March 19, 1963 S. S. CICCOTELLI 3,081,467

SWIM FLIPPER

Filed Jan. 23, 1961 2 Sheets-Sheet 1

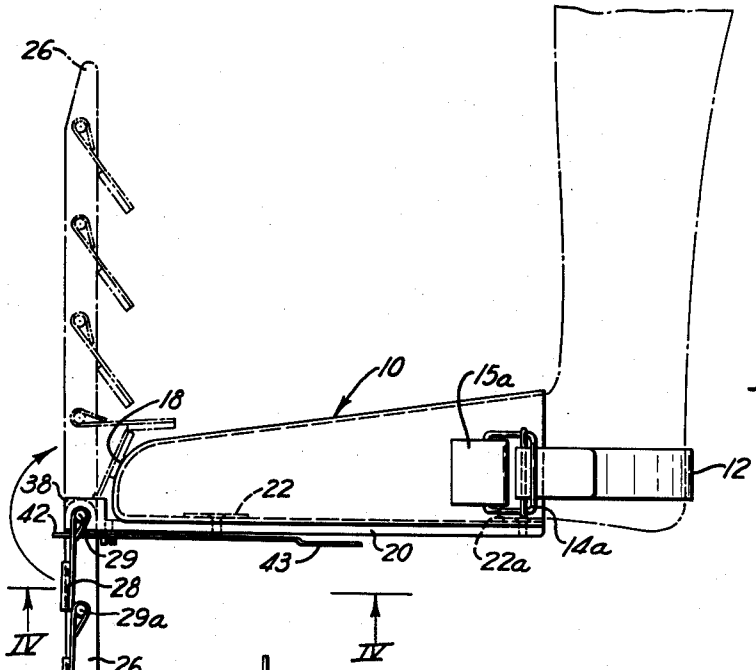


Fig. 2

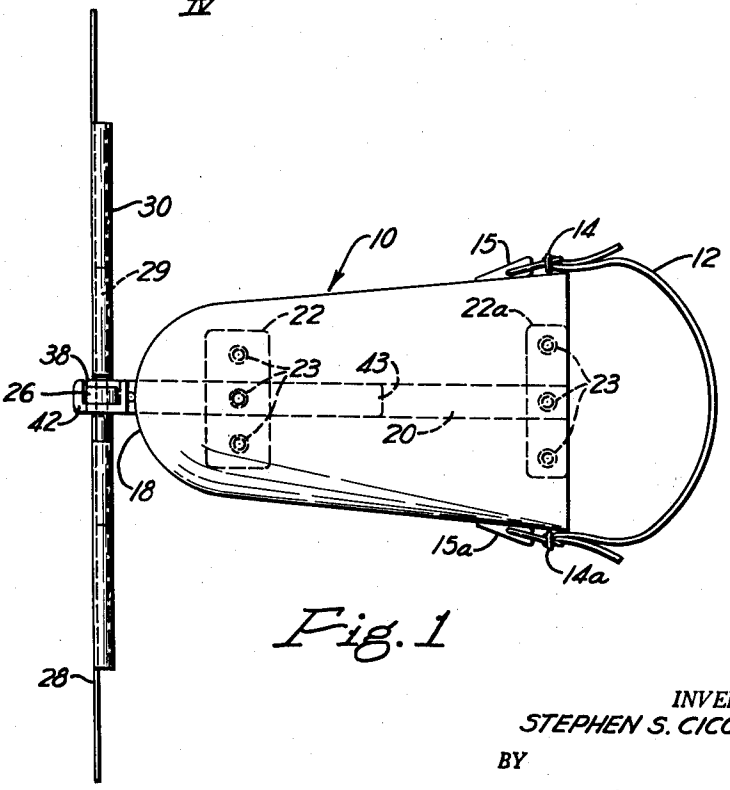


Fig. 1

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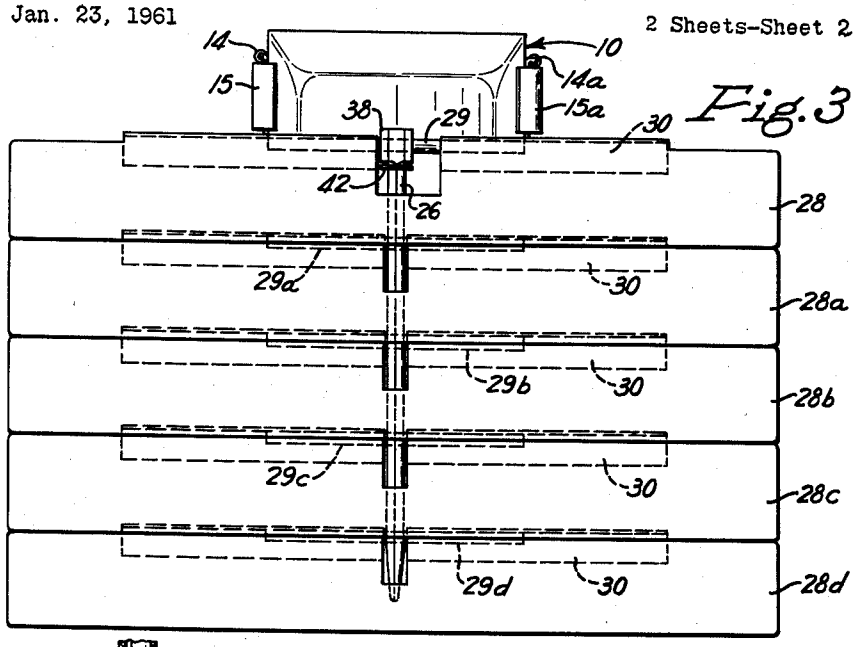


Fig. 3

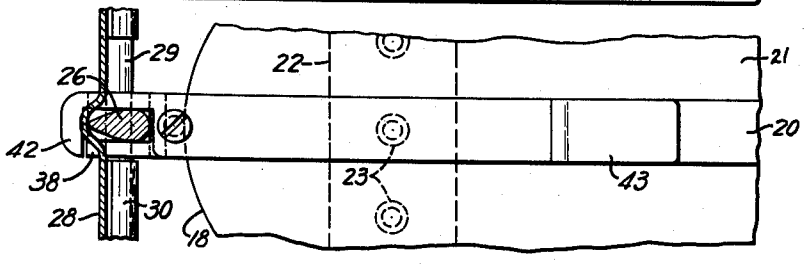


Fig. 4

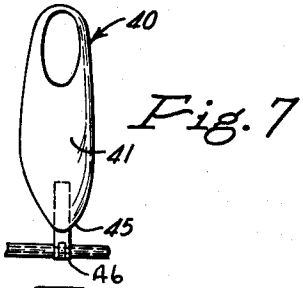


Fig. 7

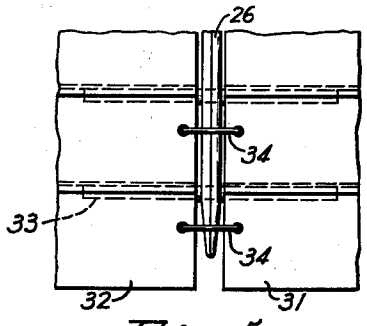


Fig. 5

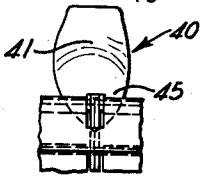


Fig. 8

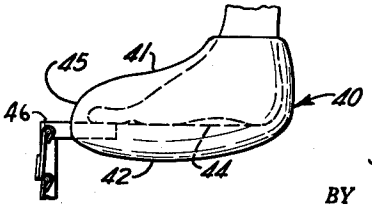


Fig. 6

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SWIM FLIPPER

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4 Claims. (Cl. 9—306)

This invention relates to a swim aid or flipper, of the type that is to be mounted on the foot, which efficiently translates kicking movement into forward thrust.

It is a primary object of the present invention to provide a novel swim flipper having a propulsion means presented to the water, when being applied for propulsion, that is in a plane largely perpendicular to the direction of the swimmer using the flipper, yet is characterized by minimum drag on the swimmer's forward motion during and following the propulsion movement.

It is another object of the invention to provide a swim flipper characterized as in the preceding object and further characterized in that the propulsion means of the flipper is movable to permit standing or walking while the flipper is attached to the foot.

