No. 717,129.

Patented Dec. 30, 1902.

E. G. SJÖSTRAND.

BATHOMETER.

(Application filed Sept. 10, 1900.)

(No Model.)

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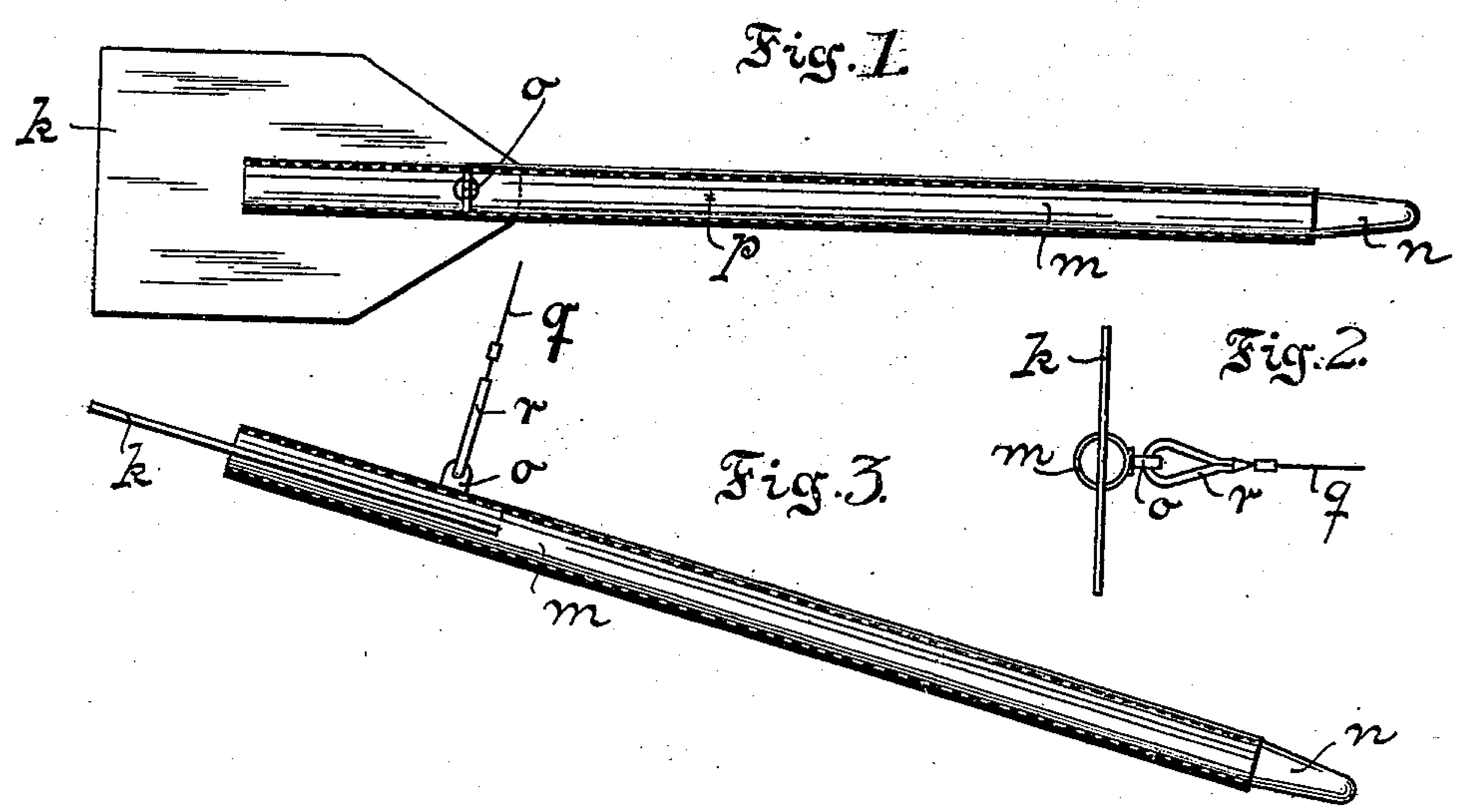

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by [illegible]
his att'y

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 717,129. **Patented Dec. 30, 1902.**

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(No Model.) 4 Sheets—Sheet 2.

