

**COUPLING BETWEEN TWO OBJECTS, OBJECT INTENDED FOR THIS
PURPOSE, AND MODULAR CONSTRUCTION SYSTEM**

Couplings between two objects are known in many
embodiments, for instance to serve as basis for toys or
for educational purposes. As example can be given the
meccano system that has long fallen into disuse wherein
5 objects had one or more panels with one or more
continuous holes. Two similar objects could then be
coupled using this system by means of a nut-bolt
connection. Spatial constructions could in this way be
built. Another example is the Lego® system which is
10 intended mainly for younger children.

It is an object of the invention to provide a
coupling between two objects which has in common with
the known systems that the coupling between two objects
can be selected in a specific manner as desired by the
15 user within a determined number of selection options,
and that the coupling is releasable.

It is an object of the invention to embody a
coupling such that it provides specific selection
options which allow a wide range of variation in the
20 building structures that can be made. According to the
invention the releasability does not have to be such
that mutually coupled objects come apart easily. It is
assumed according to the invention that the user must
perform specific well-considered actions to bring about
25 a coupling of a specific type or to release the
coupling.

In respect of the above objectives the invention
provides a coupling between two objects (1, 2) by means
of a coupling element (3);

30 wherein each object (1, 2) comprises:

a panel (4) with a continuous first hole (5)
with a round main shape and four inward protruding
tongues (6) which each have two sides (25, 26) extending
at least more or less in radial direction, which tongues
35 (6) are arranged angularly equidistant and each extend
over an angle of substantially 22.5°;

wherein the coupling element (3) comprises:

a shank (8) which can be inserted between the ends (7) of the tongues (6) into the first hole (5) and has an axis (29);

5 an insert stop member (19, 20) which is present on the central zone of the shank (8) and which defines the maximum distance over which the shank (8) can be inserted as desired with the one orientation or the other orientation into the first hole (5);

10 four locking cams (9, 10, 11, 12); (13, 14, 15, 16) on each of the two end zones (17, 18) of the shank (8), which locking cams (9-16) each extend over an angle of substantially 22.5° and are disposed at relative angular positions of substantially 0° , $(90^\circ - 22.5^\circ)$, 180° ,
15 $(270^\circ - 22.5^\circ)$; and

four rotation stop members (21, 22, 23, 24) which are each added to a locking cam (9-16) and arranged angularly equidistant and which can co-act with said sides (25, 26);

20 such that the coupling element (3) can be inserted into the first hole (5) in a chosen orientation as desired in one of four angularly equidistant angular positions until the insert stop member (19, 20) comes into contact with the panel (4) and the coupling element
25 (3) can then be rotated relative to the relevant object (1, 2) as desired through substantially 22.5° in the one or in the other direction until the rotation stop member (21-24) comes into contact with a relevant side (25, 26), whereby the locking cams (9-12); (13-16) engage
30 behind the panel (4) and the coupling element (3) is locked against axial displacement relative to the panel (4);

wherein rotation locking means (27, 28) are present for the purpose of releasably locking the coupling
35 element (3) relative to each of the two objects (1, 2) in each possible angular position, i.e. $(0^\circ \pm 22.5^\circ)$, $(90^\circ \pm 22.5^\circ)$, $(180^\circ \pm 22.5^\circ)$, $(270^\circ \pm 22.5^\circ)$.

As noted above, it must only be possible to realize or release the coupling by performing well-considered
40 actions. In this respect the coupling according to the invention preferably has the special feature that the

rotation locking means can be carried in and out of their locking state only by exerting a determined rotational moment between the coupling element and the relevant object.

5 In a specific embodiment the coupling has the special feature that the rotation locking means comprise a combination of a recess and a protrusion engaging elastically therein added at each possible angular position.

10 A practical embodiment comprises a resilient strip with the main shape of a circular arc, which strip is provided with three recesses which have relative angular positions of -22.5° , 0° , $+22.5^\circ$.

In a practical embodiment the coupling comprises
15 four strips which are each carried by two adjacent rotation stop members.

The latter two embodiments can advantageously comprise four protrusions which have the same angular positions as the tongues, form part of the panel and can
20 co-act with at least one of four resilient strips which each extend over an angle of substantially 90° and form part of the coupling element.

It is noted that the angles referred to in the foregoing must be deemed as technically functional
25 indications.

In a specific embodiment the coupling has the special feature that each object and/or the coupling element consists of plastic.

