide a space which will correspond to the eventually moulded corner side rib 19 located between the apertures 23 and 29. It will be apparent that the eleven non-illustrated spigots are located in the cavity of the female section 30 adjacent to the inner surfaces thereof at positions which will correspond to apertures 20 to 29 associated with the side walls 2 and 3 and to aperture 24 associated with side wall 4 in the moulded container.

The further male section 32 is substantially rectangular in section and is carried on a closure plate 47. With the die closed the further male section 32 extends downwardly in the drawing into the cavity of the female section 30 and into the space bounded by the array of twenty spigots. The external profile of the further male section 32 is shaped so that when it is inserted into the female section 30 it defines with the female section 30 a land corresponding to the top rim 6 on the container when moulded. In addition, the side surfaces of the further male section, that is those surfaces which directly oppose the inner side surfaces of elements 33 and 35 of the female section correspond with the profile of the inner surfaces of the side walls 2 to 5 of the container when moulded. The inner end 48 of the further male section 32 (that is the end which leads during closing of the die) defines with the plate 36 (when the die is fully closed) a cavity which corresponds in shape to the base 1 of the container when moulded. Although in Figure 1 the container is shown with a substantially solid base, if it is required to be of open framework structure, for example with a rectangular grid pattern, the inner end 48 of the section 32 may carry an array of lands which are complementary to the holes to be provided in the base of the container. The bottoms of these lands about the plate 36 when the die is fully closed so that the recesses between the adjacent lands together with the plate 36 define a cavity which conforms to the desired configuration of the base 1.

To provide the apertures 7 in the sides of

the moulded container the movable elements of the female section 30 are provided with appropriately shaped projections (one of which is shown at 49 on element 33) which extend into the cavity of the closed mould at positions corresponding to those of the apertures until they abut against the respectively opposed side surfaces of the further male section 32. The projections 49 correspond in shape to the apertures 7 and, when inserted, provide spaces between themselves and the free ends of their respectively adjacent spigots 38, 39, 43 and 44; these spaces will correspond to the flanges 13 and 18 on the moulded container. As is shown in Figure 4, the surface of the portion of the movable element 33 (and similarly for the movable element 35) adjacent to the projection 49 and on the side thereof remote from the plate 36 is appropriately profiled so that the cavity part this portion defines with the further male section 32 corresponds to the parts of the container immediately above the apertures 7 being recessed (as at 50) on the outer surfaces of the side walls 2 to 5 and having external reinforcing flanges 51.

Plastics material is injected in known manner into the closed die to mould the container. After cooling of the injected plastics material, the die is opened by raising the closure plate 47 and the further male section 32 which it carries, lowering the male section 31 on the closure plate 46, and retracting the movable elements of the female section 30 (that is by withdrawing the elements 33 to 35 rightwardly in Figures 3 and 4). On opening of the die it will be apparent that the male section 31 can be relatively withdrawn straight from the moulded container since the twenty spigots will pass unhindered through their respective apertures 20 to 29 in the base of the container. After removal of the moulded container from the open die, the die is closed in preparation for a further moulding operation.

The present invention is primarily concerned with the formation of the internal side ribs 8 to 12, 15 to 17, and 19, and it is to be realised that the general construction of the container may be varied in a manner which is well known in the injection moulding art. For example the base may, as above mentioned, be of open framework structure in addition to the apertures 20 to 29; apertures (in addition to apertures 7) may be provided in the side walls as required, the external surfaces of the side walls need not be plain and substantially flat but may be externally recessed (in addition to recesses 50) or ribbed if required (although this may necessitate the use of additional retractable elements in the female section); the interior of the container may be provided with an array of crossing par-

titition walls to provide individual compartments as in a bottle crate, and the underside of the base of the container may be provided with an array of projections to facilitate bonding in a stack of similar containers.

In the modification of the container shown in Figure 5 (in which the same parts as those above described with reference to Figure 1 are indicated by the same references) the corner side ribs 19 are relatively broad in comparison with those shown in Figure 1 and may be hollow as is well known in the art. The base 1 is provided with internal flange parts 52 which are integral with the base and upstanding therefrom parallel with side walls 2 to 5 of the container. The flange parts 52 extend between, and are integral with, adjacent pairs of internal side ribs 8 to 12, 15 to 17 and 19 (of which two ribs 8 and 19 are shown in Figure 5) and lie alongside their respectively associated apertures 20 to 29 on the sides of such apertures remote from their respectively adjacent side walls 2 to 5. The flange parts 52 are advantageous in that they provide an increase in thickness of plastics material over the area where the internal side ribs may be considered as joining with the base 1 and as such reinforce these areas against splitting when the container is subjected to shear forces.

It will be noted in Figure 5 that the lower part lengths $8a$ and $19a$ of the side ribs 8 and 19 respectively (and also of the side ribs 9 to 12 and 15 to 17 not shown) flair or taper outwardly towards the base 1 to be of increased thickness where they effectively join with the top of the flange parts 52.

