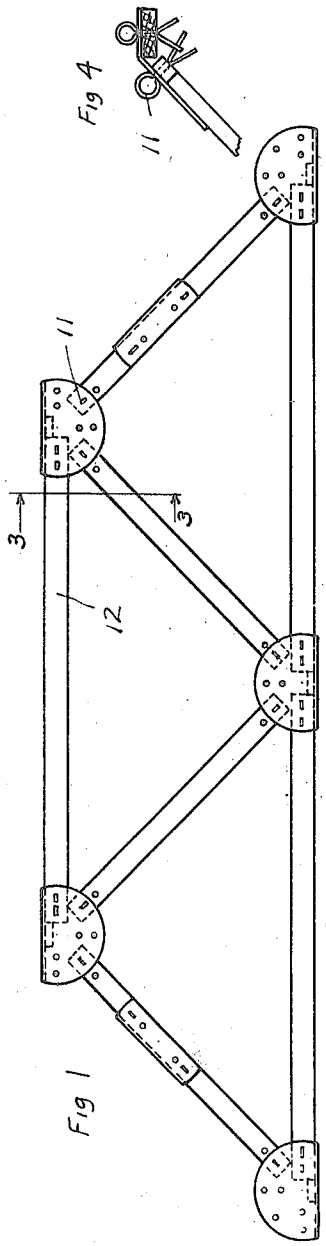
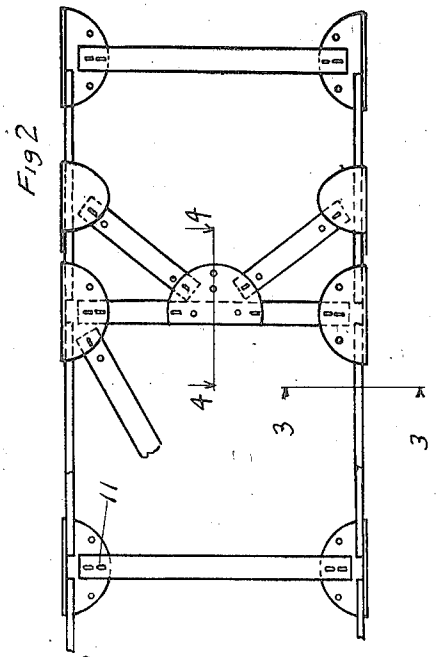
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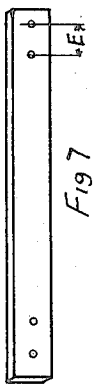
STRUCTURAL TOY.

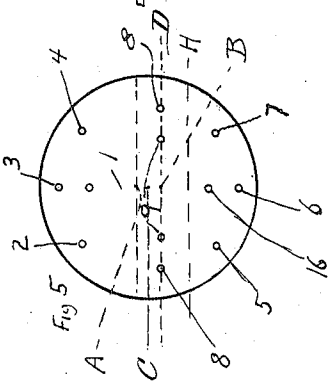
APPLICATION FILED MAR. 9, 1921.

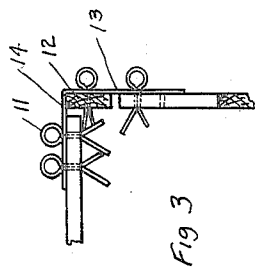
1,433,273. Patented Oct. 24, 1922.

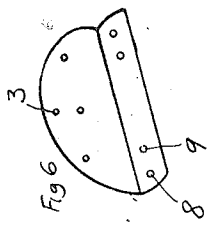












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Patented Oct. 24, 1922. 1,433,273

UNITED STATES PATENT OFFICE.

HENRY W. GRAVES, OF CHICAGO, ILLINOIS.

STRUCTURAL TOY.

Application filed March 9, 1921. Serial No. 451,019.

To all whom it may concern:

Be it known that I, HENRY W. GRAVES, citizen of the United States, residing at Chicago, Illinois, have invented certain new and useful Improvements in a Structural Toy; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to structural toys or toy construction blocks of the general type in which rods or strips are connected to each other for various arrangements. For this purpose it has long been customary to employ thin metal strips equipped with numerous perforations and to fasten such strips to one another by means of bolts, thereby requiring considerable time in threading the bolt parts on each other when assembling the desired structure and also requiring the use of tools for this purpose.