Another object of the invention is to provide an improved boot to be used in conjunction with propulsion means that are to be worn by individual swimmers.

Still another object of the invention is to provide a strong and light-weight flipper at a minimum of cost.

Other objects of the invention will be apparent from the following description and drawings illustrating a preferred embodiment of a flipper and a boot of this invention and in which:

FIG. 1 is a top plan view of a boot and blade assembly of this invention;

FIG. 2 is a side view of the device of FIG. 1, with the blade assembly located in swimming position, and showing that assembly in the walking position in dotted lines;

FIG. 3 is a front view of the flipper of FIGS. 1 and 2;

FIG. 4 is a detail view of a locking means for the blade assembly, taken along lines IV—IV of FIG. 2;

FIG. 5 is a view of a part of a blade assembly showing a second embodiment of blades that can be used in the invention;

FIG. 6 is a side view of an improved boot for swim blade assemblies in accordance with this invention;

FIG. 7 is a top view of the boot of FIG. 6; and

FIG. 8 is a front view of the boot of FIG. 6.

Referring now to the drawings, especially FIGS. 1, 2 and 3, the propulsion means that is novel with this invention is attached to a boot **10** adapted to fit over the front part of a swimmer's foot, the boot being held to the foot by a strap **12** attached by means of clips **14** and **14***a* to bosses **15** and **15***a* located on opposite sides of the side wall of boot **10**. As is readily observed in FIG. 2, the boot shown in FIGS. 1, 2 and 3 is relatively flat on its top and bottom surfaces. Its front or toe, however, is rounded, as generally indicated at arrow **18**, using the smallest radius of curvature that is economically possible for a given size foot. Hence, drag by the boot is minimized, and water is cut by the streamlined toe when the unit is being used.

The blade frame assembly, through which propulsion is brought about in accordance with my discoveries, is attached by a bar **20** to the bottom side **21** of boot **10** (see FIG. 4). One convenient way of doing this is to use spaced brackets **22** and **22***a*, shown in dotted lines in FIG. 1, on the inside of the boot and join them to the bar **20** by means of screw **23**, or rivets or the like, extending through the bottom **21** of the boot.

The propulsion means of the flipper of this invention includes a supporting bar **26** on which a plurality of blades **28**, **28***a*, **28***b*, **28***c* and **28***d* are mounted. Consistent with the object of providing minimum drag, bar

26 preferably is tear-shaped in cross-section, as is evident in FIG. 4, with the sharper end pointing away from the boot **10**. It is a requirement of this invention that the blades **28** et seq. be permitted to rotate substantially 180° about their line of support. For this purpose, the blades in the embodiment shown in FIGS. 1 to 4 are mounted on rods **29**, **29***a*, **29***b*, **29***c*, and **29***d* that extend through the main bar **26**. Each blade has a housing **30** (see FIG. 2) at least of a size sufficient to receive the rod that supports it. The housing must be large enough to permit free rotation of the blades about the mounting, rods, but must also be small to minimize drag when the unit moves through the water.

As presently considered, the preferred form of blade is a single piece of metal, or rigid plastic or other suitable material, that is prepared in a manner to provide the housing just mentioned and further to receive within an indentation centrally along its surface, the blade assembly supporting bar **26** when the blade is flat against that bar. However, other forms of a blade are within the scope of the invention. For example, the blade can be supported by means of clips freely suspending the blade from a supporting bar. In that instance, no housing would be needed. In another form, the blade could be made in two parts, each part fitting over the mounting rods from opposite sides of the main supporting bar **26**. With that arrangement, means are provided centrally of the blades to join the two parts together so that rotation beyond the 180° limitation is prevented and both parts function as a single blade. Such a blade is shown in FIG. 5. As shown, the blade is made of two parts **31** and **32** that are supported on a bar **33**, that extends through the blade assembly bar, with the parts being joined to one another by a clip **34** extending across the blade assembly bar **26**. Clip **34** thereby limits the movement of the blade to the 180° as above indicated. Other arrangements incorporating the principles of my invention will be apparent from the foregoing to those skilled in the art.