The container shown in Figure 5 is moulded in a similar manner to that above described with reference to Figures 2 to 4 except that the external profile of the further male section 32 is suitably shaped to define with the twenty spigots the flange parts (52) and of the flaring ($8a$, $19a$) for the side ribs. The suitable shaping of the further male section 32 will be readily apparent to persons skilled in the art of die-tool manufacture as will be the fact that a such shaped further male section 32 may still be freely withdrawn out of the container after a moulding.

The flange parts 52 are not essentially in the form of parallel sided strips as shown in Figure 5 and may be of any desired profile to reinforce the area of effective joining between the internal side ribs and the base. For example, the flange parts may be shaped as indicated by the broken lines 53 in Figure 5 so that they are still integral with the base 1 but effectively form webs between the pairs of side ribs between which they extend.

In the embodiment of the container shown in Figure 1, although no reinforcing flange

parts are provided between the adjacent pairs of internal side ribs, the side ribs 8 to 12 and 15 to 17 (and 19 if considered necessary) may flair or taper outwardly towards the base (in a similar manner as that shown at 8a and 19a in Figure 5) to provide an increased thickness of plastics material where the side ribs effectively join with the base. This flairing or tapering of the side walls may be used, to advantage, as bottle guides or wedges in association with internal partitioning walls when the container is in the form of an internally partitioned bottle crate.

In each of the foregoing examples the internal side ribs are considered and illustrated as being substantially rectangular in a section taken in a plane parallel to the base. It is to be realised however that by use of the moulding technique in accordance with the present invention the internal side ribs may be provided with a shape in section of almost any desired profile, for example they may be provided with a flange to be of T section.

WHAT WE CLAIM IS:—

1. A method of injection moulding a plastics container of the kind specified in a die having male and female sections and which comprises, during closing of the die, inserting into a female section which is to partly define the exterior profile of the moulded container at least two spigots of a male section so that the spigots extend through the space in the die defining the eventual base of the container and partly define, together with the female section, a space or spaces which correspond to an eventual internal side rib or ribs and to at least part of the side wall or walls of the container which such side rib or ribs reinforce; injecting plastics material into the die to mould the container; and during opening of the die, relatively withdrawing the spigots of the male section directly through the base of the container thus moulded, so as to expose the internal side rib or ribs which extend upwardly from the base and at least two apertures in the base, the or each internal side rib being located adjacent to and between two said apertures which are positioned adjacent to the side wall which that side rib reinforces and correspond to the positions of the two spigots which partly define that side rib in the die during moulding.

2. A method as claimed in claim 1 wherein the said spigots partly define, together with other portions of the die, a space which corresponds to and causes the formation of a flange part on the respective side wall or walls extending inwardly of the container, part of which flange part in the

completed container overlies the said apertures in the base.

3. A method as claimed in claim 1 or claim 2 which comprises, during closing of the die, relatively inserting into the female section a further male section which extends through the space in the die which is to correspond to the open top of the moulded container and defines with the male section having the spigots and with the female section a space which corresponds to the shape of the container.

4. A method of injection moulding a plastics container of the kind specified substantially as herein described with reference to the accompanying diagrammatic drawings.

5. A plastics container which has been injection moulded by the method as claimed in any one of the preceding claims.

6. An injection moulded plastics container of the kind specified, in which at least two apertures are provided in the base at positions adjacent to the or each internal side rib, the or each such side rib being disposed between and partly defining the two or more apertures associated therewith; said apertures being located adjacent to the side wall which that or each side rib associated therewith reinforces and corresponding to the positions at which two or more spigots of a male section in the die in which the container was moulded were located in a female section of the die to partly define that side rib and part of the side wall which that or each side rib reinforces, and through which apertures the two or more spigots were relatively withdrawn during opening of the said die.

7. An injection moulded plastics container as claimed in claim 6 wherein the one or more internal side ribs extend upwardly from the base to a flange part on the respective side wall or walls, which flange part extends inwardly from the side wall or walls of the container.

8. A container as claimed in claims 6 or 7 wherein at least one of the side walls has an array of the internal side ribs, each of which is located between two apertures in the base positioned adjacent to that side rib and to the side wall which that side rib reinforces, said array of apertures corresponding to the positions at which an array of spigots of the male section in the die were located to partly define that array of side ribs and part of the side wall which that array of side ribs reinforces.

9. A container as claimed in claims 7 and 8 when dependent on claim 7 wherein the inwardly extending flange is located below a top rim of the container.

10. A container as claimed in any one of claims 6 to 9 wherein the base has at least one upstanding flange or web which

parts are provided between the adjacent pairs of internal side ribs, the side ribs 8 to 12 and 15 to 17 (and 19 if considered necessary) may flair or taper outwardly towards the base (in a similar manner as that shown at 8a and 19a in Figure 5) to provide an increased thickness of plastics material where the side ribs effectively join with the base. This flairing or tapering of the side walls may be used, to advantage, as bottle guides or wedges in association with internal partitioning walls when the container is in the form of an internally partitioned bottle crate.