My invention aims to provide structural toy elements so arranged that they can readily be assembled in an endless variety of arrangements with ordinary spring cotters without requiring the use of tools either for connecting or disconnecting the parts. It also aims to provide connecting means which will readily permit the use of sticks of wood instead of the metal strips, thereby employing elements which are more pleasing to the touch and which are not apt to cut the hands of the children playing with the same. Furthermore, my invention aims to provide simple and cheaply constructed connectors adapted to be used interchangeably with sticks of varying lengths and so arranged as to afford unusually rigid connections between the adjoining ends of two or more sticks. For this latter purpose my invention aims to provide connectors arranged for holding sticks in predetermined angular relation to each other, aims to provide these in an exceedingly simple and cheaply manufactured form, and aims to allow for permitting an adjusting of the relative angularity of the strips connected by such connectors without requiring the use of tools for making such adjustments. Still further and more detailed objects will appear from the following specification and from the accompanying drawings, in which—

Fig. 1 is a side elevation of the frame of a bridge constructed with sticks and connectors embodying my invention.

Fig. 2 is a fragmentary plan view of the same.

Fig. 3 is an enlarged and vertical transverse section taken along the correspondingly numbered lines of Figs. 1 and 2.

Fig. 4 is a similarly enlarged vertical and longitudinal section taken along the correspondingly numbered line in Fig. 4 and showing only the parts immediately adjacent to the said line.

Fig. 5 is an enlarged view of the perforated blank from which the connecting members shown in Figs. 1 to 4 inclusive were formed.

Fig. 6 is a perspective view of the shortened form of connector shown in side elevation in Fig. 4.

Fig. 7 is an enlarged perspective view of one of the sticks of the first two figures.

In accomplishing the purposes of my invention after the manner of the illustrated embodiment, I employ sticks of various lengths but of a uniform rectangular cross-section, each of these sticks being provided near each end thereof with a pair of transverse bores spaced by a given uniform distance from the end of the stick, and the bores comprising each pair being spaced from each other by a distance which is also uniform for all of the sticks. Then I provide connectors or connecting members made of sheet metal and each having a plurality of perforations corresponding substantially in size to the said bores in the sticks. These perforations are desirably arranged on the connectors in a predetermined relation so that they will readily lend themselves to desirable angular relations between the connected strips and also to the securing of rigidity in the resulting connections. For this purpose, I desirably provide sheet metal connectors in two types as shown in Figs. 5 and 6, namely in a type formed from a complete circular blank and in one formed from the same circular blank but having a considerable portion sheared off one edge.

To make the first of these two types of blanks I take a sheet metal disk 1 as shown in Fig. 5 and provide the same with a series of perforations spaced by a uniform distance from two center points A and B which are equidistant from the center of

the disk in a direction at right angles to the line C on which the disk is to be bent. This bending line C extends through the point A in Fig. 5, the latter being spaced from the point B by a distance corresponding to one-half of the standard width of the sticks. The perforations which are thus centered around the points A and B respectively desirably include three perforations 2, 3 and 4 equidistant from the point A and respectively located on lines radiating from the point A at angles of 45, 90 and 135 degrees to the line C; also, three perforations 5, 6 and 7 equidistant from the point B and respectively on lines 45, 90 and 135 degrees to a line D which extends through the point B parallel to the center line C. Moreover, the last named portion of the connector blank, namely the lower part of the blank as shown in Fig. 5, has a pair of auxiliary perforations 8 spaced by the aforesaid standard distance from the center B and located along the line D and likewise has another pair of perforations 9 on this same line D but nearer to the center B by a distance corresponding to the standard spacing E (of Fig. 7) between the holes in each end of one of the sticks. So also, this same portion of the blank has an auxiliary perforation 16 located on the transverse line connecting the centers A and B, but nearer to the center B than the perforation 6 by a distance corresponding to the same spacing E.

Having thus equipped the sheet metal connector blanks with perforations in uniform arangement on these blanks and all corresponding in bore with those in the sticks, I can readily connect one end of any stick to such a metal connector by simply bringing a bore of a stick into alinement with a perforation in a connector and then inserting a fastening member through such alined bores. For this latter purpose, I desirably employ an ordinary spring cotter made out of a light wire, such as the cotter 11 of the drawings. I also desirably include among the elements of my construction toy sticks of lengths adapted to cooperate with the above described connectors in affording equilateral right-angled triangled constructions, thus permitting one to utilize the aforesaid angular arrangement of the perforations in each part of the connector for insuring a firm connection between the assembled parts.

