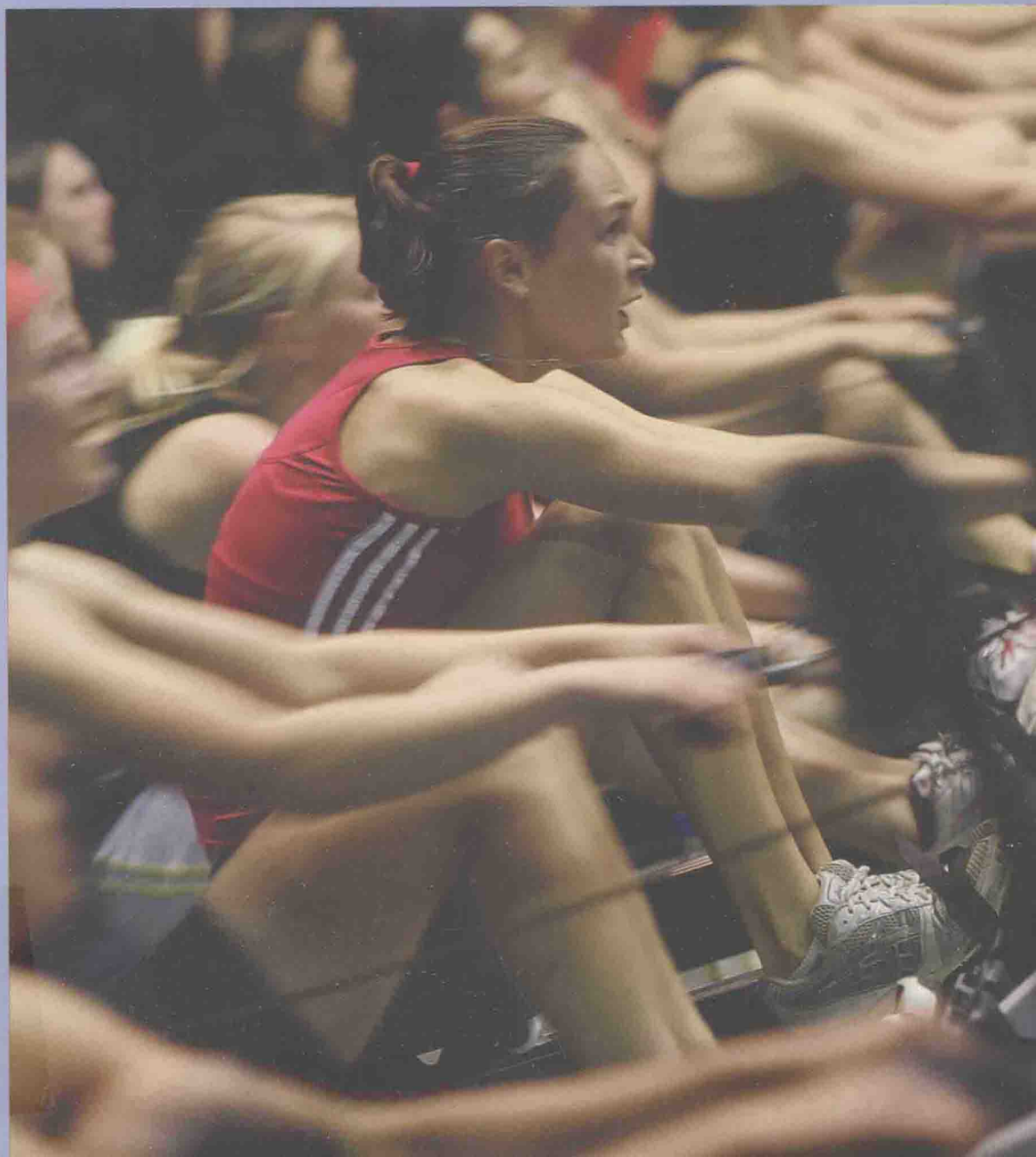
THE COMPLETE GUIDE TO

Jim Flood and Charles Simpson

INDOOR ROWING



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Jim Flood and Charles Simpson

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INTRODUCTION

Rowing machines have been used in gymnasia for over 100 years but the last 10 years have seen a huge growth in the number of people using them. This phenomenon is associated with the growth of fitness centres and the modern desire for an athletic body shape, a combination that rowing machines in particular have benefited from.