This latter embodiment can advantageously be
30 embodied such that each object and/or the coupling element is manufactured by injection-moulding.

The coupling element has a front view which is the same as, or mirror-symmetrical to, the rear view. This provides the option of a coupling in which the coupling
35 element is manufactured by

(a) making an extrudate using an extrusion head with an opening having the same form as the front view or the rear view of the coupling element,

(b) bringing the extrudate to the desired length,
40 and

(c) selectively removing excess portions such that a coupling element is obtained.

The coupling preferably has the special feature that the shank has an axially non-round continuous
5 second hole into which a suitable tool can be inserted and, by exerting a moment by means of this tool, the coupling element can then be rotated relative to the relevant object.

The invention also relates to an object designed
10 and evidently intended as component of a coupling as according to one or more of the above stated specifications, which object comprises at least one panel with at least two continuous first holes such that the object can be coupled by means of at least two
15 coupling elements to at least two further similar objects.

This object can comprise a number of panels with a number of continuous first holes with equal
centre-to-centre distances as measured along the surface
20 of the panels, wherein in the case of more than one first hole in a panel these holes are ordered in straight rows and, insofar as applicable, mutually perpendicular rows.

The invention further relates to a modular
25 construction system, intended for instance as toy or for educational purposes, comprising a number of objects as according to the specifications stated in the foregoing paragraphs, in addition to a number of coupling elements for mutually coupling objects by means of coupling
30 elements as desired by a user, whereby a number of objects and coupling elements are assembled into a unit.

Finally, the invention relates to a packaging with a modular construction system as according to the above stated specification.

35 The invention will now be elucidated with reference to the accompanying drawings. In the drawings:

Fig. 1 shows a perspective view of an object and a coupling element drawn at some mutual distance;

Fig. 2 shows a perspective view corresponding with
40 Fig. 1 in which the coupling element is inserted into the object;

Fig. 3 shows a perspective view corresponding with Fig. 2 in which the coupling element is rotated through 22.5° and is thus secured to the object;

Fig. 4A and 4B, 4C and 4D show on smaller scale and, drawn for the sake of clarity in mutual co-action, the first phase of Fig. 1, the second phase of Fig. 2, the realized third phase of Fig. 3, and the potential third phase of Fig. 4;

Fig. 5A shows a top view of the object with the coupling element as according to Fig. 2;

Fig. 5B shows a side view of the object with coupling element as according to Fig. 5A;

Fig. 6A shows a top view corresponding with Fig. 5A of an object and a coupling element inserted in reverse orientation;

Fig. 6B shows a side view of the object and the coupling element in the situation of Fig. 1; and

Fig. 7A, 7B, 7C, 7D, 7E, 7F, 7G and 7H show couplings between two objects with relative orientations of respectively 0° , 45° , 90° , 135° , 180° , 225° , 270° and 315° .

Fig. 1 to 6 show the basic components of a part of a coupling according to the invention. Fig. 7 shows the manner in which these basic components can be assembled with a further object to form a unit on the basis of a complete coupling according to the invention.

Said Fig. 1 to 6 show a coupling between two objects by means of a coupling element;

wherein each object comprises:

a panel with a continuous first hole with a round main shape and four inward protruding tongues which each have two sides extending at least more or less in radial direction, which tongues are arranged angularly equidistant and each extend over an angle of substantially 22.5° ;

wherein the coupling element comprises:

a shank which can be inserted between the ends of the tongues into the first hole and has an axis;

an insert stop member which is present on the central zone of the shank and which defines the maximum distance over which the shank can be inserted as desired

with the one orientation or the other orientation into the first hole;

four locking cams on each of the two end zones of the shank, which locking cams each extend over an angle of substantially 22.5° and are disposed at relative angular positions of substantially 0° , $(90^\circ - 22.5^\circ)$, 180° , $(270^\circ - 22.5^\circ)$; and

four rotation stop members which are each added to a locking cam and are arranged angularly equidistant and which can co-act with said sides;

such that the coupling element can be inserted into the first hole in a chosen orientation as desired in one of four angularly equidistant angular positions until the insert stop member comes into contact with the panel and the coupling element can then be rotated relative to the relevant object as desired through substantially 22.5° in the one or in the other direction until the rotation stop member comes into contact with a relevant side, whereby the locking cams engage behind the panel and the coupling element is locked against axial displacement relative to the panel;

wherein rotation locking means are present for the purpose of releasably locking the coupling element relative to each of the two objects in each possible angular position, i.e. $(0^\circ \pm 22.5^\circ)$, $(90^\circ \pm 22.5^\circ)$, $(180^\circ \pm 22.5^\circ)$, $(270^\circ \pm 22.5^\circ)$.

