

June 24, 1930.

S. L. REDMAN

1,766,355

EDUCATIONAL APPARATUS

Filed May 31, 1928

2 Sheets-Sheet 1

Fig. 1

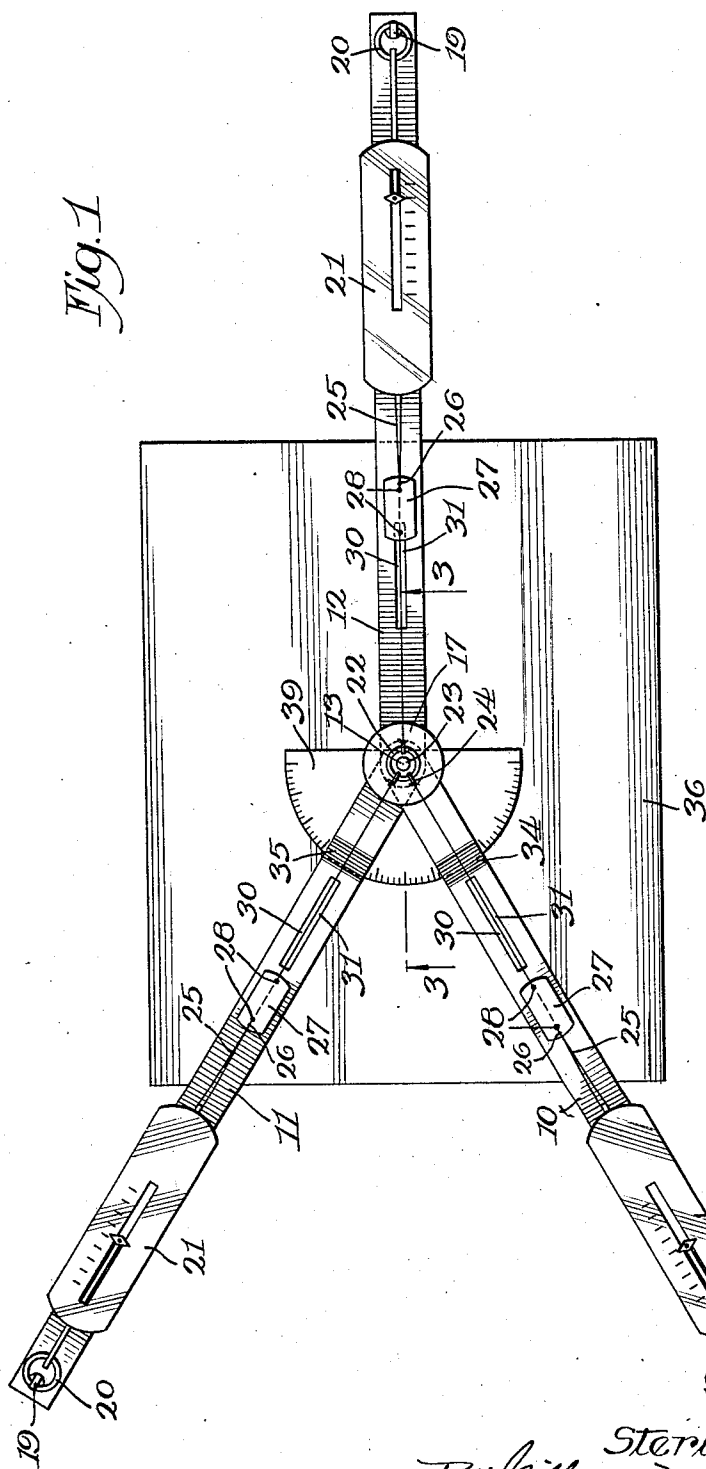
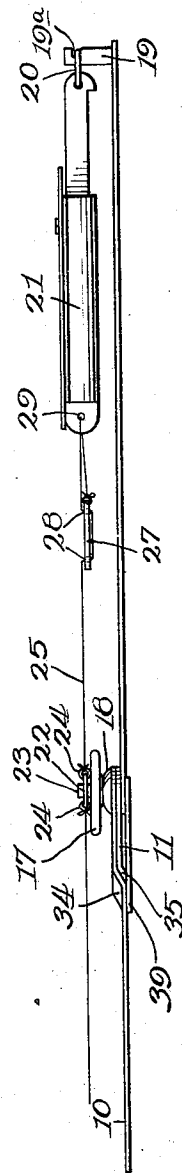