So why is the rowing machine proving to be so popular? The answer is probably a result of the smooth 'feel' of the rowing action, the low impact on the limbs and the large range of muscles that are exercised. For the many people who suffer from knee problems that limit their ability to run or to exercise, it is an ideal solution.

There is increasing evidence that exercise can help in the treatment of depression. Exercise helps people to improve their confidence and self-image, gives them positive goals and releases endorphins, the hormones that induce feelings of well being. It can also improve sleep and reduce stress. Rowing machines are easy to use and provide an ideal introduction to an exercise programme for beginners.

Relieving stress though exercise is also a useful process for men and women in the armed services. In many of the fortified camps used by the coalition forces in Iraq and Afghanistan, rowing machines are used to provide intensive exercise in places where space is at a premium. Another place where space is at a premium and it is necessary to exercise is on the International Space Station, where a rowing machine is used by astronauts to maintain fitness and bone density.

Rowers have been using rowing machines since the late 70s both for fitness training and to develop good technique. When rowers had to train on rowing machines because of dangerous conditions on the water, this inevitably led to competitions over set distances – much like regattas only using rowing machines instead of boats. This soon developed into a separate sport based on competitions using rowing machines.

Indoor rowing competitions began in the United States and quickly spread. The British Indoor Rowing Championships is now the largest participatory indoor sporting event in the UK. In 2010, throughout the world:

- 40,000 athletes competed in indoor regattas;
- 400 indoor rowing events were staged in 40 countries; and
- 1900 athletes competed in the World Indoor Rowing Championships.

There are many more smaller competitions organised by fitness centres and schools. For example, in 2010, over 7000 students in 20 schools in County Durham (UK) took part in a Get Going, Get Rowing competition. In London in 2011, over 2500 students between the ages of 14 to 18 took part in an indoor rowing event organised by London Youth Rowing. In both of these examples, the vast majority of the participants were from state schools – a point worth emphasising because in the UK, junior rowing on water is still dominated by private schools.

