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OTTO WAHLE,
New York A.C.; Member of A.A.U. Record Committee and World's Swimming Authority.

PREFACE

In undertaking the task of giving to the public a short treatise on swimming I recognized the wisdom of obtaining the collaboration of someone well versed in theoretical as well as practical swimming. In looking about me I soon realized that I could do no better than in applying to either Mr. L. de B. Handley, or Mr. Otto Wahle. Both had had a brilliant competitive career; both had followed closely the development of swimming at home and abroad, and though only amateurs, had coached with as much success as any professionals in the country. I was fortunate in finding them only too glad to assist me, and with their aid I put together this book, trying to condense into a few pages all that could be useful to the swimmer, aiming at clearness and brevity, and omitting all unnecessary stuff.

Most of the illustrations are from photographs posed for by representative exponents of the strokes, but owing to the difficulty experienced in getting proper effects with the camera, through water, I deemed it advisable to pose them on terra firma. As a consequence, in several cases the body is so strained as to give a slightly erroneous impression, but the positions of the arms and legs are accurate both individually and in respect to each other, and the only fault lies in the fact that the legs are at times too far below the surface. The line drawn across illustrations indicates approximate water-line. In taking these positions in the water, however, the body will, of itself, correct the fault, and unconsciously the right balance will be established.

C. M. Daniels.

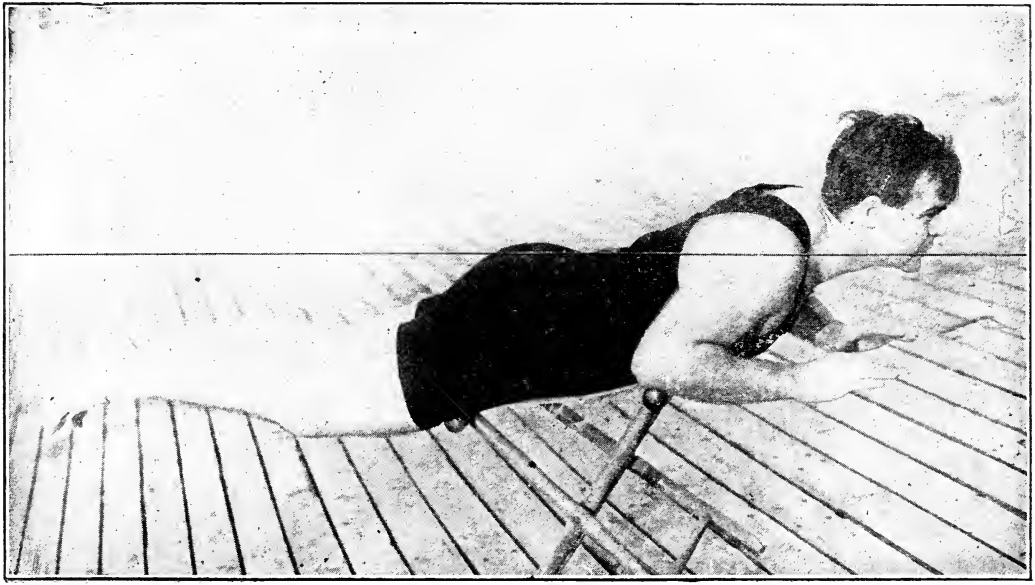
TEACHING THE NOVICE.

INTRODUCTION

Whole volumes have been devoted to telling why every man and woman should know how to swim, but the reasons may be concisely condensed into three: Swimming is a pleasant pastime; it is an exercise which develops the body symmetrically and thoroughly; and it is often the means of protecting and saving life.

As a pastime it has few equals. The pleasures of bathing, whether outdoors in summer, or in a natatorium in winter, can only be fully appreciated by the good swimmers. The average man tires after a few spasmodic strokes and cannot possibly experience that exhilarating feeling that comes to the expert as he glides swiftly and easily through the "treacherous element" with absolute confidence in himself.

Of the hygienic value of swimming, little need be said. Its very cleanliness insures hygiene; for cleanliness is the foundation of good health, just as uncleanliness is the primary cause of disease. But on the subject of swimming as physical culture many erroneous beliefs are held which need correcting. To begin with, there are few exercises that will develop the body as symmetrically as will swimming; and by symmetrically I mean proportionately and from head to foot, with no muscle developed at the expense of another. One often hears the remark made that a swimmer has no muscles at all. It is true, in a way. He shows none of the bulging, knotty muscles of the

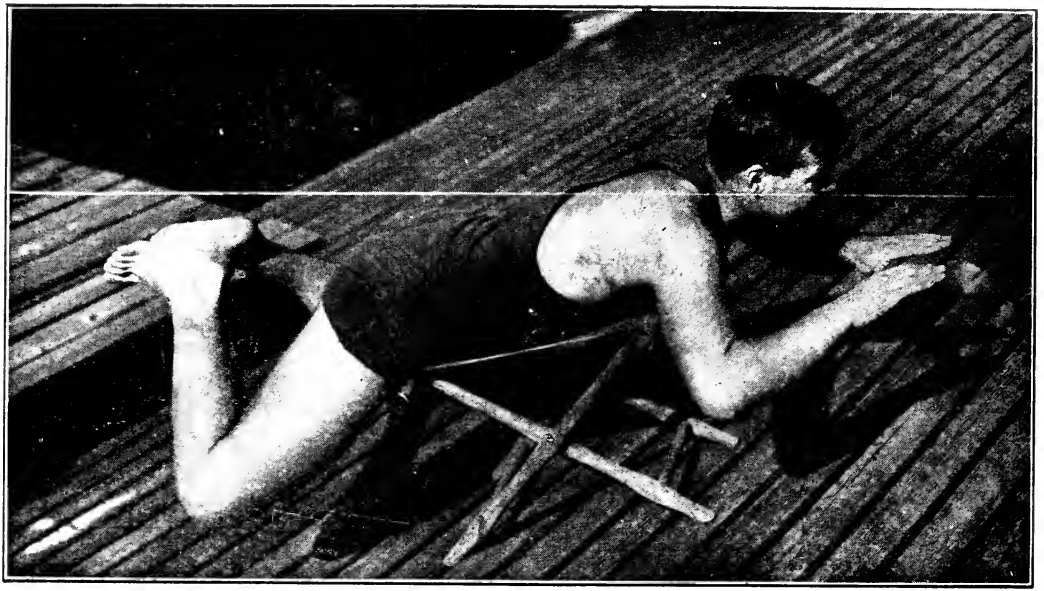


BREAST STROKE—FIRST POSITION.

professional poser. But those clean, smooth arms and legs of his are blessed with the only muscles that will benefit an athlete, the long, pliant, "working" muscles, that never tire and that don't know what it is to cramp or to bind.

I have become so convinced of the value of swimming as an all round developer that I do not hesitate to advocate it as preliminary work for running, jumping, rowing, tennis, or any other branch of athletics, even to wrestling and weight lifting. There is no doubt that it improves the wind, and it has the great advantage of strengthening the muscles without hardening them. One emerges from a two or three weeks' period of training in the pink of condition, yet feeling supple and free in every part of the body. And the very softness of one's muscles permits of the taking up of any other kind of exercise without fear of the soreness that comes from using another set of muscles than the one which has been hardened by exercising.

An athlete of my acquaintance established, a few years ago, a world's record for that all round test called the Medley Race, in which six consecutive quarter miles have to be negotiated—walking, running, bicycling, horseback riding, rowing and swimming. I asked him one day how he ever managed to train for all these different events at the same time. "I didn't," he told me; "I tried it when this competition was first instituted and although my time in the race was indifferent, I finished quite exhausted. In my second attempt at the record, I decided to give a trial to a system advocated by Alex Meffert, and the only training I did, was to swim two quarter miles every afternoon at an interval of fifteen minutes. It proved most successful. I felt strong up to the finish, I experienced no soreness then or after, and although I clipped fully two minutes off my previous



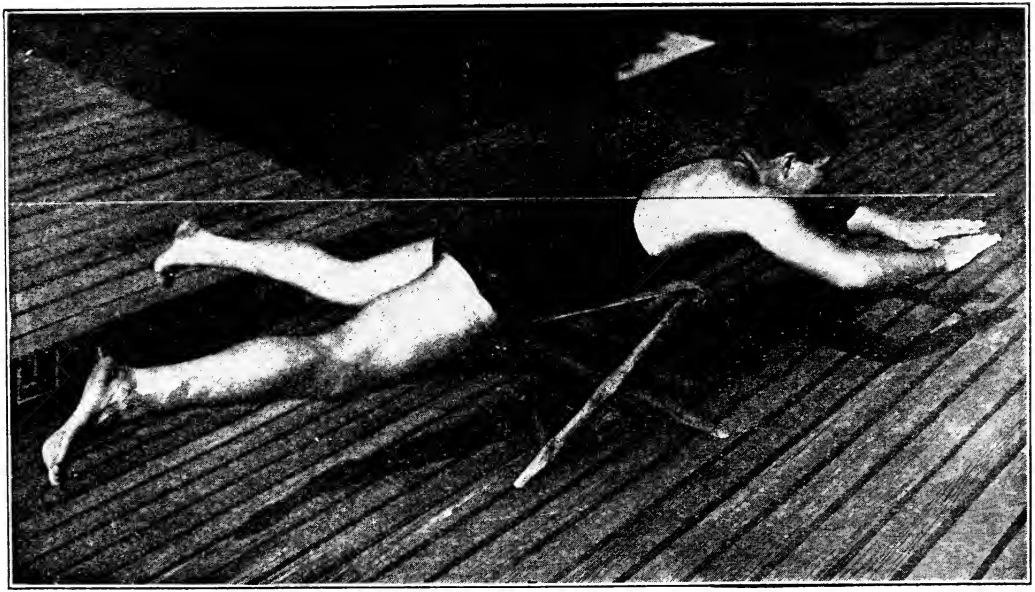
BREAST STROKE—SECOND POSITION.

performance I crossed the line in splendid condition. I believe swimming had made my muscles so supple that there was nothing to tire or to bind, and my wind and endurance just carrried me through."

Those coaches and trainers who forbid their men going into the water during training, are either crassly ignorant or know their wards too well to trust them. The average athlete behaves a good deal like a boy in school and tries to take a yard every time he is conceded an inch. If you allow him to take a swim during the summer he will interpret the permission into meaning that he may lie around the water by the hour; or, if it is winter, that he may spend half the day between the hot room and the pool. Of course the next day he is unfit for work and complains of a tired feeling. Then the coach says: "Ah! that swim," and anyone who says "swim" to him thereafter stirs up a row. I know, and no one can convince me to the contrary, that a daily swim of three or four minutes (as much as is needed to cover two or three hundred yards at a brisk pace) far from being injurious to an athlete will increase his snap and dash.

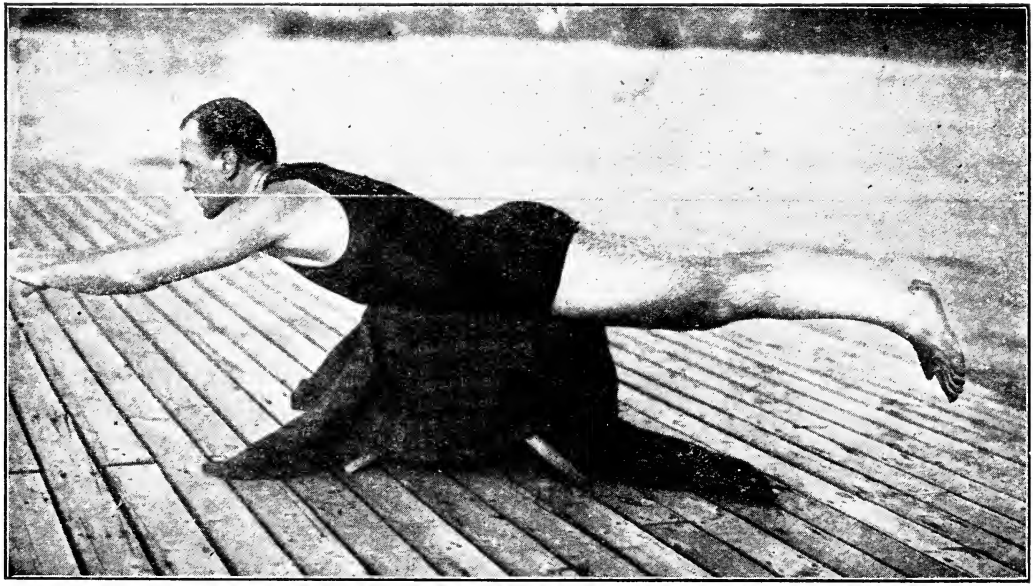
Coming next to the question of its usefulness, it is undoubted that every man owes it to himself to be able to swim. We live so much on, in, and near the water that there are daily possibilities of being called upon to use our knowledge of swimming. Is not the fact that by it we may save ourselves, or others, from a ghastly death by drowning, a sufficient incentive to have us incur a little trouble in learning? What tragedies could be averted were everyone to give the subject a little thought.

There seems to be a prevalent belief among parents that children should not be taught to swim until they are over ten years



BREAST STROKE—THIRD POSITION.

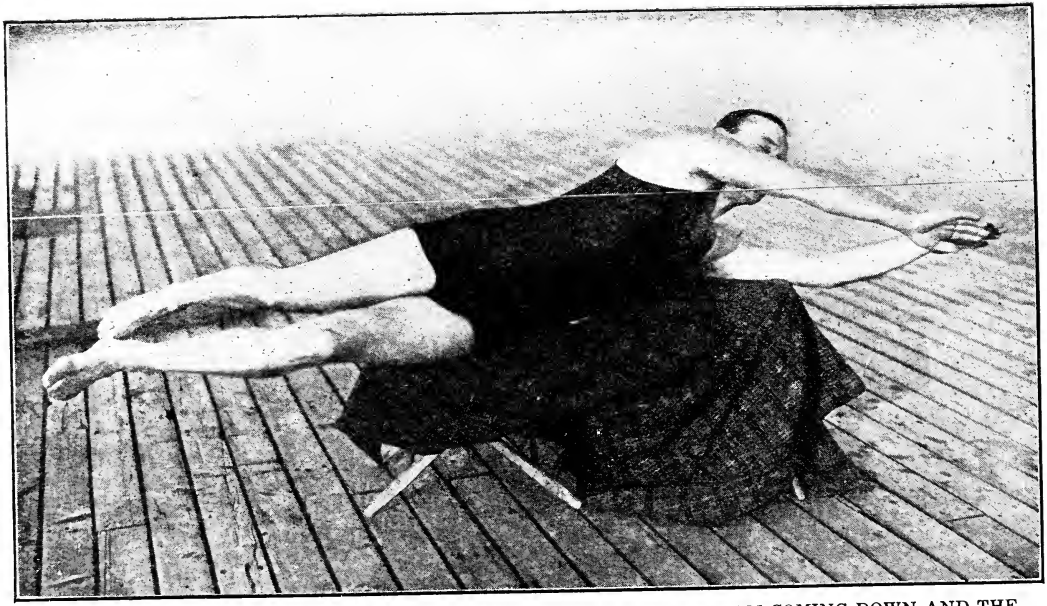
old and that to teach them younger is injurious to their health. Where the idea could have emanated, it is hard to understand, but it is rank nonsense. I have seen in England youngsters under seven who could use the complicated speed strokes just as prettily as grown-up experts, and their ruddy cheeks and sturdy young frames were tangible enough proofs of their not having suffered from their early training. It is the duty of every father and mother to see that their children are taught at the most tender age.



BREAST STROKE—FOURTH POSITION.

LEARNING TO SWIM

Before beginning the instructive text of this book I want to say a word in regard to a question that swimming teachers and coaches are often asked. It is: "Why are not all swimmers taught the same stroke in the same way?" The query is natural, for one seldom sees two men swim alike, even when they are using the same stroke. Nevertheless those men have undoubtedly been taught in identically the same way; only, in each case the individuality of the pupil has asserted itself, and so, while both men are going through the movements as taught them, they are doing so in the manner best suited to their personality. If you want to realize what I mean, ask a few men to lift their arms above their head as in the first position of the trudgeon stroke and see if they don't all hold them up in a different way. Each is assuming his natural position and he will assume it when learning the stroke in the water. Now, how can you expect these men to swim alike when they don't even hold their limbs in the same way? To the man with abnormal development of the shoulders an extreme reach is neither possible nor advisable; it would be a decided strain to him and he will tire much sooner than if a shorter one is used. To the supple, slight man, instead, there will be no difficulty in reaching out and he will benefit by the added length of his stroke. The same may be said of every other part of the stroke. And has the reader ever considered how an imperceptible change



THE SIDE STROKE—POSITION OF THE BODY, SHOWING THE UPPER ARM COMING DOWN AND THE LEGS OPENING FOR THE SCISSOR KICK.

of time will affect the entire stroke? Of course it is not possible to get arms and legs to start automatically at the exact fraction of a second, nor is it likely that the same time would suit everyone; inclination is a factor not to be disregarded.

The lesson to be learned from this is that the best results are obtained by adapting the various movements to one's build; not by changing them, but by using them in such a manner as to place no unnatural strain on any part of the body.

PREPARATORY LAND EXERCISES.

Paradoxical though it may seem, the movements necessary in swimming are best acquired out of water and I strongly advise the beginner to go through a period of land exercise before attempting to learn. Especially in the case of women and children I have found the system excellent. The fact is, people often have a morbid dread of the water (born probably of unfamiliarity with it) and get so nervous in it that they are quite unable to keep their mind properly on what they are doing, while you teach them. On land, the action of both arms and legs, the correct way of breathing, and the respective time of all three can be practiced at ease until they become so familiar as to be gone through instinctively when one enters the water.

The different parts of the stroke should first be taken up separately, beginning with the legs, then the arms and breathing, and finally all together.

To master the leg movement, stand with heels together and hands on the hips. Lift right leg off the ground, pointing the knee outward until the heel almost touches the left knee, then straighten it out so that the ankles are about two feet apart and

TRUDGEON—FIRST POSITION.

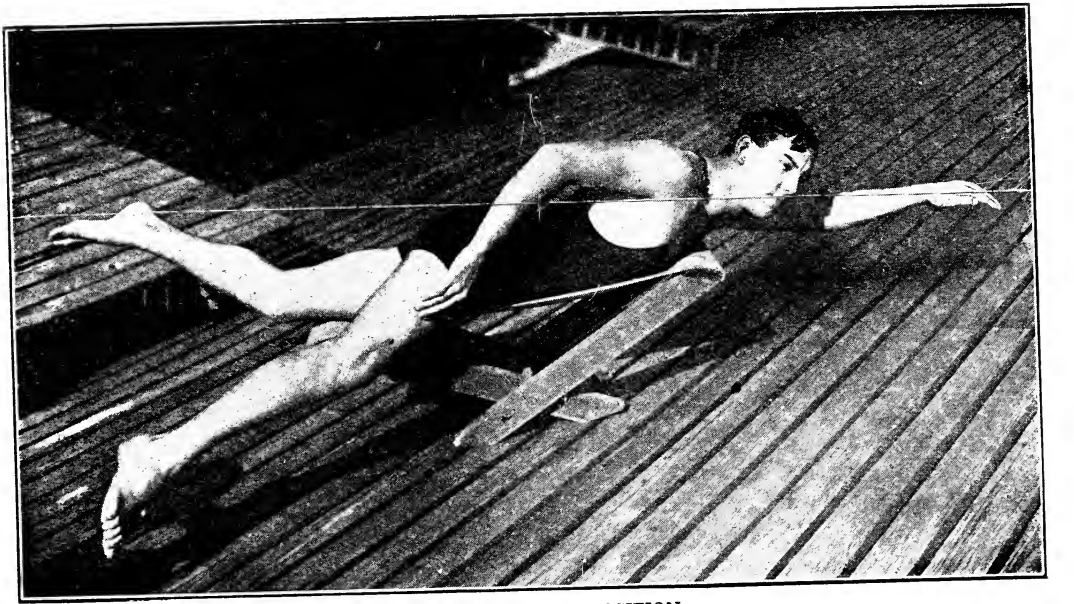
bring it briskly down to starting position. Do the same with the left leg and proceed, alternating them.

To learn the arm stroke, begin by placing the hands at the height of the chest, about a foot below the chin, palms down, fingers close and pointing before you. Push the hands out parallel to the ground until they are at full length. Turn palms outward (thumb down) and bring arms back, stiff at the elbow and still parallel to the ground, until they are at right angles to the body. In other words, let them describe a quarter of a circle. Then bend the elbow backwards and gradually turning the palms down again, return to original position. Repeat until familiar with.

In breathing, you should inhale through the mouth and exhale through the nostrils. Inhale while the arms are coming back and exhale while they go forward. A suggestion made by the Hon. Sydney Holland I have found to work wonders. He tells novices to blow their hands away from them. The breathing in swimming should be easy, not short and hard. Begin to inhale as soon as the hands start down and manage so that you will just have filled your lungs by the time they reach the chest. Begin to exhale as they start forward and continue until they are on the full reach.

Now take the stroke all together. Start with the arms stretched out before you and as you bring them back, take a deep, slow breath. When the hands are about to reach the chest, bring up the right leg; as the hands go forward straighten the leg out and when they are about to become extended, snap it down alongside of the other. On the next stroke let the left leg do its work, and continue, alternating them.

Before entering the water it is advisable to learn to use both



TRUDGEON—SECOND POSITION.

