

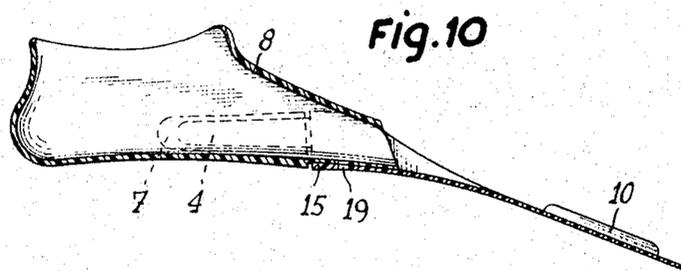
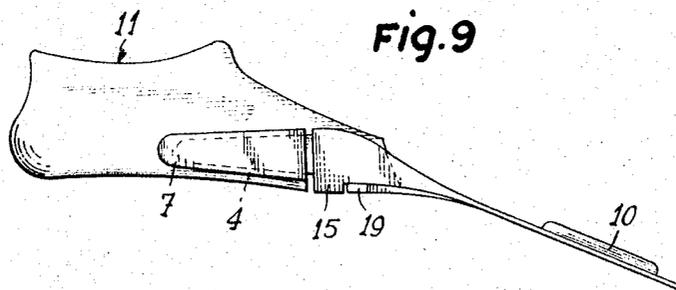
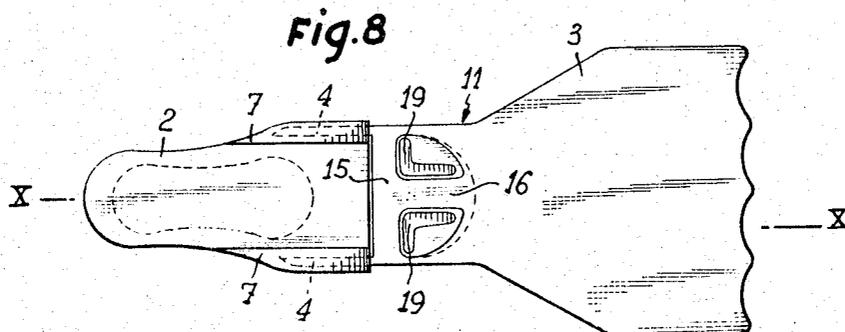
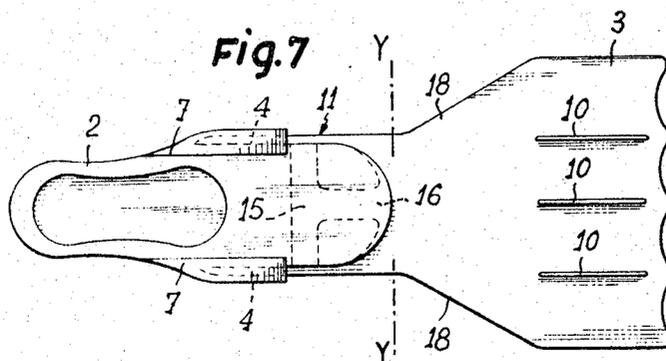
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L. FERRARO
SWIMMING FLIPPER