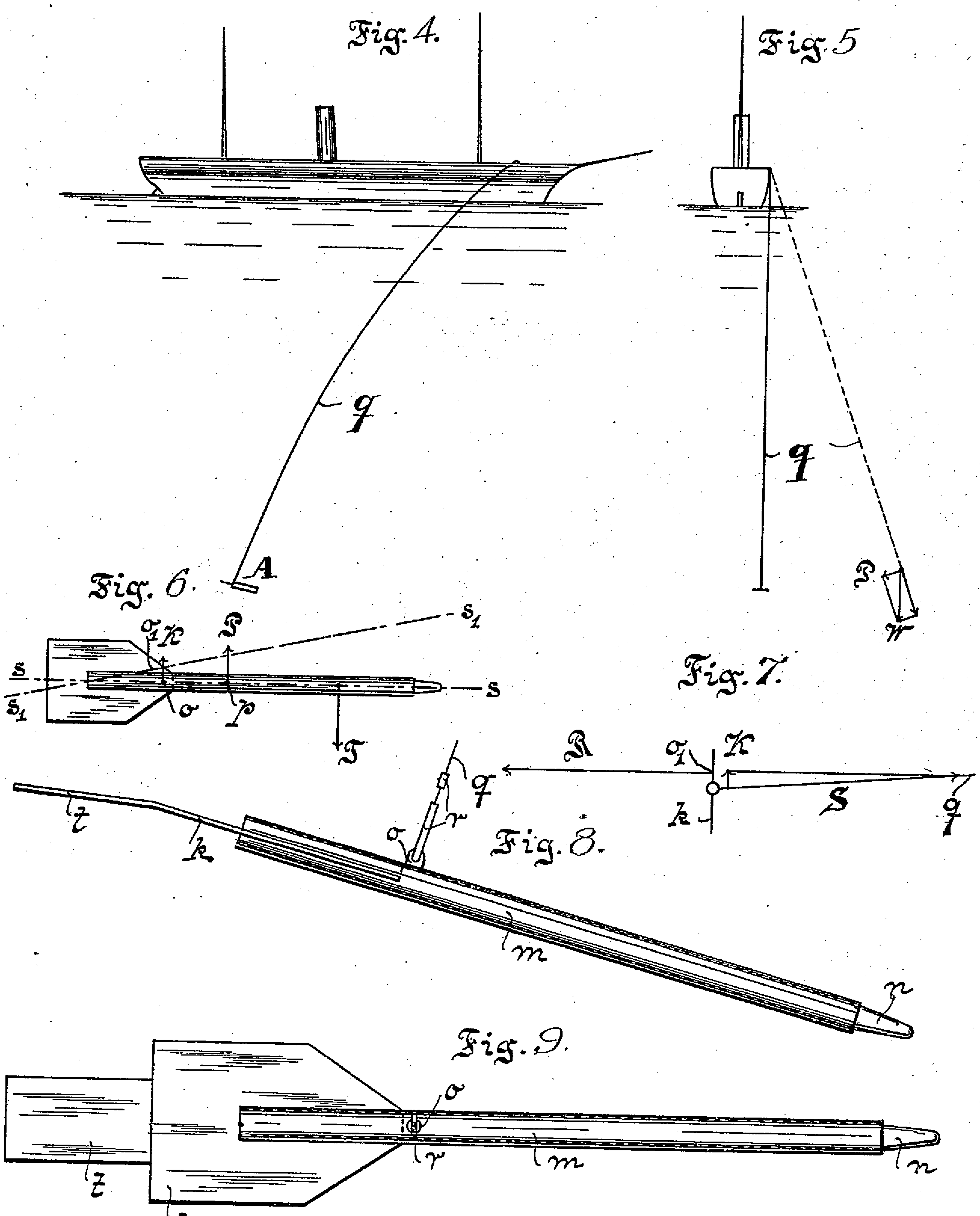

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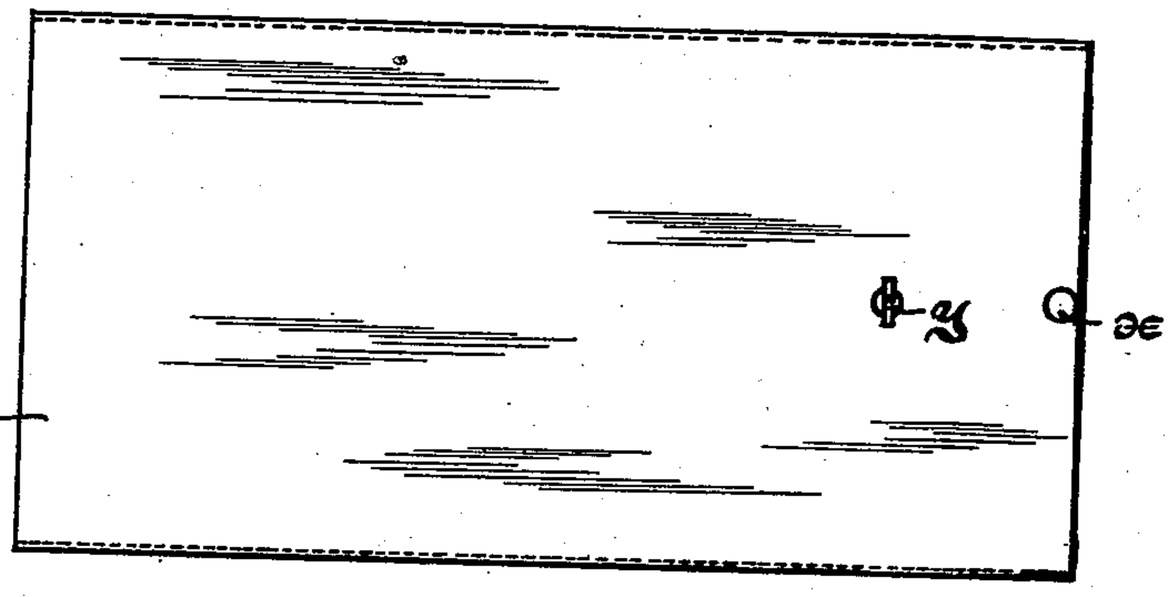
Fig. 10.