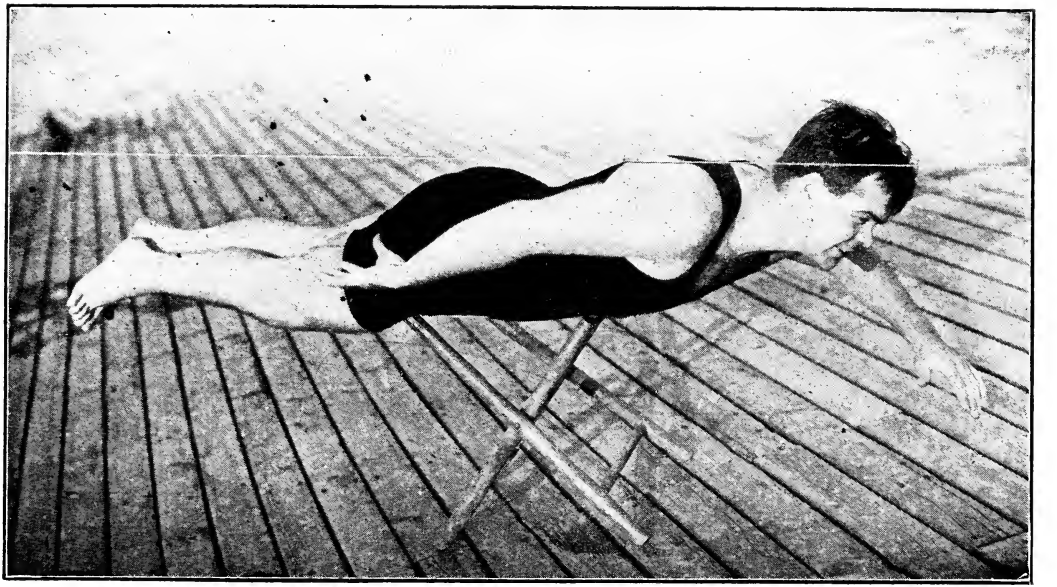
legs at the same time in connection with the rest of the stroke. You can do this by lying face down on a stool or chair. The position is not a very comfortable one, but you only need do a few minutes at a time of it and the work will certaintly benefit you a lot.

In some books I have seen land drills for the trudgeon and crawl advocated as instructive. Personally, while I believe them an excellent exercise for developing the body, I do not think they teach anything. The strokes are far too complicated. It is an entirely different matter from the simple breast stroke movements, and it will be found much more satisfactory not to lose any time at them.

HINTS TO THE BEGINNER.

In undertaking the actual task of swimming, salt water is preferable to fresh, because it has more sustaining power. Whether you have indulged in land exercises or not you will find it hard to support yourself, at first, and if you can find water about four or five feet deep, where you can touch bottom at will, if you get nervous, I should advise your doing so.

Most instructors are in favor of cork belts, white wings, inflated bags, and other floating devices for beginners; but I think them a mistake. Swimming is entirely a question of balance, as the body floats naturally, and all artificial buoying-up destroys the right idea of how to hold one's self. I realize that one learns more readily when no effort has to be made to keep above water, but there is a way of giving support without affecting the balance. Place a canvas belt or a strip of cloth around your chest, to a thin piece of rope to it and attach the end of this rope to a



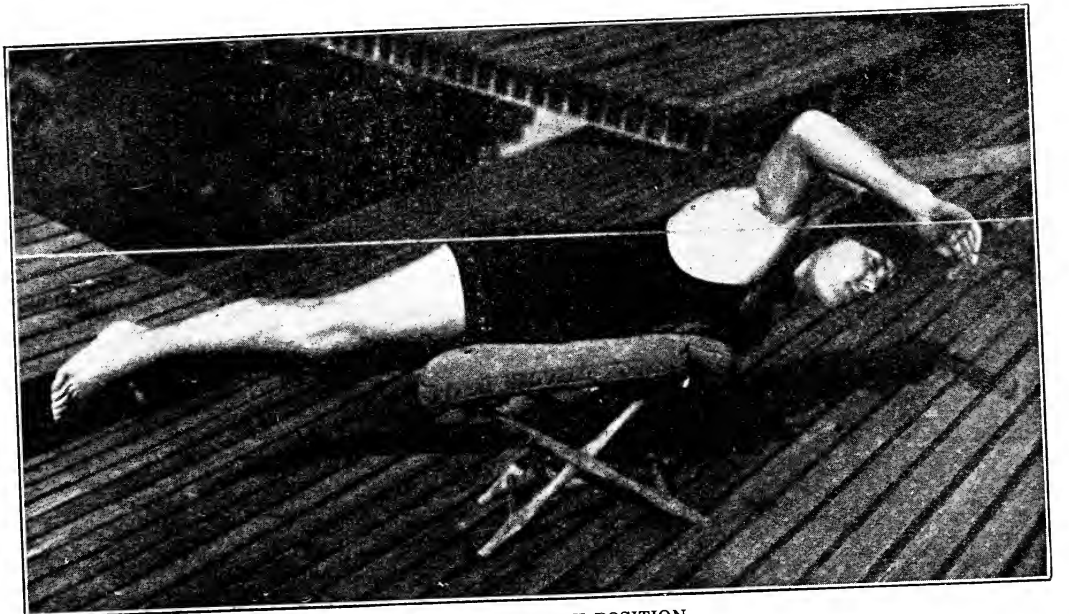
TRUDGEON—THIRD POSITION.

short stick, as on Page 6. The instructor or a friend can hold the stick while you practice, placing on it only sufficient pressure to keep you afloat. How little this is you will understand by watching a performer in the plunge for distance; without moving a muscle he keeps on the surface indefinitely. The belt system has the advantage of allowing the holder to gradually diminish the sustaining pressure until, without being conscious of it, one swims without support.

If you cannot find help it may be best, in case of nervousness, to provide yourself with white wings or an inflated bag; then let out the air a little at a time, until you become used to swimming without props at all.

The position of the body is an all-important matter in swimming, for it is position that insures the proper balance. One often sees the beginner floundering along with head thrown back to such an angle that it looks about to fall off, and this, besides placing a terrible strain on the neck, brings the feet far too low in the water, retarding progress. The position is generally due to faulty breathing, for in breathing properly there is no need to crane the neck to get air. Just watch a good swimmer of the breast stroke and notice his easy position, half the time mouth is under water as on Page 10. That is the correct way to carry the head. While the arms are coming back, their applied power lifts the body and brings the mouth well above water; then is the time to inhale; later, as the hands go forward, the mouth sinks below the surface and one exhales under water, preferably through the nostrils. Pay great attention to the breathing, it is the secret of easy swimming.

In learning to swim never hurry the movements, haste is the negation of form and you can only acquire the correct stroke by



TRUDGEON—FOURTH POSITION.

making every move a slow, careful one, thinking all the time of what you are doing.

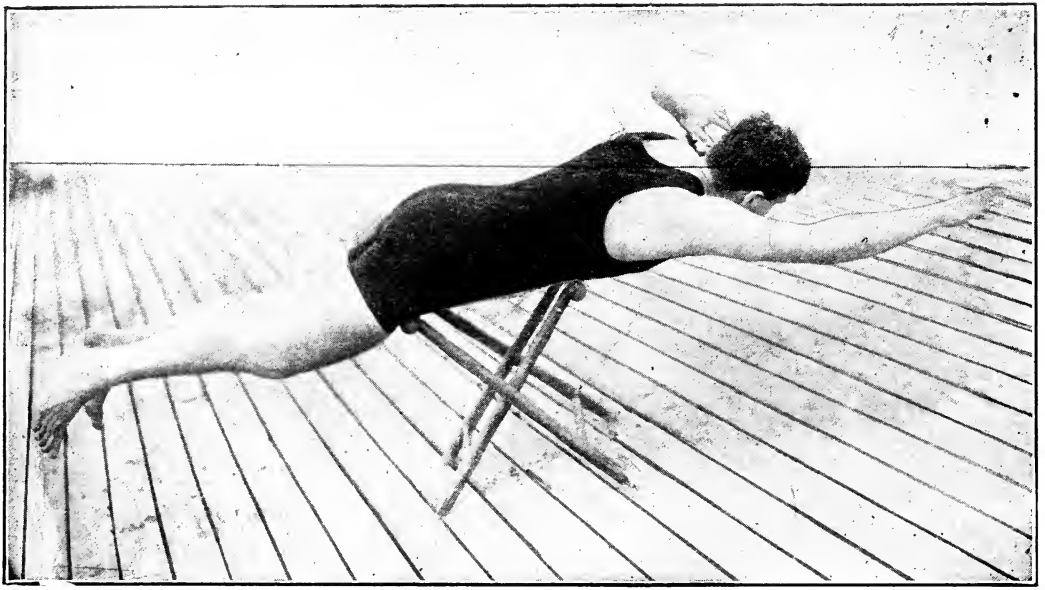
If you have taken no preparatory land exercise before tackling the stroke, or if you find that the movements don't come to you at once in the water, you had better try the various parts separately, as advocated previously, until you have mastered them thoroughly.

THE BREAST STROKE.

Racing men as a rule are wont to look upon the breast stroke as useless and obsolete as proved by the fact that efforts have been made to have it stricken from the list of championship events.

The men guilty of this senseless move can not have given the subject very careful consideration. On a long swim, whether forced on one by chance or taken for pleasure, nothing is more restful than a short change from the speed strokes to the breast. And as to its usefulness, it is the only stroke, barring the back stroke, that will allow one to make shore with a victim in case of a rescue from drowning.

To learn the breast stroke, lie comfortably on the surface so that your feet are only a few inches below it and your mouth is just under water. Place legs together and straight, toes pointing back, arms extended in front, hands touching, fingers closed, and palms down. In starting to swim, turn the palms outward, thumbs down, and, keeping the elbow stiff, draw the arms back just below the surface and parallel to it until at right angles to the body; then bend the elbow backward and gradually turning the palms down, bring the hands together at the chest; then shoot them forward to starting position. The legs are not moved



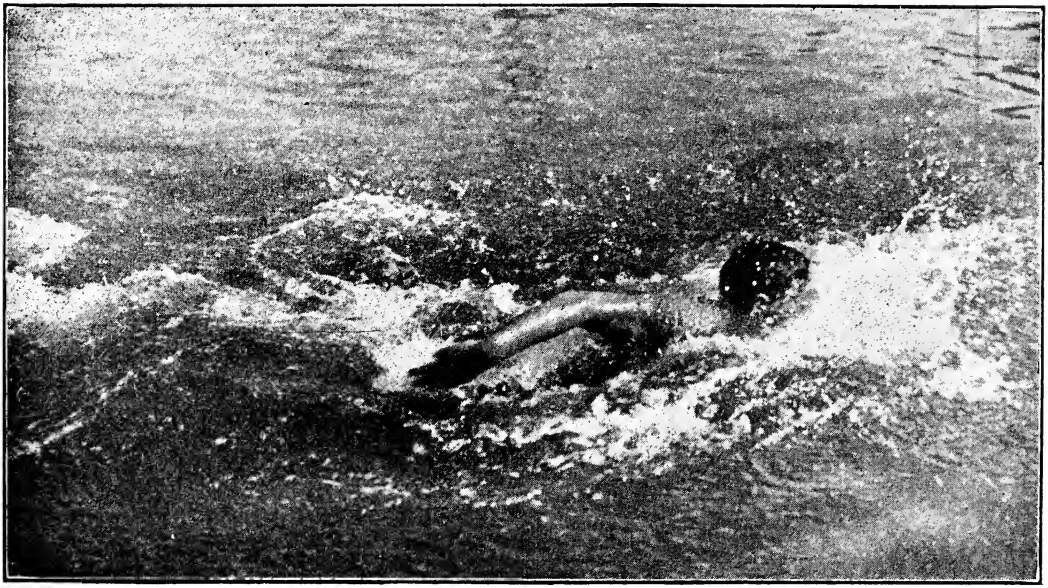
TRUDGEON—FIFTH POSITION.

until the hands approach the chest, then they are drawn up, knees out, heels together; when the hands start forward the legs are kicked out straight without closing them, and as the arms get to the full reach the legs are snapped sharply together. In this position the body, driven by the impetus of the kick, is allowed to "slide" until the momentum is all but exhausted, when the arms are started again. Of course, though the various parts of the stroke are described separately, in action they are run into one another so closely as to produce a smooth, continuous motion.

THE SIDE STROKE.

I hesitated some time before giving this stroke space. It is one of the racing strokes that has seen its day, and is slowly passing away. Nevertheless it is used by many coaches to prepare the pupil for the more complicated trudgeon, and it undoubtedly facilitates the acquisition of the scissor kick, so I will give the way to learn it.

The body rests on the water with one shoulder down, and it will be well, at first, to hang on to some stationary support to practice this kick. It is absolutely different from the old frog kick and not easy to learn properly, so don't get discouraged if you fail to become perfect after half an hour's trial. Things that are worth while do not come as rapidly as that. The first movement of the scissor kick consists in bringing the upper leg forward quite stiff at the knee and the under one back to a kneeling position. The under leg should not be moved from the hip, but from the knee. The action of the scissor kick should be front and back, just as in walking, with no side motion at all. When the toes of the under leg are two to three feet from



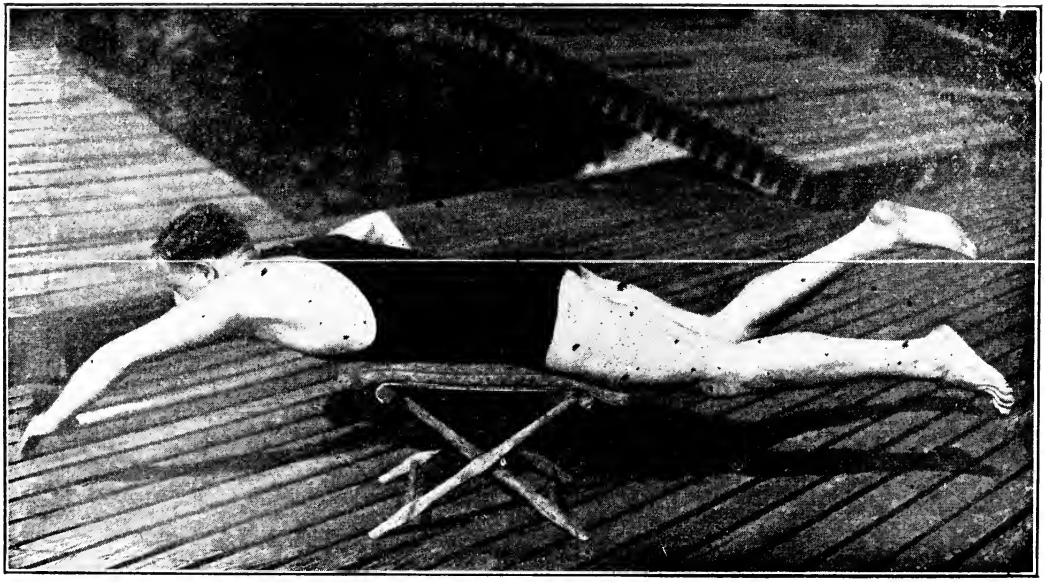
THE TRUDGEON IN ACTION.

the heel of the upper one (according to one's size) the legs are brought smartly together. The ankles are bent up just as the legs separate and then return to their original position as the legs close. Particular pains should be taken to keep the upper leg rigid; it comes instinctively to bend it and unless you exaggerate in practice you will not hold it properly later. In bending the knee, a resisting surface is presented to the water which offsets all the good derived from the kick. The opening of the legs should be done very slowly, as a sudden movement in this, acts like a brake, and they should be brought together with a snap. It is a fault to open the legs too wide, as it increases the resistance.

For the arm action, place your arms above the head, palms turned away from the face. Bring upper arm down smartly, with elbow rigid, hand the least bit spooned, fingers together. Carry through the water just below the surface, describing a semicircle to end at the thigh, then bend the elbow and bring it forward well above water until on the full reach again. The under arm should be started just as the upper one finishes and brought down parallel to it, so that it brushes the lower thigh; then the elbow is bent and the arm is shot forward below the surface, palm down. Breath is taken as the upper arm comes down and exhaled as the under arm goes forward. The legs are opened as the upper arm starts down, and snapped back as it finishes. The side stroke should give a smooth run with no jerks.

THE TRUDGEON.

A thing which I omitted in the side stroke, but now becomes a necessity, is a coach. This point I must emphasize before proceeding any further. Swimming is a sport different from most



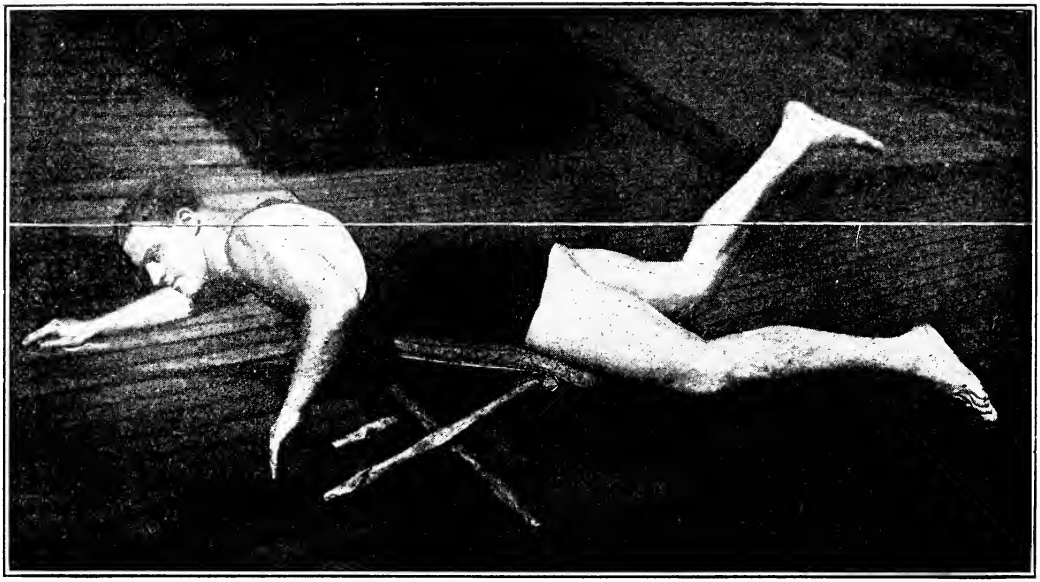
CRAWL—FIRST POSITION.

others inasmuch as the pupil cannot see what he is doing and often falls into serious faults without being aware of it. These, if not corrected at once, become chronic. The coach should be an expert, if possible, though anyone is better than no one; only, it is essential that faults should be corrected and the uninitiated cannot very well tell you how.

The trudgeon is the least tiring of strokes, when its relative speed is considered, and may be used for any distance. It is my opinion that a judicious alternating of the breast and the trudgeon will tire less and give better results than the use of the under- and over-arm side strokes.

The trudgeon is a double over-arm stroke combined with the above described scissor kick. In not a few cases, however, it has been modified by an additional fluttering of the lower leg as the under arm goes forward. This keeps the body moving until the upper arm is ready to start downward again. That the name of trudgeon should be given to this new form of stroke is rather odd, as it does not resemble it very closely, but then, "trudgeon" has come to be a sort of generic appellation to be given to any variety of double over-arm.

In learning the trudgeon the swimmer should take up the more simple kind, adding the crawl flutter later, if found advisable. The kick is the first thing to study and if one has tried the side stroke the arm action only will have to be practiced, as the scissor kick is used in both. I will remark here, though, that it is a great mistake to pass from one part of the stroke to another until the first has been thoroughly mastered. The trudgeon is far too complicated a stroke to allow of its being learned all together. Therefore, until that scissor kick is perfect, do not attempt to go any further.

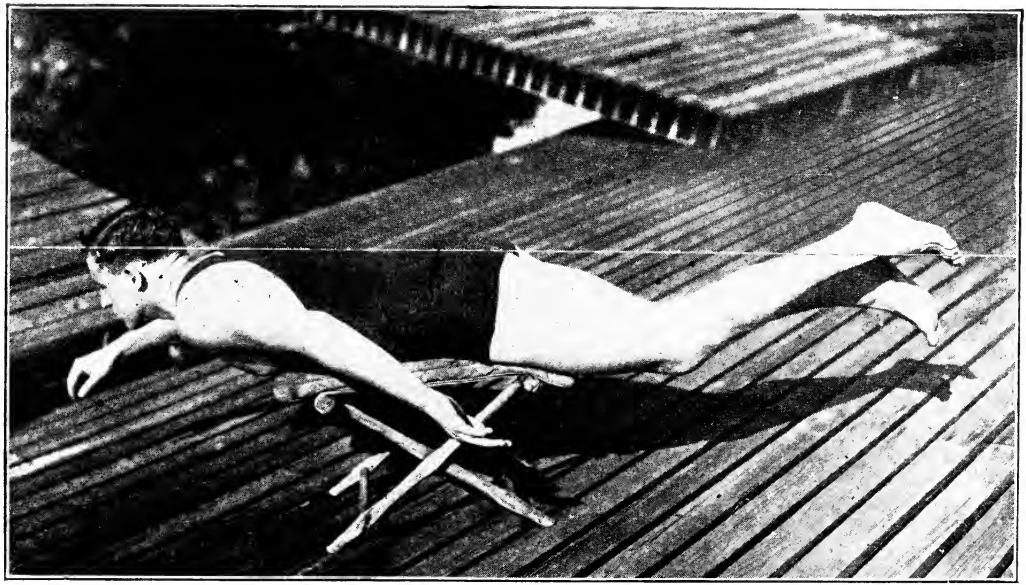


CRAWL—SECOND POSITION.

When you feel confident of being an adept kicker, take up breathing. It is essential that this most important part of the stroke be acquired before bothering with the arms. To learn to breathe properly, lie flat on the water, face down, and begin by freeing the lungs of air, blowing it out under water, slowly and easily. Do not attempt to clear the lungs with one powerful blow, but let the air out gradually; it should take at least three or four seconds. This done, turn your head from the shoulders, to the side the upper arm is going to be, and take a long, deep breath, without haste. When the lungs are full, twist the head back and exhale under water as before, through the nostrils. Repeat until the method has lost its strangeness.