3,302,222

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Fig. 11

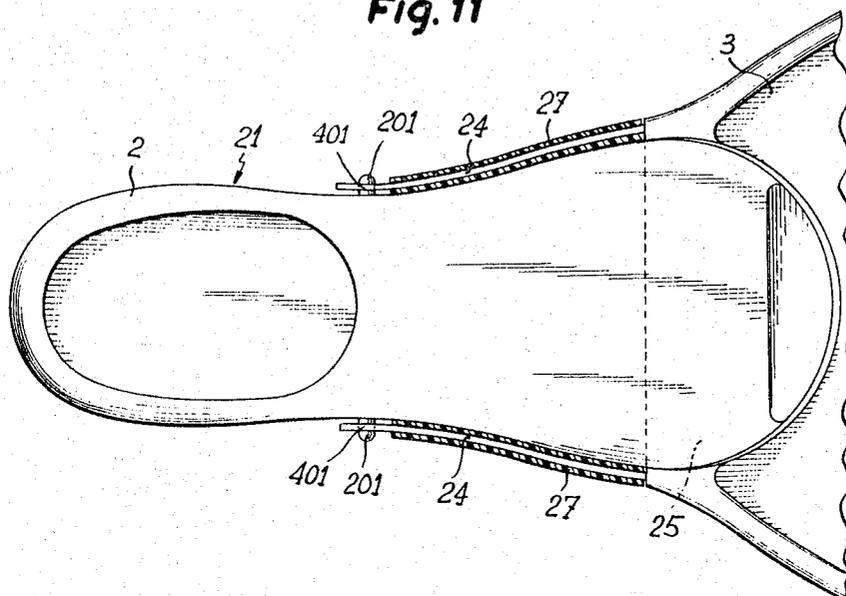
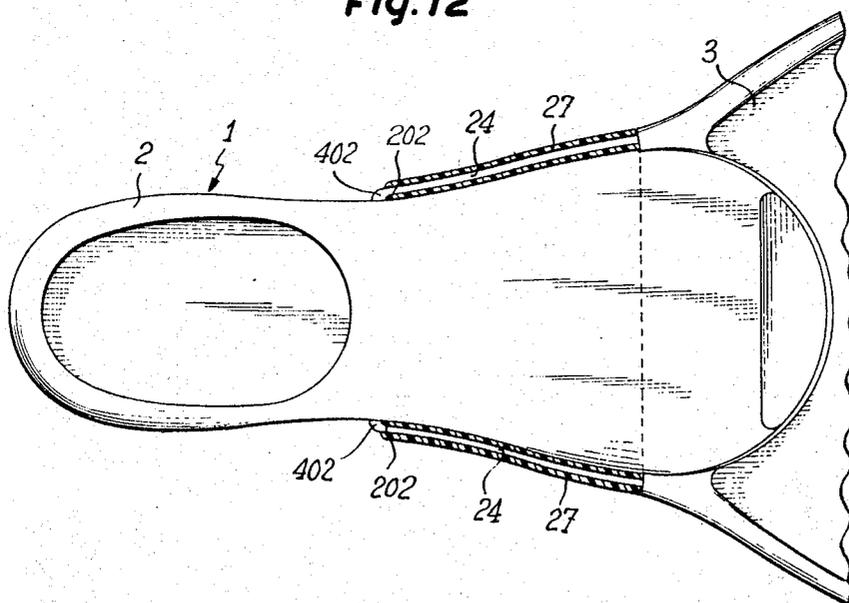


Fig. 12



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3,302,222

SWIMMING FLIPPER

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11 Claims. (Cl. 9—309)

The present invention relates to a swimming flipper having a propulsion surface and a "shoe" portion which are made from different materials. With this arrangement, it becomes possible to select for these two parts of the flipper those materials which are most suitable for the different functions to be fulfilled by each part.

It is known that flippers of the type comprising a "shoe" portion as in the present invention involve different requirements in respect of the propulsion surface or the flipper proper and of the "shoe" portion, these requirements resulting from the difference in the functions of these parts.

With regard to the shoe portion it is necessary, in fact, that this part should have a certain flexibility and pliability in order that it may adapt itself closely to the shape of the foot, may not "pinch" or fatigue the foot, thus impeding the mobility of the wearer, and that it may not exert any kind of abrasive friction on the foot itself, this being something which readily takes place in the event of prolonged use of such flippers.

On the other hand, the best natatory effect is achieved with the flipper when the propulsion surface exhibits a degree of sinewousness and springiness which it is impossible to obtain with a material which is suitable for the shoe portion, in view of the fact that the qualities required in each case are almost opposite qualities. This quality of "sinewousness" and "springiness" means that if the propulsion surface is bent and then released it returns to its initial shape rapidly and without substantial residual deformation.

These contrary requirements are difficult to satisfy with standard flippers, even if they are made from qualities of rubber of differing degrees of hardness and if the propulsion surface is subsequently given greater rigidity with the aid of thick ribs made from the same material. This solution would involve the serious disadvantage that it would make the flipper extremely heavy, with thicknesses and profiles which are detrimental to the propulsion effect and which, in the long run, would fatigue the wearer more than necessary. Consequently, the solution achieved would not be entirely satisfactory from the hydrodynamic viewpoint and consequently from the view-point of how to achieve the greatest efficiency with the least effort.

