

Dec. 23, 1969

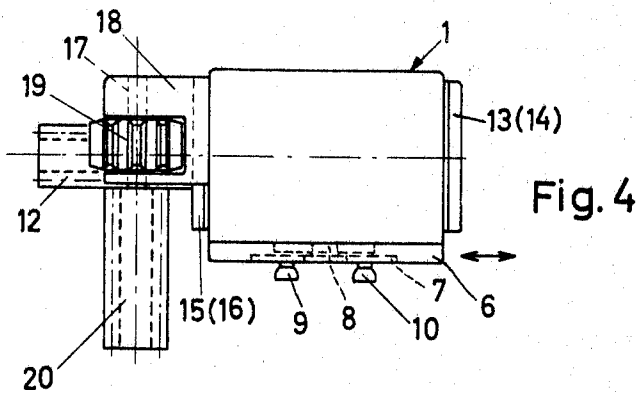
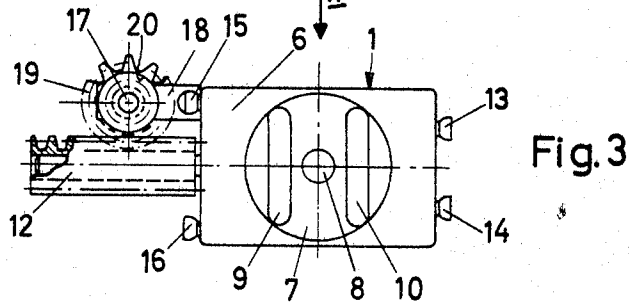
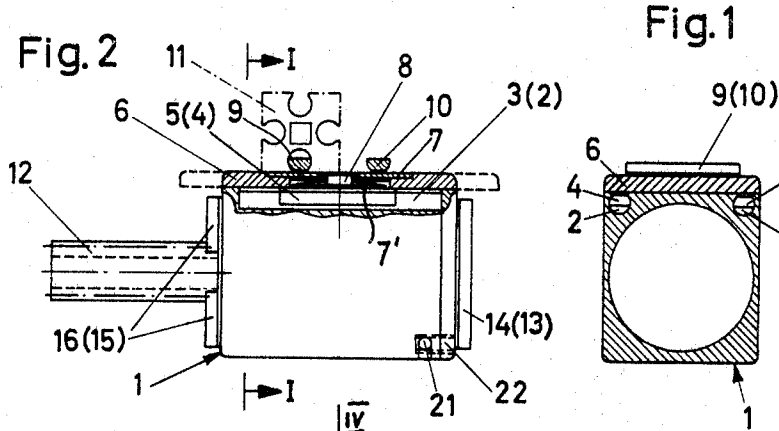
A. FISCHER

3,484,983

POWER UNIT FOR TOY BUILDING KIT

Filed May 8, 1967

2 Sheets-Sheet 1



INVENTOR:  
ARTUR FISCHER  
BY *Michael S. Stuckey*  
Attorney

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A. FISCHER

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POWER UNIT FOR TOY BUILDING KIT