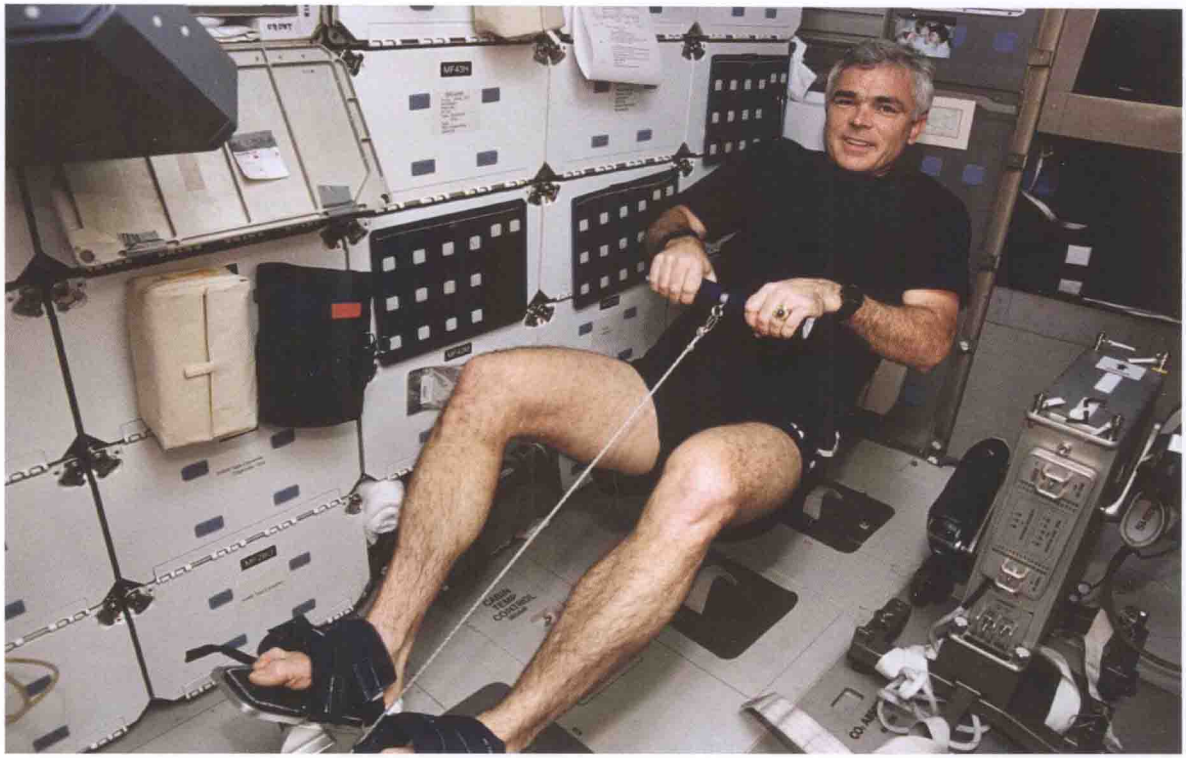

Fig 0.1 Astronaut Michael R. (Rich) Clifford, mission specialist, uses the rowing machine temporarily deployed on the Space Shuttle Endeavour's mid-deck. Many of the crew members put in time on the device during the week and a half mission (courtesy of NASA with permission)

For competitions it is necessary to have a standard machine which is the Concept2 rower. The key factor is a display unit that can be programmed to ensure that competition between participants is absolutely fair. For example, if rowers set the drag lever at different settings, the microprocessor in the display unit will still calculate how far they travel with each stroke.

New technologies have opened up the possibility of virtual competitions. You can now hook up your Concept2 machine to a computer and compete against other rowers thousands of miles away. You can also check your fitness levels against tables of results and obtain advice on training and technique.

WHAT THIS BOOK AIMS TO ACHIEVE

This book has been written as a resource for individual rowers, coaches and trainee coaches. Because it is in the format of a resource, it is not necessary to read the chapters in sequence. Find the sections that interest you and make this a

Fig 0.2 Competitors in the 2010 British National Junior Indoor Rowing Championship (courtesy of London Youth Rowing with permission)

starting point to explore further. We have aimed to provide basic information that can be used as a resource for beginners, as well as detailed advice and analysis on technique and training.

We believe that skilled coaching is vital so chapter 4, which covers coaching styles and techniques, is important to us. You might not be a coach but this section should enable you to have informed discussions with your coach about the style of coaching that suits you best.

Sport now draws on the sciences of physiology, biomechanics, nutrition and psychology, and our work draws on the latest research in these fields. We have aimed to provide a basic grounding in these areas so that you will have a basis for more advanced study.

We have included case studies on individual rowers. We hope that you will be able to identify with, and learn from, some of their thoughts and experiences. They are of different ages and backgrounds – a reflection of the broad base of society from which indoor rowers are drawn. Several of them are senior citizens, proving that age is no barrier to this sport. In fact the benefits of exercise for those over 50 are now well recognised, and indoor rowing provides a low

impact form of exercise, making it an ideal system for this purpose.

Indoor rowing has also been quicker than most sports to provide opportunities for the participation of people with disabilities. Adaptive rowing events have been included in competitions since 2004, another aspect of the inclusive nature of this sport.

If you are using a rowing machine to train for rowing, then you will find much useful information that will help with your technique and training. Using a rowing machine is not just about getting the highest score possible – you can use it to improve your speed on the water through better technique.

Therefore, whatever level of experience you have with indoor rowing, and whatever it is you hope to achieve, we hope that this book will help to support and promote your development in this sport.

CONTENTS

THE DEVELOPMENT OF INDOOR ROWING

1

Rowing machines have been in use for about 140 years. The first patent was filed in the United States in June 1871 by WB Curtis. Between 1871 and 1952 there were more than 40 patents filed for rowing machines. One of the best known was the Narragansett hydraulic rowing machine designed in 1900 and manufactured until the late 50s. They were installed in the gymnasium of the Titanic, the ship that hit an iceberg and sank on its maiden voyage in April 1912, and there is a short sequence in the 1997 film which shows Narragansett rowing machines in use.