This problem is still greater with flippers of the so-called "floating" type, i.e. those made from materials of cellular structure having a specific weight which is less than that of water and which are consequently still more flexible than materials which do not float.

This problem and other problems in known flippers are solved in accordance with the present invention which provides a swimming flipper having a propulsion surface portion and a shoe portion manufactured from different materials, wherein connection between the said two portions is effected by the interengagement of seatings or sockets and complementary elongated finger elements provided on the respective portions.

The shoe portion may then be manufactured from a flexible and pliable material such as rubber and the propulsion surface portion from, for example, a plastic material or thin metal sheet having the properties of flexibility and springiness. The propulsion surface may be provided with the elongated finger elements or with the seatings or sockets or with an elongated finger element and a

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seating or socket, the shoe part being provided with complementary assembly members. It is generally preferable, however, that the elongated finger elements should be in one piece with the propulsion surface and that the seatings or sockets should form a part of the shoe portion.

This type of assembly has the additional advantage that it is possible to make the width of the propulsion surface small in the vicinity of the shoe portion; this width may even be less than the maximum width of the shoe. In this way, the area of the said surface is diminished in the portion thereof which is nearest to the foot, this being the portion which provides the smallest degree of propulsion for equal fatigue in the diver.

Further features and advantages of the flipper of the invention will be disclosed in the detailed description thereof which is given hereinbelow with reference to the accompanying drawings showing a plurality of embodiments given by way of non-limitative example of the invention. In the drawings,

FIGURE 1 is a plan view of a flipper having a shoe portion embodying the invention,

FIGURE 2 is a corresponding view from below,

FIGURE 3 is a view in section through the same flipper taken along the line III—III of FIGURE 2,

FIGURE 4 is a side view of the flipper of FIGURES 1 to 3,

FIGURE 5 is a view in section along an extension of the line V—V of FIGURE 2,

FIGURE 6 is a view in section along the line VI—VI of FIGURE 1,

FIGURE 7 is a plan view of a further flipper having a shoe portion and embodying the invention,

FIGURE 8 is a view from below of the flipper shown in FIGURE 7,

FIGURE 9 is a side view of the flipper shown in FIGURES 7 and 8,

FIGURE 10 is a sectional view of the same flipper taken along the line X—X of FIGURE 8, and

FIGURES 11 and 12 are part-plan views of two other flippers embodying the invention.

Referring now to the drawings, a flipper 1 shown in FIGURES 1 to 6 comprises a "shoe" portion 2 and a propulsion surface portion 3, joined in a manner herein-after described.

The shoe portion 2 is made of a suitably flexible material such as, for example, rubber, an elastomeric substance or a flexible plastics material whereas the propulsion surface 3 is made of a less flexible springy thin material such as a suitable plastics material, for example, polypropylene or from metallic sheet. The propulsion surface portion could also be made from a flexible material reinforced by metal elements.

The propulsion surface 3 has (see FIGURES 1 and 4) at the end thereof adjoining the shoe portion two longitudinal lateral prolongations having the form of elongated elements or fingers 4 transversely interconnected by means of a closed annular element 5. Alternatively the element 5 could be open at the top. A small lug 6 connects the lower portion of the annular element 5 to the propulsion surface 3; thus there is formed on the end of the propulsion surface adjoining the shoe portion a cage-like seating for the toe of the shoe portion, the said cage being provided with lateral engagement fingers 4.

The shoe portion 2 is provided with lateral seatings or sockets 7 for receiving the fingers 4, and has at the toe a transverse bulge or enlargement 8 which is integral with or attached to said shoe portion and on the sole portion has two further corresponding sector-shaped bulges 9.

