

The relative efficiency of the safety bicycle has led Wilson (1973:82) to conclude that for travel it is ergonomically 'the optimum design'. Whitt (1974:80), however, points out that in particular circumstances trained riders could do better 'with various alternatives such as additional hand cranking or by adopting a recumbent position with the normal pedal-and-crank system'. That the basic safety design of some 85 years standing has not been effectively altered Whitt (1974:221) attributes not to the machine being 'the ultimate in man-powered vehicles', but rather to the fact that the internal combustion engine and automobile 'siphoned off all the adventurous mechanical engineers and backyard mechanics'. He agrees, however, that for 'all-round efficiency under the most commonly encountered circumstances the normal pedal-and-crank system with the rider in the vertical position is a well-proved method of human power generation' (Whitt 1974:79). Interestingly, two Australians in Gympie, QLD, built and tested a machine in 1896 that used manual propulsion in addition to the normal pedal and cranks (Austr 20/6/96:1172); unfortunately no other information has been obtained on it. Also, while recumbent machines may prove more efficient in some respects, it is doubtful they would prove so in rough rural conditions. The increased padding and springing necessary to minimise the trauma of shocks and vibrations to the expansive, supine trunk, and the problem of attempting to steer through the bush from that position, could well negate any advantages in pedalling efficiency.

Power Output

'It may be the finest machine built, but it won't go without pushing'.

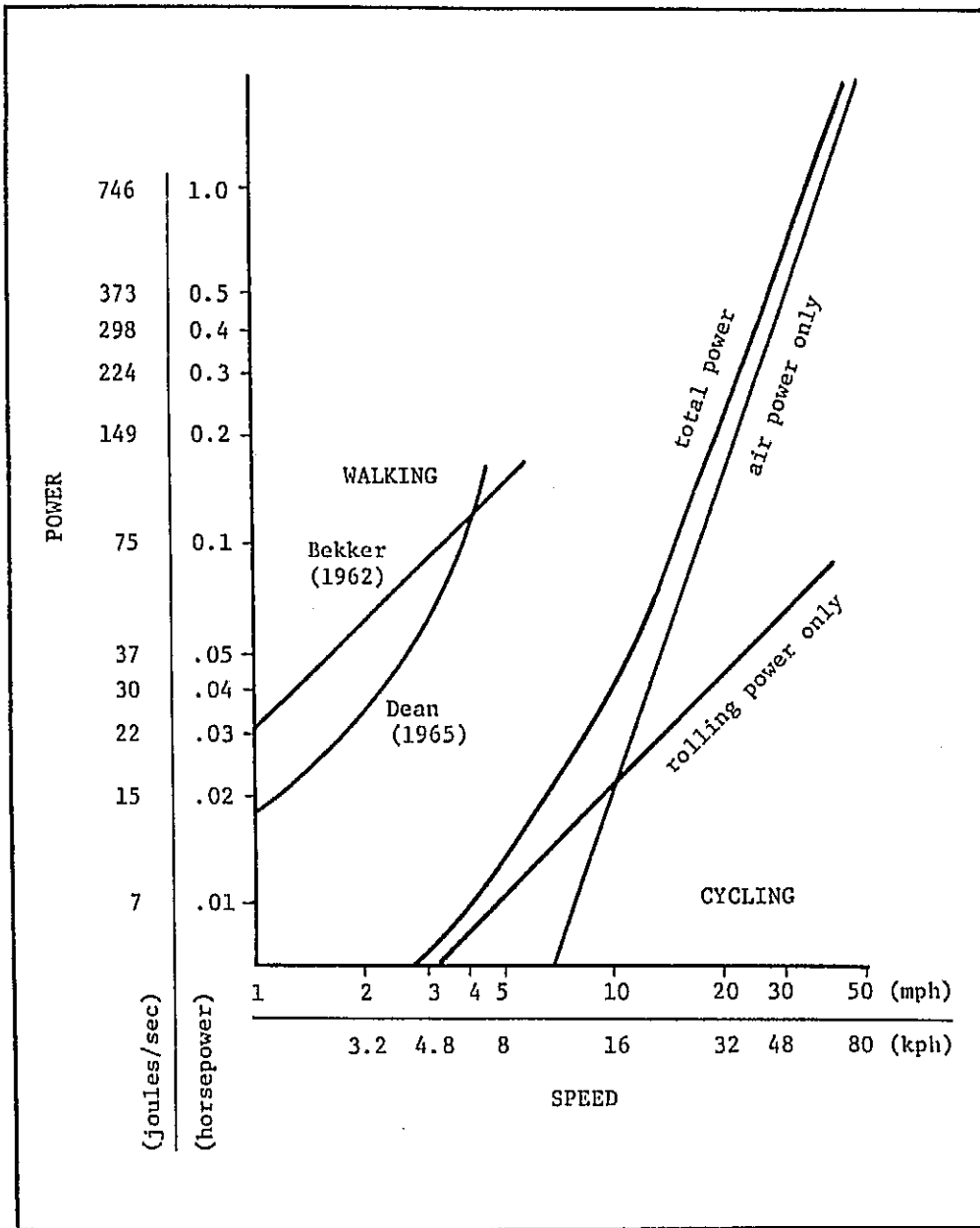
(Anonymous)