The drawn embodiments are such that the rotation locking means can be carried in and out of their locking state only by exerting a determined rotational moment between the coupling element and the relevant object 1, 2.

The rotation locking means comprise a combination of a recess 28 and a protrusion 27 engaging elastically therein added at each possible angular position.

In the drawn embodiment this coupling comprises a resilient strip 30 with the main shape of a circular arc, which strip is provided with three recesses 28a, 28b, 28c which have relative angular positions of -22.5° , 0° , $+22.5^\circ$.

The coupling in fact comprises four strips 30 which are each carried by two adjacent rotation stop members 21-24.

5 The coupling further comprises four protrusions 27a, 27b, 27c, 27d which have the same angular positions as tongues 6, form part of panel 4 and can co-act with at least one of four resilient strips 30 which each extend over an angle of substantially 90° and form part of coupling element 3.

10 In all the drawn embodiments each object 1, 2 and/or coupling element 3 consists of plastic.

Injection-moulding in particular is a very suitable method of manufacture.

It will be apparent, particularly from Fig. 5A, 15 that in the drawn embodiment the front view and the rear view of the coupling element are identical. Coupling element 3 can therefore be manufactured by

(a) making an extrudate using an extrusion head with an opening having the same form as the front view 20 or the rear view of coupling element 3,

(b) bringing the extrudate to the desired length, and

(c) selectively removing excess portions such that a coupling element 3 is obtained.

25 It will further be apparent from the drawings that shank 8 has an axially non-round continuous second hole 31 into which a suitable tool can be inserted and that coupling element 3 can then be rotated relative to the relevant object 1, 2 by exerting a moment by means of 30 this tool. The continuous second hole 31 has for this purpose four grooves 32a, 32b, 32c, 32d arranged angularly equidistant and extending over the whole length of hole 31. A screwdriver can for instance be inserted and co-act with grooves 32a, 32c and 32b, 32d 35 lying diametrically opposite each other.

The invention further relates to an object of the type such as object 3 according to the Figure. An object can for instance consist of one panel with at least two continuous holes. It can also be a corner element with 40 two or three panels with a desired number of continuous holes at random. It is also possible to apply a cube

having on each of the six square panels one hole or straight rows of holes which can be registered.

A block shape such as the object 1, 2 as according to all of the drawings is also an option.

5 It is generally practical to ensure that in the case two objects are coupled the thereby created rows of holes have the same centre-to-centre distance as the centre-to-centre distances of the holes in one object.

10 Not drawn is a modular construction system on the basis of the coupling according to the invention. Such a modular construction system can be supplied in a packaging and comprises a number of objects 1, 2 of the type specified and drawn as example in the Figure, in addition to a number of coupling elements 3 for mutually
15 coupling these objects 1, 2 in the manner specified according to the invention to form a spatial building construction.

 It will be apparent that within the stated framework the coupling according to the invention can be
20 embodied in very many different ways. What is essential is that a coupling element 3 is inserted into a first object 1, optionally then in combination with a second object 2 arranged on the other side over the coupling element, whereafter the coupling between coupling
25 element 3 and object 1, 2 is effected by rotation in the one or the other direction. Particularly in the case where coupling element 3 is not readily accessible with the hand, so when coupling element 3 is inserted into two objects 1, 2 arranged on either side, it is
30 practical to make use of the described non-round hole and a suitable tool such as a screwdriver in order to perform the necessary rotation of coupling element 3. A tool can also be used for uncoupling.