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2 Sheets-Sheet 2

Fig. 6

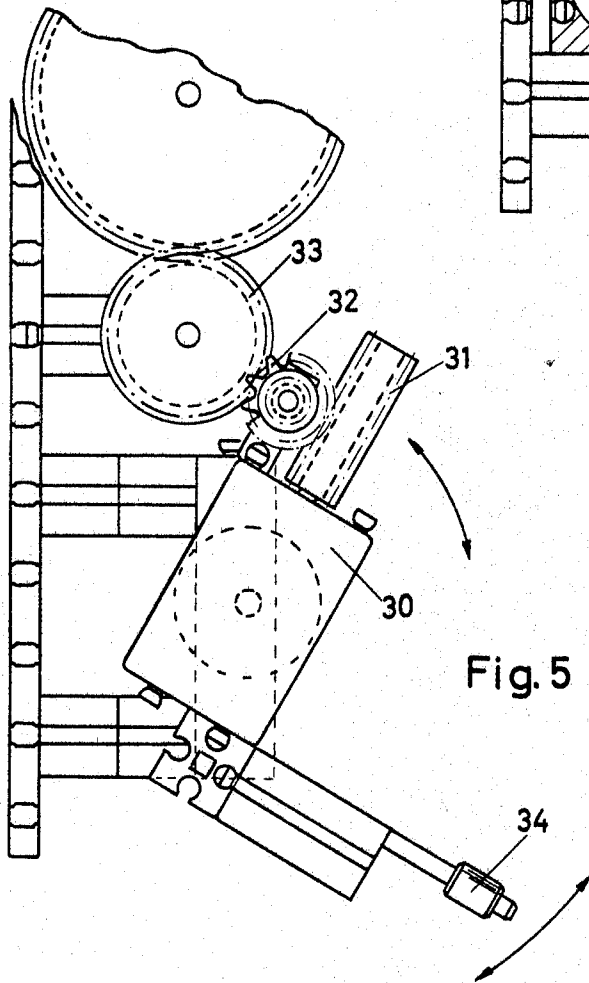
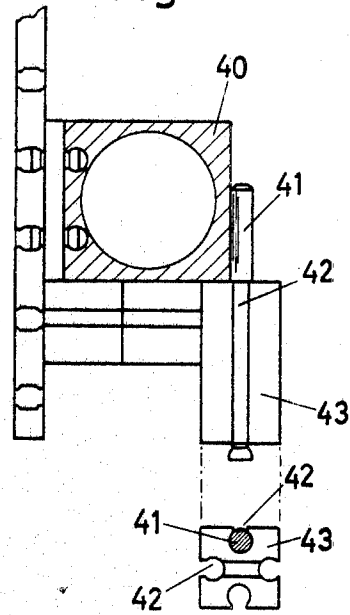


Fig. 5

INVENTOR:  
ARTUR FISCHER

BY *Michael S. Stricker*  
Attorney

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**POWER UNIT FOR TOY BUILDING KIT**

Artur Fischer, 133 Gruenmettstetterstrasse, 7241  
Tumlingen, Kreis Freudenstadt, Germany  
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U.S. Cl. 46-23

23 Claims

**ABSTRACT OF THE DISCLOSURE**

A motor housing including a first portion and a second portion. Shaft means which connects these portions for turning movement relative to each other. And coupling means provided on at least one of these portions and being adapted to mate with complementary coupling means on other elements to which said housing means is to be connected.

**CROSS-REFERENCES TO RELATED APPLICATIONS**

A building kit of the type in which the construction according to the present invention can find use is disclosed in my copending application, Ser. No. 592,691 entitled "Building Kit" and filed on Nov. 4, 1966.

**BACKGROUND OF THE INVENTION**

The invention relates generally to a building kit, and more particularly to a building kit of the type in which cooperating structural elements are provided with mating coupling arrangements. Still more specifically, the invention relates to a building kit in which such cooperating structural elements are provided with undercut grooves and complementarily configured coupling projections receivable in such grooves for securing the elements to one another.

In my above-mentioned copending application, Ser. No. 592,691 I have disclosed a building kit comprising a plurality of structural elements which are intended to be releasably coupled to one another. Such a building kit is particularly adapted as a toy and enables a child to erect various structures, such as replicas of houses, models of vehicles, and the like. Some or all of the structural elements in this kit are provided with undercut grooves in one or more of their exposed faces. Again, some or all of these elements are provided on one or more of their exposed faces with coupling projections which are so configured that, when a wider head portion of the coupling projection is received in the undercut part of one of the aforementioned grooves, while a narrower neck portion connecting the head portion with the respective structural elements extends outwardly through the narrower part of the groove to structural elements on which the groove and the projection are respectively provided are so united against separation that they cannot be accidentally moved apart in a direction transversely of the elongation of the undercut groove.