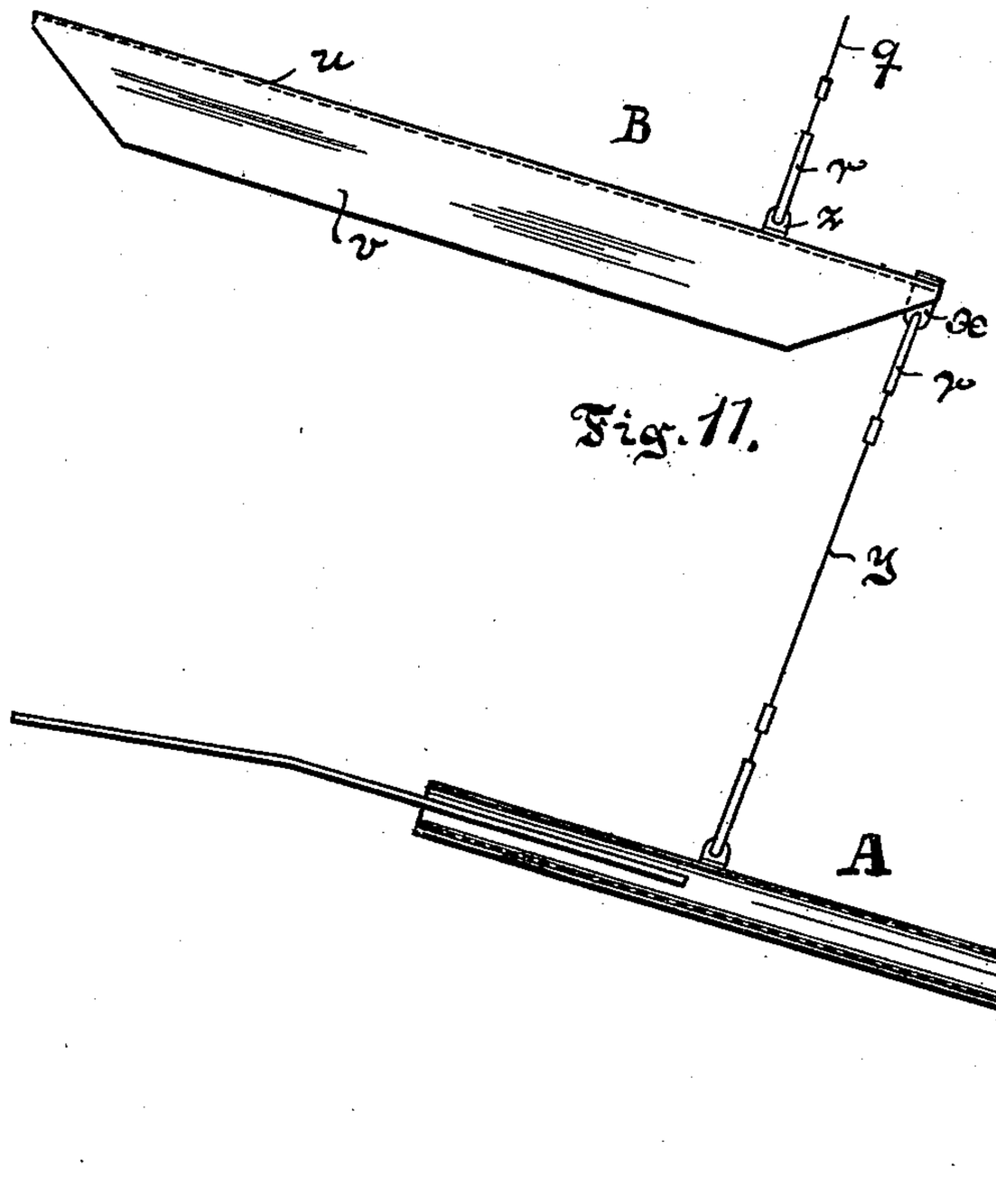
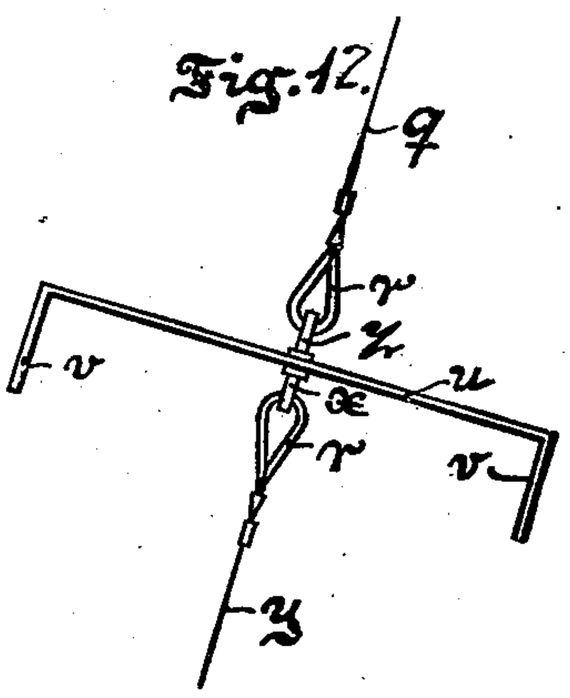