Fig. 2



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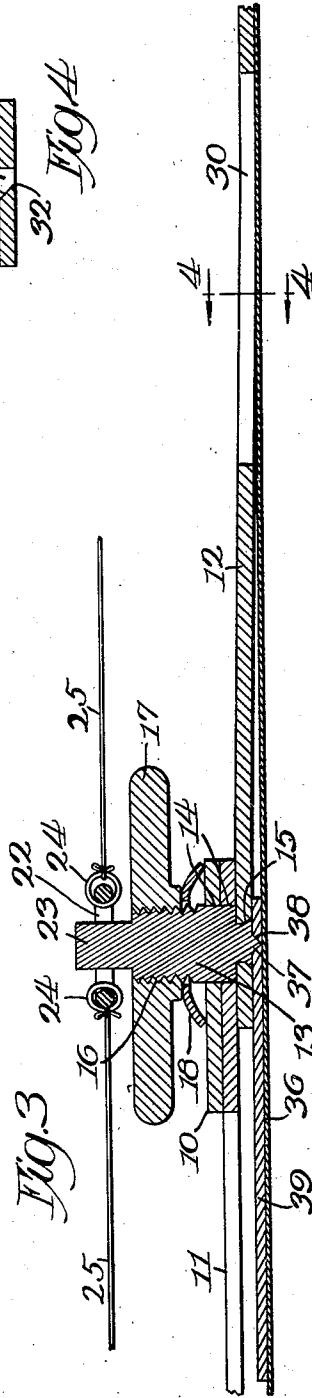
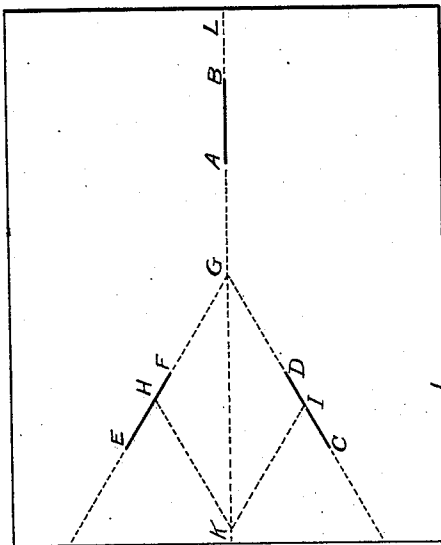
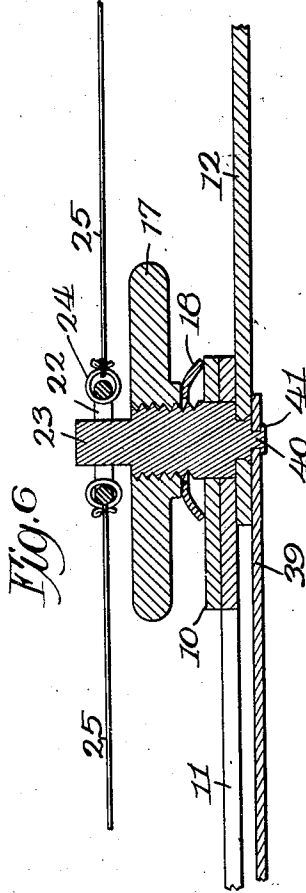
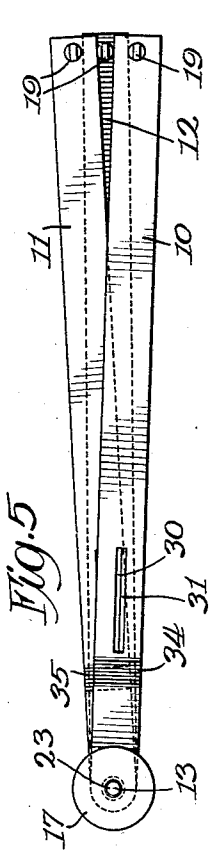
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

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EDUCATIONAL APPARATUS

Application filed May 31, 1923. Serial No. 231,663.

This invention relates to educational apparatus for use in studying the composition of forces, and has for its principal objects to provide apparatus that can be compactly folded for storage and readily extended for a wide range of experiments, and which will facilitate the accurate determination of the directions and relative values of groups of concurrent forces.

Further objects and advantages of the invention will become apparent as the disclosure proceeds and the description is read in connection with the accompanying drawings illustrating selected embodiments of the invention, and in which

Fig. 1 is a plan view of the apparatus in use;

Fig. 2 is a side elevation of a portion of the apparatus shown in Fig. 1;

Fig. 3 is a vertical sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a transverse vertical section taken on the line 4—4 of Fig. 3;

Fig. 5 is a plan view of the frame of the apparatus folded for storage;

Fig. 6 is a sectional view similar to Fig. 3, illustrating a modification, and

Fig. 7 is a plan view illustrating the use of data obtained from the apparatus.

But these specific illustrations and the correspondingly specific descriptions are to be considered as illustrative only, for it is realized that many other embodiments of the invention will readily occur to those skilled in the art.

The frame of the apparatus includes three bars 10, 11 and 12, having corresponding ends superposed and pivoted to swing about a common axis normal to the bars to assume a plurality of angular relations of which that shown in Fig. 1 is an example.

The pivotal connection is formed by a pin 13 extending through perforations 14 in bars 10 and 11, and riveted or otherwise secured at 15 to bar 12. The pin projects above the bar 10 and is threaded at 16 to receive a hand wheel 17 which may be rotated to vary the pressure on a spring 18 and thereby vary the friction between the surfaces of the bars

to restrain or facilitate their relative movement.