The maximum power output measured for a cyclist, although sustained for only five seconds, was 1.5 horsepower (1,119 J) (Whitt 1974:22). For

longer periods of intensive effort, such as 12 hour time trials, trained riders can produce an average of about 0.33 horsepower (246 J), and for 24 hour periods about 0.22 horsepower (164 J) (Whitt 1974:39). For a wide variety of tasks -- towing a barge, turning a winch, climbing a staircase, walking on a treadmill -- a man not engaged in competition and intending to work for a prolonged period will adjust his power output to about 0.1 horsepower (75 J) (Whitt 1974:12); 'These conditions are thought to be such that an average fit man could work for several hours without suffering fatigue to an extent from which reasonably rapid recovery is not possible' (Whitt 1974:28). This amounts to about half of a man's breathing capacity and would mean a bicycling speed of 9 to 13 miles per hour (14 to 21 kph), and a walking speed of about 3.5 miles per hour (5.6 kph) (Whitt 1974:14). An ordinary untrained bicyclist can maintain only about 0.05 horsepower (37 J) for a useful period; this would result in a cycling speed of about eight miles per hour (13 kph) on the level with no wind (Whitt 1974:18-19). Figure 3.2 summarises the power requirements for a walker and crouched racing cyclist; for an erect rider on a modern touring bicycle, the required power would be about 20 percent greater (Whitt 1974:23).

However, all of the above values relating power output to cycling speeds have assumed smooth, hard surfaces and the type of tyres used on bicycles today. In considering the implications of power output for rural Australian travel it must be appreciated that riding circumstances were often quite different. Cyclists formerly used broader roadster tyres at lower pressures than those commonly fitted today. Also many bush cyclists used 'thorn proof' tyres that were thicker, more rigid, and 'heavier' to push. As well, they occasionally modified their tyres by inserting leather, rubber, hides, or other materials inside the tyre to increase puncture resistance. All of these factors meant a greater rolling

Figure 3.2
WALKING AND BICYCLING POWER REQUIREMENTS
(Whitt 1974:25)



resistance than normally encountered today.

In addition rural travellers often carried considerable weight on their bicycles and the effect, both in terms of tyre distention (and increased rolling resistance) and increased wind resistance resulting from large swags on the handlebars and forks, is unknown.

Also, while some bush cycling surfaces such as hardened clay pans and camel pads were probably as smooth as the concrete and bitumen surfaces on which modern cycling measurements are commonly made, much rural Australian cycling was done on soft surfaces ranging from firm roads and tracks to sand and mud. Whitt (1974:103) notes that although 'wheel motion upon soft ground is of great interest to agricultural engineers and military-vehicle designers, this type of work is of less general interest. As a consequence, less information is available for the resistance offered by soft surfaces to the rolling of a wheel compared with that produced by hard roads'.

In summary, because of a lack of accurately established values for wind resistance, tyre rolling resistance, weights carried, and surfaces travelled, it is impossible to convert the average 0.1 horsepower (74 J) output of a cyclist, for example, to a mean travel speed in the rural Australian environment. However, there are numerous records of cyclists' performances throughout the continent in many situations, and these allow an appreciation of the general degree of man-machine efficiency over a wide spectrum of conditions. These are discussed in a later section.

'Work' and 'Travel'

In modern society travellers expend relatively little work in the course of their journeys. In contrast, in 1890 the limited railway and riverboat networks left vast spaces to be covered by horse or horse-drawn

vehicles, camels or on foot.