In choosing a side to swim on, consult inclination. If you feel more comfortable on the right, adopt that side, but if you are equally at ease on both sides, swim with the right shoulder down, as this brings up the left flank and relieves the heart of a good deal of pressure that is placed upon it in swimming the other way.

For the arm movement let the body rest on the water with hands at full reach above the head, palms down. This is the first and last position of the stroke. In catching the water the body is rolled a little and the head twisted around to bring the mouth above the surface. The palms are turned a wee bit to the side the body turns, and the upper arm is brought down with a strong, steady pull—elbow fairly rigid, wrist the least bit bent down, fingers together—until straight down alongside, then the elbow is bent and the arm brought forward well above water. The semi-circle described by the arm in the trudgeon is not like in the side stroke, parallel to the water, but almost at right angles to it. It is at right angles to the body, really, and as the body is rolled, the angle becomes more acute. Some men,



CRAWL—THIRD POSITION.

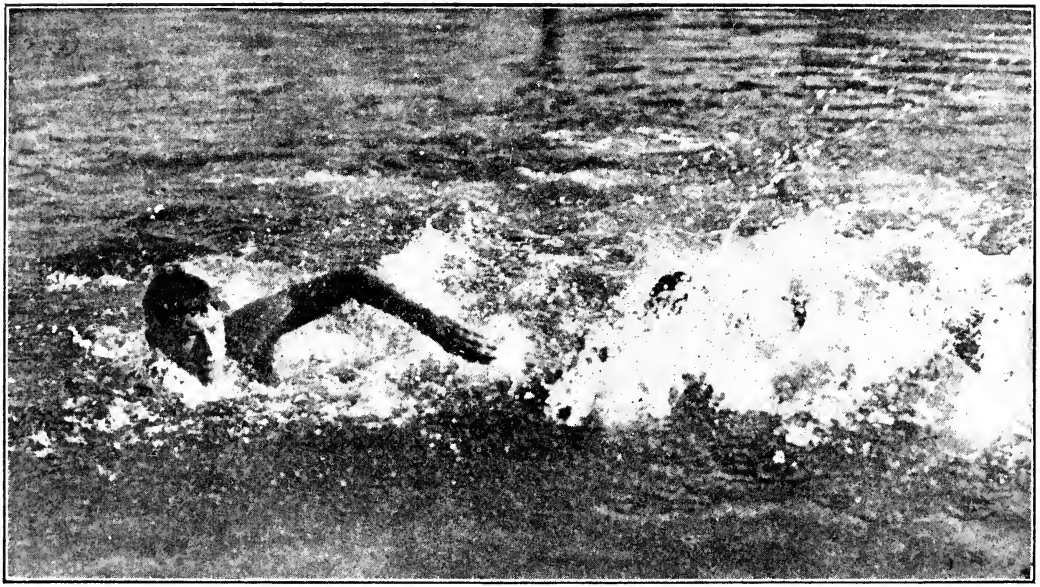
in swimming distance, roll until the arms are at an angle of about 45 degrees. The under arm is started just as the upper finishes, except in some cases. I have seen distance men "slide" for several yards, holding the upper arm alongside and the under one on the full reach, to be brought down only as the momentum died away. The under arm follows the same orbit that does the upper one, almost parallel to it; as it reaches its completion the body is rolled back on its face, the elbow bent, and the arm shot forward as the other, clear of the water; just as it gets to the full reach the upper arm is started down again.

I have remarked already that in distance swimming the body rolls strongly; in sprinting, instead, it travels almost flat on the water, so that breath has to be taken by a rapid twist of the head from the shoulders. Also the elbows are bent a bit more in sprinting to facilitate a quicker stroke, and instead of going straight down, they pull a little to each side, finishing at the hip instead of at the thigh.

In swimming the whole stroke, the time to be followed is: Upper arm first; legs are opened up as it starts and snapped together as it finishes; under arm comes down next; upper arm starts the recovery as the under arm catches the water and begins another stroke as the under arm lifts to go forward. Breath is inhaled while the upper arm is pulling and exhaled while the under arm recovers.

THE CRAWL.

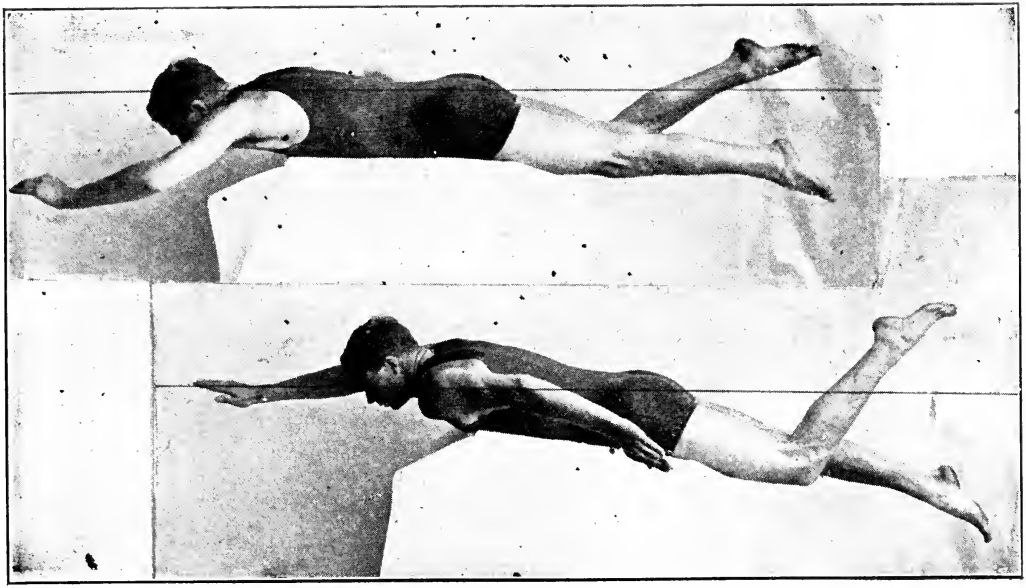
This stroke, which experts have come to look upon as the stroke of the future, is a combination of an abbreviated over-arm and a peculiar leg drive learned by the Australians from the natives of the South Sea Islands. The leg drive cannot be called



A CLOSE FINISH IN A SPRINT RACE—ALL THE CONTESTANTS ARE CRAWLING.

a kick; it is a continuous up and down alternate thrash of the lower legs from the knee down. In Australia the action of the arms and legs is synchronous, that is, the right arm comes back as the left leg goes down, and vice versa. In America, with few exceptions, the arms and legs are worked independently, and the thrash has a narrower scope, the legs being opened less.

That our system is the best seems undoubted, if theory counts for anything in swimming. Mr. Robert Sandon, whom I consider one of the world's leading authorities on aquatic matters, explains the reason in a manner that I think convincing. He asks us to watch the flight of a flat stone that has been thrown hard along the surface of the water, and note its progress. So long as the flat side strikes the water it bounces on without a check until its momentum ceases, but, let even the smallest portion of it become immersed and it is brought to a sudden stop, its flight checked instantly, never mind how great its speed. Apply this to swimming, now. In the trudgeon, or even in the Australian crawl, when swum easily, there is a time when the propelling forces pause, the body sinks lower in the water, and a check is noted; in some swimmers a very decided one. In the American crawl, instead, the continuous action of the legs keeps the body constantly in motion, so that there is no check or sinking and the stroke must perforce be faster. Of course, in sprinting with the Australian crawl the pause is so infinitesimal that there can be little advantage over it in the American stroke, but as it is very probable that eventually we will use the crawl for all distances, the point is not to be overlooked. A small number of Americans have adopted the Australian stroke, with its wide and synchronous thrash, but have added a fluttering of the feet between arm strokes, which makes the action continuous.



First Position

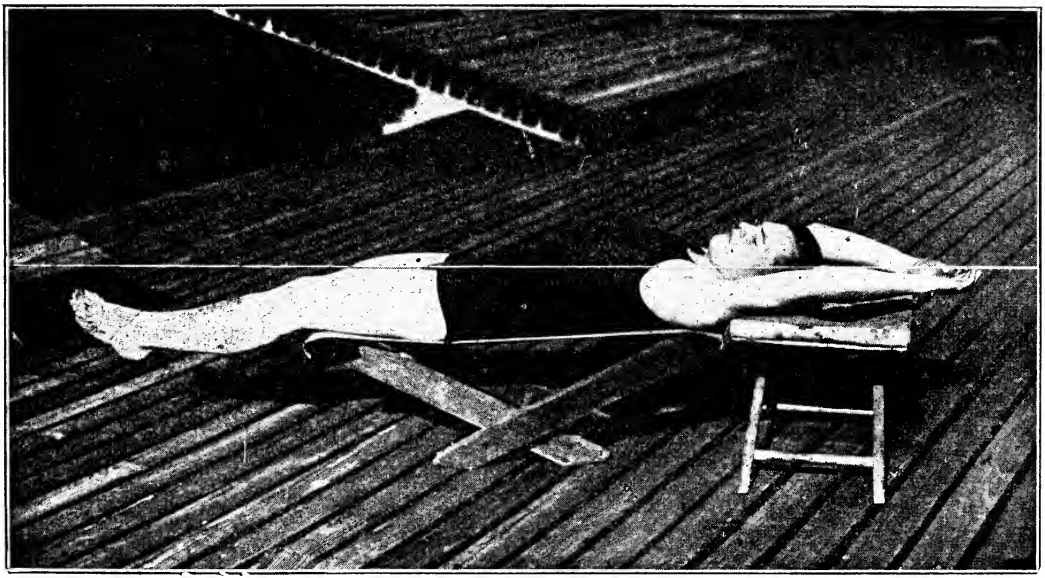
Second Position

THE AUSTRALIAN CRAWL—ILLUSTRATED BY C. M. DANIELS

The relative time of the arms and legs, in the American crawl, can best be determined by the individual or his coach; one with strong arms and weak legs can adopt a rapid arm motion and a slow kick; one with strong legs can do the contrary. This is one of the stroke's best features, for it can be fitted to each person. Some of our best men use the arms almost entirely, and one at least, Mr. H. J. Handy, of Chicago, lets his legs trail behind him. He tried the kick, but found he could not swim without tiring when using it, so he abandoned it. Others can go almost as fast with legs alone as when using the arms.

A good deal of discussion has been raised in regard to whether the ankles should move or not in the crawl. Mr. Gus Sundstrom, instructor at the New York Athletic Club, who was indirectly responsible for the introduction of the crawl in America and who has more speed with the leg drive alone than any man I have seen, not only bends the ankles back and forth, but he says it is by doing it that he gets his wonderful speed. His drive is more of a pedaling motion, he brings the toes up as the leg rises and points them down as the leg snaps back. A few of our swimmers also move the ankle a little, but most of them keep it rigid. At the present stage we cannot say positively which is the better method, but from Mr. Sundstrom's success we should say using them is.

There are as many varieties of the crawl nowadays as there are men using it. No two swim it alike and each indulges in a little experimenting of his own. This will gradually lead to progress, and it is probable that as the men discard the inefficient details in favor of the successful ones, the different varieties will condense into definite strokes from which the best will eventually be picked.

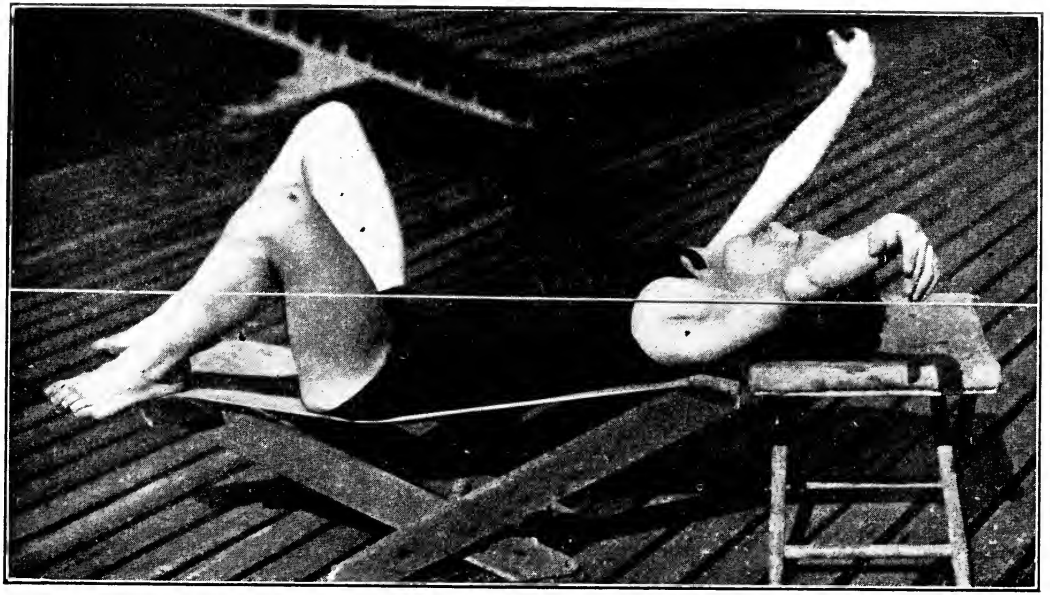


FIRST AND LAST POSITION OF THE BACK-STROKE.

To learn the American crawl, start with the arms. In fact, you will probably do well not to try the legs at all until you can swim a good fifty with your arms only. Lie flat on the water, with arms a little bent at the elbow and stretched out above your head. The wrists should be just beyond your head and the arms a little more open than in the trudgeon, hands bent down a little. Catch the water with a decided snap and drive them through at a brisk pace, always bent at the elbow, until they reach the hip, then lift them clear of the water and carry them forward with elbow well up in the air. The arms being started wider apart than in the trudgeon, they are also brought down further apart. The under arm is started just as the upper one finishes.

For the kick, move the legs up and down alternately, keeping them stiff at the hip and holding the knees close together. There is little difficulty in learning this, if one knows how it should be done, but the best way, after reading the description, is to watch it in action. To imitate it without having read it up, is not easy, and to acquire it without seeing it is harder still, but with the help of both a few days of practice will be sufficient. Don't open the feet more than twelve or eighteen inches from heel to toe. The real difficulty in the crawl is in working the arms and legs into a smooth stroke, and also in learning to hold the tiring leg drive over a given distance. Both are a matter of practice.

The position of the body in the crawl is flat on the face, much like when sprinting with the trudgeon; there should be hardly any rolling and breath should be taken only every two or three strokes by a quick twist of the head as the upper arm is being brought down. The time for exhaling is as the under arm goes forward.



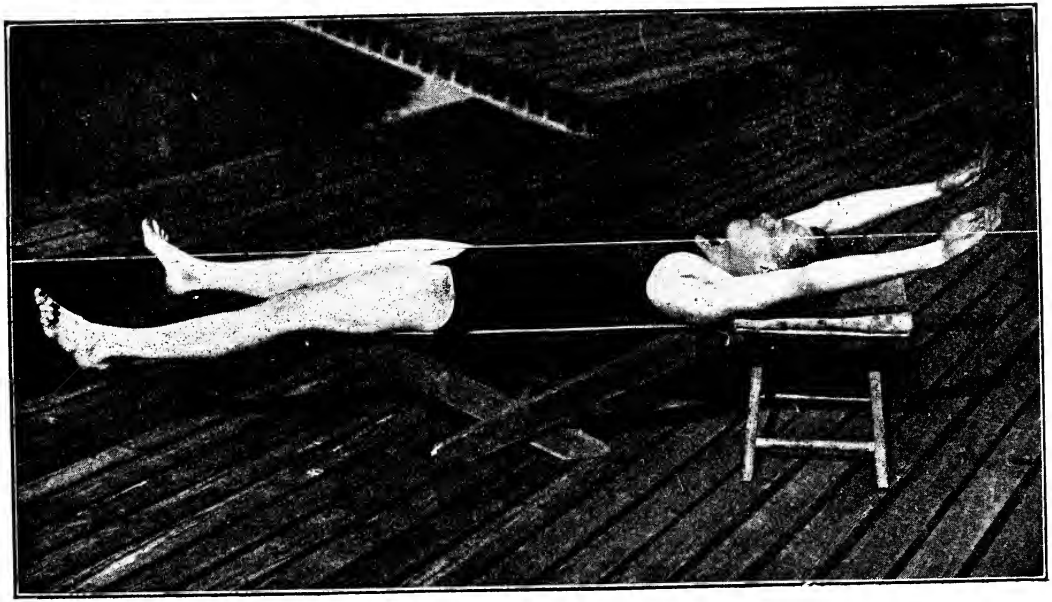
SECOND POSITION OF THE BACK STROKE.

When the crawl is swum slowly, as it is over the distances, the arm stroke is lengthened, so as to resemble that of the trudgeon, and the legs are slowed according to the distance; then breath is taken at every stroke.

SWIMMING ON THE BACK.

Those few who are students of the back stroke have attempted to adapt the latest speed strokes to back swimming and while the success achieved has not proved decisively the superiority of any one form, there are three strokes now being used. The first is a counterpart of the breast stroke, altered only enough to suit the different positions. The arms, instead of recovering in the water, are lifted into the air to get to the full reach, and the action much resembles that of a windmill. The second has this same arm action with the leg drive of the crawl, and the third is identical, except inasmuch as the arms move alternately as in the trudgeon, instead of together, as in the breast stroke. Of course, in alternating, a decided roll is given to the body.

To learn the plain back stroke, lie flat on the water, as in floating, with arms fully extended above your head, hands flat, palms turned upward. This position also ends the stroke and should be held while the body is allowed to "run," after the legs have kicked. In bringing down the arms, catch the water sharply with hands back to back, palms outward, and pull them through with a steady pull, stiff at the elbow, describing a semi-circle just below the surface and parallel to it. When the arms are alongside, turn palms downward and keeping them rigid, carry them to the full reach by waving them up well clear of the water. The legs are held close together, toes down, until the arms start their recovery, then they are bent up, and open, just like in the

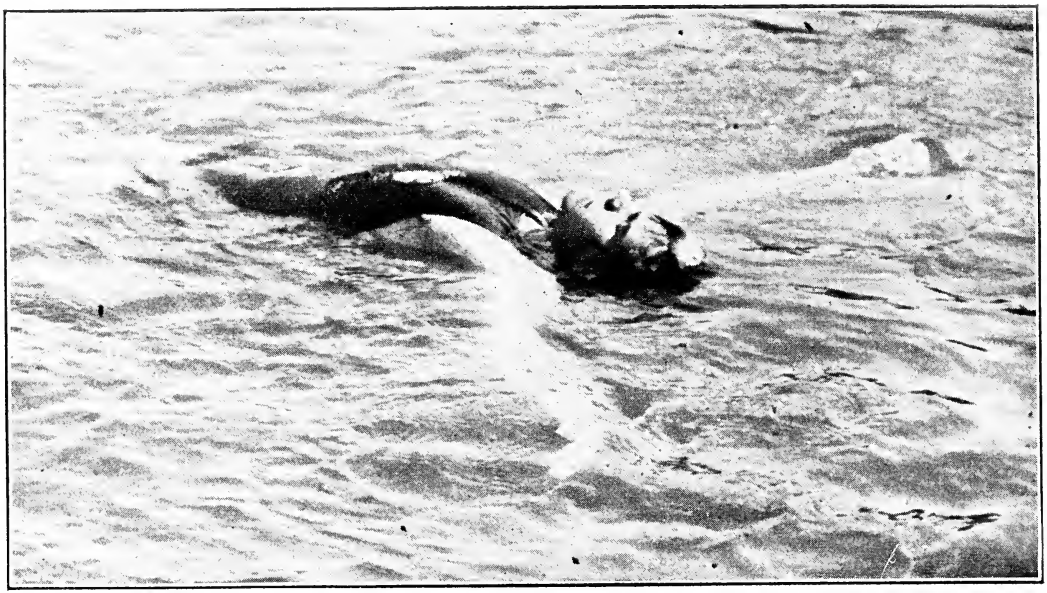


THIRD POSITION OF THE BACK-STROKE.

breast stroke kick, and they are snapped together as the arms attain the full reach, when the body, now in original position, is let "glide" until the momentum imparted by the kick wears off. Then another arm stroke is started. It is really the action and time of the breast stroke.

For the two other varieties the work of each individual arm and leg is the same and the leg drive has been described in detail in connection with the crawl. The time, in either, may be suited to oneself as the arms and legs work independently of each other.

Swimming on the back is best adapted to men with long, strong arms, so that tall people generally turn out its best exponents. It is not a popular method of natation, and many look upon it as a very useless accomplishment. This it is not by any means, though, for in life saving it is used with great success.