Fig. 11.

Fig. 12.



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4 Sheets—Sheet 4.

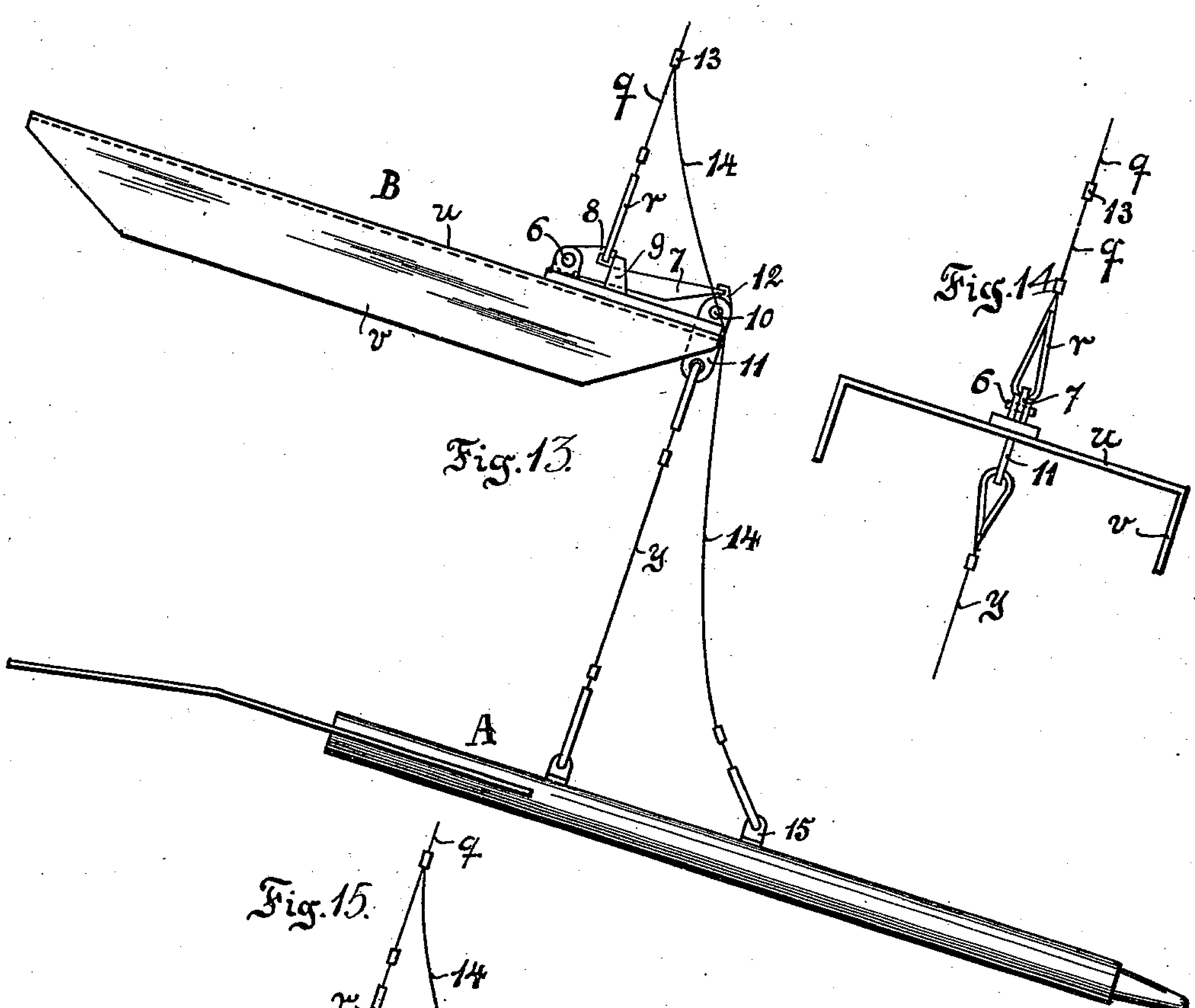

Fig. 13.