Rowing machines were also used in hospitals for rehabilitating the injured. A 1938 news film documenting a rehabilitation centre at the Albert Dock Hospital in London shows seamen who are recovering from injuries using rowing machines that move across the floor.

It is likely that the development of rowing machines was influenced by rowing races that attracted large numbers of spectators in both London and New York. By 1715 there was an established annual race between the Thames Watermen who operated the ferry services around the rivers of London. The winner was awarded a coat and badge, and this event is still held today, making it the longest continuously recorded sporting event in the world. By 1756 there were rowing races in New York that created a great deal of public interest. All of these races were for prize money so this form of the sport could not be considered a 'gentlemanly' activity. However,

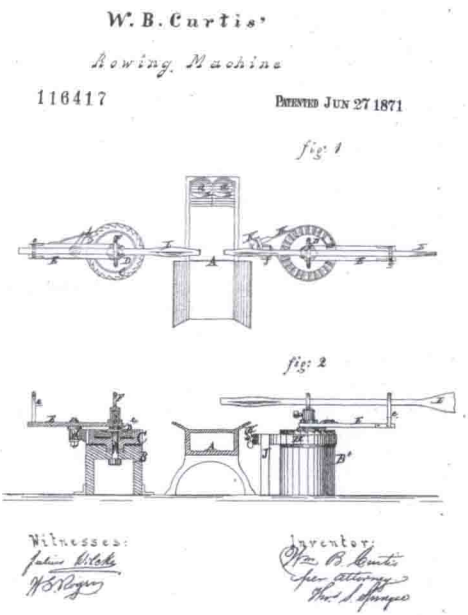
W. B. Curtis'
Rowing Machine
116417
PATENTED JUN 27 1871
fig: 1
fig: 2
Witnesses:
Inventor:

Fig 1.1 WB Curtis' rowing machine, the first patent for such a machine, in 1871 (courtesy of US Patent Office)

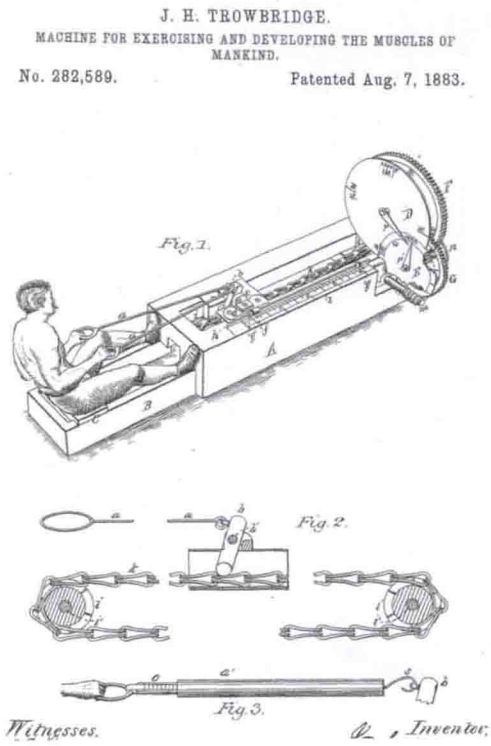
J. H. TROWBRIDGE.
MACHINE FOR EXERCISING AND DEVELOPING THE MUSCLES OF MANKIND.
No. 282,589. Patented Aug. 7, 1883.
Fig. 1.
Fig. 2.
Fig. 3.
Witnesses.
Inventor.

Fig 1.2 Another rowing machine patent, from 1883: 'A machine for exercising the muscles of mankind' (courtesy of US Patent Office)

rowing for pleasure was a 'gentlemanly' activity, and one which is described in Jerome K Jerome's novel *Three Men in a Boat*, published in 1889.

Another influence on the development of the rowing machine is likely to have been the cult of physical fitness amongst 'gentlemen', which began in the mid 1800s. Newspapers of the day carried adverts for a range of patent devices for exercising muscles.