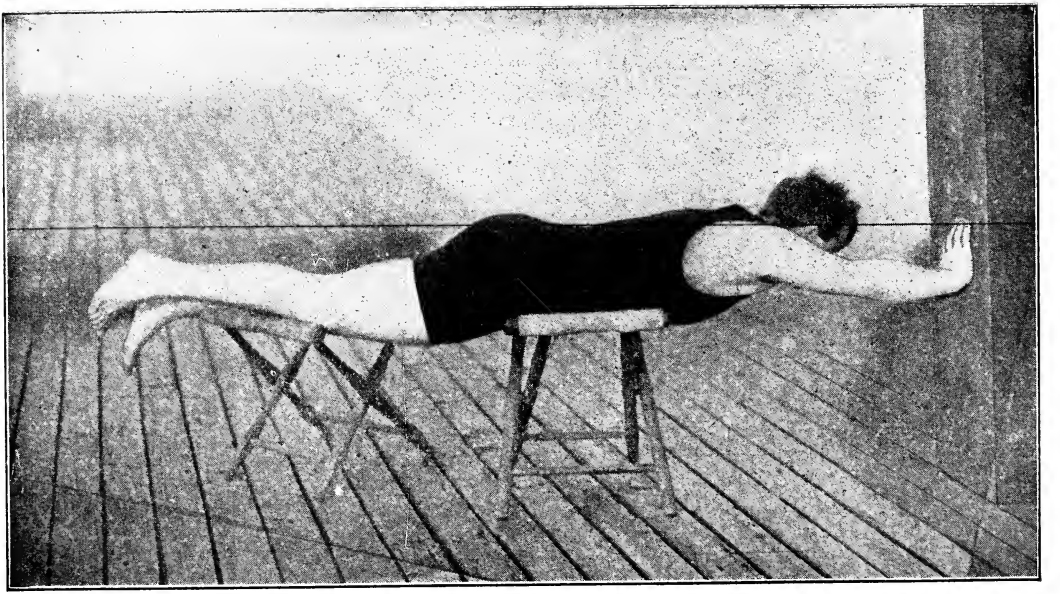


SWIMMING ON THE BACK, IN ACTION.

COMPETITIVE SWIMMING

HOW TO CHOOSE ONE'S DISTANCE.

Every man, in deciding to enter the competitive field as a swimmer has some idea as to whether he wants to become a sprinter or a distance swimmer, for nine times out of ten it is the realization of one's possibilities that leads to racing. In either case, there are but two strokes worth taking up, the trudgeon and the crawl. For a sprinter the crawl is undoubtedly the one to adopt and many maintain that it is also the fastest distance stroke. Learned for the purpose, and timed accordingly, there is no reason why it should not give the best results. The fact that it is admittedly the speediest sprinting stroke proves beyond question that the movements are the best and that it is merely a case of making them just slow enough to be held over the distance to be covered. Several swimmers have negotiated the mile in competition with it, so that we know it can be done. The aspirant to distance honors can lose nothing by giving it a trial; it is easy to revert to the trudgeon if it proves unsatisfactory. And in advocating a trial, I do not mean for the candidate to try to hold the vertiginous fifty yard speed over a half mile or mile course, an attempt most novices make, but the swimming of easy stretches, say of two or three hundred yards, very slowly and paying close attention to form. Not one out of ten has a really good conception of pace, and few men seem even to appreciate that pace must be adjusted to the distance



FIRST POSITION IN TURNING.

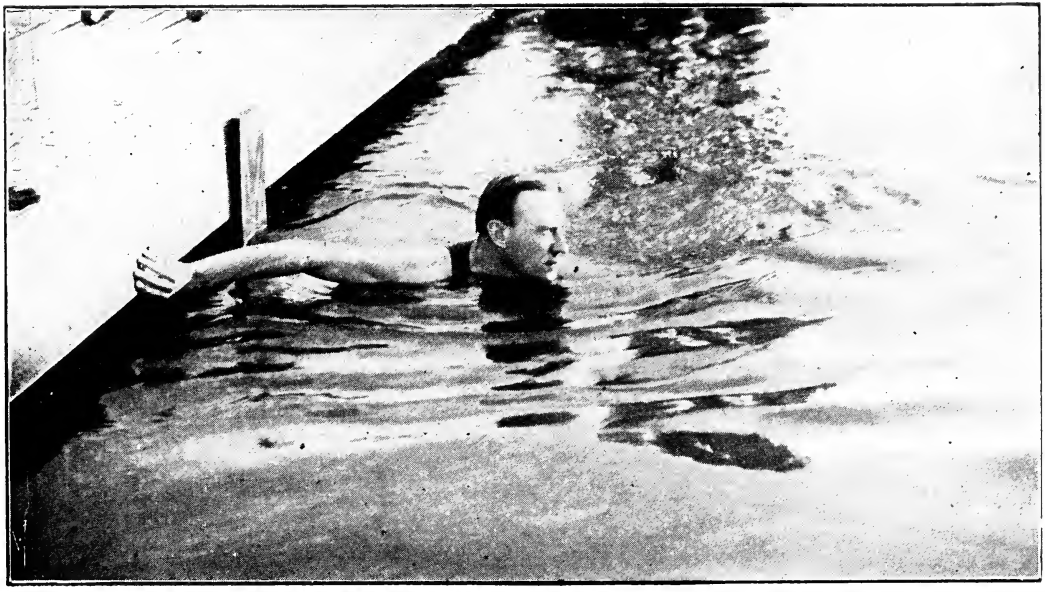
before one. They will start out on a long swim, especially if they are trying a stroke that is new to them, as if they were going only fifty yards, and of course they die out before the hundred mark is reached. I believe this to be the reason that at the appearance of both the trudgeon and the crawl everyone predicted that they would never be held over the furlong.

Whether it is best for one to become a sprinter or distance swimmer cannot very well be ascertained until a good deal of racing has been done. Everyone begins at the sprints, and if one is better fitted to the distances he will soon find it out without being told. The knowledge comes instinctively.

In taking up racing, or in deciding to, the prospective competitor should bear in mind that the only way to succeed is to learn the stroke correctly and thoroughly before attempting any fast work at all. To race with a faulty stroke is simply to develop and confirm one's faults and to doom oneself to mediocrity. Many youngsters who win their novice race, and possibly some other unimportant event by brute strength, firmly believe that they are on the high road to success, and neglect form altogether, with the result that they never accomplish anything. Form is indispensable nowadays; we have progressed so far towards scientific swimming that even the most favored by nature will never reach the championship class unless through form. The temptation is great to start racing as soon as speed appears, and one's first prizes look very enticing, but a little self denial and early application will amply repay in the long run.

HOW TO TRAIN FOR A RACE.

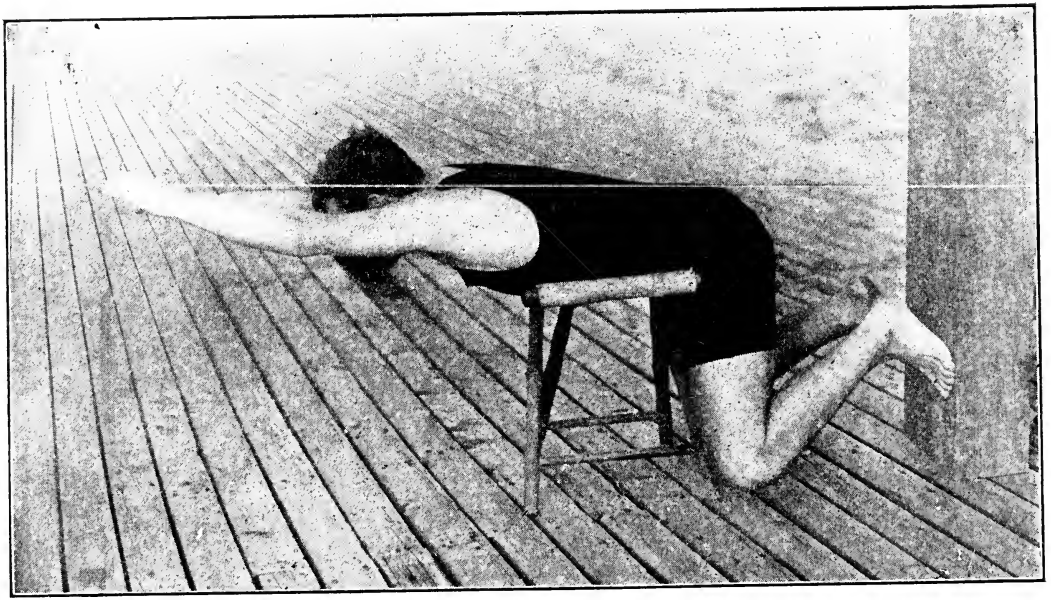
It is probable that no two men train alike for a swimming race and it is quite certain that most of them should not train



SECOND POSITION IN TURNING.

alike. With the exception of a few generalities no rockbound rules can be set down; each must learn by experience what is best for him. Some men will only round into form after going through work that would send others stale in jig time; and again some thrive on food that would be quite unfit for others. It is a matter of idiosyncrasies.

In regard to food I believe that a mixed diet, with meat in moderation and plenty of fresh vegetables and ripe fruit, can be recommended to everyone. Prominent dietiticians of the day have come to the conclusion that meat is not necessary to the training athlete, and it has been my experience that fat producing foods are best for the swimmer. Meat is said to give strength while keeping down weight, but an aquatic competitor does not want to be down fine, he will do much better work if a few pounds above normal. The extra avoirdupois adds to the buoyancy, makes impervious to cold, and gives that reserve energy that is so often the deciding factor in a closely contested race. Eat heartily, therefore, and only avoid those notably indigestible foods such as pastry, pork, veal, lobsters, etc.; though indeed, in the early part of training even these may be taken in moderation with impunity, if thoroughly masticated. This eating slowly and chewing the food properly is the great secret of a healthy digestion. During the fortnight preceding competition, however, the swimmer should become discriminating and be extremely careful of what he eats and drinks. Ice water is not conducive to digestion, in fact it retards it materially by lowering the temperature of the stomach. Take of it sparingly throughout your training, and drink in preference cocoa, milk, water at an even temperature; or, ale, beer and claret in small quantities Between meals good filtered, or spring water, is most



THIRD POSITION IN TURNING.

beneficial. Coffee, tea, intoxicants, stimulants, and drugs of all kinds had best be left alone altogether in training, and tobacco should not be used under any consideration.

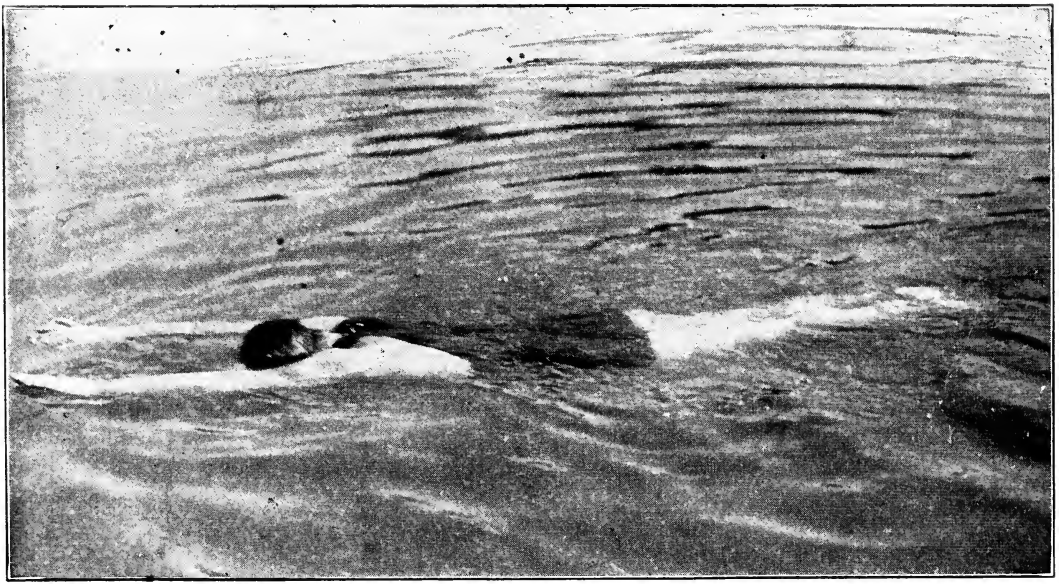
One more very important point and I pass to the work to be done. Don't cut your sleep. Sleep is nature's great panacea for all ills, its own means of replenishing the exhausted storage batteries of strength and energy. If we want to be in good condition we must give her sufficient time to do her good work. Plenty of sleep is an absolute necessity to the training athlete; he should have at least eight hours a night. Staying up late is also bad for you, even if you get your eight hours; the hours before midnight are the most beneficial and your curfew should not ring later than 10.30.

In regard to work, much depends on the distance in sight, on the time at one's disposal, and on the constitution of the swimmer. A distance man requires more time than a sprinter, a strong constitution allows more work than a weak one and, of course, if you have one or three months to train in makes all the difference in the division of your training. In no case, however, should less than a month be taken.

Experience is really the only efficient teacher; each man must work out his own system, or his coach must do it for him, but for the novice I can advocate one that having proved satisfactory in many instances may be safely recommended. It will serve the purpose until a personal system has been evolved.

Most novices, either through anxiety to enter competition, or through ignorance of what should be, limit their training time to two or three weeks, so that I will not extend it to over a month, but I will advise a longer period whenever it is possible.

The first week should be devoted to improving the general con-



POSITION IN THE PLUNGE FOR DISTANCE.

dition of the body and almost any kind of healthy exercise will do this. It should be borne in mind, though, that to swim, the muscles must be supple so that any work so heavy as to harden them is detrimental to speed. Running, lifting heavy dumbbells, wrestling and like exercises are not advisable. A daily swim, during the first week, is beneficial but not essential. If you swim every day take only short, easy stretches of fifty and one hundred yards, going through the movements slowly, so as to acquire form.

During the second week the land exercises should be cut down to a very few minutes, and the swims lengthened. It is only by perfecting the stroke that one progresses and it cannot be perfected in sprinting; faults are emphasized by fast, exhausting work. To correct them take easy, careful swims, increasing the distance gradually, and always having some one to look over your work and coach you.

Dr. Shell advises swimming only three times a week, while training, and I mention this opinion because he has devoted a deal of time and study to the question, but I must admit that I differ from him, and that I think one day of rest a week is quite sufficient.

The distance to be gone on the first day of the second week is two hundred yards, and it should be increased daily by fifty yards, the last day's swim being a good hard quarter under the watch. Not what is understood as a time trial, but just a quarter at a brisk pace. In fact I believe one's individual laps should be timed all through training, whether one goes fast or slowly. These will tell how even a pace is held and little by little make one a good judge of pace. A few champions I have known grew so accustomed to this timing that they could suspend a stop watch

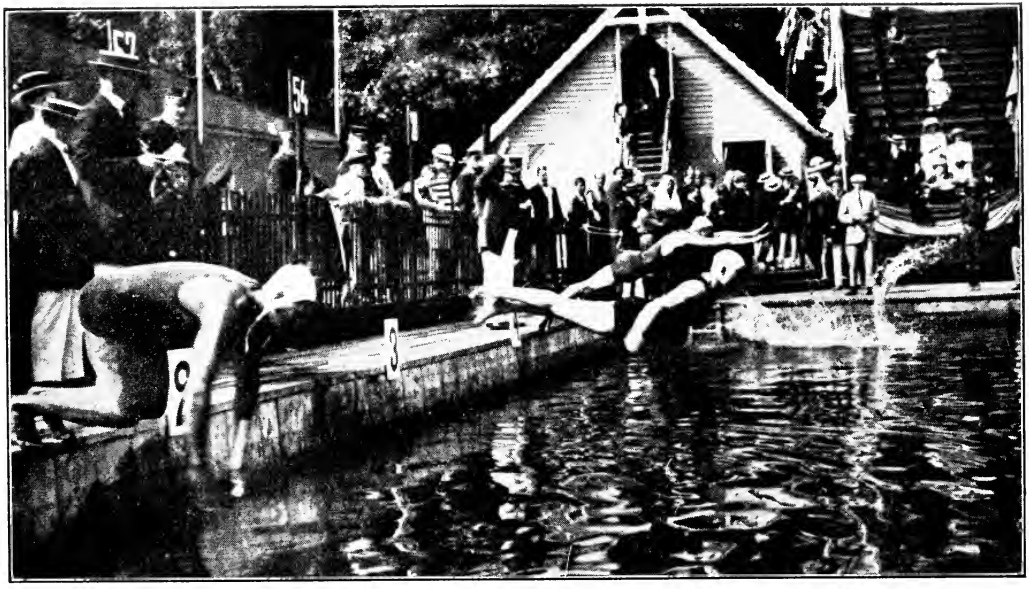
POSITION IN THE HIGH DIVE.

just above the surface of the water and time themselves, so that in a trial they knew just when to increase or slacken their speed. This only comes after much practice, though, for one has to remember the time of every other lap.

On the third week only aquatic work should be indulged in, the swimmer alternating short sprints one day with distances the next. If your race is at the furlong, or under, go about 300 yards on the distance days and sprint 50 and 100 yards on the others. If your race is at the quarter, alternate quarters and sprints; if over, lengthen the stretches gradually, making them 600, 750, and 880, if you are to go the half, and 880, 1,320, and 1,760, if you are going the mile. In going these distances a good steady pace should be held. Not racing speed, because, form must still be aimed at, but fast enough to get one used to hard work and, as said before, under the watch. Never sprint at the end of these long swims—it is injurious. It is bad enough to have to put the terrific strain on the heart in a race. Try to keep an even pace throughout.

On the first day of the last week make a time trial over the entire course, whatever it be, and swim it just as you would a race. On the second day take only an easy stretch of at most 200 yards; on the third, another time trial; on the fourth, a few starts, with a couple of 25 yard sprints, and on the eve of the race absolute rest.

In training for a sprint it will do no harm to go time trials twice a week throughout the period of training. And, of course, if two months of preparation can be indulged in, the system must be modified accordingly. For two months the doubling of the week's work will prove satisfactory, except that the distances may be lengthened more gradually.

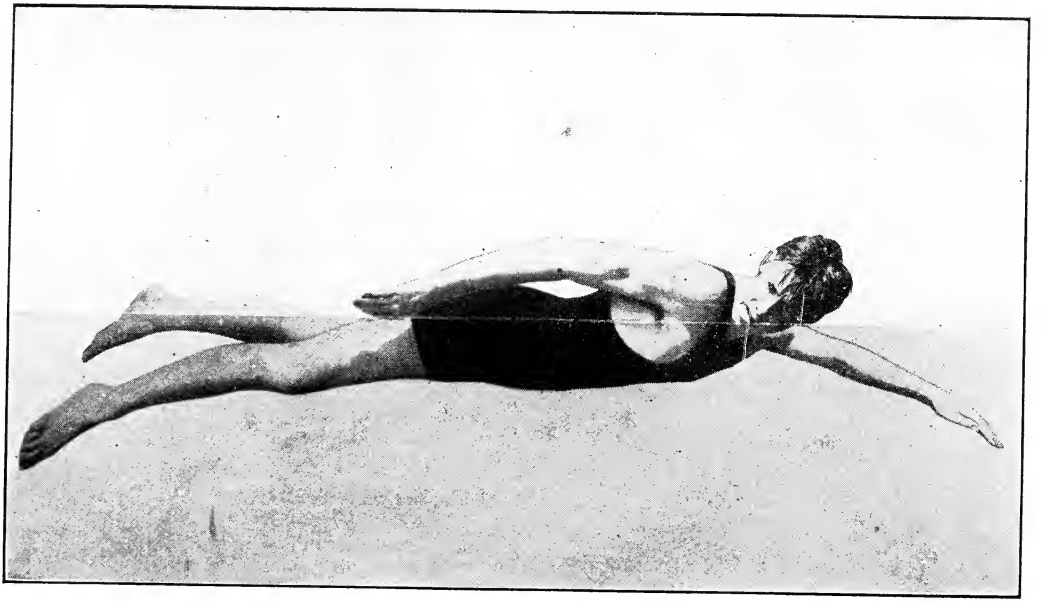


OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.
Start of one of the heats in the 100 meter swim.

An important item in indoor racing is the turn. Experts estimate that a good turner gains from one-fifth to four-fifths of a second on a bad one at each turn, so that in a mile race held in a sixty-foot tank the bad turner would be handicapped one minute and ten seconds, or in the neighborhood of one hundred yards.

In learning the turn the first thing to tackle is the approach of the wall; it must be timed so as to reach it with the turning arm stretched out in front. This is done by taking a couple of long strokes, or two or three short ones, as the wall is neared. When the hand touches the wall, which it does just above the waterline, the palm is laid down on it, the fingers pointing in the direction the body is going to circle, and parallel to the surface. The body is now swung around, helped by the under arm, which is stretched alongside, so that the soles of the feet come into contact with the wall, a few inches below the surface. Now the hands are brought rapidly to the hip, palms pointing in front, fingers down, and they give a backward stroke, which brings the body right against the wall, with the hips nearly touching it. Then the arms are put forward, as in starting the trudgeon, the legs are straightened out suddenly with a snap, and the body is allowed to travel on the impetus of the push-off until it slows down, when the arms take a stroke. The legs do not move until the arms are recovering, when they fall into their proper action. It is a great mistake to try to kick before the arms have taken a full stroke. Many swimmers take advantage of the turn to get a deep breath; it is taken as on Page 50, just before the hands take the backward stroke to force the body in position for the push-off.

