Sept. 21, 1965 D. F. GEBHART 3,207,259

SPIRAL STAIRWAY

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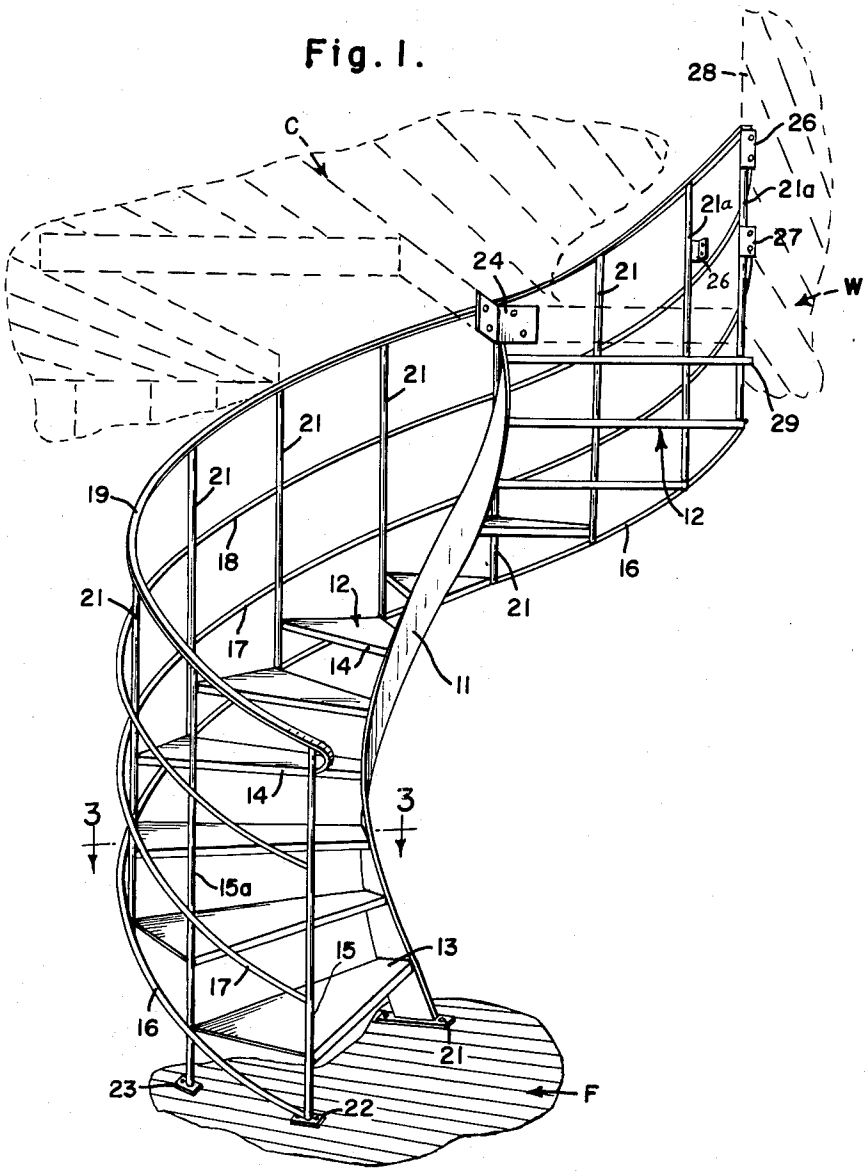
Fig. 1.



INVENTOR.

Dave F. Gebhart

BY

Townsend and Townsend

attorneys

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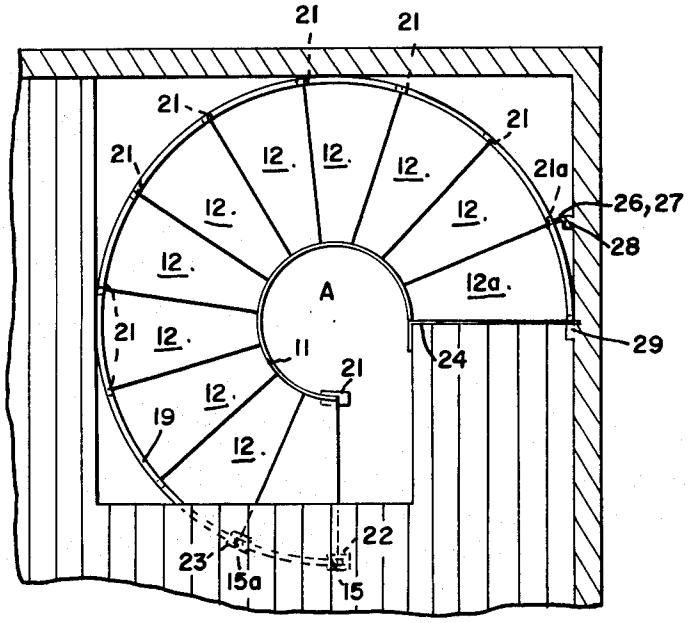
Fig. 2.