In order to secure the propulsion surface to the shoe portion, the following procedure is adopted:

The toe of the shoe portion 2 is inserted in the cage-

like seating provided on the rear end of the propulsion surface 3 by the elongated finger elements 4, the annular or part-annular element 5 and the lug 6, the fingers 4 being inserted in the lateral seatings 7 in the shoe portion until the upper portion of the element 5 has passed beyond the bulge 8. The bulges 9 are then introduced into the empty spaces between the rear edge of the propulsion surface, the lower portion of the element 5 and the lug 6. The bulge 8 and the bulges 9 then prevent any undesired separation of the propulsion surface from the shoe portion.

The propulsion surface and the shoe portion may also be secured together by further engaging means (not shown) the engagement being maintained, for example, with the aid of small bars inserted one within the other.

Due to the interaction of each seating 7 and finger 4 inserted therein, the propulsion surface is fixed on the shoe portion in such manner as to prevent undesirable reciprocal oscillation of the two parts, since such oscillation could be detrimental to the propulsive efficiency of the flipper. The annular element 5 surrounds the shoe portion 2 in a comparatively small region around the instep or metatarsus of the foot; thus, the movement of the foot is transmitted to the propulsion surface without subjecting the ankle to excessive stressing, since this point of securing to the foot is nearer to the ankle than in other types of flipper. The lug 6 provides a firm bearing surface for the toe of the shoe and contributes to improved transmission of the propulsive force.

As will be seen still more clearly in FIGURES 1, 3 and 6, the thickness of the propulsion surface is slight and for the greater part constant and the said propulsion surface is provided at its end with direction or stabilization ribs 10 preventing possible lateral slipping movements of the propulsion surface under the force exerted. The said ribs extend towards the shoe portion over a certain distance but stop in the zone of flexion of the propulsion surface.

Naturally, whereas the flipper described and illustrated is of the type wherein the propulsion surface may be secured by engagement and also withdrawn from the shoe portion, it is possible to make provision for permanent securing of the shoe portion to the propulsion surface, for example, by pressing or by some other suitable means.

The flipper shown in FIGURES 7 to 10 has certain advantages relatively to that described hereinabove. The quantity of material used for the propulsion surface is smaller; the profile and orientation of the propulsion surface are improved, thus improving the hydrodynamic propulsion efficiency; due to a number of modifications in the attachment of the propulsion surface to the shoe portion, the force of the propulsion surface is shifted into a zone nearer the ankle, so that the joints and muscles of the lower limbs of the swimmer, and in particular those of the foot, are subjected (with output remaining constant) to substantially less stress. Thus, for an equal effort, the output which can be achieved is substantially higher. This effort is more rationally applied and distributed. In fact, the bearing of the propulsion surface on the shoe portion is then limited to a simple lower cross-member, with exclusion of collars or special complete rings surrounding the front portion of the shoe portion. In this manner, the toe of the shoe portion and consequently of the foot of the user bear firmly on the rear end or neck of the propulsion surface proper during the active phase of the swimming movement during which this support is necessary; the force resulting therefrom is better supported by the ankle and the latter is entirely free during the return phase, so that the entire force of the propulsion surface is necessarily applied on the shoe portion at the point at which the rubber seatings for the ribs on the propulsion surface commence, and, consequently, in a zone which is much nearer the ankle than in all other

types of flippers, with a noteworthy diminution in the stress on the joint and on the muscles.

The flipper 11 shown in FIGURES 7 to 10 comprises a portion 2 serving as a shoe and a portion 3 serving as a propulsion surface. The propulsion surface 3 comprises two prolongations or longitudinal and lateral finger elements 4 directed towards the rear and extending from the rear end or neck of the propulsion surface towards the shoe portion. Beyond the lower portion or sole of the shoe portion 2 the fingers 4 are transversely interconnected by a cross-member 15, whereas no connecting element is provided between the said fingers above the upper portion or ridge of the shoe portion. A member 16 connects the cross-member 15 to the propulsion surface 3 practically along the longitudinal median axis of the shoe portion, so that it forms, on the end of the propulsion surface intended to be engaged in the shoe portion, a sort of framework for supporting the shoe portion, corresponding practically speaking to an extension of the lateral engagement fingers 4.