In FIG. 2, the blade assembly is, relative to the boot, in the swimming position, or below and in a plane that is essentially perpendicular to the plane of the bottom of the foot of the swimmer. To hold the assembly in that relative position, the blade assembly bar **26** is pivotally mounted on the end of the bar **20** by which the assembly is attached to the boot **10**. For this purpose, a U-shaped clevis or bracket **38** at the end of the boot bar **20** can be provided to receive an end of the main blade assembly bar **26**. The blade bar **26** is made pivotable by using as a pivoting means through the U-shaped bracket, the top-most blade **28** supporting rod **29**. By making the prongs of bracket **38** short, bar **26** is caused to bear against the end of that bracket when the bar is substantially perpendicular to the bottom of the boot, thus preventing rotation to the bottom of the boot. To maintain the blade bar assembly in the swimming position there is provided a simple lock, such as an L-shaped member **42** (FIG. 4) mounted on the bottom of the boot bar **20**, so that the L means engages the bar **26** in locked position for the swimming position. For simplicity, the locking means can be the end of a lever **43** pivotally mounted to the boot bar **20** (FIG. 4). For walking with the boot and assembly on the foot, the locking means **42** is released and the main blade assembly is rotated about its pivoting rod **29** to the position shown in dotted lines FIG. 2. By having the bar **26** of the blade assembly frictionally engaged in the bracket **38**, locking means are unnecessary to hold the blade assembly in the upright or walking position, though of course such could be readily provided if desired.

In operation with the swim flipper in the position

shown in FIG. 2 and a swimmer swimming with his face towards the bottom, as the swimmer moves forward through the water, the water flows between the blades keeping them in open or a trailing position in which the blades approach the plane of forward movement. Hence, the blades and the assembly of which they are a part will present the minimum drag at that time. By kicking the foot to propel the swimmer, the blades will tend to close against bar **26** to the position shown in FIGS. 1, 2, and 3 and thus present a large area that pushes against the water in an arcuate path. In this manner, the kicking of the swimmer is translated into thrust. It should be noted that the motion of the foot when kicking is essentially an arc. Hence, the blades of the blade assembly will close against the bar **26** to the position shown in FIGS. 1, 2, and 3 at all times when kicking, whether the swimmer is swimming with his face to the bottom or on his back; accordingly, the blades push the water away from the foot of the swimmer, or more correctly, push the swimmer away from the water in contact with the blades. It is this effect that provides the actual thrust of this unit. At the end of a kicking movement, the blades will again trail; as the unit is raised for the next kicking step, they will trail as a consequence of water flowing past them, and provide but little drag. It is to be noted that the same advantages are attained with the invention by one swimming on his back.

For purposes of having a most efficient assembly, it should be noted that there are several considerations that go into the design of a blade. The first is the density of the material of which the blade is made. Since gravity exerts a certain influence, the less dense the material, the more efficient will be the resulting blade, other considerations being held constant. Consequently, about 0.025 inch thick aluminum or a suitable rigid plastic is preferred to steel. Secondly, it is preferred that most of the weight of the blade, or as much as possible, be located as close to the hinge means as is practical. This minimizes the effective mass of the blade because most of the mass moves the minimum distance of any part of the blade, and the center of gravity of each blade will approach its point of rotation. For an average size individual, it has been found that a blade that is approximately 1¾ inches wide and about 12 inches long results in the best possible efficiency, with about five blades being used per assembly. A width of much over 2½ inches would probably result in a blade so sluggish that efficiency of the translation of kicking to thrust would be sharply decreased. Since the area of the blades in the swimming position constitutes the means by which thrust has been achieved, it is evident that the size of that area should be chosen with a view to the thrust needed to propel the swimmer. Therefore, a very large swimmer might need considerably greater area than that provided by five blades 1¾ inch wide by 12 inches long. The blades must be freely movable about the hinging means, i.e. the rods **29**; therefore it is evident that the friction at these rods can be a material source of adverse blade performance. If the friction is so high that the blades do not respond promptly to kicking movement or the movement of water through the blades, increased drag will be experienced. To avoid unnecessary friction and to reduce cost, it has been found that the rods **29**, that support the blades, can be made short and need not occupy the full length of the streamlined housing **30** on the upper or supporting edge of the blades **28**. Beyond the end of the supporting rod **29**, the housing provides strength for the blades and prevents the blades from bending or collapsing during use. To further reduce fluid resistance, the housing is not extended to the tip of the blade, the blade material being stiff enough to require no support for a short distance. Hence, advantage is taken of the stiffness of the blade material to reduce the drag and minimize the weight.

