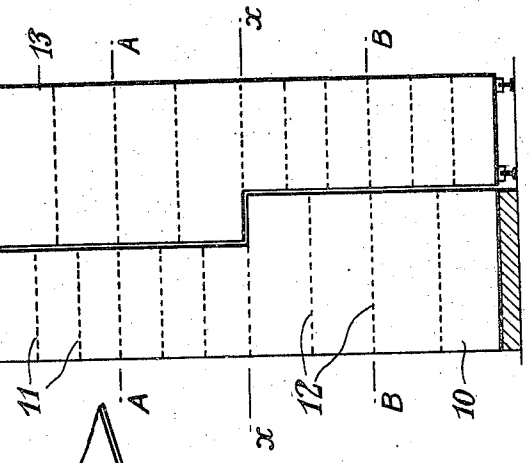
Aug. 6, 1946. T. E. FOULKES 2,405,416

STORAGE ARRANGEMENT

Filed Feb. 10, 1943 3 Sheets-Sheet 1

Fig. 2.



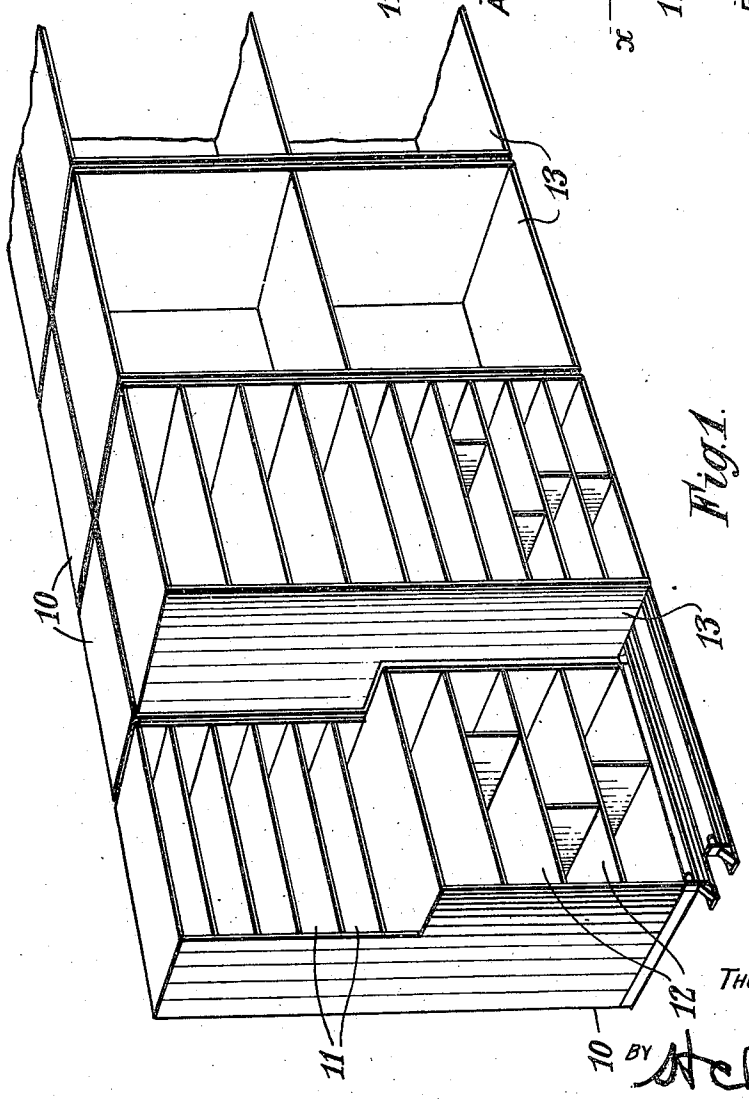


Fig. 1.

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STORAGE ARRANGEMENT

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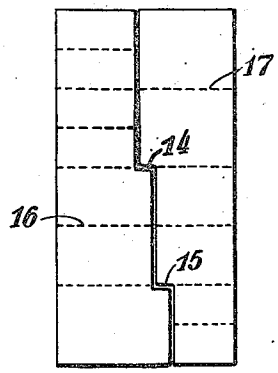

Fig. 3.