The shoe portion 2 is manufactured from rubber or from a suitable pliable plastics material; it is provided with a pair of lateral seatings or sockets 7. The sockets are horizontally disposed and open out at the front of the shoe portion opposite the fingers 4, in such manner that the said fingers are able to penetrate into the respective sockets with a slight degree of force, so as to provide between the propulsion surface and the shoe portion an engagement connection capable of effectively resisting the stresses and bending forces to which the flipper is subjected, notably during the active phase of the swimming movement. It will be noted, in particular, that the sockets 7 are disposed symmetrically but in a position withdrawn from the toe of the shoe portion. More precisely, the opening in the sockets 7 towards the propulsion surface is disposed practically opposite the metatarsus. Furthermore, since no connecting element is provided between the fingers 4 on the upper portion or ridge of the shoe portion, the swimming movement force is, when the swimmer displaces his leg in the direction of the under portion of his foot, supported solely by the zone of engagement between the fingers 4 and the socket 7, and since the said sockets are withdrawn relatively to the toe of the shoe portion, this force is applied to the feet at points which are nearer the ankle, in such manner that the said joints, the muscles of the foot and more generally of the leg of the swimmer are stressed to a very much lesser degree. On the other hand, in conventional swimming flippers wherein the propulsion surface and the shoe portion are made in a single piece or are rigidly secured, the force is exerted in a zone nearer the toe of the foot, i.e. in a zone which is further from the ankle, so that the ankle is stressed very much more considerably.

It will also be noted that, whereas there is no connection between the propulsion surface and the shoe portion starting from the upper portion or ridge of the shoe portion, the said shoe portion bears firmly on the propulsion surface via the lower cross-member 15 and the connecting member 16. Consequently, during the active phase of the swimming movement, during which the toe of the foot is required to bear on the propulsion surface, no lack of strength or resistance is permitted between the propulsion surface and the shoe portion. During the passive phase, on the contrary, i.e. during the return phase of the swimming movement, during which the propulsion surface bends rearwardly and would require the excessive extension of the foot and excessive work of the ankle, the toe of the shoe portion and consequently the front portion of the foot are not affected by the movement and it is precisely for this reason that they are "detached" from each other with all the consequent advantages in respect of efficiency and stressing, since the working point is not the toe of the foot but the metatarsus.

Since the force of the propulsion surface is now transmitted entirely to the shoe portion via the engagement

sockets 7, the front zone or ridge 8 of the shoe portion is preferably suitably reinforced, for example by thickening the portion of the shoe in the zone and/or by making this zone of a harder rubber.

The finger elements 4 and the engagement sockets 7 constitute the engagement elements operating by flexion or engagement of the flipper and have the task of withstanding and transmitting the swimming movement force between the propulsion surface and the shoe portion. In order to prevent spontaneous or accidental detachment of the propulsion surface from the shoe portion during swimming, there are longitudinal connecting elements comprising relief portions 19 projecting preferably symmetrically on the base of the sole of the shoe portion, near the toe of the latter; when the fingers 4 have been embedded for as far as they will go in the respective sockets 7, the cross-member 15 and the member 16 are then engaged by the relief portions 19, in such manner that the propulsion surface cannot be displaced relatively to the shoe portion either forwardly or laterally.

FIGURES 9 and 10 show clearly that the propulsion surface is of small thickness and preferably becomes gradually thinner towards the extremity, where it is provided with a series of parallel stabilising ribs 10 for preventing possible lateral slipping movements of the propulsion surface under the force exerted. The said ribs extend towards the rear, i.e. towards the shoe portion, over a predetermined length, but they are limited by the flexion zone of the propulsion surface.

The profile of the propulsion surface is of the type of a flipper having a connecting zone 18 between the propulsion surface proper and the engagement fingers 4, so that the flexible portion of the propulsion surface extends from the extremity of the latter (i.e. to the right in the figures) as far as the line I—I of FIGURE 7 and the less flexible or practically rigid portions of the propulsion surface are reduced to a minimum and are practically speaking limited solely to the zone of attack or to the root of the engagement fingers. Furthermore, the plane of the propulsion surface has been so designed that it is slightly inclined downwardly relatively to the engagement fingers and preferably at an angle of 12° to 18° thereto. This feature of the propulsion surface, combined with the advantages resulting from the connection described hereinabove operating by engagement between a flexible, springy propulsion surface arranged at an appropriate angle on the one hand and a pliable and flexible shoe portion on the other hand permits the construction of a type of flipper which is extremely light and functional and which combines the velocity effect due to the sinewy and springy propulsion surface with the advantages of minimum muscular effort in the swimmer.