The starting dive is also an important part of racing, specially in sprinting. A fast, shallow dive should be adopted. Performed

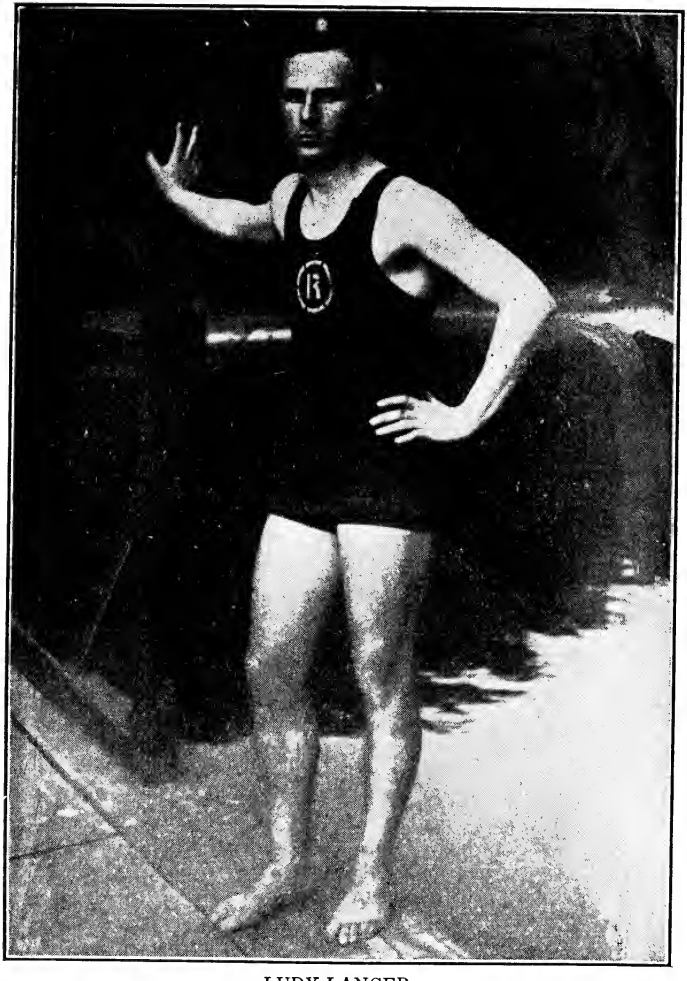


HERBERT VOLLMER, THE WORLD'S FASTEST SWIMMER

slowly, this racing dive would be an over-balancing of the body forward, with a mighty spring, aided by arms and legs, as it passes beyond its center of gravity. Stand with body bent forward, or with knees slightly bent. As the signal is given get on tiptoe and swing your arms back, much as in jumping; then swing them forward as the body falls over, bend well on your knees, lower your heels and spring out with head erect, arms extended over your head, palms down. These are the movements dissected, but of course in diving they are gone through so quickly as to make just one rapid spring. Try to strike the water with arms, body and legs in a straight line, at such an angle that you will only sink a few inches. To go deep is to kill your speed. As the hands touch the water, arch the back a little, pointing the hands up, so as to get to the surface at once and then set the arms going, remembering that, like in the turn, the legs must not be moved until the arms have taken a stroke and are recovering.

Coming now to the hygienic details of training, it may be pointed out that too much indulgence in the steam and hot rooms is as injurious a habit as it is prevalent. Three or four minutes of heat, preferably in the steam room, are quite sufficient to open the pores, and more is weakening. As for sitting in the steam room by the half hour, a thing training swimmers often do, it is the death of snap.

Long stays in the water are also conducive to sluggishness, and standing around the pool wet is responsible for a long list of ills. This noted, make it a principle to limit yourself to at most five minutes of steam, then a swim, a good brisk rub as soon as you come out of the water, and if you want to stay in the natatorium after, a warm bath robe and slippers.



LUDY LANGER

Captain University of California Swimming Team. American Champion at 440 yards, 500 yards, 880 yards and one-mile swims; world's record holder for 500 yards, and American open water record holder for 440 yards, 880 yards and one mile.

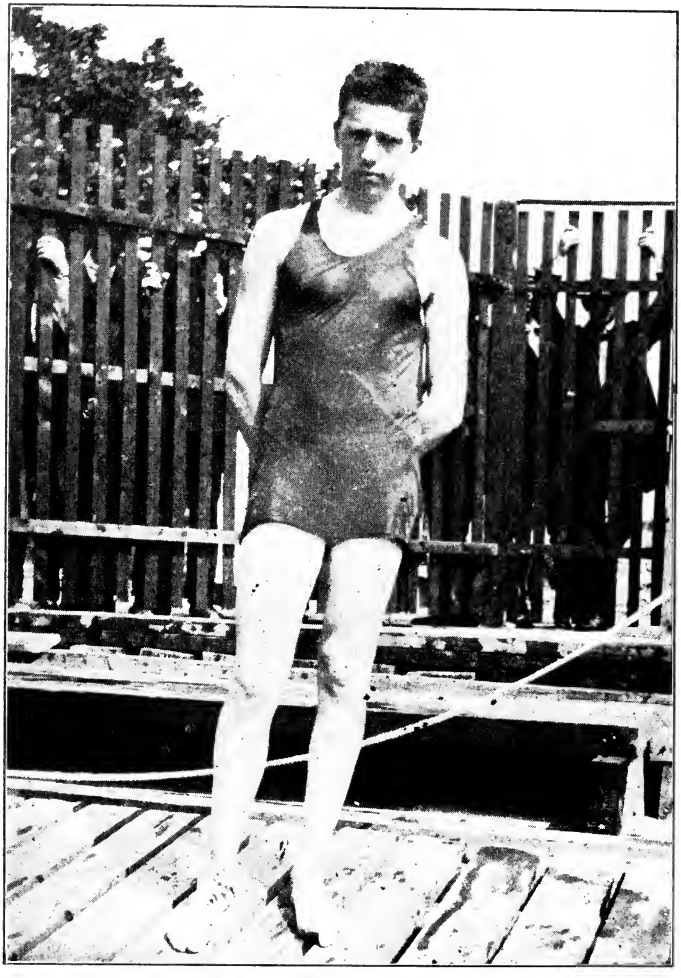
It is a wise move to stuff the ears with cotton on entering the water and to change this wet cotton for dry, on coming out. The dry absorbs all the moisture and prevents ear trouble, so prevalent among careless swimmers.

During the winter the hair should be dried very thoroughly and the body allowed to cool off before leaving the natatorium building. To go into the freezing atmosphere outside, especially with wet hair, from the torrid temperature of the bath is enough to give pneumonia to even the strongest.

On the day of the race, don't make the mistake of changing all your habits, as so many athletes do, thinking it is the proper thing. We are such creatures of habit that the slightest change affects us. Try to follow the lines of your daily life; if you take coffee and steak for breakfast don't change to milk and eggs, though, of course, if your race is at one and you usually eat a hearty meal at twelve, the case changes aspect. Use judgment, and eat very sparingly, unless you have three or four hours to digest in. But, above all, keep your mind busy and don't worry over the issue of the race. Worry saps up more energy than the hardest kind of physical work.

HINTS ABOUT RACING.

If I have been asked once, I have been asked a hundred times by ambitious youngsters whether it is best to sprint at the beginning, in the mddle, or at the end of a race. The correct way of racing, in theory, is not to sprint at all, but to find the fastest gait one can hold over the distance to go, and to hold it. Unluckily, we are all such poor judges of pace that it is next to impossible for us to apportion our energy equally over the course so that it will just run out in the last few yards. We



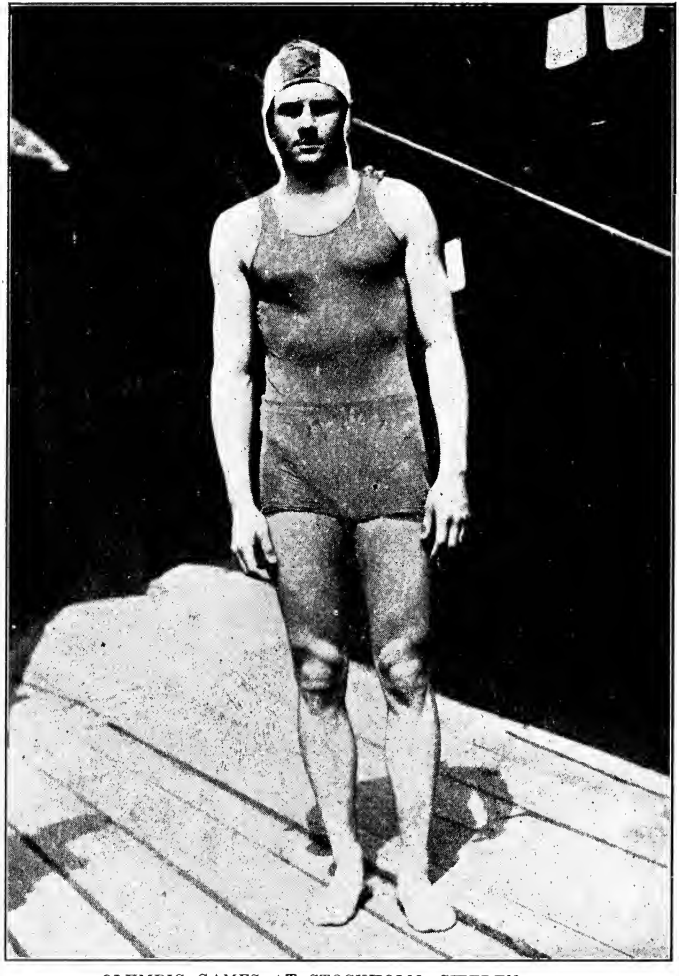
OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.
George Hodgson, Montreal A.A.C.; winner of 400 meters and 1500 meters swims in world's record time.

either kill ourselves by early sprinting or reserve energy for a sensational finish which would have been far better employed sooner.

I consider good judgment in pacing the most valuable asset of the fast swimmer. It is undoubtedly the pace that kills, the pace above the individual's normal one for the distance, and a punishing sprint, whether indulged in at the start or at any other part of a race, is harmful, and detrimental to the best results. Distributed evenly over the entire course the extra strength needed for that sprint would have made the final time better. Fast men are often seen to "lay back," sprint away from an opponent and then slow down, and do all sorts of jockeying. Put down anything you see in this line to play to the galleries and in very bad taste. A man who feels certain of victory should be enough of a sportsman not to try to bring ridicule on his opponent, and the man who is not certain of victory will find it far more profitable to swim his own race without bothering about what his adversaries are doing and by holding a steady gait. To allow oneself to be drawn out by an early sprint, or to lay back, is always folly.

It is rather a common habit to try to steal on the starter, and not a few take pride in being experts at it. It is bad policy even apart from the fact that one should not take unfair advantage of one's opponent. An impartial referee will disqualify anyone guilty of stealing and the swimmer may find it decidedly unpleasant if he loses a prize after having won a hard-fought race, just because he took an unfair advantage that he may not have needed.

Another bad mistake is to enter into noisy arguments with an official, to challenge the decision of the judges and to use un-

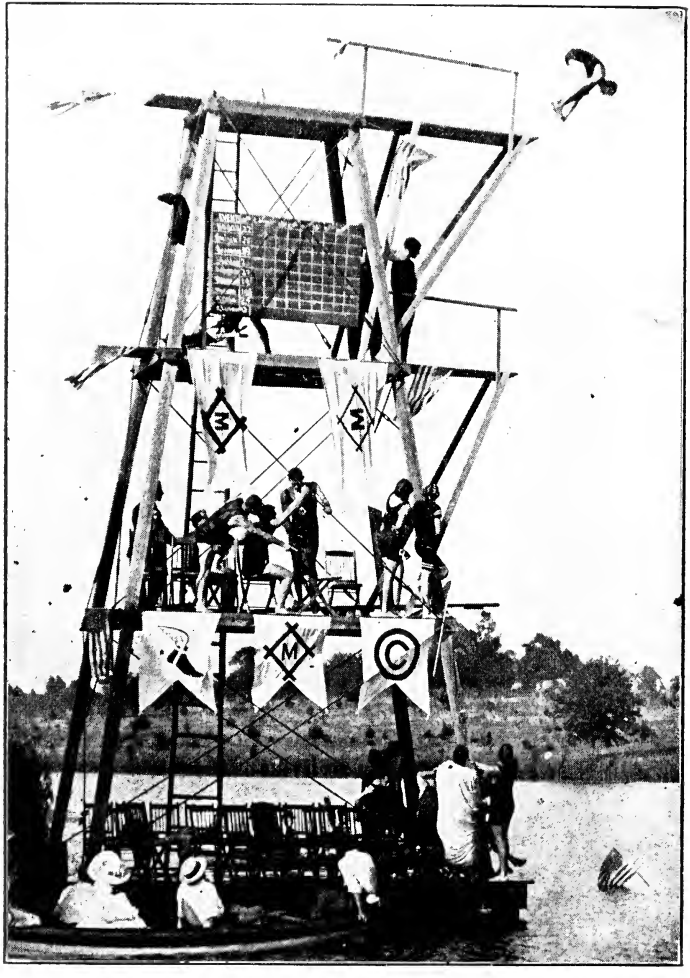


OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912

H. J. Hebner, Illinois Athletic Club, Chicago; winner of 100 meters, back stroke race and member of American team which finished second.

parliamentary language. These things are offensive to every one present. Just place yourself in the position of the questioned official and try to think how you would like it if a shouting and gesticulating contestant threw the taunt of unfairness at you, or became profane to you. A quiet, gentlemanly remonstrance will always be listened to, and if fair, probably heeded. But a noisy or abusive one will even turn a wavering judge against the protestant.

When your instincts urge you to a strenuous objection, remember that it is the wise man who keeps on the right side of the officials. Nothing is ever gained by loud and boisterous tactics.



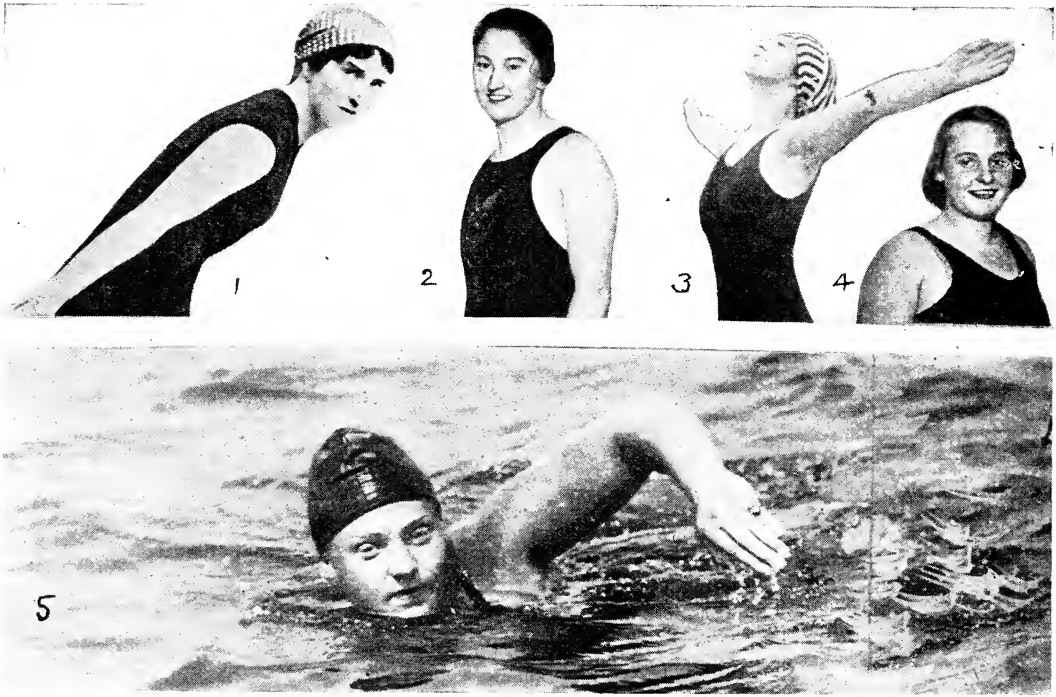
THE DIVING TOWER USED IN 1906 CHAMPIONSHIPS, HELD AT ST. LOUIS, MO. (DR. SHELDON DIVING).

FLOATING AND DIVING

Floating is a mere question of balance, so that to learn how one must find a position in which the dead weight of the body is distributed evenly, above and below the buoyant center, the lungs. The legs will be found to overbalance the head and shoulders and in most cases the feet sink. This can be obviated by throwing the head back and by extending the arms at full length above the head; the additional leverage generally establishes the balance and brings the feet up. But if it should not prove sufficient the legs may be opened first, and if even this is not enough, brought up bent at the knees. Floating is greatly facilitated by breathing in such a manner that the lungs are kept partially full of air all the time. Try to allow the air to get as low as possible in the lungs, and then, by short breaths, keep it there. Deep breathing and long exhaling should be avoided.

Women float more readily than men, and stout people better than slight ones, but even the slightest can learn. To learn, get into water where you have a footing and placing your arms over your head let yourself drop backwards very slowly, arching the spine, and throwing the head back. Don't breathe until you have settled, as the face generally sinks for a second as you fall and then comes above water again. If you don't float at once try bending the legs as told above.

Floating is not only an enjoyable pastime, it is a most useful accomplishment. Should one tire on a long swim, or be wrecked



1, Miss Fanny Durack, Sydney, N. S. W., holder of several world's records—Photo copyright, 1918, by William Unmack. 2, Claire Galligan, Women's Swimming Association of New York, National A.A.U. champion for 220, 440, 500, 880 yards and long distance swims. 3, Miss Frances Cowells, San Francisco, all-around swimming champion of Northern California. 4 and 5, Miss Charlotte Boyle, Women's Swimming Association of New York, National A.A.U. champion for 50 and 100 yards straightaway swim.

N. Y. Tribune Photos.

where it is not possible to make land for hours, floating not only allows a complete rest, but one may keep on top indefinitely by it, even when exhausted, and in case of a cramp it is indispensable.

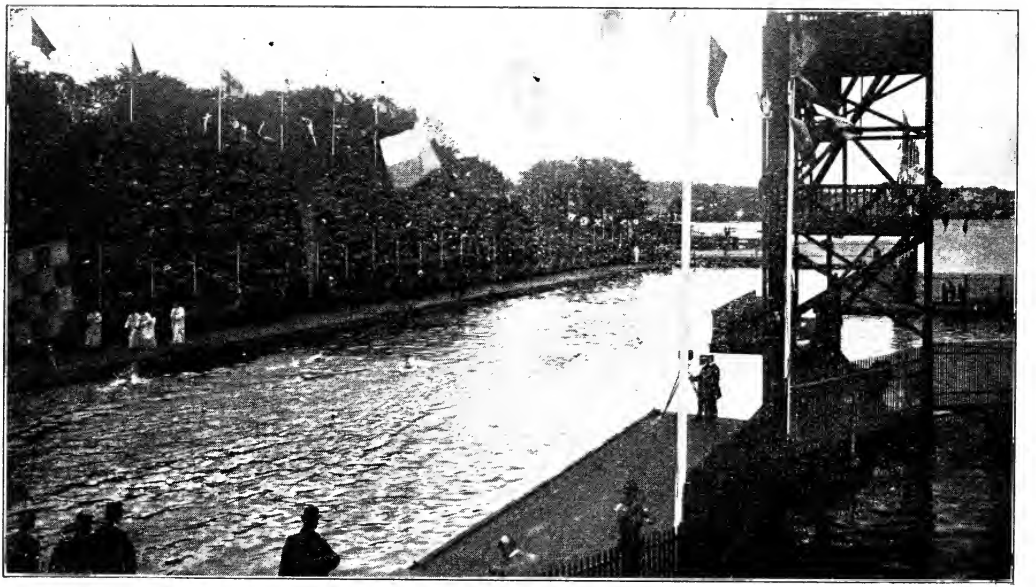
PLUNGE FOR DISTANCE.

Here, too, we find a question of balance, and it is really nothing but floating on one's face, the position being identical As in floating, it is very important to keep the lower portion of the lungs well filled with air, and as there is no breathing to be done it is not as hard.

Good plungers are stout men, as a rule, with large shoulders and comparatively light legs; but there are exceptions, and even slight men with good lung capacity will be able to hold out the sixty seconds allowed by rules, if their position is good.

There are three points to be considered in plunging; the dive, the position of the body in the water, and the direction; the dive gives speed, the proper position enables one to retain it, and, of course, direction is essential in competition, when to touch the wall is to lose all the following distance.

The dive to be taken in plunging is the shallow dive described as the racing dive. Before starting, the lungs must be cleaned out by two or three long, deep breaths, and then filled well. The dive must be made as speedy as possible and as soon as the body strikes the water all tension of the muscles should be relaxed and an effort should be made to get the air as low in the lungs as one can. In case a divergence from the true course is noticed, the plunger can straighten himself by moving the arms and head very slowly to the opposite side; the movement must be insensible, though, or it will check the progress almost instantaneously.



OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.
The Swimming Course.

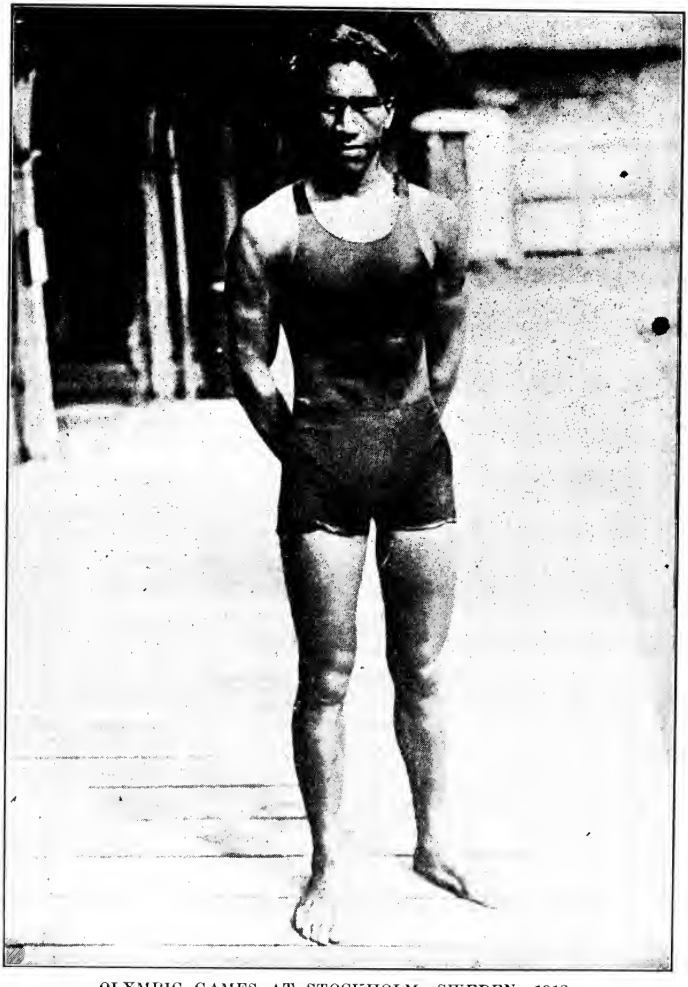
As nine-tenths of those who take up plunging for distance do so with the object of competing, it may be recommended to them to put on as much flesh as possible. The heavier the body the greater its force of inertia and the added pounds also add to one's buoyancy.