Fig. 14.

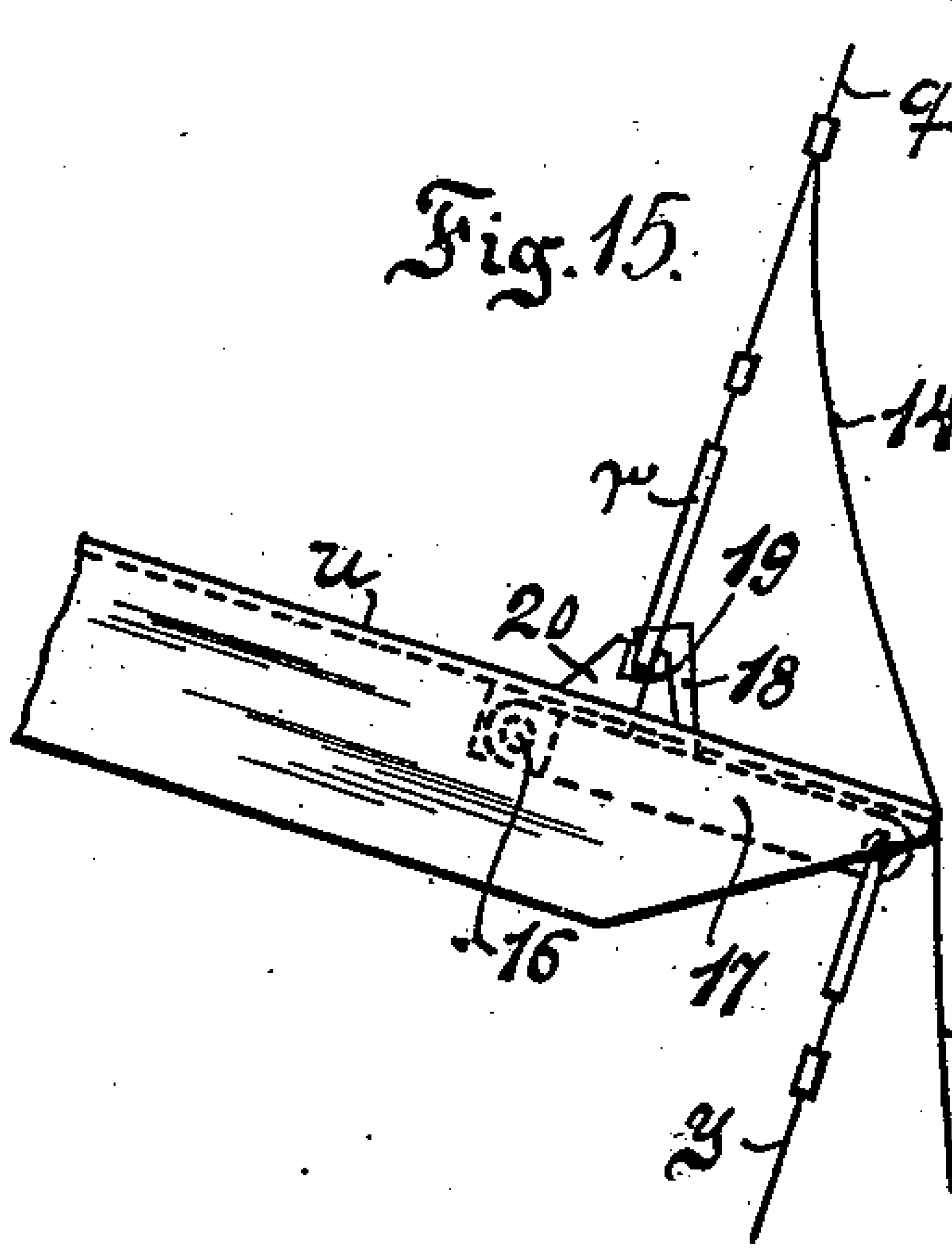

Fig. 15.

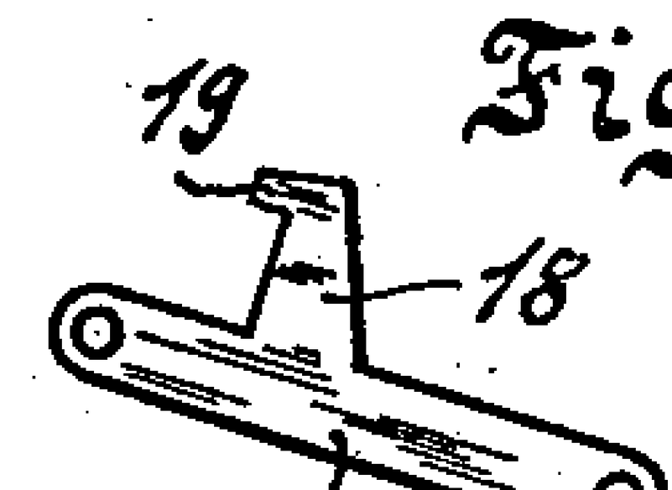

Fig. 16.