Generally, although this is not to be considered limiting, the structural elements in such building kits are of polygonal cross-section and the grooves extending from one end face of the structural element to another opposite end face. Thus, to secure one structural element to another in the manner described above, the coupling head of one element is inserted into the undercut groove of the other element from one of the end faces of the latter, at which the groove is open.

As has been pointed out above, it is possible with kits of this type to construct models or replicas not only of buildings and similar objects but also of vehicles, of

cranes or of other artifacts which are capable of movement, either by propagation of the entire thus-constructed model, or by motion of certain portions thereof. To power these models for such movements it is possible to provide a prime mover, particularly a miniature electrical motor. Such a motor can advantageously be provided in a housing having a size and configuration which makes it compatible as an element which can cooperate with the other structural elements of the kit, and by providing coupling portions of the type outlined above on such housing, the housing with the motor disposed therewithin can be connected to other structural elements of the building kit. Unfortunately, however, the arrangement of the housing relative to the other structural elements to which it is to be connected, and thereby the position of the motor output shaft relative to these elements and to other cooperating structural elements of the model which is to be powered, is dictated by the fixed location of the cooperating coupling portions provided on the housing and the other structural elements of the kit. Thus, the output shaft of the motor can assume only a very few positions with respect to the other structural elements of the model which is to be powered, and if the particularity of such model requires that the output shaft assume a location intermediate these predetermined positions, which, as pointed out above, are given by the provision of the cooperating coupling portions, the motor cannot be used to power the model.

Evidently, this is very undesirable. On the other hand, it is a relatively common occurrence, particularly if there is not enough room for providing auxiliary gears which can change the direction of power transmission, or if cantilevered constructions are involved or other constructions which are susceptible to bending stresses. Furthermore, it is not possible, under these circumstances, to swivel the motor relative to the elements which are to be driven, and this of course precludes a highly desirable and very simple manner of permanently or temporarily the drive of such elements without having to stop the motor—which may still be needed for other purposes—or having to disassemble the model. Another disadvantage is the fact that wherever it is necessary to provide a speed-reduction gear, the limitations on the positioning of the motor output shaft dictate a certain arrangement of speed reduction gear in relation to the motor output shaft which frequently cannot be provided because of space limitations.

It is therefore desirable to provide the requisite improvements so as to make construction or building kits of the general type here under discussion still more versatile.

**SUMMARY OF THE INVENTION**

The present invention relates to a construction element which provides all such improvements as have been characterized above as desirable.

More particularly, the present invention provides a construction element, including a motor housing, which can be reliably connected to other structural elements of a building kit of the type mentioned before, but which can at least in part be moved relative to such other structural elements to a plurality of angularly offset positions. It is clear that this makes it possible to position the output shaft of a motor disposed in such motor housing and constituting a portion of the novel construction element, in a great many positions relative to these structural elements to which the novel construction element is connected.

The construction element in accordance with the present invention increases greatly the versatility of building kits in which it is used.

Furthermore, the novel construction element and its above-mentioned adjustability makes possible the use of

speed-reduction arrangements in conjunction with the construction element, or more particularly with the motor forming a part of such construction element, without requiring a large volume of space for the arrangement of such speed reduction arrangements.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a section taken on the line I—I of FIG. 2; FIG. 2 is a partially sectioned side-elevation view of the novel construction element shown in FIG. 1;

FIG. 3 is a top-plan view of FIG. 2;

FIG. 4 is a view as seen in the direction of the arrow IV in FIG. 3;

FIG. 5 shows in elevation an exemplary construction utilizing the novel construction element according to the present invention in conjunction with additional structural elements; and