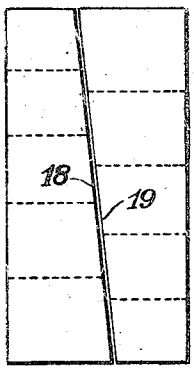

Fig. 4.

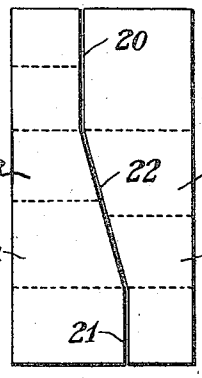

Fig. 5.

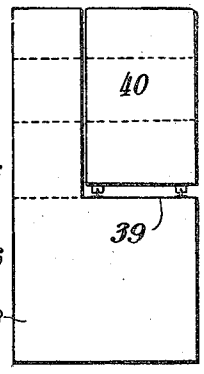

Fig. 8.

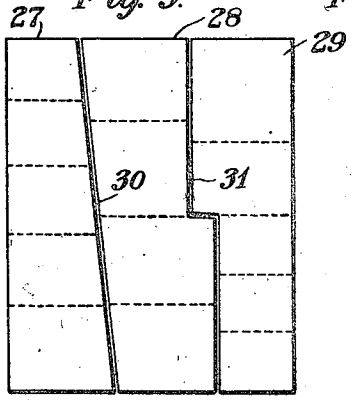

Fig. 6.

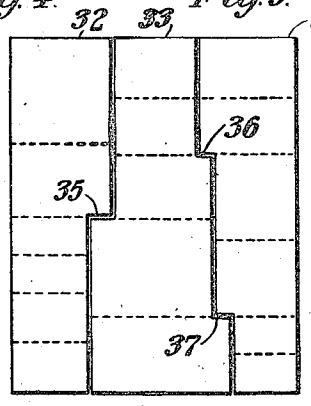

Fig. 7.

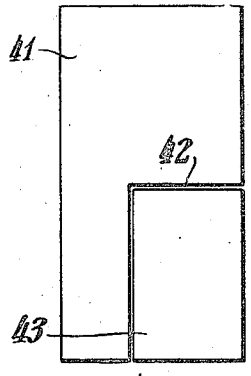

Fig. 9.

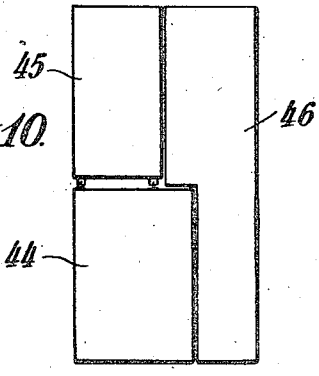

Fig. 10.

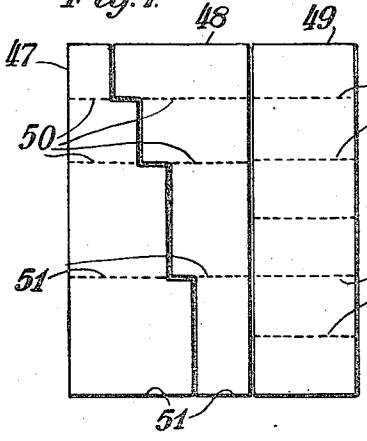

Fig. 11.

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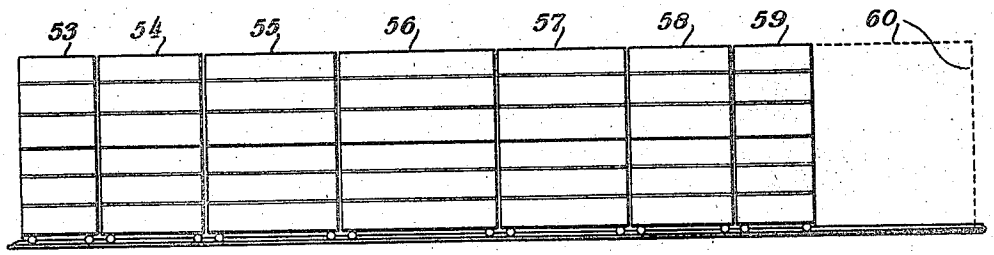

Fig. 12.