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UNITED STATES PATENT OFFICE.

ERNST GUSTAF SJÖSTRAND, OF STOCKHOLM, SWEDEN.

BATHOMETER.

SPECIFICATION forming part of Letters Patent No. 717,129, dated December 30, 1902.

Application filed September 10, 1900. Serial No. 29,545. (No model.)

To all whom it may concern:

Be it known that I, ERNST GUSTAF SJÖSTRAND, a subject of the King of Sweden and Norway, and a resident of 1 Bergsgatan, Stockholm, Sweden, have invented a new and useful Improvement in Bathometers, of which the following is a specification, reference being had to the drawings accompanying and forming a part hereof.

This invention relates to water-kites, and has for its object to make such apparatus simple in construction and reliable in function.

Water-kites as hitherto constructed suffer from the disadvantages that by lateral motions they easily rise to the surface of the water and that they do not keep themselves on the same depth at different speeds of the vessel to which they are attached. I have now succeeded after having made extensive experiments in constructing a kite which will fully overcome the said disadvantages.

The invention consists, briefly, in using a thin plate or the like which is provided at its fore end with a heavy slender bar and in having the line by which the kite is attached to the vessel fixed to the apparatus behind the center of gravity of the same, whereby the kite will take up such a position in the water that a pressure will be exerted on its upper side, so that lateral motions will be prevented, as hereinafter more fully described. According to the present invention I moreover connect the said kite by means of a short line or the like to the fore end of a plate having two equally-acting longitudinal halves and being fixed in the manner hereinafter described to the line hanging down from the vessel. The invention finally consists in the combinations and constructions of parts hereinafter described and claimed.

The invention is illustrated in the accompanying drawings, containing sixteen figures, hereinafter explained.

Figure 1 is a plan view of an apparatus for plunging a shorter line. Fig. 2 is an end view of the same apparatus; and Fig. 3 is a side elevation of the same, showing the downwardly-inclined position it takes up in the water. Fig. 4 shows the apparatus suspended in a rope from a vessel seen from the side. Fig. 5 likewise shows the apparatus suspended in a rope from a vessel seen from the back. Figs. 6 and 7 show the apparatus in respectively plan and end view on a somewhat smaller scale than that of Figs. 1 and 2. Figs. 8 and 9 show in side view and plan, respectively, a somewhat modified form of the apparatus. Fig. 10 is a plan view of a part of the apparatus shown in Fig. 11, the latter showing a side view of another constructional form of the apparatus. Fig. 12 is an end view of the upper part of the apparatus illustrated in Fig. 11. Fig. 13 is a side view of an apparatus constructed in accordance with Figs. 10 to 12 and provided with an uncoupling device. Fig. 14 is an end view of the upper part of the apparatus illustrated in Fig. 13. Fig. 15 shows a side view of another uncoupling device, and Fig. 16 a detail of the latter.

The apparatus consists chiefly of a thin plate k, fastened to a tube m or the like. The rear part of the tube is cut into two halves, embracing the plate k and fastened to it by nails or in any other suitable way. A metal bar n, tapered at the fore end and suitably reaching with the rear end to the plate k, is driven into the tube n for the purpose of increasing the weight of the apparatus and placing its center of gravity, for instance, to the point p forward of the point of suspension. To the tube m is attached a loop o or the like for fastening the line. The latter suitably consists of a small steel or phosphor-bronze wire q, fastened by means of a swiveling ring or link r to the loop o. If this apparatus is thrown from a vessel to which the line is attached into the water, it will take up when the vessel is in motion the position shown in Fig. 3. It is obvious that a pressure is exerted on the apparatus, which pressure pulls the line downward and forces it to assume the form shown in Fig. 4, where the apparatus is marked A.