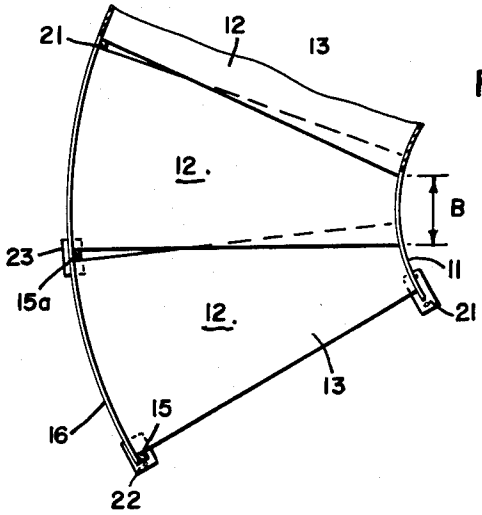


Fig. 3.

INVENTOR.
Dave F. Gebhart

BY
Townsend and Townsend
attorneys

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SPIRAL STAIRWAY

Dave F. Gebhart, 578 Lincoln Way, Auburn, Calif.

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This invention relates to fabricated "spiral" staircases—the form is technically that of a helix—of the type commonly encountered in residences and commercial buildings.

Such staircases are commonly fabricated using a small diameter iron pipe with stair treads projecting radially outwardly either in pure cantilever fashion or with additional secondary bracing. Other more elaborate types commonly seen in residences often involve a larger diameter helical course with treads composed of various materials such as steel, concrete of various colors, and terrazzo.

There are many disadvantages to the aforementioned spiral staircase designs which are overcome with the present invention.

First, the small diameter pipe and cantilever design, although of low cost, involves a configuration wherein the tread of the stair next to its pipe attachment is extremely narrow, causing an inconvenient and dangerous condition for the user. In recent years, many state codes prohibit the tread in horizontal projection with the rest of the stair system to be less than 6". Thus, this type of stairway may be outlawed altogether. Even if the basic design is allowed, a handrail must be erected along the inner region of the stairs to prevent the user from encountering the narrow tread; then, in order to maintain a given—usually required stairway width—the outer diameter of the stairway configuration must be greatly enlarged thus adding substantially to awkwardness of fabrication and cost.

Second, despite its low cost, the pipe and cantilever construction presents certain fabrication problems; it is frequently difficult to obtain true alignment of the successive helically oriented treads which emanate radially from the small diameter pipe. This has been overcome in part by prefabricating the stair treads on sleeves which slip over a central pipe, but this adds to the cost, gives a somewhat odd appearance to the over-all installation, and, in any event, fails to achieve a wider effective tread at the inner part of the stair.

An obvious solution to some of the above problems is to provide a central column or pipe which has a large enough diameter so that the minimum tread width at the inner part of the stairway is at least 6". The difficulty here, however, is that the minimum size column that can accomplish this is about 16" in diameter when other requirements of normal head room and stair rise relationship in the helix are attained. Ordinary steel pipe is one of the least expensive prior means of providing such a column, but even such pipe is extremely costly, in the magnitude of 200 times the cost of the corresponding helical strip hereinafter to be explained as part of this invention. Moreover, this and other types of fabricated columns are heavy, awkward to handle, and create a lost space through the central core of the stairway which could otherwise be used for convenient storage or ornamental displays. In addition, this type of large central column or pipe design has the added disadvantage that the inner face of the pipe wall immediately adjacent to the stair tread connection is inaccessible for purposes of forming convenient and economic attachment by bolting or conventional spot welding.

Another common solution, spiral stairs of special design and larger sweep, is even more costly than the large diameter pipe and cantilever construction, more difficult

to fabricate, and generally must be especially designed for each installation.

Thus, it is a principal object of the present invention to provide an efficient helical steel, or other suitable material, staircase which has a convenient tread and rise relationship with a minimum tread in horizontal projection of about 6". Such construction would not only be safe and pleasant to use, but would meet the various State Safety Code regulations.