DIVING.

The shallow or racing dive, which has been described in connection with competitive swimming, is the most practical and useful of dives. In a race, in plunging, in playing water polo, it gives more speed than other dives and in swimming in unknown waters it is safe to use, as it keeps the body near the surface where the chances of colliding with sunken rocks or obstructions are very slight. There are only two other dives which need be mentioned, the plain front, and the plain back. Once these two are mastered perfectly the others will come readily, for they are merely these dives combined with some acrobatic feat. I will not attempt to touch on fancy diving at all, because it would take volumes to treat the intricate subject adequately.

FRONT DIVE.

In many respects this dive resembles the racing one, only it is slower in action and more deliberate, its beauty resting in the perfect form and composure of the diver. Stand erect with hands at your sides, and slowly allow the body to fall forward without moving the feet; as it passes the balance point swing the arms back and bend the knees. Then swing the arms before you, above the head, spring out (not down, but right out parallel to the water) and, curving the body the least bit downward, enter the water almost at right angles, with every muscle set, and the arms, head, body and legs forming a straight line, even to the



OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.

Duke P. Kahanamoku, Honolulu, H. I.; winner of 100 meters swim and member of the American relay team which finished second; holder of world's record for 100 meters.

toes which point backward. The angle at which the water is struck varies according to the height of the take-off; the higher the take-off the straighter the dive.

In diving from a height, especially if the water is not very deep, it is prudent to arch the back as soon as one strikes, so as to bring the body to the surface. In competition, however, or when a particularly clean dive wants to be taken, it is best to make it very straight and to keep rigid without a move, until the feet are covered. In curving the back, the shins and feet are made to strike the water, causing a splash that spoils the effect of the dive. Particular attention should be paid to the lower leg, in diving, as it is almost a universal fault to bend it back as the shoulders hit the water.

For the running high dive follow the same rules only, of course, instead of stopping at the take-off, take a good spring into the air, having care to spring out and up, as told above.

BACK DIVE.

In this dive the swimmer turns his back to the water and stands on the edge of the platform, or board, with the ball of his feet resting on it, but the heels in space. The arms are raised slowly above the head, the body curved backwards and allowed to fall over, then as it passes the balance point a good spring is taken and turning a graceful curve the body enters the water almost at right angles.

OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.

America's Swimming Team, which won second place in the One-Mile Relay Race. Left to right—Kenneth Huszagh, Duke Kahanamoku, Harry Hebner and Perry McGillivray.

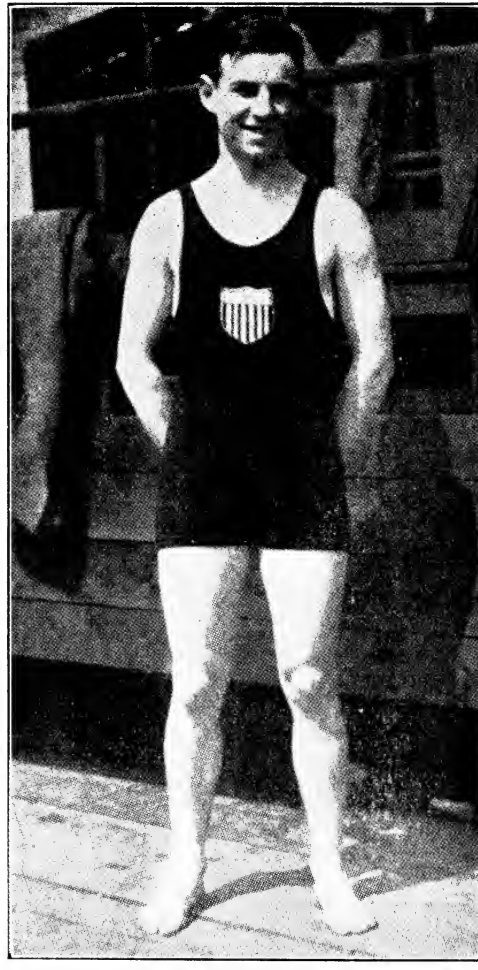
ORNAMENTAL SWIMMING

This generic name includes every aquatic feat that can be performed. Be it easy or difficult, common or uncommon, it comes under the heading of ornamental swimming.

For the man who is at home in the water most of the tricks that can be performed are merely a matter of practice and no one should neglect to learn a dozen or so, and go through them co-ordinately, every now and then, so that if called upon at any time one can roll them off one after the other without interruptions or pauses. They make an interesting exhibiton, always acceptable at a swimming meet, and are a constant source of enjoyment to one's less expert friends. I will confine myself to describing a few of the best known and the pupil can easily pick up the others.

THE ROLLING LOG.

One of the easiest and most effective tricks is the rolling log, which anyone knowing how to float can learn in a few minutes. Take a floating position and locking the thumbs together exert the muscles of the side, without moving hands and legs, until you turn on your side, then apply the other set and complete the circle. At first do it very slowly, for the beauty of the trick lies in showing as little movement as possible. After a little practice you will be able to turn quite rapidly, as a log that is being rolled, though the muscles hardly move.



OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.
Arthur McAleenan, Jr., New York Athletic Club diver. at swimming stadium, Stockholm; youngest member of the American team.

SWIMMING LIKE A DOG.

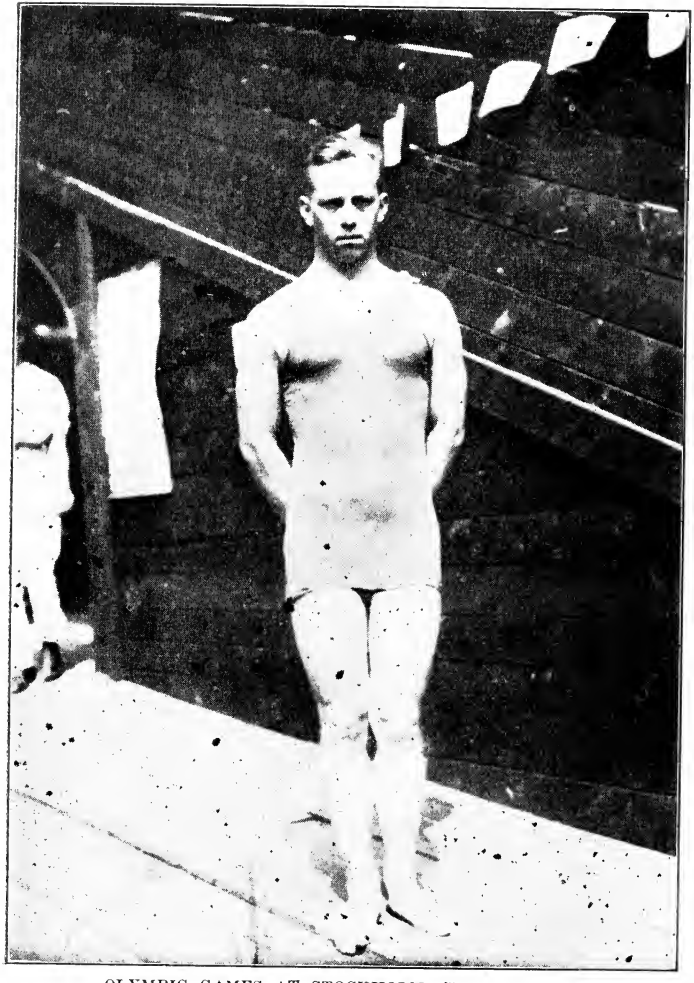
This style of swimming has no value, except for exhibition purposes. The body is held like in the breast stroke, but the action of both arms and legs is separately alternate. The hands go out in front, palms down, until on three-quarter reach, and then come down into the body describing a circle; they move front and back only, and do not go out to the sides, as in the breast stroke. The legs are moved very much as in bicycling. Watch a dog swim and it will be an easy matter to imitate him.

SOMERSAULTS.

If performed cleanly and swiftly, somersaults always please the spectator and they need no study. For the front somersault stand upright, treading water, with arms out to the sides, at right angles to the body, palms down. Bend head forward and taking a hard stroke force the body over, keeping it curved under water until it returns to the surface again.

For the back somersault, assume the same position, then throw back the head, curve the spine, and bend the knees under you; a quick backspring, aided by a good stroke of the hands, will cause the body to circle around as on an axle.

The double somersault, performed by two swimmers together, is a very pretty trick. The men get side by side, one floating, the other as in swimming, the one's head at the other's feet. Then the one on his face submerges himself and placing his head between the floating man's ankles he takes hold of the latter's head in a similar way. They are thus back to back. They now proceed to turn back somersaults and one after the other the heads appear over the surface and then disappear as they go round.



OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.
Perry McGillivray, Illinois A.C., Chicago; member of relay team which finished second; also winner of 100 yards championship of England.

SCULLING.

This method of propulsion should be practiced with care, for it is the keynote of several of the neatest feats of ornamental swimming. The body starts in the usual floating position, but with arms down at the sides. Sculling is a circular motion of the hands from the wrist, aided by a slight bending of the elbow. Its action is quite rapid, but I will take the different moves apart, so that the beginner may know how to learn it. The arms are alongside, palms down, hands open, fingers together and wrist straight; then the wrist is bent a little, the hands are twisted up and away from the body, then snapped inward towards the feet, the elbow helping, describing a circular motion much resembling that, of one baling with the hand.

SWIMMING BACKWARD.

There are two ways of doing this, floating and swimming. In either case the arms are at full reach over the head, the position of the body being respectively the same as in floating and plunging. Then the hands begin to scull as told above and the body will be propelled feet foremost. The legs may either move in a slow crawl movement or keep still.

THE TORPEDO.

This is only a modification of floating backward. Having assumed a floating position, the legs are bent at the knees so that the lower legs come well to the surface, then the head is thrown back, the hands give an upward stroke that buries the head and shoulders, and in this position the hands (still above the head) begin to scull. From above, all that can be seen is the feet glid-

OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.

American swimming team on board S.S. Finland, en route to Stockholm; 1, Arthur McAleenan, Jr., New York Athletic Club; 2, N. T. Nerich, New York Athletic Club; 3. Hon. James E. Sullivan, United States Commissioner to Olympic Games; 4, Otto Wahle, New York Athletic Club, adviser to swimming team; 5, Duke P. Kahanamoku, Honolulu, H. I.; 6, H. J. Hebner, Chicago A.A.; 7, G. W. Gaidzik, Chicago A.A.; 8, K. Huszagh, Chicago A.A.; 9, P. McGillivray, Illinois A.C.; 10, M. McDermott, Chicago, Ill.; 11, J. H. Reilly, New York A.C.

ing through the water. As the body has a tendency to rise in this, it is well to give the sculling a slight upward slant; practice will tell just how much.

THE SHIP.

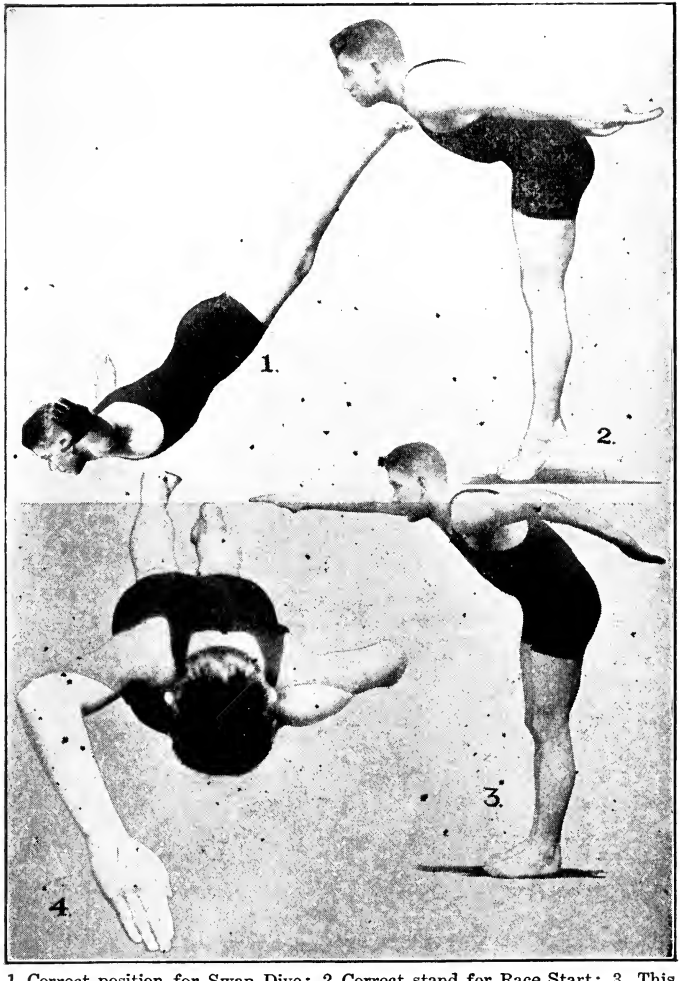
This is another sculling trick, and not so easy. Body is held as in floating, arms alongside. Keeping one leg in the usual position, lift the other straight into the air, so that it sticks out of the water at right angles to the body as a funnel on a steamer. By sculling with a downward slant you will keep afloat and propel yourself in either direction. It is a real feat to do the schooner, lifting both legs up.

THE TOP.

Tread water, then bend up legs until the knees are against your chest. Place arms out at right angles and set yourself spinning by taking strong, fast, alternate strokes. The arms never leave the water, being carried back to starting point palm down, so that they offer no resistance to the water.

MONTE CRISTO.

This is the most sensational of tricks, and can be done by anyone used to underwater work. A large sack is provided; one in which a man fits comfortably. At its neck, where the fastening goes, a hole is made through which two thin pieces of cord are passed. When the swimmer gets into the sack he takes the two loose ends of the cord in his hand and some one closes the mouth, binding it around a couple of times before putting in the knots. After a momentary pause the sack is thrown over-



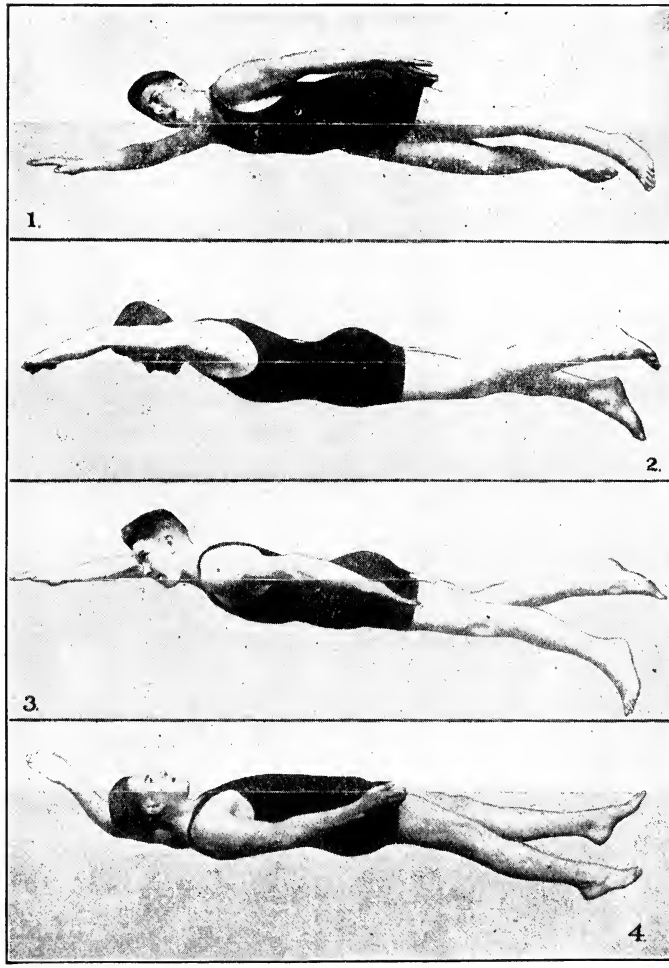
1, Correct position for Swan Dive; 2, Correct stand for Race Start; 3, This illustration is only designed to show the Crawl Stroke position of the hands; 4, Crawl Stroke (in action) position.

Photos posed by Teddy Cann of the New York Athletic Club and copyrighted by American Press Association, N. Y.

board with a cry. On reaching the water the imprisoned man lets go of the two ends of the cord, which he has been holding, and the mouth of the sack can then be loosened with no trouble. The swimmer makes his exit and comes to the surface. If the water is at all muddy the trick can be made more thrilling by staying under water until want of air compels coming to the surface.

There are a hundred other tricks which can be performed, all of them entertaining, but every book on swimming is full of them and it is an easy matter to work out a good program. The few given herein are merely the fundamental ones from which most of the others can be evolved.

"Ted" Cann, who posed for the pictures on opposite and following pages, was awarded the Congressional medal for bravery in 1918, his experience and bravery, while a member of the United States Naval Reserve on board a transatlantic vessel, enabling him to dive into the hold of the vessel, which was rapidly filling with water, and close a hole sufficiently to prevent the vessel from sinking.



1, Position for breathing; 2, Correct position for Crawl, showing arched back; 3, Overhand Stroke with Crawl Kick; 4, Back Overhand Stroke.

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SYMPOSIUM ON THE CRAWL STROKE

Reprinted from the Intercollegiate Swimming Guide

Edited by Fred W. Luehring.

The frequency with which American speed swimmers have been shattering world records has stimulated world-wide interest in the American crawl stroke which is yielding such phenomenal driving power. This stroke, which consists of a differentiation of its Australian predecessor, has been analyzed with wide variations in different parts of the country. In an effort to determine whether these differences are real or imagined, and with a view to standardizing if possible the constituent elements of this new type of stroke, the following carefully worded questions have been submitted to sixteen of our leading swimming experts:

1. What do you consider the best position of the body and the head in this stroke?

2(a). What, in your judgment, is the best form in the arm stroke regarding "reach," "catch," and "pull through the water"?

(b). Should a roll of the body be introduced; and, if so, how would you describe it?

(c). Would you modify 2(a) and 2(b) for short and middle distances; and, if so, how?

3(a). What are your ideas as to the most desirable leg movements in the way of the type of kick; rhythm to be maintained; width of thrash; position of legs, whether close together at knees or spread out?

(b). Would you modify 3(a) for short and middle distances; and, if so, how?

4. At what time in the stroke should inhalation be made, and how often should one breathe for different distances?
5. Write briefly on any other important points not brought out in the above questions.

The eleven replies which have been received are reproduced in alphabetical order:

By L. deB. Handley, New York Athletic Club.

Question No. 1.—In swimming the crawl the body should be held as in standing erect, on tip-toe. It should rest on the water with a slight slant—shoulders higher than feet—the amount of slant being determined, partly, by the buoyancy of the individual. It is advisable to increase the slant in sprinting, as the speed at which one travels then enables the swimmer to take advantage of the hydroplaning principle. The body should roll from side to side, in order to facilitate a clean recovery of the arms. The roll is slight in sprinting, but should be emphasized more and more as the distance to be covered increases.

Question No. 2—The arm action of the crawl is alternate and equidistant. As one arm completes its drives the other should be "catching." Each arm is dipped close to the head and a trifle to its own side, with elbow raised, and then pushed forward under water and downward, so that on attaining comfortable full reach the hand is about six or eight inches below surface. Here power is applied and the arm is swept vigorously down and back, under the body, following a straight line from full reach to near thigh, carrying even pressure throughout. When the hand is about to touch the thigh, power is relinquished and the muscles are completely relaxed. Then the elbow is raised, lifting the forearm and hand from the water, the arm is now carried forward slowly, close to the side, and with elbow still raised, so that it will be in the correct position for entering, after recovering beyond the shoulder. The action of the arms should be slow. It is all important to make the drive energetic and the recovery very easy, in relaxation.

(*b*).—Answered in No. 1.

(*c*).—No change should be made in the arm movements at any time. Only their speed is adjusted to the distance in sight. The roll is increased gradually, with the lengthening of course.

Question No. 3 (*a* and *b*).—I am in favor of the trudgeon-crawl leg drive for all purposes. It consists of one or two narrow scissor kicks, taken at the end of the arm drives, as in the trudgeon stroke, and an alternate thrash of the feet introduced between scissors. In sprinting, the scissors are reduced in width, until they do not exceed the scope of the following thrash, so that a pure crawl action (merely distinguished by a more accented marking of the rhythm) is obtained. This form of drive is performed up and down (perpendicularly), or nearly so.

As the distance increases and the roll of the body is emphasized accordingly, the width of the scissor is also enlarged by degrees and its direction becomes more and more lateral, so that eventually the scissor is performed horizontally, or almost, while the intervening thrash continues to be vertical. The scissor should never have an opening of more than 16 to 24 inches, this margin being allowed for difference in size of swimmer. The feet should never rise above water. The heels, at most, should appear.

The number of downward leg movements per full stroke of the two arms must be two, four or six. The six-beat is used by the world's fastest sprinters, but it is not generally practical for middle or long distance swimming. The two-beat is not recommendable, except for tests of out-and-out endurance. The four-beat is the ideal all 'round stroke and will be found most advantageous by the great majority.

The same principles govern both scissor kick and thrash. It should be the aim of the swimmer to avoid all possible resistance by (1) refraining from raising either upper leg toward the abdomen; (2) avoiding upward bending of the feet; (3) making all the negative movements slowly, in relaxation.