Referring to Figs. 5 to 7, I will now further explain what forces are acting on the apparatus during its movement in the water. On account of the oblique position of the apparatus with respect to the direction of movement and the water-pressure thus exerted on the apparatus a pull (graphically represented by the line S, Fig. 7) is exerted in the line q. In order that the apparatus may move straight on in the water, the pull S in the line must

obviously be absolutely perpendicular to the plate *k*. If not, the apparatus would obviously not move in its longitudinal direction *s s*, Fig. 6, but in a somewhat oblique direction *s' s'*. If this oblique motion results, a force T will arise and press against the side surface of the apparatus, which is thus forced to deviate with the fore end in the opposite direction to that in which the component K, Figs. 6 and 7, of the tension in the line perpendicular to the longitudinal direction of the apparatus acts. It might now be conjectured that the couple of forces K T should turn the apparatus in positions more and more oblique to the direction of movement, so that if the apparatus had once got a slight deviation from the vertical plane it would depart more and more from the said plane until it finally would emerge at the side of the vessel. It will, however, be seen from the following arguments that this is not the case provided the apparatus be properly constructed. As soon as the apparatus departs from the vertical plane (see the dotted line *q* at the right of Fig. 5) a component P of the weight W begins to act to the side in the same direction as the force K, Fig. 6, so that the direction of movement of the apparatus will be still more oblique. In consequence hereof the center of pressure R, Fig. 7, on plate *k*, which lay before on the midline *s s*, is moved aside to another point *o'*. The forces S and R now turn the apparatus so that the component K is destroyed and the apparatus ceases to deviate, but remains in deep waters. It is, however, necessary, if the weight shall prevent the apparatus to deviate, that, first, the weight is sufficiently great, (according to experiments not less than one-seventh of the tension of the line at the greatest speed,) and, second, that the center of gravity *p* is found sufficiently forward. The accuracy of the explanation may be proved by direct experiments. It will be found that the apparatus works as well whether the line be attached close to the plate *k* or high above it and that if the plate *k* is made too narrow the weight cannot prevent the apparatus from deviating to the side, since the center *o'*, Fig. 7, of pressure R cannot then come sufficiently long to the side.

The dotted line *q* to the right of Fig. 5 has for the sake of clearness been drawn considerably more on the side of the vertical plane through the fastening of the line at the vessel than the line will, in fact, ever place itself. The deviation of the line at one or the other side of the vertical plane will, in fact, never exceed ten degrees.

The above conditions for a proper function of the apparatus—viz., that the weight of the apparatus is sufficiently great and the center of gravity sufficiently forward—constitute, in fact, the essential properties of the apparatus shown in Figs. 1 to 3. The only mission of the tube *m* and bar *n* are to increase the weight and bring forward the center of gravity, and for the same may therefore be substituted a bar of other section, provided it offers a small resistance to the water in every direction. The plate *k* need not be plane. Its two halves may be bent upward or downward, provided they are so balanced that the pressure is equally divided on both sides of the vertical plane through the mid-line *s s*, Fig. 6.

The apparatus described has, nevertheless, a great inconvenience. The center of gravity being in front of the fastening of the line, the weight at a small speed tends to place the apparatus in a more transverse position than at a greater speed. The tension of the line, therefore, does not increase and decrease in proportion to the speed, and when a long line is out the apparatus at different speeds does not keep itself on the same depth. These inconveniences are fully removed in the constructional form of the apparatus shown in Figs. 8 and 9, which only differs from the former therein that the plate *k* is at the back prolonged with a plate *t*, inclined a small angle downward against the extension of the first plate. The action of the plate *t* is the following: At a great speed a suction is exerted on the upper side of the plate, since the water has got a considerable velocity in the direction of the plate *k*. At a small speed, when the weight tends to place the apparatus more transversely, a counter-pressure arises on the upper side of the plate *t*. On account thereof the apparatus at different speeds keeps nearly the same inclination to the horizontal plane. The tension in the line increases in proportion to the speed, and the apparatus, therefore, at different speeds keeps itself at the same depth.

It has been stated above that the weight of the apparatus should exceed one-seventh of the tension in the line at the greatest speed for which the apparatus is made. As the resistance at a great speed is great even against a thin line, the apparatus, if desired to be driven to a large depth, should be very heavy. In the following manner, however, an apparatus can be obtained that without being heavy exerts a considerable strain. Figs. 10 to 12 show such an apparatus. It consists of the upper apparatus B, Fig. 11, and the under apparatus A, hanging under the former. The upper apparatus is shown in Fig. 11 in side elevation in the position it occupies in the water. Figs. 10 and 12 show the upper apparatus in plan and from the end. The upper apparatus B suitably consists of a rectangular plate *u*, with its edges *v* bent down. The under apparatus A, which is of the same kind as that illustrated in Figs. 8 and 9, is fastened in the front of B at *x* by means of a short wire *y*. From the link of attachment *z* the line *q* passes to the vessel. This apparatus works in a similar manner as that described with reference to Figs. 1 to 3, but is free from its inconveniences, since the point of suspension *z* need not here lie behind the

center of gravity of the apparatus. The plate *k*, Figs. 1 to 3, corresponds in the apparatus shown in Fig. 11 to the plate *u*, and the heavy bar *m n*, Figs. 1 to 3, is in the apparatus last described replaced by the under apparatus A, hanging in front.