FIG. 6 is another view showing an exemplary arrangement of the novel construction element in conjunction with additional structural elements of a building kit.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Discussing now the drawing in detail, and firstly FIGS. 1-4 thereof, it will be seen that the novel construction element in accordance with the present invention comprises a motor housing 1, such, in the illustrated embodiment is assumed to be of rectangular configuration, although this is of course by way of example only. The housing 1 has a plurality of exposed surfaces, one of which is provided with two parallel undercut grooves 2, 3 (see FIG. 1) extending in the longitudinal direction of the housing. A plate 6 overlies this exposed surface of housing 1 in which the grooves 2 and 3 are formed and this plate 6 is provided on its underside with a pair of coupling heads or projections 4, 5 whose cross-sectional configuration is such that they can be received in the grooves 2, 3 thus securing the plate 6 to the housing 1, and preventing withdrawal of accidental removal in the direction transversely of the elongation of the grooves 2, 3 while permitting movement of the plate 6 relative to the housing 1 in the longitudinal direction of these grooves. In fact, the plate 6 may be thought of as one part of the housing 1 which constitutes a support means, and the remainder of the housing may be thought of as a second part. Parenthetically it might be added that the plate 6 could be rigid with the housing 1, that is not slidable relative thereto as illustrated in the drawing, and that it could also be entirely eliminated.

A disk 7, comprising a support means overlies the exposed major surface of plate 6. The drawing shows two possibilities in that the disk 7 is illustrated in FIG. 1 as being disposed atop plate 6, whereas in FIG. 2 it is shown as being recessed in the exposed major surface of the plate 6. In either case, however, disk 7 is secured to the plate 6 by a pin or shaft 8 so that it can be rotated with reference to the plate 6 to assure that the disk 7 cannot loosely rotate that is that it will not turn unless such turning is specifically intended, friction-promoting means can be provided. In FIG. 2 this is shown in form of a spring 7' which is interposed between the surface of plate 6 and the underface of the disk 7. Of course, other means than a spring can be provided, for instance roughened portions can be provided on the juxtaposed surfaces of plate 6 and disk 7 or small interengaging projections or teeth can be provided on these surfaces.

On its upper free face the disk 7 is provided with a pair of coupling heads 9 and 10 which correspond in configuration to the coupling heads 4 and 5 provided on the plate 6. The purpose of the coupling heads 9 and 10 is to secure the housing 1 to a support, such as the building block 11 which is shown connected with coupling element 9 and which is indicated in phantom lines. It is clear that when the housing 1 is so secured to the building block 11 or other structural elements, it cannot only be rotated relative thereto by turning it about the pin 8, but it can also be longitudinally displaced by shifting the housing 1 relative to the plate 6 or conversely by shifting the plate relative to the housing 1. Two possible shifted or extended positions of the plate 6 have been indicated in phantom lines in FIG. 2, to facilitate understanding.

Disposed within an interior chamber defined by the housing 1 is a prime mover, for instance an electromotor of known construction, whose features do not form part of the present invention and which require no detailed discussion. Such motor has an output shaft which has connected thereto either permanently or releasably a worm 12 (see FIGS. 2 and 3). In addition to the coupling portions already discussed above the housing 1 is also provided on its respective axial end faces with a first pair of additional coupling projections 13 and 14, and with a second pair of additional coupling projections 15, 16. These additional coupling projections can be utilized in a variety of ways, for instance by securing a handle thereto, or by rigidly connecting the housing 1 to additional structural elements of a building kit whenever the adjustability is not required. In the arrangement shown in FIG. 3 the coupling projection 15, which as is evident from FIG. 2 may consist of two spaced portions analogously to the coupling projection 16 which is visible in the FIG. 2, has secured thereto a transmission gear which permits not only a speed reduction but also take-off of power at an angle to the axis of the motor. The transmission gear is provided with a rotatable shaft 17 secured in a bearing 18 which latter is provided with an undercut groove (not identified by reference numeral) into which the coupling projection 15 is introduced to thereby secure the transmission gear to the housing 1. It is evident that the transmission gear can be turned through 180 degrees so that the shaft 17, and a worm 20 carried on the shaft 17, will extend to the side of the worm 12 which is opposite the side shown in FIG. 4. A gear 19 cooperates with the worm 12 on the motor output shaft to be driven thereby and in turn the gear 19 drives the worm 20 of the transmission gear 17. It will be understood, of course, that while the worm 20 is used for transmitting power to one power user, it is possible to place a suitable gear into engagement with the teeth of the gear 19 so as to take-off power from there for another application. By way of information it should be mentioned that it is possible with the worm 20 to achieve a speed reduction of a 1:10 ratio.