A principal advantage in fabrication, as compared to the pipe construction, is that since an open helical strip is involved as the central element supporting the cantilevered stairs, the area of attachment directly adjacent to and behind the stairs is easily accessible. This enables numerous improvements to be made in construction because of the ease with which the stairs may be attached to the spiral, i.e., helical, strip. For example, ordinary bolting techniques may be used which are impossible to achieve using even a large diameter pipe wherein one is limited to the less satisfactory and costly tapping of threads in drilled holes with the use of cap screws or various arc welding techniques other than ordinary inexpensive spot welding.

Another feature and advantage of this arrangement is that the components for fabrication are of low cost sheet and plate strips which are easily and conveniently handled, formed and fabricated to the finished product.

Still another advantage and feature of the present invention is that by avoiding the small diameter "pipe and slip on" construction, elaborate bracing, or the larger diameter pipe design, which is cumbersome and has a ponderous appearance, an extremely graceful and pleasant appearing design is created which lends itself to numerous applications in private residences as well as offices in commercial applications.

Another feature of this invention is its ease of fabrication which enables sections to be preformed and fabricated in a shop before delivery to the job site, thus considerably reducing cost.

Still a further useful feature of this invention is that although a pipe is not used in its center section, the fabrication is a continuous helix forming a columnar structural element. Such an element acts as secondary bracing and stiffening in the vertical support of the ceiling and floor above the level where the "spiral" stair is anchored.

Finally, a feature of this new type of spiral staircase is that by avoiding the use of a large diameter central pipe support, or other elaborate bracing arrangement, a convenient space is created through the center of the helical arrangement that can be used either for storage or for ornamentation.

Other objects of the present invention will become apparent upon reading the following specifications and referring to the accompanying drawings in which similar characters of reference represent corresponding parts in each of the several views.

Turning now to the drawings, FIGURE 1 is a perspective elevation showing the staircase and its connection between two floors.

FIGURE 2 is a plan view looking down from the opening on the upper floor to which it connects.

FIGURE 3 is a section in plan view as indicated in FIGURE 1.

Columnar element **11** is formed in the shape of a helix having a diameter of at least about 16", indicated by dimension A, FIGURE 2, and a helix pitch of about 6'6", one entire pitch not utilized in the embodiment shown on the drawings. A plurality of stairs **12**, with trapezoidal shaped treads **13** and lips **14**, are attached at the stairs inner end, i.e., end next to central helix element **11**, and extend radially outward from columnar

element **11**. Vertical posts **15** and **15***a* are attached to the outer corners of the lowest stair, and **15***a* is also attached to the trailing outer corner of the next higher stair. Posts **15** and **15***a* extend vertically adjacent, and are normally fastened to, toe rail **16**, first immediate rail **17**, second intermediate rail **18** and handrail **19**. A plurality of vertical posts **21** are attached to the outside leading and trailing corners of successive stairs **12** extending between toe rail **16** and handrail **19** with connections at first and second intermediate rails **17** and **18**.

The stair structure is fastened to first floor F by bracket **21** attached to the lower extremity of columnar element **11** and foot brackets **22** and **23** attached to the lower extremities of vertical posts **15** and **15***a* respectively. The spiral stairway is fastened at its upper extremity to ceiling and second floor C by bracket **24** which is attached to the upper extremity of columnar element **11**. Also, uppermost vertical post **21***a* has attached to it brackets **26** and **27** which fasten to a scab **28** on wall W just above ceiling and second floor C elevation.

Uppermost stair **12***a* has attached to it bracket **29** which is fastened to wall W at second floor and ceiling C elevation.

The minimum clear tread at stairs **12** and **12***a* is indicated by dimension B at FIGURE 3. It is dimension B that is critical in respect to meeting various State Safety Code regulations which generally require that it be at least about 6". Dimension B also determines the relative safety, comfort and convenience to the user of the stairway, and this is optimum for values of at least about 6".

The individual stair rise is not specifically indicated on the drawings. In this respect standard architectural practice is followed wherein the total stair interval is conveniently subdivided into a number of subintervals, i.e., rises, that bear an accepted relationship to the minimum tread dimension B of at least about 6". This accepted relationship in standard architectural practice is that the sum of the tread and rise be equal to about 14".

Although the foregoing invention has been described in some detail by way of illustration and example for purposes of clarity of understanding, it is understood that certain changes and modification may be practiced within the spirit of the invention and scope of the appended claims.