The flippers illustrated in FIGURES 11 and 12 each comprise a locking system wherein one or more retaining elements provided at any desired appropriate point on the propulsion surface or the shoe portion co-operate with corresponding retaining elements on the shoe portion or on the propulsion surface for locking the propulsion surface and the shoe portion reciprocally in an assembly position; this locking excludes practically speaking any possibility of accidental sliding of the propulsion surface when the swimmer's foot is disposed in the shoe portion, whereas it permits the rapid withdrawal of the propulsion surface from the shoe portion, without the aid of a tool, when the latter is not on the foot. Thus, the double advantages are simultaneously achieved that it is no longer possible for the propulsion surface to be accidentally detached from the shoe portion during swimming and that due to the possibility for rapid detachment of the propulsion surface, it becomes possible rapidly to convert the swimming flipper to a simple shoe which may serve for example quite easily for walking on a beach or for climbing to safety on a rock.

The flipper 21 illustrated in FIGURE 11 comprises a shoe portion 2 and a propulsion surface 3. The propul-

sion surface 3 has two prolongations or longitudinal and lateral finger elements 24 projecting to the rear of the neck of the propulsion surface towards the shoe portion. At the height of the front portion of the sole of the shoe portion 2, the finger elements 24 are transversely interconnected by a member 25 having a solid portion which constitutes a rear prolongation of the propulsion surface 3; the said solid portion is in FIGURE 11 concealed by the front of the shoe portion. No connection is provided between these finger elements above the shoe portion.

The shoe portion 2, which is made of rubber or of an appropriate plastics material having a different degree of hardness is provided with a pair of seatings or lateral sockets 27. The sockets 27 are disposed longitudinally on the shoe portion and are open at their two ends. The sockets 27 are slightly shorter than the finger elements 24, so that when the propulsion surface is engaged in the shoe portion the finger elements 24 penetrate as far as possible into the sockets 27 through their front aperture and finally extend slightly beyond the open rear socket ends. In the portion of each finger element 24 which thus projects there is an aperture 401 in which engages a button or corresponding relief portion 201 which projects externally laterally of the shoe portion 2. Due to the flexibility of the finger elements 24 and the flexibility of the material from which the shoe portion is made, the buttons 201 may be readily engaged in and withdrawn from the apertures 401. Thus, for example, in order to withdraw a button 201 from the associated aperture 401 when the shoe portion is not on the foot, it will suffice to fold slightly towards the exterior the portion of the flexible finger element which projects or to urge towards the interior the wall of the shoe portion in the vicinity of the button until the latter withdraws from the aperture under the effect of the deformation of the shoe portion. On the contrary, when the shoe portion is on the foot, this deformation is no longer possible due to the pressure of the foot on the shoe portion, so that it is impossible for the propulsion surface to become accidentally detached from the shoe portion during swimming.

In the case of the flipper illustrated in FIGURE 12, the sockets 27 are also open at the rear ends, but the portion of the finger elements 24 projecting beyond the rear open socket ends when the propulsion surface is embedded in the shoe portion are each provided with a small tooth 402 which engages over a stop member or shoulder 202 which may take the form of a relief member on the shoe portion. Alternatively the stop members or shoulders 202 may be formed by the ends of sockets 27 in cases wherein the latter, for example in order to make the arrangement more robust, are designed as separate elements without requiring the direct co-operation of the wall of the shoe portion in order to form the sockets. The small teeth 402 are relatively short. On the other hand, the sockets 27, as already stated, are slightly deformable (i.e. preferably made from the same material as the shoe portion), so that the finger elements 24 are readily able to pass through the sockets 27. When the propulsion surface is engaged or urged as far as possible into the shoe portion, the teeth 402 emerge from the open rear ends of the sockets 27 and engage automatically in the corresponding relief portions 202 which are fast with the shoe portion. In this case also, despite the flexibility of the finger element 24 and that of the shoe portion 2, when the latter is drawn on to the foot, the wall of the shoe portion is urged towards the exterior under the effect of the pressure of the foot, so that the relief portions 202 firmly retain the teeth 402. Accidental detachment of the propulsion surface from the shoe portion, for example during swimming is thus practically impossible. In order to detach the propulsion surface from the shoe portion when the latter is not on the foot, the procedure will be in accordance with the indications given with reference to FIGURE 11, i.e. the wall of the shoe portion is urged towards the interior near