FIG. 2 shows the position of two sets of electrical terminals for the motor, one set being designated with reference numeral 21 and the other being designated with reference numeral 22. To assure universality of arrangement of the housing 1, the sets 21, 22 are connected in parallel but are located on different exposed surfaces of the housing 1 such that one set is located on a surface which is inclined with respect to the surface on which the other set is arranged.

Provision of the novel construction element in accordance with the present invention makes possible a universality of power transmission not heretofore achieved, that is it provides the possibility of transmitting power to all models and under all circumstances such as are encountered in use of a building kit of the type discussed earlier and for which the novel construction element is particularly suited.

FIG. 5 is an exemplary arrangement of a model utilizing the novel construction element according to the pres-

ent invention. The construction element per se is designated with reference numeral 30 and the worm driven by the shaft of the motor of construction element 30 is designated with reference numeral 31. The transmission gear is identified with reference numeral 32 and will be seen to mesh with a gear 33 which in turn meshes with an additional gear to which no reference numeral has been assigned. The entire construction is supported by various structural elements which also have not been designated with reference numerals because this is not believed necessary for proper understanding of the arrangement in FIG. 5. It is to be noted, however, that the construction element 30 is secured in a manner evident from FIGS. 1-4 and not specifically shown in FIG. 5, to the supporting structural elements and can be turned about the disk which is indicated in phantom lines. A handle 34 is also secured to the construction element 30 thus making it possible to readily turn the same relative to the disk in the direction of the double-headed arrow so that the transmission 32 can be selectively moved into and out of engagement with the gear 33.

It is advantageous to select the dimensions of the housing of the novel construction element in such a manner that the width of the housing corresponds to double the width of the normal structural element found in building kits of the type here under discussion. The height of the housing is somewhat greater in view of the provision of the plate 6 and the disk 7. To provide a universal adaptability and cooperation between the housing of the novel construction element and the other structural elements of the building kit of the aforementioned type it is advantageous that the height of the housing correspond to three times the width of the other structural elements. However, adequate space is not always available to make use of such a solution, and FIG. 6 therefore shows an alternate solution which requires less space. In this figure the novel construction element is identified with reference numeral 40 and it will be seen that the element 40 is supported by a shaft 41 which normally forms a part of building kits of the type in question. The shaft 41 is received in an undercut groove 42 of an auxiliary structural element 43 and the height of the motor housing including the plate 6 and disk 7 (see FIGS. 1 and 2) is calculated accordingly. Specifically, and remembering that two of the undercut grooves will be provided in parallel on one and the same exposed surface of the housing of the novel construction element, as evident from the housing, the height of the housing, that is the dimension normal to the upper exposed face of the disk 7 and including both the thickness of the latter and of the plate 6 will be selected to constitute a multiple of the spacing between the two parallel grooves plus one-half the spacing between the two parallel grooves, but minus one-half the width of one of these grooves.

Various different materials are suitable for constructing the novel construction element according to the present invention, and of these, plastic materials of different types have been found particularly suitable.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of applications differing from the types described above.