The free end of each bar is equipped with a post 19 notched at 19^a to receive the ring 20 of a spring balance 21.

A ring 22 adapted to surround a projection 23, on the pin 13, is equipped with three smaller rings 24, each of which is secured to one end of a cord 25, the other end of which is attached at 26 to one end of a plate 27 after the body of the cord has been passed through two openings 28 in the plate and the eye 29 at the inner end of the corresponding spring balance 21.

Each bar is provided with a slot 30, one wall 31 of which is beveled to an edge 32 coinciding with the line connecting the axis of the pivot 13 with the axis of the corresponding post 19. The bars 10 and 11 are offset at 34 and 35 to bring the straight edge 32 of each flat upon a sheet of paper 36 upon which the frame work is rested. The lower end of the pin 13 is provided with a conical point 37 adapted to seat in a pocket 38 containing the center of a protractor 39.

In the modified form, shown in Fig. 6, the pin has, instead of the conical point, a reduced stem 40 upon which the protractor 39 is swivelled.

The frame work will be stored in the condition shown in Fig. 5, and the rings, cords, and spring balances may be wrapped with it in a single package, or made up in a separate package.

When the apparatus is to be used the frame work is extended to place the arms at suitable angles and laid with a protractor and a sheet of paper on a table, substantially as illustrated in Fig. 1. The rings 20 are engaged with the notches 19^a of the posts 19. The plates 27 are then slid along the cords to adjust the tension until the ring 22 is coaxial with the projection 23. The spring balances are read and the measurements recorded. A sharp pencil is inserted through the slots and drawn along the bevelled straight edge to make a corresponding mark on the paper. And the protractor

is shifted and the angles between the bars read and recorded.

With the bars in the position shown in Fig. 1, lines A—B, C—D and E—F (Fig. 7) would thus be drawn upon the sheet of paper 36. By producing these lines to their common intersection, point G, corresponding to the axis of the pivot 13, or the point of conjunction of the forces is established. Then, by giving the spring balance measurements suitable values and constructing the parallelogram of forces in the familiar manner, the composition of the forces can be visually demonstrated and experimentally checked.

For example, the resultant of the forces G—H and G—I, corresponding to the tension on the cords attached to the arms 10—11 acting along the lines C—D and E—F, will be found as represented by a line G—K, equal to and oppositely directed to the line G—L, representing the pull of the cord on the arm 12.

The beveled edges 32 enable the student to obtain force lines having a common intersection which simplifies the demonstration. A subsequent exercise of value may be had by requiring the student to use similar apparatus having nothing corresponding to edges 32, thereby making it necessary to work from lines drawn along edges of the bars and therefore having no common intersection, for it requires him to use some initiative.

I claim as my invention:

1. In apparatus of the class described, several similar bars having corresponding ends superposed, a pivot connecting said bars to swing about a common axis normal to the bars, a floating ring disposed coaxially with the pivot, and a connection between the ring and the outer portion of each of the bars including a tension measuring device and a tension adjusting device.

2. In apparatus of the class described, several similar bars having corresponding ends superposed, a pivot connecting said bars to swing about a common axis normal to the bars, a floating ring disposed coaxially with the pivot, and a connection between the ring and the free end portion of each of the bars including a tension measuring device and a tension adjusting device, and a protractor rotatable about the axis of the pivot for indicating the angle between the bars.

3. In a device of the class described, several bars pivoted together adjacent to corresponding ends to swing about a common axis and adapted to assume a plurality of selected angular relations, each bar presenting a straight edge aligned with the pivot and exposed for use as a ruling edge, a floating centering device concentric with the pivot, and a connection between the

centering device and the free end of each of the bars including a tension measuring device and a tension adjusting device.

4. In an apparatus of the class described, several bars having corresponding ends superposed, a pivot connecting said bars to swing about a common axis and assume a variety of selected angular relations, adjustable means cooperating with the pivot to restrain or allow such swinging movement, a centering projection on the pivot, a ring loosely surrounding the projection, and a connection between the ring and the free end of each bar including a tension measuring device and a tension adjusting device.

5. An educational device of the class described, comprising at least three bars having their inner ends superposed and pivotally connected to one another, a floating ring located at the pivotal connection of the bars, a spring tension device for each bar, a connection between the outer end of each tension device and the outer end portion of each bar, an adjustable connection between the floating ring and the inner end of each tension device, each bar having a ruling edge disposed in longitudinal alignment with the connection between the ring and the adjacent tension device and between said tension device and the outer end of the bar, and a protractor disposed beneath the bars and concentric with the device.

6. In an apparatus of the class described at least three bars having corresponding ends superposed, a pivot connecting the superposed ends of the bars and on which pivot the bars may be swung about a common axis into a variety of selected angular relations, each bar being provided with a tension device secured at its outer end to the said bar, the inner ends of the several tension devices having a common floating connection located at the pivot, and means for selectively varying the tension of the respective tension devices.

In testimony whereof I affix my signature.

STERLING L. REDMAN.