Where adjacent sticks are disposed in the same plane and connected at 45 degree angles to one another, it will be obvious from Figs. 1 and 2 that the resulting triangular construction will readily afford the desired rigidity. For constructions involving right angles, the same metal connector also affords this rigidity by two other features, one of these being the spacing of the bending line C from the line D which extends through the axis of the four perforations 8 and 9. As this spacing is substantially equal to one-half the standard width of the sticks, any stick extending parallel to the bending line and fastened to one web of the connector by one or two cotters, such as the stick 12 fastened to the web 13 in Fig. 3, will have one edge bearing against the other web 14 of the connector formed by bending the blank of Fig. 5 at right angles along the line C. Consequently, the edge-wise abutting of the stick 12 against the web 14 will prevent this stick from rocking about the connector which secures it to the web 13, thereby insuring rigidity even if only a single cotter is used at this end of the stick 12. For sticks extending at right angles to the bending line of the connector, I desirably do not depend on an edgewise abutting of a stick against a web of the connector, but employ two cotter pins connecting a single end of the stick to the connector, as for example by utilizing both the bores 5 and 6 in the connector formed from the blank of Fig. 5.

It will be obvious from the above that by thus standardizing the diameters and perforations of the sticks while also furnishing the latter in varying lengths, and by standardizing the arrangement of the perforations in the metal connectors, I can readily employ such construction elements interchangeably for building an endless variety of framed or skeleton constructions. Moreover, by employing sheet metal of such a gage as to permit of its being bent with the fingers, I can readily vary the angularity between the planes of the webs of each connector, so that I need not be limited to the right-angled form of the same as shown in Fig. 3 but can also employ the same connectors with their webs relatively oblique to each other, as for example after the manner of Fig. 4.

Moreover, while I have illustrated and described my invention as comprising certain desirable stick and connector arrangements, I do not wish to be limited to the details of the construction and arrangement thus disclosed, it being obvious that the same might be modified in many ways without departing from the spirit of my invention or from the appended claims. For example, the metal connectors formed from the complete disks of Fig. 5 would project too far beyond the adjacent sticks in many structures to present the desired sightly appearance. I may therefore shear off the lower portion of the blank of Fig. 5 for many of these blanks along the line H of that figure, so that the resulting connector would appear substantially as shown in per-

spective in Fig. 6 and would afford a straight edge in alinement with an edge of an adjacent stick as shown at the middle of Fig. 2.

I claim as my invention:

1. In a structural toy, the combination with transversely perforated sticks, of an angle plate having each web equipped with perforations disposed in substantially a semicircle about a point near the juncture of the webs, and fastening elements each adapted to extend interchangeably through alined perforations in the angle plate and in one of the sticks, the angle plate being digitally bendable to vary the angle between the plane of its webs.

2. In a structural toy, the combination with transversely perforated sticks of uniform width, of an angle plate having each web equipped with perforations, and fastening elements each adapted to extend interchangeably through alined perforations in the angle plate and in one of the sticks; certain of the perforations in the angle plate being spaced from the bend therein by substantially half the width of the said sticks.

3. In a structural toy, the combination with transversely perforated sticks of uniform width, of an angle plate having each web equipped with perforations disposed in substantially semicircular arrangement, and fastening elements each adapted to extend interchangeably through alined perforations in the angle plate and in one of the sticks, the semicircular arrangement of the perforations in one web of the angle plate having its center substantially at the bend of the said plate.

4. In a structural toy, the combination with transversely perforated sticks of uniform width, of an angle plate having each web equipped with perforations disposed in substantially semicircular arrangement, and fastening elements each adapted to extend interchangeably through alined perforations in the angle plate and in one of the sticks, the semicircular arrangement of the perforations in one web of the angle plate having its center substantially at the bend of the said plate, and the semicircular arrangement of the perforations in the other web being centered at a distance from the said bend corresponding to half the width of the strips.

5. In a structural toy, the combination with transversely perforated sticks, of an angle plate having each web equipped with perforations and having the perforations in one web disposed in substantially semicircular arrangement centering about a point adjacent to the bend of the plate, certain of the perforations in the last named web being disposed respectively on lines radiating from the said centering points at angles of 45 and 90 degrees with the line of the said bend.

6. Toy construction blocks comprising sticks of similar cross-sections each having a pair of spaced perforations near each end thereof, sheet metal angle plates having each web thereof equipped with perforations corresponding in diameter to those in in the sticks, and fastening members each adapted to extend through alined perforations in a stick and in a web of an angle plate, each angle plate having perforations in one web spaced from the bend of the plate by substantially half the standard width of the sticks and having among the perforations in its other web a pair of perforations spaced from each other transversely of the aforesaid web by a distance corresponding to the spacing between the perforations in an end of one of the sticks.

Signed at Chicago, March 4th, 1921.

HENRY W. GRAVES.