CLAIMS

- 5 1. Coupling between two objects (1, 2) by means of
a coupling element (3);
 wherein each object (1, 2) comprises:
 a panel (4) with a continuous first hole (5)
with a round main shape and four inward protruding
10 tongues (6) which each have two sides (25, 26) extending
at least more or less in radial direction, which tongues
(6) are arranged angularly equidistant and each extend
over an angle of substantially 22.5° ;
 wherein the coupling element (3) comprises:
15 a shank (8) which can be inserted between the
ends (7) of the tongues (6) into the first hole (5) and
has an axis (29);
 an insert stop member (19, 20) which is
present on the central zone of the shank (8) and which
20 defines the maximum distance over which the shank (8)
can be inserted as desired with the one orientation or
the other orientation into the first hole (5);
 four locking cams (9, 10, 11, 12); (13, 14,
15, 16) on each of the two end zones (17, 18) of the
25 shank (8), which locking cams (9-16) each extend over an
angle of substantially 22.5° and are disposed at
relative angular positions of substantially 0° , $(90^\circ -$
 $22.5^\circ)$, 180° , $(270^\circ - 22.5^\circ)$; and
 four rotation stop members (21, 22, 23, 24)
30 which are each added to a locking cam (9-16) and are
arranged angularly equidistant and which can co-act with
said sides (25, 26);
 such that the coupling element (3) can be inserted
into the first hole (5) in a chosen orientation as
35 desired in one of four angularly equidistant angular
positions until the insert stop member (19, 20) comes
into contact with the panel (4) and the coupling element
(3) can then be rotated relative to the relevant object
(1, 2) as desired through substantially 22.5° in the one
40 or in the other direction until the rotation stop member
(21-24) comes into contact with a relevant side (25,

26), whereby the locking cams (9-12); (13-16) engage behind the panel (4) and the coupling element (3) is locked against axial displacement relative to the panel (4);

5 wherein rotation locking means (27, 28) are present for the purpose of releasably locking the coupling element (3) relative to each of the two objects (1, 2) in each possible angular position, i.e. ($0^\circ \pm 22.5^\circ$), ($90^\circ \pm 22.5^\circ$), ($180^\circ \pm 22.5^\circ$), ($270^\circ \pm 22.5^\circ$).

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2. Coupling as claimed in claim 1, wherein the rotation locking means (27, 28) can be carried in and out of their locking state only by exerting a determined rotational moment between the coupling element and the
15 relevant object (1, 2).

3. Coupling as claimed in claim 2, wherein the rotation locking means (27, 28) comprise a combination of a recess (28) and a protrusion (27) engaging
20 elastically therein added at each possible angular position.

4. Coupling as claimed in claim 3, comprising a resilient strip (30) with the main shape of a circular
25 arc, which strip is provided with three recesses (28a, 28b, 28c) which have relative angular positions of -22.5° , 0° , $+22.5^\circ$.

5. Coupling as claimed in claim 4, comprising four
30 strips (30) which are each carried by two adjacent rotation stop members (21-24).

6. Coupling as claimed in claim 4 or 5, comprising four protrusions (27a, 27b, 27c, 27d) which have the
35 same angular positions as the tongues (6), form part of the panel (4) and can co-act with at least one of four resilient strips (30) which each extend over an angle of substantially 90° and form part of the coupling element (3).

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7. Coupling as claimed in any of the foregoing claims, wherein each object (1, 2) and/or the coupling element (3) consists of plastic.

5 8. Coupling as claimed in claim 6, wherein each object (1, 2) and/or the coupling element (3) is manufactured by injection-moulding.

10 9. Coupling as claimed in claim 6, wherein the coupling element (3) is manufactured by

(a) making an extrudate using an extrusion head with an opening having the same form as the front view or the rear view of the coupling element (3),

15 (b) bringing the extrudate to the desired length, and

(c) selectively removing excess portions such that a coupling element (3) is obtained.

20 10. Coupling as claimed in any of the foregoing claims, wherein the shank (8) has an axially non-round continuous second hole (31) into which a suitable tool can be inserted and, by exerting a moment by means of this tool, the coupling element (3) can then be rotated relative to the relevant object (1, 2).

25 11. Object (1) designed and evidently intended as component of a coupling as claimed in any of the foregoing claims, which object (1) comprises at least one panel (4) with at least two continuous first holes (5) such that the object (1) can be coupled by means of at least two coupling elements (3) to at least two further similar objects (2).

35 12. Object as claimed in claim 10, comprising a number of panels (4) with a number of continuous first holes (5) with equal centre-to-centre distances as measured along the surface of the panels, wherein in the case of more than one first hole (5) in a panel (4) these holes (5) are ordered in straight rows and,
40 insofar as applicable, mutually perpendicular rows.

13. Modular construction system, intended for instance as toy or for educational purposes, comprising a number of objects (1, 2) as claimed in claim 11 or 12, in addition to a number of coupling elements (3) for
- 5 mutually coupling objects (1, 2) by means of coupling elements (3) as desired by a user, whereby a number of objects (1, 2) and coupling elements (3) are assembled into a unit.
- 10 14. Packaging with a modular construction system as claimed in claim 13.