the relief portions 202, so as to disengage the teeth 402 from the said relief portions under the action of the deformation of the shoe portion due to this pressure.

The embodiments described hereinabove may be modified without exceeding the scope of the present invention. The members contributing to the locking effect, for example the buttons 201 and the apertures 401, or the relief portions 202 and the teeth 402 may be provided in any desired number and they can be disposed at any desired appropriate point on the shoe portion and on the propulsion surface respectively. Furthermore, the presence of such locking members does not exclude the provision of auxiliary retaining members such as for example the cross-member 15 and the member 16 which co-operate with relief members 19 on the sole of the shoe portion. The connection between the shoe portion and the propulsion surface may also be made permanent or semi-permanent by local heating, sticking or in any other manner.

What I claim is:

1. A swimming flipper comprising a shoe portion and a propulsion portion, a socket on each side of the shoe portion, a finger on each side of the propulsion portion engaged in each of the sockets, means for retaining the fingers in the sockets, the means for retaining the fingers in the sockets comprising bulges on the upper and lower parts of the shoe portion forwardly of the sockets, and an annular band integral with the propulsion portion between the bulges and sockets and in engagement with the shoe.

2. A device as defined in claim 1 in which the openings in the sockets are at the height of the metatarsus portion of the shoe.

3. A device as defined in claim 1 further including spaced ribs extending longitudinally of the propulsion portion.

4. A device as defined in claim 1 wherein the propulsion portion is planar and is inclined relative to a central line of the fingers.

5. A swimming flipper comprising a shoe portion and a propulsion portion, a socket on each side of the shoe portion, a finger on each side of the propulsion portion engaged in each of the sockets, means for retaining the fingers in the sockets, the means for retaining the fingers in the sockets comprising a pair of projections on the sole portion only of the shoe adjacent the toe, and a cross-member integral with the propulsion portion and in engagement with the sole between the projections and the sockets.

6. A device as defined in claim 5 wherein the means

for retaining the fingers in the sockets comprises a projection extending laterally from the shoe at each side thereof and an aperture in each finger fitted over the projection.

7. A device as defined in claim 5 wherein the means for retaining the fingers in the sockets comprises a lateral protuberance on the end of each finger in engagement with an end wall of the socket.

8. A device as defined in claim 1 wherein the means for retaining the fingers in the sockets comprises a projection extending laterally from the shoe at each side thereof and an aperture in each finger fitted over the projection.

9. A device as defined in claim 1 wherein the means for retaining the fingers in the sockets comprises a lateral protuberance on the end of each finger in engagement with an end wall of the socket.

10. A swimming flipper comprising a shoe portion and a propulsion portion, socket means carried by one of said portions, finger means carried by the other of said portions and engaged in said socket means, means for retaining the finger means in the socket means, the means for retaining the fingers in the sockets comprising bulges on the upper and lower parts of the shoe portion forwardly of the sockets, and an annular band integral with the propulsion portion between the bulges and sockets and in engagement with the shoe.

11. A swimming flipper comprising a shoe portion and a propulsion portion, socket means carried by one of said portions, finger means carried by the other of said portions and engaged in said socket means, means for retaining the finger means in the socket means, the means for retaining the fingers in the sockets comprising a pair of projections on the sole portion only of the shoe adjacent the toe, and a cross-member integral with the propulsion portion and in engagement with the sole between the projections and the sockets.

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