In the apparatus shown in Figs. 10 to 12 the plate *u* is of rectangular shape. It may, however, have any form, provided it has two equally-acting longitudinal halves, which can, if desired, be bent upward or downward. The purpose of the turned-down edges *v* is that the apparatus shall offer resistance against lateral motion.

Figs. 13 and 14 show an apparatus with uncoupling device constructed in other respects in accordance with the apparatus shown in Figs. 10 to 12. The uncoupling device consists of a lever 7, mounted on a pivot 6 and formed at 8 as a hook for retaining the fastening-link *r* of the line *q*. At the sides of the lever 7 are stops 9 to prevent the link *r* from slipping. A lever 11 is mounted on a pivot 10 and provided at 12 with a hook for retaining the lever 7. The lever 11 passes through an opening in the plate *u* and carries the under apparatus A, hanging below in the wire *y*. A line 14 is connected at 13 to the line *q* and loosely stretched to the fastening-link 15 of the under apparatus. The function of this apparatus will be easily understood. When the under apparatus A strikes the bottom, it is retained, while the upper apparatus B continues to move forward. On account thereof the lever 11 is turned backward, so that the hook 12 releases the lever 7, which is then turned upward, so that the link *r* is slipped. The line *q*, which now grips at 15, carries the resistless apparatus up to the surface of the water.

The uncoupling device can obviously be constructed in any suitable way. Fig. 15 shows another uncoupling device applied to the same apparatus. In this device a lever 17 is mounted on a pivot 16, the lever being shown withdrawn in Fig. 16. One arm 18 of the lever 17 passes through an aperture in the plate *u* and is formed at 19 as a hook for retaining the link *r*. Below the hook 19 of the said arm 18 are stops 20 for preventing the link from slipping. The line *y* of the under apparatus is attached at the fore end 21 of the lever 17. The lines *q* and *y* are thus both attached to the lever 17, and their moments are so proportioned that when the apparatus does not reach the bottom the lever 17 is pressed upward against the plate *u*. The line 14 passes, as in the former uncoupling device, to the under apparatus. The uncoupling takes place in the following manner: When the under apparatus reaches the bottom, a violent pull is exerted in the line *y*, whereby the lever 17 is turned downward, the link *r* is released, and the same course is repeated as described with reference to Figs. 13 and 14.

Having now described my invention and how it may be applied, I claim—

1. In a water-kite the combination of, a plate, a bar attached to said plate so as to form a forward extension of the same, and an attachment for the carrying-line behind the center of gravity of the said combined plate and bar, substantially as and for the purpose set forth.

2. In a water-kite the combination of a plate, a bar attached to said plate so as to form a forward extension of the same, a rearward extension of said plate at a slight angle downward, and an attachment for the carrying-line behind the center of gravity of the apparatus, substantially as and for the purpose set forth.

3. In a water-kite the combination of, a plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate, so as to form an extension of the same, and a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar behind the center of gravity of the same, substantially as and for the purpose set forth.

4. In a water-kite the combination of, a plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar, a releasing device between the two attachments on the first-mentioned plate, and a line connected to the carrying-line and to the said bar, substantially as and for the purpose set forth.

5. In a water-kite the combination of, a plate, guide-flanges on said plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, and a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar behind the center of gravity of the same, substantially as and for the purpose set forth.

6. In a water-kite the combination of, a plate, guide-flanges on said plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar behind the center of gravity of the same, a releasing device between the two attachments on the first-mentioned plate, and a line connected to the carrying-line and to the said bar, substantially as and for the purpose set forth.

7. In a water-kite the combination of, a plate, an attachment for the carrying-line in

the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a rearward extension of the second plate at a slight angle downward, and a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar behind the center of gravity of the same, substantially as and for the purpose set forth.

8. In a water-kite the combination of, a plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a rearward extension of the second plate at a slight angle downward, a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar, a releasing device between the two attachments on the first-mentioned plate, and a line connected to the carrying-line and to the said bar, substantially as and for the purpose set forth.

9. In a water-kite the combination of, a plate, guide-flanges on said plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a rearward extension of the second plate at a slight angle downward, and a line attached to the first-mentioned plate of the attachment of the carrying-line and to the said combined plate and bar, behind the center of gravity of the same, substantially as and for the purpose set forth.

10. In a water-kite the combination of, a plate, guide-flanges on said plate, an attachment for the carrying-line in the fore part of said plate, another plate, a bar attached to the last-mentioned plate so as to form an extension of the same, a rearward extension of the second plate at a slight angle downward, a line attached to the first-mentioned plate forward of the attachment of the carrying-line and to the said combined plate and bar behind the center of gravity of the same, a releasing device between the said attachments of the first-mentioned plate, and a line connected to the carrying-line and to the said bar, substantially as and for the purpose set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

ERNST GUSTAF SJÖSTRAND.

Witnesses:
GERDA LINDKVIST,
GUSTAF ISFALT.