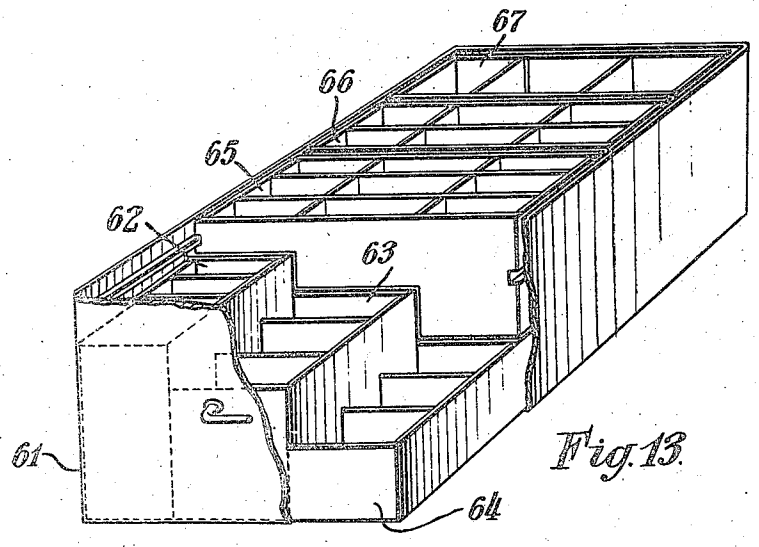

Fig. 13.

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Patented Aug. 6, 1946

2,405,416

UNITED STATES PATENT OFFICE

2,405,416

STORAGE ARRANGEMENT

Thomas Edward Foulkes, Ilford, England

Application February 10, 1943, Serial No. 475,414
In Great Britain February 12, 1942

12 Claims. (Cl. 312—107)

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This invention relates to a method of and means for storing articles of different sizes in the most efficient manner for concentration, accessibility, variety and coordination. It is applicable both to static storage systems as for example in a warehouse, or shop, or factory, and also to movable systems such as transport vehicles (including mobile shops and communal-assistance vehicles) aircraft, ships (including under-water craft) and other movable elements. In all its applications, however, the invention embodies the principle of compact storage set forth in my prior U. S. Patent No. 2,285,962, dated June 9, 1942, in which contiguous rows of containers are employed, with the containers in at least one row in side-by-side, laterally-movable sections, arranged so that those in a forward row may be separated to give access to those in the row or rows behind. Such principle has come to be known as the "Mobile unit storage system."

The present invention seeks to extend and amplify the already wide uses of the said earlier system, by embodying therein a further and generic principle of grading the capacities of the several containers to suit assortments of articles of different sizes, whereby to make full use of the capacity of each container, and also to classify and sub-classify the different sizes so as to enhance the accessibility of each within the concentration made possible by the earlier system. The invention relates to vertical systems such as those comprising rows of shelving, and to horizontal systems such as those comprising super-posed drawers, or super-posed trays in a single drawer.

The major problem, to the solution of which the present invention is directed, can be appreciated from a discussion of the limitations of all the vertical systems hitherto known.

Storage shelving is frequently used for articles of different sizes whose close proximity is desirable. In such cases, with the known arrangements, there can be considerable waste of space and loss of accessibility where the smaller articles, in quantities insufficient to fill them, are placed in compartments large enough, either in depth from back to front and/or in height from one shelf to the next, for the larger articles. It is known to make a single row of shelving, for example a book case, relatively stepped, that is to say with its upper portion shallower from back to front than the lower portion and set back on the lower portion, and whilst this arrangements does, to some extent, restore the balance of proportion as regards the relative sizes of the compartments (back to front) by allowing the smaller articles to

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be stored in the upper space, it does so only by removing storage capacity, and thus reduces the total storage capacity of the shelving.

A further disadvantage of the aforesaid known arrangement of stepped shelving is the consequent limitation as regards the balance of distribution of the articles, all the larger articles being necessarily allocated to the lower parts of the shelving and all the smaller articles to the upper parts of the shelving.

As regards height, it is known to construct shelving of graded heights using fixed or adjustable shelves, but this does not meet requirements for all types of articles, and again entails limitation of allocation.