The early rowing machines were designed to simulate the rowing action and to provide an opportunity to maintain fitness indoors. In this sense, they are the forerunners of the huge range of fitness machines that are now available. These early rowing machines had fixed seats, much like the boats they were modelled on. A much later development was the sliding seat that enabled rowers to take a longer stroke. This is thought to have originated when Thames Watermen greased their seats so that they could slide up and down on them.

From the 1960s the coaching of rowing became based less on intuition and more on evidence from accurate testing, therefore, there was a need for a machine that could accurately measure the force that rowers could exert, and also the level of fitness they had achieved. This is now known as evidence-based coaching. A more detailed description of the methods of testing can be found in chapter 8.

This need for testing stimulated the development of a new breed of rowing machines that could provide accurate data and would be a useful training aid. One of the first of these was developed in Australia in the early 40s and, using the Greek words for work (ergon) and measure (metron), it was given the name 'ergometer'. The three people involved in this development were Frank Cotton, Professor of Physiology at Sydney University, John Harrison, an engineer, and Ted Curtain, a welder and boilermaker. Frank Cotton believed that in rowing (and in other sports) there was too much emphasis on style. He wanted a machine that would prove that fitness and power were much more important factors. John Harrison, a successful surf rower, was tested on an early version of the ergometer which indicated that he had huge potential as a flat water rower. This proved to be the case when he rowed for Australia in a coxless four at the 1956 Olympics. Both John Harrison and Ted

Curtain made significant contributions to Frank Cotton's first machine to provide the basis of the modern ergometer – and a system for objective research into fitness and power. John Harrison was offered a lectureship in mechanical engineering at the University of New South Wales where he completed a PhD in 1966 on the design of a universal ergometer. Rowers will be interested to know that he is also credited with the development of the big blade and the use of computer-aided design to develop modern racing boats. He also predicted that an ergometer would not be able to accurately represent the action of rowing in water until it had a fixed seat with a moving footrest. Several of the machines developed by Cotton, Harrison and Curtain were built in and used in rowing clubs in Australia. One of these machines has survived and is in the collection of exhibits at the River and Rowing Museum at Henley on Thames in the UK.

Fig 1.3 The first ergometer. Professor Frank Cotton is in the white coat (courtesy of Leichhartd Rowing Club, Sydney, Australia)

A version of this Australian machine was exported to the United States and used in the selection process for the 1968 Olympic rowing team. This machine was developed further by the Gamut Engineering Company of California and used extensively in rowing training in the United States throughout the 70s.

However, what enabled the sport of indoor rowing to develop was the adoption of the

Fig 1.4 A Gamut ergometer on display at Florida Institute of Technology (courtesy of Florida Tech Athletics)

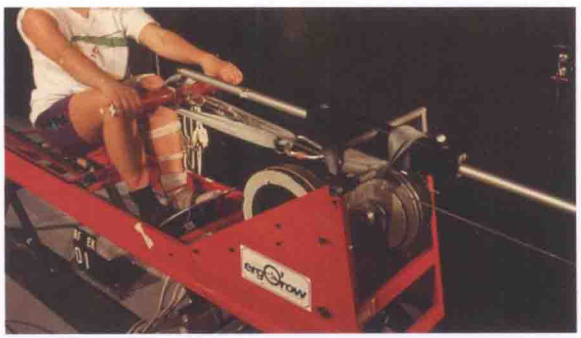

Fig 1.5 Another machine that provided valuable research data in the 70s was the Gjessing ErgoRow (courtesy of Professor Gordon E. Robertson of the School of Human Kinetics, University of Ottowa)

Concept2 as a standard machine that enabled comparisons to be made across all rowers. The range of Concept machines was developed by Peter and Dick Dreissigacker, two brothers who were both very successful rowers. Dick Dreissigacker rowed for the USA in the 1972 Olympics. In 1980, after establishing a successful company for the design and development of oars, they decided to diversify into other products. After considering such items as masts for windsurfers and ski poles, they eventually decided to develop a training machine for rowers that would be cheaper than the Gamut or the Gjessing models that cost around $3000 at that time. Their first prototype was made from bicycle parts. This quickly developed into the first production model, costing $600. The market need was quickly established with an order for 20 of the Model A machines for Columbia University, which were fitted with a bicycle computer to provide a measure of speed and distance. A significant breakthrough was made with the Model B, which was fitted with a display unit that gave much of the information that is now seen on the latest PM4 display units, such as split times and set workouts.