While the invention has been illustrated and described as embodied in a construction element, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are in-

tended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims:

1. A toy construction element, particularly for use in assembly kits having a plurality of connectable elements, comprising a housing; support means carried by said housing; shaft means provided on said housing and connecting the latter and said support means for turning movement relative to each other; a motor positioned in said housing; and coupling means provided on said support means and adapted to mate with complementary coupling means on other elements to which said construction element is to be turnably connected.
2. A construction element as defined in claim 1, wherein said coupling means is provided on said support means for movement therewith to a plurality of angularly spaced positions.
3. A construction element as defined in claim 1, wherein said housing includes one member defining an internal chamber, and another member carried by said one member.
4. A construction element as defined in claim 3, wherein said support means is carried by and connected to said other member.
5. A construction element as defined in claim 3, wherein said other member is rigid with said one member.
6. A construction element as defined in claim 4, wherein said one member has a plurality of external faces, and wherein said other member overlies one of said faces; and additional coupling means connecting said other member to said one member for sliding movement with reference to said one face.
7. A construction element as defined in claim 6, wherein said additional coupling means are provided on said other member and said one face respectively and include elongated groove means and coupling head means received in said groove means for sliding movement there-within.
8. A construction element as defined in claim 6, wherein said support means overlies an exposed surface of said other member.
9. A construction element as defined in claim 1, wherein said coupling means comprise an elongated undercut groove adapted to receive a complementary coupling head provided on another element to which said toy construction element is to be connected.
10. A construction element as defined in claim 1, wherein said coupling means comprise an undercut coupling head projecting from said housing and adapted to be introduced into an undercut groove provided on another element to which said toy construction element is to be connected.
11. A construction element as defined in claim 7, wherein said coupling means comprise undercut groove means and complementary projecting undercut coupling head means adapted to be received in such groove means.
12. A construction element as defined in claim 8, wherein said support means is a disc; and further comprising friction-promoting means cooperating with said support means and said exposed surface for preventing accidental turning of said support means.
13. A construction element as defined in claim 12, wherein said friction-promoting means comprises biasing means interposed between said support means and said exposed surface and engaging both thereof.
14. A construction element as defined in claim 12, wherein said friction-promoting means comprises a plurality of interengaging projections provided on said support means and on said exposed surface.
15. A construction element as defined in claim 8; said prime mover being a motor accommodated within said internal chamber and having an output shaft extending in axial direction of said motor.

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16. A construction element as defined in claim 15, wherein said shaft means connecting said support means and said other member, and about which said support means is turnable, extends substantially normal to said output shaft of said motor.

17. A construction element as defined in claim 16, wherein said additional coupling means connects said other member to said one member for sliding movement in parallelism with said output shaft of said motor.

18. A construction element as defined in claim 6, wherein said support means has an outer face facing away from said other member, and wherein said housing has a given overall dimension as seen in a first direction normal to said outer face and a different overall dimension as seen in a second direction normal to said first direction.

19. A construction element as defined in claim 18, wherein said coupling means comprise at least one pair of coupling portions spaced from one another in said first direction and at least one further pair of coupling portions spaced from one another in said second direction, the dimension of said housing in said second direction being a multiple of the spacing between the coupling portions of a respective pair.

20. A construction element as defined in claim 19, wherein said coupling portions of said one pair are undercut grooves having a given width and wherein the dimension of said housing in said first direction is a multiple of the spacing between said grooves plus one-half of such spacing less one-half of the width of one of said grooves.

21. A construction element as defined in claim 15, and further comprising transmission means carried by said housing and comprising an output member adapted

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to be driven by said output shaft of said motor and having an axis; and connecting means connecting said transmission means to said housing so that said axis of said output member is out of alignment with said output shaft.

22. A construction element as defined in claim 21, wherein said axis of said output member crosses in space the axis of said output shaft.

23. A construction element as defined in claim 15, wherein said other member defining said internal chamber has additional exposed surfaces inclined with reference to one another and to the first-mentioned exposed surface; and further comprising one set of electrical terminals provided on one of said additional exposed surfaces, and at least one additional set of electrical terminals provided on another of said additional exposed surfaces, all of said terminals being connected with said motor.

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RUSSELL R. KINSEY, Primary Examiner

R. F. CUTTING, Assistant Examiner

U.S. Cl. X.R.

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