The object of this invention is to provide the advantage of close-proximity storage for articles of different sizes without loss of storage space or accessibility and with less distribution limitations than heretofore.

According to the invention, the improved storage arrangements comprise rows of containers each partitioned longitudinally to divide it into a plurality of storage spaces, with the containers in at least one row in side-by-side longitudinally movable sections; the faces between the containers of at least two contiguous rows being shaped as as to mate with each other and thereby provide storage spaces of several different depths measured to such faces, for economic accommodation with balanced distribution for articles of different sizes.

According to a second feature of the invention, the contiguous faces of the longitudinally partitioned containers are formed with one or more steps with the open faces between the steps preferably graded in height and the grading may be such that for storage spaces of the same measurement from back to front in at least two adjacent rows there are at least two different heights of open faces.

According to a third feature of the invention, the container units in at least one row are of graded lengths (e. g. end-to-end of each unit).

According to one embodiment of the invention, means for storing articles of different sizes with balanced distribution, comprises longitudinally partitioned containers, suitably proportioned in depth from back to front for allocation of the articles according to their size, and so that the respective proportions of storage spaces for such allocation in one row of shelving are opposite and complementary to those in an adjacent row, or rows, and preferably so that the containers of

such complementary rows together provide uniform total depth, back to front.

In the accompanying drawing:

Fig. 1 is a perspective view of a storage arrangement according to one form of the invention;

Fig. 2 is a diagrammatic end view of the example of storage arrangement shown in Fig. 1;

Figs. 3, 4 and 5 show modifications of the arrangement shown in Figs. 1 and 2;

Fig. 6 shows a combination of the arrangements of Figs. 3 and 4;

Fig. 7 shows a combination of the arrangement of Fig. 3 with an inversion of the arrangement of Figs. 1 and 2;

Fig. 8 shows a further example of storage arrangement according to the invention;

Figs. 9, 10 and 11 show other combinations of arrangements; and

Figs. 12 and 13 show further arrangements according to the invention.

In the example of the invention shown in Figs. 1 and 2, the shelving comprises a fixed row of shelving units **10** which is stepped halfway up in its height at line *x*—*x* so that the shelves **11** in the upper part are shallower, from back to front, than those **12** in the lower part. The individual shelves **11** of the upper part are also arranged closer together than those **12** of the lower part and vertical sub-dividing partitions, if any, may also be closer together in the upper than in the lower shelves to provide smaller compartments which are in better balanced sizes relative to the size of the smaller articles to be stored. In front of the fixed row of shelving or rack **10** is mounted a row of mobile units **13** which, at their rear faces, are stepped to mate with the front face of the fixed shelving units **10** so that in the mobile units, the shelving at the upper part will be as deep from back to front, as the lower shelves **12** of the fixed shelving, whilst the lower shelves of the mobile units will be shallower and will correspond with the upper shelving **11** of the fixed units. The spacing and sub-division of the shelves in the mobile units are conveniently the same as in the fixed rack, which latter are also constructed in side-by-side units, and therefore, considering any fixed unit and its complementary mobile unit, or even considering the shelving in rows, it will be seen that the articles may be distributed in compartments suitably balanced, in proportion to their size, so that the whole range of sizes, back to front, is obtainable not only in one unit, or in one row of units, distributed between the upper and lower shelves, but also the articles in the upper part of one unit, or row, may be complementary to those in the upper part of one unit or units of the adjacent row, and equally, the articles in the lower parts of the two rows will be complementary. Thus for example, in the upper and lower shelves of the installation, there will be found suitable storage for both the largest and the smallest sizes of articles, whilst from the mean line *x*—*x* at the step, articles of the same size will be found both above and below such line, though in different but adjacent rows.

Thus, for example, considering a storage system with a single central step as shown in Fig. 2 the upper and lower parts could be divided as to regions normally within and beyond average reach above and below the step. The region within normal reach lying for example between the lines A—A and B—B would serve to carry stock of all sizes for immediate use, whilst the regions out of normal reach i. e. above the line A—A and below the line B—B would also carry stocks of all sizes, in the same proportion, and accessible in emergency or for periodic replenishing of the aforesaid region within normal reach.