Fig 1.6 The first prototype Concept rowing machine (courtesy of Concept2)

This turned it into a much more sophisticated training machine that could be used to monitor individual progress, as well as a means of fair testing athletes for their potential as competitive rowers. Concept2 machines are now the accepted standard for competitions – and for use in rowing clubs throughout the world.

Fig 1.7 The first production Model A Concept rowing machine (courtesy of Concept2)

THE DEVELOPMENT OF NATIONAL AND INTERNATIONAL COMPETITIONS

By 1982 a group of ex international and Olympic rowers known as the Charles River All Star Has-Beens (C.R.A.S.H.-B.) was organising competitions using rowing machines provided by the Dreissigacker brothers. This grew into the World Indoor Rowing Championship, although it is still affectionately known as the CRASH-B. There are now national and local competitions held in most countries that participate in international rowing events.

In 2010, at the 20th British Indoor Rowing Championship (BIRC) there were over 2200 competitors. The oldest (who set a world record) was 100 years of age.

Fig 1.8 The C.R.A.S.H.–B. sprints (courtesy of C.R.A.S.H.–B)

Today, there are also many indoor rowing sports events that are not based on racing over a set distance. Many clubs and organisations now use rowing machines for fund-raising events and challenges. They also offer fitness classes in which activities take the form of non-competitive games.

COMPETING OVER THE INTERNET

It is now possible to compete against another person on your rowing machine without ever leaving your home. Using a combination of a computer, a connection to the Internet, software such as Skype and a webcam, you can link up with others to organise your own race.

ADAPTIVE INDOOR ROWING

This is a sport that developed from the wider movement to provide access to indoor rowing for people with different forms of disabilities.

The first adaptive sports competition for those with disabilities was in 1924 in Paris. The Silent Games was a version of the Olympic Games for deaf people. After the Second World War there were rehabilitation programmes for injured soldiers and civilians involving games that were adapted from various sports. In 1948 the Olympic Games was held in London, during which a wheelchair Olympics was held at Stoke Mandeville hospital. This movement gradually resulted in the modern Paralympic Games that now runs in parallel with the Olympic Games. There are also adaptive competitions in several other World Championship events. It is possible that, in the future, indoor rowing might become an Olympic event.

Fig 1.9 Adaptive events organised by UcanRow2 in the United States (courtesy of UcanRow2)

There are now adaptive categories in some indoor rowing events. One such category is for wheelchair users. This requires a wheelchair to be in a fixed position in front of an adapted Concept2. The use is limited to arms only or arms and body.

One very interesting development is that the sport of indoor rowing is opening up to people with spinal cord injuries (SCIs), which cause paralysis of the lower part of the body. Using a system called Functional Electrical Stimulation (FES), muscles can be stimulated through electrodes on the surface of the skin which then cause paralysed limbs to move in a set sequence –

Fig 1.10 Robin Gibbons, a champion FES rower (courtesy of Robin Gibbons)

such as that of the leg action needed to operate a rowing machine. Since 2004 there has been an FES section in the British Indoor Rowing Championship (see Robin Gibbon's case study, p. 153).

Rowing machine systems that supply exercise for paralysed limbs can provide enormous benefits such as improved fitness and blood circulation, which can help to avoid diabetes and respiratory disease.

Although indoor rowing is a sport that began with rowers using rowing machines as part of their training programmes, the rate of growth has been such that there are now more non-rowers than rowers taking part – and certainly more people using rowing machines than rowing on water.

Summary

- Indoor rowing, as a competitive sport, is growing rapidly
- Rowing machines have been used for over one hundred years but it is only in the last 30 years that a standard machine has been developed that is suitable for competitions
- Internet technology means that individuals and groups can compete against each other in any part of the world where Internet access is available
- Rowing machines can be modified easily for use by adaptive athletes.