The considerations underlying this invention have been determined by painstaking research of both a theoretical and practical nature. In addition, I have constructed experimental models that are within the principles of my discovery and have tested them under practical conditions. For example, actual tests of the blade assembly action have involved their use in swimming over many miles, and it was noted that it was accomplished quite effortlessly as compared to the exertions required with prior art flippers or no swimming aid whatsoever.

The thrust achieved by my invention results from a flat surface formed of movable blades as described. So long as the flat surface acts in the manner stated, thrust is achieved and drag is minimized. The human foot has flat surfaces on it and as the foot moves through the water, these flat surfaces are, with respect to the water and the direction of the swimmer, in an improper position. Hence, the flat surfaces of the foot and of a foot to which a flipper or propulsion means is attached constitute sources of decreased efficiency. To overcome this situation, I have devised an improved boot and this is shown in FIGS. 6, 7, and 8.

Referring to these figures, it will be noted that the boot **40** is adapted to fit snugly over the foot to about the ankle bone. The surface **41** at the top of the boot has been rounded and the surface **42** at the bottom of the boot has been tapered to a V shape. This eliminates the two large flat surfaces that characterize other flipper boots. These surfaces then are brought to a smooth rounded front or toe **45** as shown in FIG. 7 so that a streamline front or kicking point is presented to cut through the water in the most efficient manner. My improved boot, as is observed from the dotted lines in FIG. 6, is adapted to shape over the entire foot up to about the ankle. For this reason, each of these boots need be specially made for a particular swimmer.

The blade assembly propulsion means of this invention can be attached to my new boot by means of a bracket integral with the toe of the boot. Many ways are available for doing this and will be evident to those skilled in the art. However, I prefer to rigidly affix a bar **44** within the boot by constructing it integrally therewith, and provide a terminal bracket **46** extending beyond the toe to attach the blade assembly.

Generally, my improved boot is made of rubber, molded to snugly and comfortably receive the foot. Obviously, it is more expensive to make than is the boot of FIGS. 1 and 2. However, the increased efficiency more than outweighs its cost and it is, therefore, of particular utility for professional and military application.

In accordance with the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now believe to be its best embodiment. However, it should be understood that, within the scope of the appended claims, the invention can be practiced otherwise than as specifically illustrated and described.

I claim:

1. In a swim flipper adapted to be mounted on a foot and which is designed for swimming with an arcuate kicking motion, comprising a boot, a first bar attached to said boot and having an end extending beyond the toe of said boot, a second bar supported at the end of said first bar and at least in part extending below said boot, at least one blade member hinged to said second bar below said boot and free to swing in front of said second bar, and means to lock said second bar into a position in which the thrust position of the major surface of said blade is below and substantially perpendicular to the plane of the bottom of said foot, said second bar being pivotally supported at said first bar whereby said second bar with said blade can be moved above the foot to permit walking.

2. A swim flipper in accordance with claim 1 includ-

ing a plurality of said blades, each blade being supported by said second bar by rods extending through said second bar, said blades being spaced from one another so that a large surface is defined when they are against the bar in a common plane.

3. In a swim flipper in accordance with claim 1, said blade comprising a rectangular member having a housing along one edge adapted to receive a rod extending through said housing and said second bar, whereby said blade is hinge to said second bar and is free to move in front of it.

4. In a swim flipper adapted to be mounted on a foot and which is designed for swimming with an arcuate kicking motion, comprising a boot, a bar, a plurality of rectangular blades, and a number of rods equal to the number of rectangular blades, each blade having a housing along one edge adapted to receive one of said rods, said bar being attached to said boot whereby its major surface is directed parallel to the plane defined by the leg in performing said arcuate kicking motion, said rods being

mounted on said bar so that the axes of said rods are perpendicular to the major surface of said bar and whereby each said rod extends through a housing of a blade, and said blades are free to swing in front of said bar, said rods being spaced from one another so that a large surface is defined when the blades are against the bar in a common plane.

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