In another example of the invention, the variation in depth back to front may have more than one step as shown in Fig. 3 there being two steps **14** and **15**. It will be seen that the steps are not equally spaced, and the intermediate faces are graded to provide different heights for some of the parts of the same depth (back and front). Thus the shelves **16** and **17** are of equal depth (back and front) but the spacing is such that those of **16** are shallower in height than those of **17**.

As shown in Fig. 4 the variation may be gradual through the whole of the mating faces, such faces **18** and **19** being equally inclined, sloping backwards in a plane surface gradually from the ground. In this example the spacing of the shelves in the complementary rows is equal and for substantially equal height/depth ratio. Alternatively, such surfaces **18** and **19** may be curved in whole or in part.

As shown in Fig. 5 the complementary mating faces may be in part vertical, as at **20** and **21**, which are unequal, and in part inclined, as at **22**, with suitably-proportioned shelf spacing in which, for example, the spaces **23** and **26** are equal, as also are **24** and **25**.

In another arrangement, as shown in Fig. 6, there are three complementary rows of shelving comprising a fixed rack **27** and mobile rows **28** and **29** both the back and front face shaped to give the required varying depth the back face **30** being inclined whilst the front face **31** is stepped. The shelf spacing in row **27** is shown the same as in part of Fig. 4 which it resembles, whilst the shelf spacing in rows **28** and **29** may conveniently be as shown.

Obviously there are many other possible combinations of shape and size which cannot all be described or shown herein. For example the back and front faces of the middle row may be parallel with each other or one may be the reverse shape of the other as shown in Fig. 7, in which there are three rows **32**, **33** and **34**, the units of the row **33** having a single backward step **35** whilst at the front face there are two forward steps **36** and **37** respectively.

In an example where a part only of the meeting faces of adjacent rows mate, the construction as shown in Fig. 8 may comprise a row of fixed units **38** with a single step **39** as in the example shown in Fig. 2 and mobile units **30** arranged to run on the step **39** in front of the upper or narrower shelves only. This arrangement could be reversed as shown in Fig. 9 with a fixed or mobile row of units **41** having the deeper (back to front) compartments above a reverse step **42** and a second row of shallower units **43**, below such step, and mating with the step and with the face of the shallower part of the units **41**.

In another example, see Fig. 10, instead of the whole of one row of stepped units being fixed, the deeper (back to front) lower part **44** only may be fixed, as for example resembling a show case or sale counter or work-bench, and shallower (back to front) upper units **45** be mobile thereon whilst the mobile units **46** of the complementary row would overhang the said fixed lower units **44** to mate with them and with the smaller upper mobile units **45**. By this means a full-depth counter or table could be available at any point in its length by separating the adjacent units **45** and

46 leaving the top of the units 44 available for such use.

In an example of the second feature aforesaid, of the invention, in combination with the graded depth (back to front) of the shelving there is provided graded height. For instance, the units may be made with shelving of four different depths (back to front) and with the height between the upper shelves say half that between the lower. The shelf arrangements shown in the drawings all embody some grading of height but obviously for some requirements such grading may not be required when the spacing of the shelves could be equal, or when it may even be desired to reverse the proportions so that the spacing for the shelves which are shallower (back to front) is wider than the spacing of the shelves which are deeper (back to front). The invention may be combined with shelving, mobile or fixed, which is of uniform depth (back to front) and either of uniform or graded spacing of the shelves. Thus, as shown in Fig. 11, there are three rows comprising a fixed row 47 and a mobile row 48 which have three complementary steps at which there are shelves 50 such that the height above the two upper shelves is the same, and so that for such height there are four grades of depth (back to front). Similarly, for the lower shelves 51 of greater height there are also four grades of depth (back to front). In front of the row 48 there is a further row of mobile units 49 which are of uniform (non-graded) height having equally-spaced shelves 52.

Instead of having any four grades of depth (back to front) and all of the same height, the stepping may be graded to any other required dimension.