HOW ROWING MACHINES WORK

2

This chapter explains some of the basic mechanisms and technology used in rowing machines. The main purpose of a rowing machine is to simulate the action of rowing with an oar in the water. For example, when the oar is placed in the water at the beginning of the stroke, the boat is driven forward through the water by pushing with the legs and pulling on the handle. At the end of the stroke the oar is extracted from the water and moved forward for the next stroke. Good rowing machines simulate the 'feel' of this action. Even the best machines provide only a limited simulation and the search continues for a machine that will give exactly the same feel of an oar in the water. For the sport of indoor rowing this is not essential, but as a tool for training rowers, it is much more important.

CREATING RESISTANCE

There are five basic methods for creating resistance (i.e. imitating water resistance) on the handle of a rowing machine when an athlete gets into position and begins to row.

Keypoint
A rowing machine aims to simulate the action of an oar in the water.

1. A MECHANICAL BRAKE

The simplest method, found on low cost rowing machines, uses a wheel with a form of brake which slows the wheel down, and which can be adjusted to change the force required to spin the wheel. This is similar to the system used on many static cycling machines. It was also used on the original Gjessing machine mentioned in chapter 1.

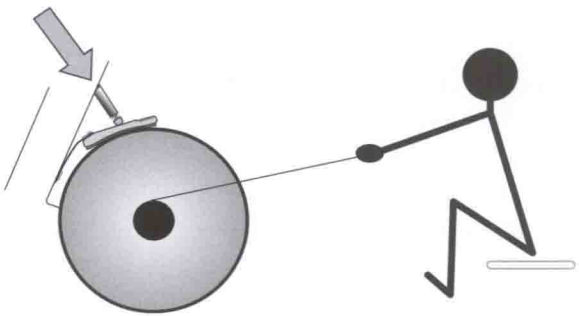

Fig 2.1 Brake mechanism

The cord is wound around a pulley which has a free wheel recoil mechanism similar to that of a starting cord for an outboard motor or

petrol powered lawnmower. This provides a very poor 'feel' for the rowing action because the wheel slows down quickly between strokes causing a heavy load at the beginning of the stroke.

2. HYDRAULIC RESISTANCE

This was popular in some of the early designs such as the Gamut machine mentioned in chapter 1. The system is still used on compact designs for home use.

Fig 2.2 The Beny improver dual hydraulic rower (courtesy of Beny Fitness Equipment)

The resistance is provided by hydraulic cylinders that have the appearance of bicycle inflaters. These 'inflaters' are filled with oil which provides a steady resistance as the piston moves through it. The piston is fitted with a one-way valve that provides resistance in the drive phase but hardly any resistance in the recovery phase.

3. THE AIR IMPELLER

This is in fact an air pump that is in wide use both in the home and in industry. The most obvious examples that can be found are the hairdryer and vacuum cleaner. Both are devices for blowing air, which is what happens in the Concept2 machines and others that use the same system.

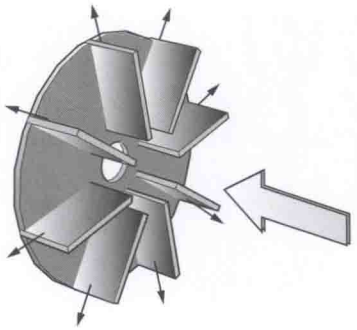

Fig 2.3 The impeller

As the impeller spins, the air is moved away from the centre by centrifugal force. As the air moves away from the centre, more air is drawn in to replace it. This effect can be felt by holding a book or magazine at the bottom edge and flicking it around like a fan.

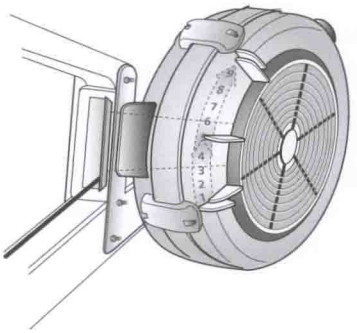

Fig 2.4 The damper lever that changes the effort required to row on the machine

In the case of a hairdryer, the air being forced to the periphery of the impeller is captured by a casing and is directed out through a nozzle. With rowing machines that use this system the air is allowed to escape through small holes around the perimeter of the impeller casing. By restricting the amount of air