15 In each of the foregoing examples the internal side ribs are considered and illustrated as being substantially rectangular in a section taken in a plane parallel to the base. It is to be realised however that by use of the moulding technique in accordance with the present invention the internal side ribs may be provided with a shape in section of almost any desired profile, for example they may be provided with a flange to be of T section.

WHAT WE CLAIM IS:—

1. A method of injection moulding a plastics container of the kind specified in a die having male and female sections and which comprises, during closing of the die, inserting into a female section which is to partly define the exterior profile of the moulded container at least two spigots of a male section so that the spigots extend through the space in the die defining the eventual base of the container and partly define, together with the female section, a space or spaces which correspond to an eventual internal side rib or ribs and to at least part of the side wall or walls of the container which such side rib or ribs reinforce; injecting plastics material into the die to mould the container; and during opening of the die, relatively withdrawing the spigots of the male section directly through the base of the container thus moulded, so as to expose the internal side rib or ribs which extend upwardly from the base and at least two apertures in the base, the or each internal side rib being located adjacent to and between two said apertures which are positioned adjacent to the side wall which that side rib reinforces and correspond to the positions of the two spigots which partly define that side rib in the die during moulding.

2. A method as claimed in claim 1 wherein the said spigots partly define, together with other portions of the die, a space which corresponds to and causes the formation of a flange part on the respective side wall or walls extending inwardly of the container, part of which flange part in the

completed container overlies the said apertures in the base.

3. A method as claimed in claim 1 or claim 2 which comprises, during closing of the die, relatively inserting into the female section a further male section which extends through the space in the die which is to correspond to the open top of the moulded container and defines with the male section having the spigots and with the female section a space which corresponds to the shape of the container.

4. A method of injection moulding a plastics container of the kind specified substantially as herein described with reference to the accompanying diagrammatic drawings.

5. A plastics container which has been injection moulded by the method as claimed in any one of the preceding claims.

6. An injection moulded plastics container of the kind specified, in which at least two apertures are provided in the base at positions adjacent to the or each internal side rib, the or each such side rib being disposed between and partly defining the two or more apertures associated therewith; said apertures being located adjacent to the side wall which that or each side rib associated therewith reinforces and corresponding to the positions at which two or more spigots of a male section in the die in which the container was moulded were located in a female section of the die to partly define that side rib and part of the side wall which that or each side rib reinforces, and through which apertures the two or more spigots were relatively withdrawn during opening of the said die.

7. An injection moulded plastics container as claimed in claim 6 wherein the one or more internal side ribs extend upwardly from the base to a flange part on the respective side wall or walls, which flange part extends inwardly from the side wall or walls of the container.

8. A container as claimed in claims 6 or 7 wherein at least one of the side walls has an array of the internal side ribs, each of which is located between two apertures in the base positioned adjacent to that side rib and to the side wall which that side rib reinforces, said array of apertures corresponding to the positions at which an array of spigots of the male section in the die were located to partly define that array of side ribs and part of the side wall which that array of side ribs reinforces.

9. A container as claimed in claims 7 and 8 when dependent on claim 7 wherein the inwardly extending flange is located below a top rim of the container.

10. A container as claimed in any one of claims 6 to 9 wherein the base has at least one upstanding flange or web which



substantially extends between two adjacent internal side ribs and each such flange or web is spaced inwardly of the container from the side wall which its two associated side ribs reinforce and is located adjacent to the aperture in the base between said two associated side ribs on the side of said aperture remote from the said side wall.

1. A container as claimed in any one of claims 6 to 10 wherein the internal side rib or ribs increase in thickness towards the ends thereof adjacent the base, said thickness being measured in a direction substantially perpendicular to the side wall which the respective side rib or ribs support.

12. A container as claimed in claim 11 in which the increase in thickness of the internal side rib or ribs results from the inner surface of such rib or ribs flaring inwardly as a fair curve towards the end or ends of such side ribs adjacent the base.

13. A container as claimed in any one of claims 6 to 12 wherein the base of the container is substantially rectangular in plan.

14. A container as claimed in claim 13 wherein an internal corner side rib is located at each of the four corners of the container and the two apertures in the base between which each such corner side rib extends are positioned one adjacent to each

of the two side walls which converge and together form a said corner.

15. A container as claimed in either claim 13 or claim 14 wherein the interior of the container is provided with an array of crossing partition walls which, together with the side walls and base, define an array of bottle locating compartments as for a bottle crate.

16. A container as claimed in claim 15 when appendent to claim 12 wherein the inward flaring of the internal side rib or ribs provides a guide surface or surfaces for facilitating location of a bottle in a bottle locating compartment.

17. A container as claimed in any one of claims 6 to 16 wherein the exterior surfaces of the side walls are substantially flat and plain.

18. An injection moulded plastics container substantially as herein described with reference to Figures 1 and 5 of the accompanying diagrammatic drawings.

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Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1974.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.



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