In an example of the third feature of the invention, in combination with the first feature of graded depth (back to front) with or without the second feature of graded height, the units of shelving may be of graded lengths. As a simple illustration, Fig. 12 shows a single row of shelving, the units of which, from left to right, 53, 54, 55, 56, 57, 58 and 59 may measure respectively say 3 ft., 4 ft., 5 ft., 6 ft., 5 ft., 4 ft., and 3 ft. in length. By arranging that the end unit 59 can move 6 feet, as shown by the space outlined by the dotted line 60, it is certain that full access is obtainable to or behind the largest unit as well as to any of the others. In the case of the smaller units it will obviously be possible to get access to some of those behind or partly behind either of two units in the forward row. Therefore, two persons could, at the same time, have access to two different units in a rear row without interfering with each other. The units may be in two or several sizes and may be graded or interspaced other than as above suggested. Obviously, for example, the row of units 49 could be fixed behind the units 47, which would then be mobile. There could also be many other combinations of graded units with or without other non-graded units.

The invention obviously has a large range of use; for instance it may be applied to storage below counters, or in domestic storage cupboards, or in ship's storage or in mobile shops or transport vehicles including aircraft. The invention could be applied to horizontally-disposed storage systems consisting for example of a plurality of fixed and slidable open-topped containers or trays of different depths and being, in effect, any of the arrangements above described laid on their backs. Such latter arrangement is shown in Fig. 13, comprising a drawer 61 having fixed bottom compartments 62, 63 and 64 of graded depth, and slidably arranged above them are three mobile units of complementary graded depth. The transverse partitions are shown so that the compartments 65, 66 and 67 respectively are of different sizes. The same arrangement of the transverse partitions may be provided in the fixed compartments at the bottom of the drawer.

What I claim is:

1. An article of manufacture comprising a series of rear storage containers and at least one front storage container having access faces all in the same direction and each having a back face opposite its access face and longitudinal partitions extending from the said access face to the back face dividing the container vertically into a plurality of storage spaces, the front containers being mounted for relative lateral movement with respect to said rear containers, with the said back face of one movable close to and across the said access face of another and so that the said one container can cut off access to the said other container, the back faces of the rear storage containers and the front faces of the front storage containers being vertical, wherein the said access and back faces of such relatively movable containers are of complementary shape to mate slidably with each other, the meeting faces of said containers being along a non-vertical plane, whereby there is provided on each container storage spaces of several different depths measured from the access face.

2. An article of manufacture comprising a series of rear rows of side-by-side container units and at least one front storage container having access faces all in the same direction and each having a back face opposite its access face and longitudinal partitions extending from the said access face to the back face dividing the container vertically into a plurality of storage spaces, the containers in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row, so that they can cut off access to those in such other row, the back faces of the rear storage containers and the front faces of the front storage containers being vertical, wherein the said access and back faces of such relatively movable containers are of complementary shape as to mate with each other at any position of their movement, each container unit having storage spaces of several different depths measured from the access face.

3. An article of manufacture comprising at least three rows of side-by-side units of shelving each having a front access face and a back face and longitudinal partitions extending from the said access face to the back face dividing the container vertically into a plurality of storage spaces, the units in at least two rows being mounted for independent lateral movement with their back faces close to and movable across the access faces of the units of the row behind and wherein the units of at least one intermediate row have both their access and back faces of complementary shape to mate with the respective complementary faces of the units in the next adjacent rows, the back face of the rear storage containers and the front face of the front storage containers being vertical, the intermediate units having portions of greater depth from front to rear than other portions and the units in front and at the rear thereof as being so shaped as to be complementary thereto and as

having back and access faces, respectively, shaped to meet with adjacent faces of said intermediate units, so as to provide in each unit of at least two rows storage spaces of different depths measured from the front access faces of those units.

4. An article of manufacture comprising storage containers having access faces all in the same direction, and each having a back face opposite its access face and longitudinal partitions extending from the said access face to the back face dividing the container vertically into a plurality of storage spaces, such containers being mounted for relative lateral movement with the said back face of one movable close to and across the said access face of another and so that the said one container can cut off access to the said other container, the back faces of the rear storage containers and the front faces of the front storage containers being vertical, wherein the pairs of complementary meeting access and back faces of such relatively movable containers are stepped to mate slidably with each other and wherein each container has storage spaces of several different depths measured from the access face.