It will help the student to realize that the leg thrash is nothing but a series of reduced scissor kicks and that in using the

trudgeon-crawl it is only necessary to widen one of the individual beats to obtain the scissor proper, or major drive.

This understood, it will be seen that in performing the thrash—which should have a scope of about 12 to 15 inches—the legs are in positive, driving movement for the first half of every downward and upward sweep (from full opening until they meet), and in negative movement of resistance after passing and starting to open again. Obviously, then, the first half of every beat should be made vigorous, the second in relaxation, just as in performing a wider scissor.

The direction of the thrashing legs should be forward and back, as in walking, with no lateral opening. Knees and feet should almost brush in passing. The top leg is advanced a little, nearly straight at the knee; the under one is bent back, about half way to kneeling position.

Question No. 4.—Breathing is done in the crawl by inhaling by mouth while the body rolls on its under shoulder, and exhaling, through the nostrils, underwater, while it is face down. Inhalation should be started toward the latter part of the top-arm drive and continued through the first half of the recovery of the same arm. The head should not be raised to inhale, but only twisted toward the upper shoulder. It is best to breathe at every full stroke. Some may possibly profit by inhaling at every other stroke when sprinting fifty yards, though it is doubtful, but there is no question that intermittent breathing, at greater distances, is very harmful and exhausting.

By Harry H. Hindman, Coach of Swimming University of Wisconsin.

While there may be considerable variance of opinion regarding details of the so-called crawl stroke, there are certain fundamental principles which cannot be disregarded. The problem is how to propel the body over or through the water at the greatest speed and with the smallest expenditure of energy. This involves three things, namely: resistance against the water, application of muscular power, and relaxation between periods of effort.

For purposes of clearness the stroke may be described in four parts, the Body, the Arms, the Legs, and the Breathing. Let us consider them in the above order.

The Body.

The body should have a tendency to move over the water in the manner of a hydroplane rather than through or against it. This tendency may be obtained by holding the head in such a position that the face only will be buried in the water, with the top and back of the head showing above the surface. In the case of very buoyant swimmers, the whole head may be carried above the surface. The roll of the body should be sufficient to allow absolute freedom of movement to the arms. There is no advantage to be gained in allowing a greater roll than will make possible a powerful pull with the arms and a free and easy recovery. Under no circumstances should the body be allowed to sway from side to side and thus tend to follow a zig-zag course.

The Arms.

The catch or start of the pull should be made directly in front of the head in line with the body and as far forward as can be reached, without stretching, by extending the arm from the shoulder.

The pull should begin when the hand has been lowered five or six inches below the surface of the water and on a line directly beneath the center of the body, finishing near the thigh. The hand should come out of the water not with a jerk or throw, but smoothly and as far back as can be comfortably reached by extending the arm from the shoulder.

The recovery is the rest period for the arms and should be characterized by almost complete relaxation. After coming out of the water, the arm is raised, the elbow slightly bent and the wrist and hand relaxed. In this position the arm is carried forward by a shoulder movement to the position for the next catch. The complete arm movement may be briefly described as a shoulder rotation with the arm extended. There need be

no variance in the form of the arm movements over short and middle distances.

The Legs.

Probably the most natural, best balanced, and at the same time most powerful leg movement is the six-beat kick, that is, six kicks with each complete movement of the arms.

I believe this kick to be more effective and more natural than the four-beat and less exhausting than the eight-beat movement. The kick should be performed in such a manner that the first and fourth kicks amount to narrow scissor kicks, each followed by two straight up and down kicks. The right foot should strike the water as the left arm finishes its pull and the left foot as the right arm completes its movement. The accent in the rhythm should come on the first and fourth beats as follows: RIGHT, left, right—LEFT, right, left and so on, with the arms finishing their respective pulls as described above. The action should take place from the hips down and the knees, ankles and feet should work freely with all tendency to stiffness eliminated. This will allow the feet to point and enable the swimmer to strike the water with the top of his feet. The legs should be slightly turned in so that the feet tend to "pigeon toedness." The kicks should be wide enough to allow free movement and enable the swimmer to "feel" the water, but not wide enough to bring the feet out of the water. The heels only should be permitted to appear above the surface. The actual width in inches would, of course, vary somewhat with different swimmers. This kick will be found practical over both short and middle distances. Over middle distances, however, the scissor kicks may be somewhat wider.

Breathing.

Since proper oxygenation of the blood is so extremely important, a swimmer should secure all of the air he needs and never allow himself to feel distress by attempting to hold his breath over a number of strokes. Except in short sprints, inhalation should take place on every stroke. The most convenient

and economical period in the stroke to inhale is just at the finish of the pull of the arm on the breathing side. This brings the breathing, finish of the pull and the first kick together while the body is rolled on to the blind or non-breathing side.

In general the aim should be to develop a smooth, natural, easy movement, to eliminate as much resistance as possible, to attain the maximum of relaxation between periods of effort and to secure the greatest amount of driving force from the energy expended. In my own experience the movements so briefly described above accomplish these ends. No set rule can be laid down for all swimmers to follow, because of individual differences such as size, weight, build and natural buoyancy, but the general principles will hold for all.

By George Kistler, Swimming Director University of Pennsylvania.

The crawl stroke is the fastest means today of propelling the body of a human being from its own power through the water, the peculiarity of this stroke being considerable.

The only movement similar to other strokes is the arm movement, the leg being entirely different. However, I am unable to say which is really the best method to use in this stroke. There are so many variations to this style of swimming and all seem good. Because one man can glide through the water faster than another is not always through having a better stroke. It is the one who has the knack in performing the different movements. I have seen poor form swimmers go through the water considerably faster than one who swam in perfect form.

Some swim with straight legs, that is, worked or swung from the hips; others work from knee down; some from both hips and knees; others take extra wide kicks, some slow, others fast, and vice versa; some with arms and legs using slow arms and quick thrash, fast arms and slow kick or thrash; others about even all through the stroke; some oscillate the ankles, while others keep feet stretched to full extent; some turn toes in at each thrash and others keep them pointed.

One can look at scores of "crawl swimmers" and scarcely find two exactly alike. Some pull arms under stomach, others on outside of body, and all at different angles; some use straight arms or extended at full length; others make a rather short reach and put them in water in front of head, pushing down on an angle to where stroke is started. Some swim with head high out of water; others keep face submerged more or less. Breathing takes place at different times with different swimmers. In fact, it makes little difference which one swims the best stroke. It is the one who gets to the goal first, and I am unable to say which is really the best crawl stroke, as they are all good.

The "trudgeon," or double overarm with crawl and scissors combined, is practically the best and fastest all around stroke today for distance. Our ideas here that the Australian swimmers swim their crawl stroke to a "timing" system is all paper talk. The only difference is that they swim with a shade wider arm stroke in entering the water, otherwise they are about the same as we are, probably using more legwork from the knees down than we do. They discovered it from the natives over there, and Wickham was probably the first to swim this way, although the white man, Cavill, seems to have been credited with having introduced the stroke in Australia. I have drawings here showing that away back the Aborigines used the same identical stroke, although without doubt we have enlarged and improved on this style of propelling and are probably the fastest lot of swimmers in the world today using it for distances from 50 to 220 yards.

I myself like the thrash leg stroke. It seems to have more power, especially if the knee is bent the slightest bit, than the kick used from the knees only. The swimmers who use the side or scissor kick pick up the best and fastest at this particular style of swimming. They seem to catch on to the kick much easier than a breast stroke kicker. Any way, it is mostly a modified side or scissor kick. I have two or three men on my team who can swim 50 or 60 feet as fast with legs alone as most swimmers can go with use of arms and legs. Duke Kahanamoku, the

world's champion and fastest swimmer, swims a beautiful leg kick or thrash, according to my mind. I trained him for six months previous to the Olympic Games in 1912 and the results have long been known the world over. His kick was continuous and very fast, arms rather slow in comparison to the leg thrash. He had no particular timing of the stroke and worked independently. I do not wish to go into the whole affair pro and con on anything pertaining to swimming, as to which is really the best stroke, as all of them have their good points.

By Ludy Langer, Captain University of California Swimming Team.

1. *Position of the Head and Body.*

The position of the body should be as near on the top of the water as is possible with natural ease. I fully believe that the drive from the legs in the crawl is of far less importance than the fact that the kick keeps the legs and lower part of the body near the surface.

I think the head should not be held too far out of water nor too deep, using it if necessary to balance the rest of the body. If the legs and back have a tendency to come too far out of water the swimmer, by holding his head a little higher, will cause his legs to go down a bit and vice versa.

2. *The Arms.*

(*a*). I find that the natural tendency for most swimmers is to bend the arms too much at the elbows and also to lift the elbow too high when bringing the arm forward for the next stroke. This method loses energy and time. The method which I prefer and use is to bring the arm forward with a swing out over the water just high enough to clear it. By this method you can relax almost every muscle in the arm, bending at the elbow only enough to give added relaxation to the arm.

The reach should be straight out from the shoulder and should be far out before entering the water, instead of putting the hand

in close to the head and extending it under water to full arm's length. This saves time and energy.

(*b*). There should be very little roll of the body, just enough to help the arm clear the water and to elevate the shoulder so that the arm may be brought forward with a minimum of effort. Too much roll is worse than none at all.

(*c*). I think the reach should be extended farther out as the distance increases, because there is more time for extending the arm and it also lengthens the stroke. The natural tendency in the shorter distances is to shorten the reach, but care must be taken not to shorten it too much.

The roll should also be decreased for the shorter races because of the extra energy and time it takes to roll from one side to the other. For the longer distances the roll should be gradually increased with the distance, the limit being reached when the arm can be easily brought forward without lifting it too high above the water.

The pull through the water should be such that the swimmer has the best hold on the water at all times during the stroke. This can be determined by the amount of effort required. It is harder to pull the arm through the water when one has a better hold on it. The natural but incorrect tendency is to pull the arms through the water in either a zig zag fashion or to let them bend at the elbows when they are under water, instead of pulling them straight through from a point directly out from the shoulders and not letting them go under the body or away from it when extended straight down.

3. *The Legs.*

(*a*). I think the leg drive should be learned and used independently from the arm stroke. I think the whole secret to the leg drive is to relax the legs absolutely. Most swimmers kick too hard, too often, and open their legs too wide. The best way to describe the kick I think is to leave the legs as loose as possible and then try to shake the ankle off the foot. In this operation the legs should not open more than from nine to twelve inches and should be absolutely loose at the hips and knees.

(*b*). I think the legs should be kept close together at all times. In a short race the kick should be fast but no harder and no wider. As the distance becomes longer the kick should become slower and still as loose as before.

4. *Inhalation.*

This is a question of individual study after the first principles have been mastered. As the swimmer rolls so that the side which is always in the water when he swims single overhand is the lower side in the water the head should be turned slightly more than the roll but not lifted, and the sight should not be directed ahead. This places the head in a position most favorable for taking in a good big breath at every stroke in a long distance swim. Then roll over to the other side and exhale under water just before coming back into position to take the next breath.

In the shorter races a breath may be taken at every stroke of a given arm, at every other one, or possibly at even greater intervals. This must be decided upon in individual cases by careful observations. I might add further that the inhalation should be made before the arm which is uppermost starts forward for the next stroke. It should be started just as it starts to leave the water and ended before it is one-quarter way back to the forward position.

5. *MAKING USE OF NATURAL ABILITY and relaxation.*

The biggest mistake is to hold yourself tense while swimming. It does not take great effort to propel oneself forward in the water. In fact it is just as easy as walking when done in the right way. *Perfect relaxation in the water is essential before one can get the greatest pleasure and ease out of swimming and achieve success in the races.* Another essential is to study oneself to discover natural ability and limitations. To try a method of swimming just because some swimmer with a big reputation swims that way may be absolutely wrong, for the successful swimmer may be successful in spite of numerous faults, or his method may be absolutely unsuited to the qualifications and limitations of others.

Do not expect success in competition without hard work, and do not expect success *right away,* because it takes as much time to work up in this sport as in any other form of athletics. Too many swimmers lose heart because they do not advance rapidly enough, but they should consider that in trying to go forward too fast one usually does not pay enough attention to form, a shortcoming which prevents maximum efficiency.

It is my theory to work slowly and perfect the form, and when the swimming form has been perfected speed will come unless there are physical reasons to the contrary.

By Lionel B. MacKenzie, Coach of Swimming College of the City of New York.

Question No. 1.—The position of the body in the crawl stroke should be prone, with a normal extension on the whole body; as near parallel to the surface of the water as the above position will allow.

Question No. 2 (*a*).—The arms on the reach forward should be normally extended at right angles to the width of the shoulders. In reaching forward from the finish of the stroke, the elbow should be bent and elevated to enable the hand to clear the surface of the water. The pull or stroke through the water should be downward, until the hand is below the body, then swerving inward in a described arc finishing fully extended at the side of the body. The describing of the arc inward or under the body calls for a slight bend of the arm at the elbow. The pull or stroke should be backward, to eliminate as much as possible the body pressure and draught in the water.

(*b*).—The rolling of the body in the crawl stroke is for the purpose of breathing. It should be done in one movement of the whole body and should take place between each arm stroke. The roll should be to one side only, and to that side easiest to breathe on. In practice the roll may be changed to the other side, for the purpose of developing an equal or uniform thrash with the legs.

(*c*).—In distance swimming the roll and breathing between each arm stroke is recommended, because the more inhalation the less strain and fatigue. In short distance swimming the roll and breathing takes places when physically required, and varies from four or five strokes to every fifteen or twenty. The rapidity of the stroke only changes.

Question No. 3 (*a*).—The legs should be normally extended and their action and that of the feet should be a vertical thrash from the hips to the feet. In rolling the body the action of the legs and feet ought not to change, but the action of the thrash will change to lateral. The thrash should be confined to that width which is between the points of resistance, encountered when the legs are raised too high or submerged too deep. The thrash with the minimum resistance is essential. The rhythm of the thrash should be that which can be controlled in co-ordination with the arm stroke.

(*b*).—The above stroke should be used for short and middle distances.

Question No. 4.—Inhalation should take place when the body has rolled to the side. This takes place between each arm stroke. In distance swimming the above is recommended. In short distances or sprints, at those intervals suitable to the endurance of the individual. The holding of the breath combined with the physical action between intervals of breathing is very fatiguing and is the general cause of exhaustion in sprint races.

Many swimmers have to use a great deal of their stroke at certain points of fatigue, in order to keep the body afloat. It has been noted that many of our fast swimmers are very buoyant, thereby using the greater part of the stroke for propulsion. Many swimmers exhale under water or before the roll and inhale on the roll. It has been especially noted, in cases of fatigue, that during this short interval of exhaling and inhaling the body has increased its draught, and caused considerable effort in getting the face above water on the roll.

By Edward J. Manley, Coach of Swimming University of Illinois.

The body is kept as close to the surface of the water as possible. Place the head in such a position as to allow the water to strike just above the eyes.

The average swimmer should take a long arm stroke, extend the arms, and "catch" with the hand straight in front. Buoyant swimmers find it well to slide the hand in the water just a little before the arm has reached its full length. Bring each arm straight down with a decided pull until it is even with the hip. A slight roll from the waist up should then be made to allow the clearing of the arms from the water. Then the arm should be brought out with a little jerk from the shoulder, bent slightly at the elbow, and again thrust forward.

The legs should be extended, feet pointed and turned inward, legs about a foot or little more apart from the knees down. Do not hold the legs rigid. Work the legs up and down alternately, moving the whole leg and keeping knees bent very little. In the downward thrash, the legs should work independent of arms in most cases.

The inhalation should be taken as the arm is lifted from the water. A breath should be taken at every other arm stroke for a distance swim. For a short distance, say a 40 or 50-yard swim, inhalation should be made about every sixth complete stroke.

The crawl stroke of today is a very hard stroke to describe as there are many ways of swimming it. You cannot apply the same style to every swimmer, there being hardly two persons who can use the stroke alike. It is all on the same principle, but the build of a man will change the desired form a great deal. It is up to the coach to study his man and frame up a stroke to fit his build.

By Matthew Mann, Formerly Swimming Supervisor Town of Brookline; Former Coach of Harvard 'Varsity and U. S. Naval Academy Teams; Now with New York A. C.

I am a crawl stroke man from the beginning to the end. I teach the crawl as an elementary stroke and have done so much

better than ever I could have done with the breast stroke that I never teach anything else. Referring to the crawl, for the racing man:

Question No. 1.—The best position for the crawl stroke swimmer is perfectly flat with the face in the water, only turning the head to take a breath. The reason of this position is that there is less resistance than if you keep your head up or if you roll to get your breath.

Question No. 2 (*a*).—The best reach of the arm is so that your hand, beginning with the tips of the fingers, is in the water before any part of the arm is in, meaning that the fingers are commencing the drive before the elbow begins to resist. It is not a pull of the arm but more of a drive. It is not possible to pull the water, but you throw your shoulder forward to where your hand takes the water, making it more after the form of a lift of the body to the hand, not pulling the hand to the side.

(*b*).—A swimmer can roll when swimming a 220 or over by just reaching a little deeper into the water with the drive; it enables him to get a breath easier, also it brings in a distinct small side kick, which is quite an asset in the longer swims.

Question No. 3.—Both the arm and the leg kick are changed in the distances. In the sprint the body is kept perfectly flat, the arms taking the water a little in front of the head, but out at the side. They are forced down to a point just underneath the thigh; there they are lifted with the relaxing of the muscles in the elbow, and brought forward with a distinct shoulder action. The kick is a good thrash with a loose knee snap, so that the feet come out of the water. The kick is perfectly balanced, each leg doing its share, the feet lifting out of the water anywhere from one to four inches. The kick is also an independent motion, each swimmer having a little difference in the motion.

There is no perfect time that you could recommend to any collection of swimmers. They will find out the correct time to apply their kick as they proceed in proficiency. Some swimmers kick very fast, while others kick very slow.

The crawl stroke for distances over 100 yards should be swum with a roll and a slight side kick, not bending the knees at all; of course keep muscles relaxed so that they don't cramp. The feet should be used as if you were on your toes all the time, and also try to get the habit of toeing inwards.

Question No. 4.—The breathing is one of the chief reasons why so many men fall down on the crawl; they do not pay enough attention to it, and when they do meet someone who does breathe right they are usually second.

The best way to insure getting your breath at all times is to stand in the pool and first of all take in a breath, then put your head under water, then turn your head to the side; do not lift up the head, try and keep the ear in the water; just as you turn the head begin exhaling through the nose; when the mouth is just clear of the water open it wide and take in a quick breath through the mouth, then repeat, making sure that head does not lift, but only turns. This should be done very slowly at first. When you feel it is coming all right, start to swim slowly and turn your head the same way; do not hurry, or you will get too much water, but take it easy, until you are sure that you can get all the breath you need.

It is best at all times to take a breath on every stroke, when a man is breathing right. However, until he gets it right, the breath should be taken in a sprint race every three or four strokes, but not longer, as that would put too great a task on the heart. Special work should be given all men to help their breathing, for the man who breathes best will win nine times out of ten.

By R. F. Nelligan, Associate Professor Hygiene and Physical Education at Amherst College, Amherst, Mass.

Position of Body.

In executing the crawl stroke the position of the head and body are important. If the abdomen is drawn in and the back humped up, the under part of the body will present a concave surface to the water, a faulty position which tends to plunge the

head and feet too low, thus hindering the swimmer. If the back is slightly concave these faults disappear, the legs work to better advantage, the head being not so deeply submerged enables the swimmer to look ahead and to right and left more easily and also to breathe more freely than is possible with the head too low in the water. This latter position is also more advantageous to a powerful use of the arms.

Arms.

The best results from the use of the arms in the attainment of speed may be described as follows: With the wrist slightly bent the hand is thrust forward and slightly downward entering the water about three-quarters of the distance between the shoulder and the extreme reach, with the elbow raised and bent a little. If the elbow is not raised the upper arm comes in contact with the waves in the negative part of the arm movement and the swimmer is retarded. The extreme reach or the straightening of the arm takes place under water before the arm is pulled back in the positive or catch part of the stroke and therefore care must be taken by keeping the wrist at such an angle that the arm is straightened without hindering the swimmer. This requires a slight bending downward at the wrist. When done correctly it will be found that when the pull commences the hand will be about six inches below the surface. Each arm should enter in front of the shoulder and the body should roll slightly toward the pulling arm when going at top speed in order to apply full power. In distance work the roll is more pronounced, and the hand enters the water more nearly at the full reach. In sprinting or in distance swimming it will be readily seen that if the arm and hand forming a straight line is laid flat on the surface at the full reach, the pull really does not commence until the arm is well beneath the surface, and to get it there in this way is too slow and tiring to be of value. The arm should be pulled back well under the body and this results in a slight outward sweep of the arm at the end of the pull as the body rolls face down. When pulled nearly all the way through the arm leaves the water cleanly. It is a common mistake to raise the arm before the stroke

is finished—*i. e.,* before the hand reaches the hip or possibly a little farther back. In reaching forward for a new stroke the arms should bend at the elbow rather than swing around at the sides so as not to tire the shoulders. Both pull and recovery should be well inboard for the full application of power and conservation of strength, and this means endurance and speed. Raising and bending the elbow results in a clean, smooth, straight, and easy recovery, and a smoother roll and application of power, than is possible with a straight arm swing around at the sides or overhead. The roll should come wholly from the swing of the arms rather than from a spasmodic movement of the body.

Breathing.