I claim:

1. A spiral staircase comprising a vertical, central, columnar element formed in the shape of a helix whose diameter is at least about 16" and pitch its at least about 78", a plurality of stairs fastened to and extending radially outwardly from said columnar element, said columnar element connected to the inner ends of said stairs and constituting the primary columnar support for the stairs throughout the entire height of said staircase, a helical outer member connected to the outside leading edge of each of said stairs, a plurality of vertical members connected to said helical member and to the outside trailing portion of each of said stairs, and means connecting said columnar element at each of its extremities to at least two surfaces between which said spiral staircase connects.

2. In a spiral staircase, the combination comprising a vertical central columnar element formed in the shape of a helix, means connecting the top and bottom of said columnar element to at least two surfaces between which said spiral staircase connects, a plurality of stairs extending radially outwardly from said columnar element with minimum tread in horizontal projection of at least about 6", said columnar element connected to the inner ends of said stairs and constituting the primary columnar support for the stairs throughout the entire height of said staircase, a helical outer member connected to the outside edge of each of said stairs, and a plurality of vertical members connected to said helical member and to an outside portion of each of said stairs.

3. In a spiral staircase, the combination comprising a vertical, self-supporting, central columnar element formed in the shape of a helix, means connecting the top and bottom of said columnar element to at least two surfaces between which said spiral staircase connects, a plurality of stairs extending radially outwardly from said columnar element and with minimum tread in horizontal projection of at least about 6", said columnar element comprising the primary columnar support for said stairs, a helical outer member connected to the outside leading edge of each of said stairs, a plurality of vertical members connected to said helical member and to the outside trailing portion of each of said stairs, vertical post supports connected to the outer extremities of said stairs, helical guard members spaced at intervals along and connected to said vertical posts, said guard members formed in the shape of a helix having a diameter equal to that of said columnar element helix plus twice the width of said stairs and a helix pitch equal to that of said columnar element helix, a helical handrail connected to the top of said vertical posts, said handrail having a diameter equal to that of said columnar element plus twice the width of said stairs and a helix pitch equal to that of said columnar element.

4. A spiral staircase comprising a central columnar element formed in the shape of a helix from a sheet strip of rigid structural material whose sides are in substantially vertical planes, said columnar element having a diameter of at least about 16" with a helix pitch of at least about 78", a plurality of shaped stairs extending radially outwardly at intervals along said columnar element, treads of said stairs having a minimum dimension in horizontal projection immediately adjacent to said columnar element of at least about 6", and means connecting said stairs to said columnar element, said columnar element connected to the inner ends of said stairs and constituting the primary columnar support for the stairs throughout the entire height of said staircase, a helical outer member connected to the outside leading edge of each of said stairs, and a plurality of vertical members connected to said helical member and to the outside trailing portion of each of said stairs.

5. A spiral staircase comprising a central columnar element formed in the shape of a single helix of at least about 16" diameter and with a pitch of at least about 78", said columnar element formed from a sheet strip whose sides are in substantially vertical planes, a plurality of shaped stairs extending radially outwardly from said columnar element with a minimum tread in horizontal projection at point of attachment to said columnar element of at least about 6", means attaching said stairs at their inner extremity to said columnar element, said columnar element constituting the primary columnar support for the stairs throughout the entire height of said staircase, a helical outer member connected to the ouside leading edge of each of said stairs, a plurality of vertical members connected to said helical member and to the outside trailing portion of each of said stairs, and means connecting said columnar element at its bottom and top extremities to two consecutive floors of a structure between which said spiral staircase connects.

6. In a spiral stairway in accordance with claim **5**, a vertical surface extending from the edge of said stairs attached to said columnar element, and said means attaching said stairs comprising bolts extending through holes in said vertical surface and holes in said columnar element for conventional bolting.

7. In a spiral stairway in accordance with claim **5**, a vertical surface extending from the edge of said stairs attached to said columnar element, and said means attaching said stairs comprising ordinary spot welding of said vertical surface to said columnar element.

8. In a spiral stairway between a lower and upper horizontal surface vertically spaced from each other, a central structural portion comprising a vertical columnar ele-

ment formed in the shape of a single helix of rigid, structural, compression-bearing material, stairs extending radially outwardly from said columnar element, said columnar element connected to the inner ends of said stairs and constituting the primary columnar support for the stairs throughout the entire height of said staircase, a helical outer member connected to the outside leading edge of each of said stairs, a plurality of vertical members connected to said stairs, a plurality of vertical members connected to said helical member and to the outside trailing portion of each of said stairs, and means connecting said columnar element at its upper and lower extremities to

said upper and lower surfaces, respectively, whereby said columnar element contributes secondary bracing and stiffness to said upper surface.

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HARRISON R. MOSELEY, *Primary Examiner.*