5. An article of manufacture comprising rows of side-by-side container units having access faces all in the same direction and each having a back face opposite its access face and longitudinal partitions extending from the said access face to the back face dividing the container vertically into a plurality of storage spaces, the containers in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row so that they can cut off access to those in such other row, the back faces of the rear storage containers and the front faces of the front storage containers being vertical, wherein the pairs of complementary meeting access and back faces of such relatively movable containers are stepped to mate with each other at any position of their movement and wherein each container unit has storage spaces of several different depths measured from the access face.

6. An article of manufacture comprising rows of side-by-side container units having access faces all in the same direction and each having a back face opposite its access face, the containers in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row so that they can cut off access to those in such other row, the back faces of the rear storage containers and the front faces of the front storage containers being vertical, wherein the pairs of comlementary meeting access and back faces of such relatively movable containers are stepped to mate with each other at any position of their movement, longitudinal division members in each container extending from the said access face to the said back face and located at least at such steps and the intervals of measurement between the steps being graded wherein each container has between such division members storage spaces of different proportions measured in both such directions of measurement.

7. An article of manufacture comprising rows of side-by-side container units having access faces all in the same direction and each having a back face opposite its access face, the container units in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row so that they can cut off access to those in such other row, wherein the said access and back faces of such relatively movable containers are stepped to mate with each other at any position of their movement, longitudinal division members in each container extending from the said access face to the said back face and located at least at such steps and the intervals of measurement between the steps being graded and wherein as regards storage spaces formed by such division members in any two such container units stepped to mate with each other, the container units are proportioned with at least one storage space of one container unit equal in depth from the access face to at least one storage space of the other container unit, but different in the height thereof between the said division members.

8. An article of manufacture comprising rows of side-by-side units of shelving having access faces all in the same direction and each having a back face opposite to its access face, the shelving units in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row so that they can cut off access to those in such other row, wherein the said access and back faces of such relatively movable containers are stepped to mate slidably with each other at graded intervals of measurement and partitions located at such steps and wherein storage spaces of several different sizes are provided in each unit.

9. An article of manufacture comprising rows of side-by-side units of shelving having access faces all in the same direction and each having a back face opposite to its access face, the shelving units in at least one row being mounted for lateral movement with their back faces movable close to and across the said access face of those in another row so that they can cut off access to those in such other row, wherein the said access and back faces of such relatively movable containers are stepped to mate slidably with each other at graded intervals of measurement and shelves located at such steps and which provide in each unit several different sizes of storage spaces measured both from the access face and as regards distance between shelves, and wherein as regards storage spaces formed between shelves in any two such units stepped to mate with each other, at least one storage space in one unit is equal in depth from the access face to at least one storage space in the other unit, but different in measurement between the shelves.

10. An article of manufacture comprising a plurality of rows of side-by-side units of shelving having access faces all in the same direction, and each having a back face opposite its access face and longitudinal shelves dividing the container into a plurality of storage spaces, the containers in at least one row being mounted for lateral movement with their back faces movable close to and across the said access faces of those in another row so that they can cut off access to those in such other row, wherein, the said access and back faces of such relatively movable containers are inclined to the planes of their opposite faces to mate with each other at any position of their movement, and thereby provide in each container unit storage spaces of progressively differing depths measured from the access face.

11. An article of manufacture comprising rows of side-by-side units of shelving having access faces all in the same direction and each having a back face opposite to its access face, longitudinal shelves dividing the container in to a plurality of storage spaces, the shelving units in at least one row being mounted for lateral movement with their back faces movable close to and across the said access faces of those in another row so that they can cut off access to those in such other row, wherein the said access and back faces of such relatively movable container units are stepped to mate slidably with each other at graded intervals of measurement and shelves are located at such steps and thereby provide in each unit several different sizes of storage spaces measured both from the access face and as regards distance between shelves.

12. An article of manufacture comprising a fixed row of side-by-side storage containers each having longitudinal partitions dividing the container into a plurality of storage spaces all open at the top, at least one complementary row of side-by-side storage containers superposed on said lower row, those containers of an upper row mounted for relative lateral movement with their bottom faces close to the top faces of those in the lower row so that the upper containers can cut off access to those below and wherein the said close bottoms and top faces are stepped to mate slidably with each other, the bottom face of the lower row and the top face of the upper row being in horizontal planes and providing in each container storage spaces of several different depths.

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