Inhalation should be through the mouth in speed swimming. By turning the head this becomes easy with practice. One who naturally swims on the right side should turn the head upward to the left just enough to enable him to fill the lungs. Exhalation should take place under water as the body rolls forward. The breath should never be held even in a 50 yards race. The writer has coached swimmers who ignored this advice for a time and who thought it advisable to swim face downward for the first 25 yards of a 50 yards race, but in every instance the time was faster when the swimmer was prevailed upon to breathe on every stroke. Swimming short races is hard work and it is physiologically wrong to hold the breath in a 50 yards race or in any race over 25 yards.

Kick.

The kick seems to be the bone of contention with coaches. When first introduced into this country I very enthusiastically commenced experimenting after reading everything I could find about it. First I thought it must be a rapid movement of the feet, somewhat similar to pedalling a bicycle with a short crank and without co-ordination with the arm movement. Lying flat on the water with arms extended I found that I could make considerable headway in this manner with the feet alone. The arms were then brought into action, but the legs tired so readily and

had to be used so violently to be of any use for propulsion when the arms were working that I became disgusted. After seeing the best exponents of the crawl in this country I was convinced that the pedalling movement was useless. They seemed to get propulsion from a downward and upward thrash of the legs, with the emphasis on the downward movement. The width of the kick varied greatly and it was soon observed that the swimmers using the shorter kick, other things being equal, seemed to be able not only to attain greater speed but also to crawl a longer distance without becoming exhausted. The quickest way to tire an athlete is to make him use the legs vigorously and this led the writer to believe that the narrow kick was the better. Another reason in favor of the narrow kick seemed to be that the arms worked faster when an attempt was made to co-ordinate the arms and legs' movements. It certainly slows the all important arms' movements to kick wide and it tires the swimmer. It soon dawned on the writer that in most cases the would-be crawl stroke swimmer placed too great a value on the legs as a means of propulsion, and that a wide thrash was not only tiring but acted somewhat as a drag also. About this time it was reported that Handy of Chicago used a legless crawl, but experiments with this proved that it was hard to get a fast quick catch without a leg thrash. It then seemed to the writer that the principal use of the thrash was to enable the swimmer to use the arms to good advantage by steadying him and this did not require a wide slowing and tiring leg movement, but rather a sharp downward short beat, principally from the hips, repeated with each leg to both arm movements; in other words, four kicks to two arm movements complete the stroke. Swimming the trudgeon stroke with a very short scissors kick and adding a one, two, downward beat with the legs when the body rolls face downward is a form of stroke we hear much about lately, and it may, after all, be the best speed stroke. It is certainly easy to teach it to a man who swims the trudgeon correctly. All that is necessary is to get him to reduce the width of the kick in the trudge. He will feel instantly that the speed of the arms increases, and to keep his

balance for a firm catch he will almost instinctively add the one, two, downward thrash between scissors kicks, as the body turns face downward. This gives to the stroke rhythm. The writer used this form of stroke for years, and after the swimmer attained it he found that the same movement, done without turning the hips, or at least turning them but very little, resulted in an upward and downward thrash or, in other words, a straight crawl. Some preferred the combination trudge and crawl while others liked the straight crawl. In the straight crawl the body is turned principally from the waist, while in the combination the hips turn with the body as the scissors kick is executed. I am unable to say which is the better method for the average swimmer because I have not sufficient data to prove the superiority of either stroke. At present I rather favor the straight crawl. In any form of crawl the kick should be narrow—just enough to enable the swimmer to get a firm catch. In distance work the kick is naturally a little wider than it is when going at top speed. The toes should be pointed well backward and slightly inward in both methods, and the kick should be so narrow that the feet remain under water. The legs should be extended backward naturally. Slight variations from the above methods are noticeable in all large swimming meets.

By Frank J. Sullivan, Coach Princeton University.

There are so many theories regarding the crawl stroke advanced by coaches throughout the country, no one of which will confirm another, that it seems foolish to advance any one theory as the correct one. At the present time there are at least ten different styles of crawl, each having a large following. There is only one question that all American coaches agree on and that is, that the original crawl or Australian crawl, as it is commonly called, is obsolete today. The American crawl of the four, six or eight-beat kick has proved so successful over the users of the original method that Australian, German and English swimmers are endeavoring to master the intricacies of the American stroke.

There is no doubt in my mind that the stroke which produces the best results is the best stroke. It is plainly evident then, that to find the best stroke, one must analyze the method used by Hebner, McGillivray, Langer, Raithel, Vosburgh, Vollmer and other star swimmers of this country. To do this as it should be done would fill a volume, but the several basic principles may be written in a few words.

Careful observation on the part of several of our leading swimming authorities, as to the stroke used by the above mentioned swimmers, has brought out the conclusion that these swimmers use what is now generally known as the "trudgeon crawl." It is this type that I recommend to all swimmers, for it can be used for any distance—from 50 yards to ten miles.

I have had the privilege of reading in the manuscript Mr. Handley's article, which is contained in this symposium, in which he describes the trudgeon crawl in a much better way than I could, so to go into detail about this stroke would be merely a repetition of ideas which already have been advanced satisfactorily in Mr. Handley's well written article.

By Thomas G. Whitaker, Coach of Swimming Misssouri Athletic Association, St. Louis, Mo.

Question No. 1.—Keep the body as high on the surface as possible. The head should be held so that the water reaches the eye-brows.

Question No. 2 (*a*).—Keep the elbows slightly bent. The hand goes in before elbow, in front of head—not crossing over to opposite side, however. The arm should be straightened out about one foot under surface. Pull deep and down center line of body, making the recovery to the side.

(*b*).—In sprints have the body as flat as possible. Employ no more roll than is occasioned by using shoulders forcibly.

(*c*).—Yes. (2-*b*) is answered in previous question regarding sprinting. For distance swims, lengthen arm reach slightly, increase roll, with complete relaxation between strokes.

Question No. 3 (*a*).—For sprints a fast, powerful kick with as fast a leg beat as is possible to the complete arm stroke, or cycle—that is, to two arm movements the maximum appears to be six to eight leg beats, arrived at unconsciously with most swimmers. Width of thrash should be six inches to a foot. Keep legs loose all over and not more than a foot apart.

(*b*).—Yes. As fast a beat as possible for short distances. For middle distances either a four-beat kick to two arm strokes, or a two-beat kick—left leg on left arm pull and vice versa. Or a new kick I've worked on, in which a decided roll is taken on each arm pull. For instance, when on the left side, the left leg is underneath and delivers a sort of scissors kick and vice versa on the right side.

Question No. 4.—Breathing should be indulged in during the last half of the stroke and first part of recovery. Up to 50 yards breathe as little as possible, after that on every complete stroke.

By Joseph H. White, Swimming Instructor University of Chicago.

Question No. 1.—Keep the body horizontal and as near the surface of the water as possible with head slightly submerged.

Question No. 2 (*a*).—Reach as far forward as possible raising the elbow high enough to enable the hand to clear the water. Catch with the minimum of splash as far in front of the head as possible and pull through the water directly under the body, carrying arm stroke as far back as possible.

(*b*).—A slight roll of the body which enables one to get the maximum reach both forward and backward with the least expenditure of energy is desirable.

(*c*).—Modify 2-*a* in the short dashes by bending the arm very slightly, which, in my judgment, permits of a little more rapid movement of the arms. Modify 2-*b* in the dashes by a less frequent roll, as the swim is soon over and the need for air is less apparent.

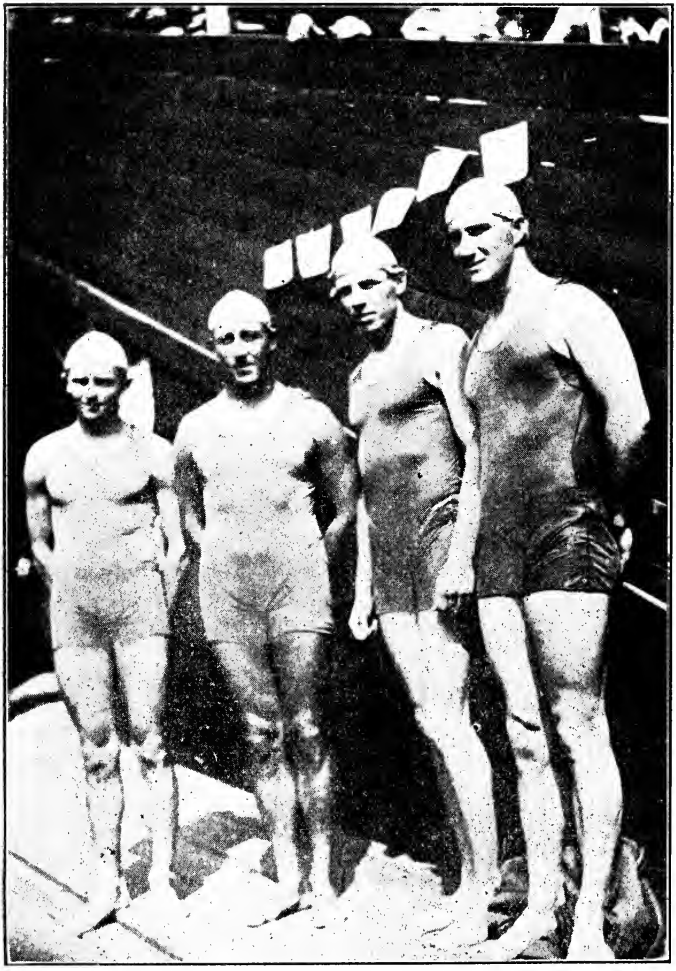
Question No. 3 (*a*).—The most desirable leg movement is a kick or thrash with the legs alternately about ten inches or twelve inches in length, legs slightly bent at the knees; toes pointed. The thrash is made by straightening the leg, together with a slight movement at the hip. Legs should not be spread except as above noted.

The rhythm to be maintained should depend upon the length of the swim entirely, for the dashes (50 to 100 yards) a rapid thrash, which should be moderated for the middle distances (220 and 440 yards), and must be still more moderated for the longer distances.

Question No. 4.—Inhalation should take place for the swimmer who takes his breath while on his right side as the left arm is being carried forward, or, as his right arm is carried forward provided he breathes more naturally on his left side, a matter of individuality entirely.

How often one should breathe for the different distances varies so with each individual that it makes it very difficult to even suggest how often one should breathe. I should say, however, generally speaking, that for the 40 and 50 yards (assuming the tank to be 20 or 25 yards in length) breathing twice going the first length and three or four should be considered the limit for the second length. In the hundred yards a breath with every fourth stroke, counting one with each arm. In distances over 100 yards a breath with every second stroke, counting as above, one with each arm.

Question No. 5.—Exhaling under the water through the nose.



OLYMPIC GAMES AT STOCKHOLM, SWEDEN, 1912.

Australasian relay team; winners of 800 meters relay race; 1, Leslie Boardman; 2, Cecil Healy, and 3, H. H. Hardwick, Sydney, N.S.W.; 4, M. Champion, New Zealand.

IS IT HARDER TO SWIM IN FRESH WATER THAN IN SALT WATER?

The following from the Sydney Referee, the great sport authority of the Antipodes, is of interest to American swimmers, who have often asked the same question.

The idea that fresh water is harder to swim in than salt water is not altogether correct, though held by many prominent swimmers. It amounts to the question of what one is accustomed to. A frequenter of salt-water basins only would find, for a time, that fresh water swims required a much harder effort, as there is no question that the ocean water is much more buoyant. The buoyancy increases with the amount of salt until the point is reached, as it is at Salt Lake, Utah, U. S. A., where swimmers have found it impossible to sink, no matter what tricks are tried. On the other hand, regular fresh-water swimmers find a similar difficulty in accustoming themselves to salt-water conditions, but on the whole fit in much more quickly and effectively than vice versa. Cases are also known where great improvement has been shown by fresh-water swimmers as the result of changing their environments and having regular salt-water swims. On the other hand, although in most cases salt-water swimmers have been able to repeat their best times in fresh water, it is very rarely that they better them. This did actually happen with the Australian team in Stockholm to the last Olympic Games, but six full weeks of preparation on the spot was responsible for this. In distances the trouble in showing up as well as in salt water is harder in fresh.

When the Americans, through their great swimmer, C. M. Daniels, copied the Australian crawl stroke, it was persevered with for a time, but eventually had to be remodelled on account of the unsuitability for the short fresh-water tanks that most of the swimming in Eastern United States is performed in. The

re-modelling was necessary owing to the leg movement being too deliberate and comparatively slow where the natural buoyancy of the water was not there to keep the legs at the surface. In salt water the alternate arm and leg movement acted all right, as the balance of body, shoulders, legs, and feet was well maintained near the surface. In fresh water the movement was not rapid enough to prevent the legs from sinking. Daniels and the various American coaches studied the thing out, and adopted a modified form of what we now refer to as the continuous crawl kick, which not only overcame the sinking of the legs trouble, but also added pace, as has been shown by the remarkable speed of Kahanamoku, McGillivray, Rathiel, Vollmer, Hebner, Cunha, and others. The legs make very little movement—just a slight opening and shutting; but the feet and ankles are continuously busy. The continuous movement is purely a fresh-water creation, but now generally adopted as the short-distance speediest stroke.

The trudgeon crawl is another evolution in the leg work. At present the continuous and independent leg and feet work is exhausting for all when the middle distances and longer distances are tried. One could see this coming as the result of fresh-water operations. Our own Australian swimmers, Beaurepaire and Hardwick, came back after a European tour with something that seemed to show the necessity of combining the trudgeon and the crawl characteristics. The scissors kick of the trudge gave impetus, the flipping of the feet in between the trudgeon kicks maintained the balance and the floating of the feet near the surface. Any dropping of the legs will be at once recognized as a retarding influence. Thus Frank Beaurepaire, with his nice, easy, continuous stroke, found the added crawl kick a great advantage in fresh water. He even found them useful in salt water after his return, and Hardwick did the same. However, the trudgeon kicks of both were still maintained in all its bigness and wideness of movement. The Americans have bettered that by adopting a short, decisive scissors movement and two or three rapid beats of the feet in between. There is no turning of the body almost completely on the side as in the old trudgeon. Albert Barry

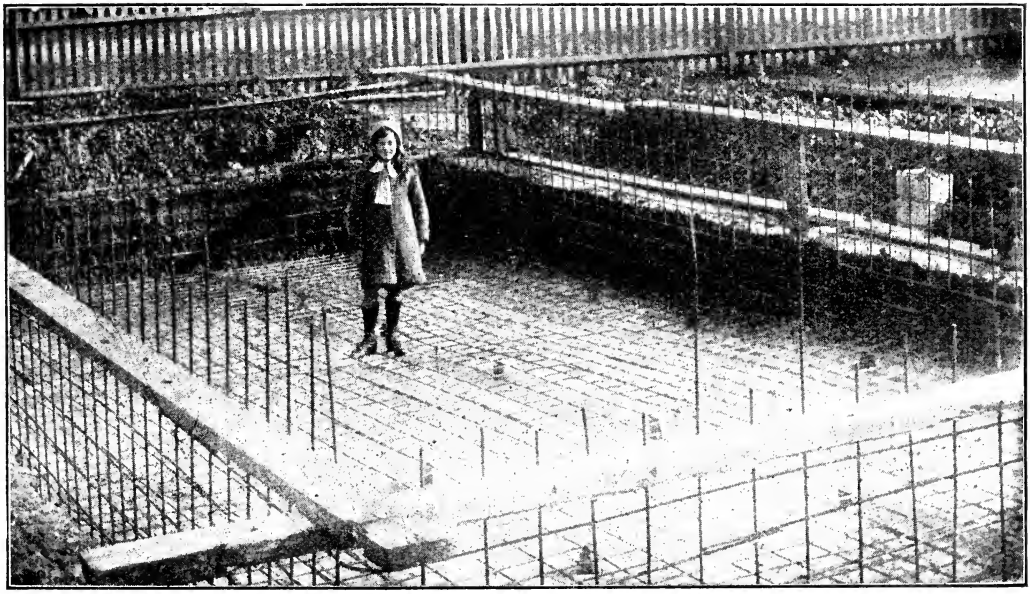
used this short, quick scissors movement in all his great swims; it undoubtedly adds pace, and, unlike the older and greater spreading kick, is quickly executed without any interference with other things that make for pace.

Many swimmers here have mastered the full trudgeon crawl, or rather the single trudgeon crawl, as defined as such by the American students of the sport. It provides for the quick scissors kick referred to, with the legs almost straight. No bending of one leg, as in the old trudge. Then in between two or three beats of the foot in consecutive crawl-kick fashion. All the time the body retains its even balance and steady perpetual motion. A slight rolling of shoulders and body down to the hips gives the driving power to the arm-work, and the various moves of the stroke tend to give a certain respite to the legs that makes longer distances possible in steady fashion, whereas the continuous alone is too exhausting as yet. Some swimmers show the double trudgeon crawl, which provides for a short trudgeon scissors kick on both sides, with the beats of the continuous crawl in between. In short distances the effects are not noticeable, but in the slower-moving thrashes of a long swim, the double kick is found to be of advantage.

A point that must be observed by learners is that the scissors kick is a narrow one, and must be performed in an almost horizontal position. There is just the slight roll as in our own style of crawl, which brings the body and legs just slightly out of the horizontal position as we put in one arm and kick the opposite leg. That is the time for the narrow scissors kick, and as the body returns to an even keel the few beats of the continuous crawl are used. The double trudgeon crawl will, of course, need the slight roll to both sides, and the narrow scissors kick, but it must be narrow.

Both are fresh water creations, so that swimmers under the same circumstances need not hesitate to try them. In answer to a youthful inquirer, I think that the continuous crawl for sprints and the trudgeon crawl for middle and longer distances are undoubtedly the strokes that all young swimmers should

master if they wish to make speedy swims, either in fresh or salt. Both are now in universal adoption in the United States, and the results achieved have been remarkable. The trudgeon crawl may be used in sprinting also, but unless, like Barry, one concentrates on the short scissors kick and leaves the crawl beats alone, the movements are so quickly executed that much of the advantage is lost.



CONSTRUCTION OF AUSTRALIAN CONCRETE SWIMMING POOL.
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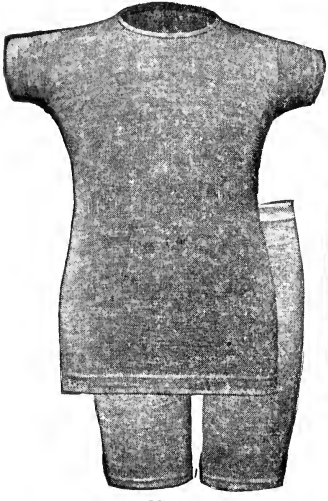

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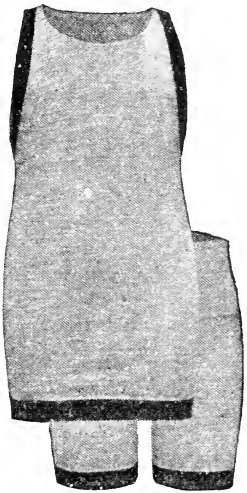

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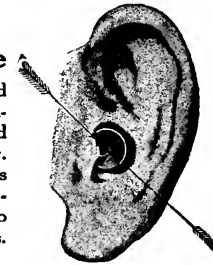

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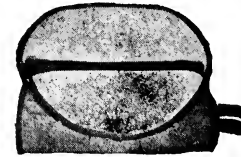

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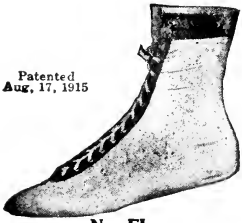

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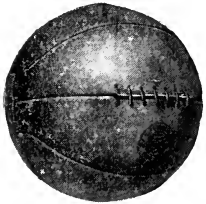
No. LC. Special leather cover water polo ball. This style is used in games under official rules. Supplied on special order only. Ea.,

No. 1. Made of white rubber fabric. Inflated with key. Regulation size. Special order only. . . . . Each,



No. LC

Spalding Official Water Polo Goal Nets

Made in accordance with official rules. . . . . Pair,

SPALDING TIGHTS TRUNKS AND RUNNING PANTS

STOCK SIZES: 24 to 42 inch waist. STOCK COLORS: Worsted knee and full tights and trunks, except where otherwise specified, Gray, White, Navy Blue, Maroon, and Black. Any other color on special orders, at no extra charge.

No. 10B

Spalding Knee Tights

No. **10B.** Best worsted. Pair,

No. **604.** Good worsted. "

Spalding Full Length Tights

No. **1A.** Best quality worsted, full fashioned. Pair,

No. **WA.** Special wrestling full tights. Specially reinforced. Special orders only. . Pair,

No. **605.** Good worsted. Pair,

No. 2

No. 14B

Spalding Worsted Trunks

No. **2.** Good quality worsted. Carried in stock in Navy or Black. . . Pair,

Spalding Y. M. C. A. Trousers

No. **4.** Flannel. . . . Pair,

Boys' Knee Pants

No. **14B.** Same quality as No. 4 Y. M. C. A. trousers; with stripe down side. Pair,

Spalding Running Pants

Stock sizes: 22 to 42 inch waist, cut good and full in size. Specify size and color when ordering.

No. **3.** White or Black Sateen. Made with fly front and laced back. Pair,

No. **4D.** White Drill. Specially recommended for indoor or Y. M. C. A. work. Fly front and laced back. . . . . Pair,

No. **4F.** Equipped with durable and reliable adjusting arrangement at sides. White, Black or Gray twill. . . . . Pair,

No. **4C.** College style; fly front, wide hips, short legs, no elastic. Made in White, Black or Gray twill. . . . . Pair,

No. **4.** White, Black or Gray twill. Fly front, laced back. . . . . Pair,

No. 4

No. 3

No. 4F

Silk Ribbon Stripes down sides of any of these running pants. . . Pair, extra,

Silk Ribbon Stripe around waist on any of these running pants. . " "

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