Horses and camels were not without their physical demands. Horses had to be cared for and caught and for short distances it was often quicker to walk. Camels, too, involved much work. In numerous narratives of camel travel in the Western Australian goldfields the amount of time spent gathering the wandering animals is commented upon. They commonly carried a bell and were allowed to forage for feed during the night. While one might be lucky and collect them within a few minutes, it was not unusual to have to spend perhaps 30 minutes to an hour catching them, occasionally longer. Broomhall (1976), for example, during his work on the Western Australian rabbit fence, once spent an entire day walking down his camels and bringing them back to camp.

Teamsters using horses or camels walked alongside the teams. Carting contractors such as Barker (1964) casually mention contracts involving trips of hundreds of miles; such transport workers routinely walked thousands of miles annually. Swagmen, shearers, rouseabouts and other rural workers were perennially on the move between jobs, frequently walking. Chinese walked from Darwin to Queensland, for example (Clune 1942:143), families walked the Nullarbor (Bolton 1976), and Queensland prospectors with the gold fever walked to Coolgardie (Young 1953:89). It was an era when a couple with a child walking to Sydney from Ardglen, NSW, were concerned not with the 200 miles (320 km) facing them and the time and effort required, but whether or not the tyres of the pram 'would see the journey out' (Tritton 1964:15).

The perception of time, distance, travel and work were very different from today, and can probably only be fully appreciated by those totally and irrevocably confined within its framework. As Tritton (1964: 22) points out, 'Thirty miles from tree to tree does not seem much in a motor car, but padding the hoof is a different matter especially under a

burning sun'. From this perspective the bicycle was very attractive. When it was first introduced it must have seemed like a gift from heaven. The same effort formerly used in walking 10 miles (16 km) could now get a traveller -- depending upon surfaces and terrain -- up to 40 miles (64 km). The context of its introduction caused it to be seen from a perspective quite foreign to us today. Interestingly, I have not found the term 'pushbike' (so commonly used in Australia during the past few decades) in any literature published prior to 1900. The term appears to have been first used to distinguish between human-powered and motor-powered bicycles. The 'pushbike' was born of the age of the internal combustion engine; previously there were only bicycles.

Gearing

In the 1890s Australian bicycles had only one gear and the rider had to select a ratio for the conditions he expected. Pearson (1925:14) used gearing ratios (Table 3.1) of 49 and 55 for his solid-tyred machine. The Austral Wheel (6/98:166) recommended a gearing of 63 for pneumatic-tyred tourers, and gears of 65 to 70 were most common. Murif rode a 62 gear on his Adelaide-to-Darwin ride (Dashwood 1897). As track racing machines influenced matters, there was a tendency for a while in the 1890s to supply roadster bicycles with ratios of 85, occasionally higher; this resulted in outcries from touring cyclists (AuWh 9/96:249). The White/MacKay party carried three rear cogs so as to be able to vary the gearing (63, 73, and 84) to suit the country (AuWh 7/99:197). Unfortunately a later description of the trip (Clune 1942) never discussed the results of the attempt. MacDonald (ACA 1898:34) used a 59 gear from Darwin to near the (now) South Australian border, then changed to a 66 for the remainder of the journey to Melbourne (via Adelaide).

Table 3.1
GEARING RATIO

$$\text{Gearing ratio} = \frac{T_f}{T_r} D$$

T_f = number of teeth on the front sprocket
 T_r = number of teeth on the rear sprocket
 D = Diameter of the rear wheel in inches

Multiple gears were not common in Australia until the turn of the century. The two-speed Collier, patented in 1889 (Caunter 1955:40) and improved subsequently, was tested and recommended by Melbourne cyclists in 1896 (AuWh 4/96:98); it was locally available but not much used. It was not until the advent of the freewheel that multiple gears were first practically available. In 1902 Henry Sturmey and James Archer patented the Sturmey-Archer three-speed hub, 'the prototype for the great majority of cycle gears which have subsequently been produced' (Caunter 1955:47). The Eadie two-speed hub gear, patented in 1903 (Caunter 1955:48), incorporated a backpedal brake. The Sturmey-Archer and Eadie hubs were the most commonly used in Australia for many years. The multiple geared hubs became quickly available, and were relatively cheap; Anthony Hordern (1907), for example, would supply them on a £13-10-0 machine for an additional £1-10-0.

How widely multiple gears were adopted for rural use is difficult to assess, but the impression is that they were not particularly common. Initial acceptance would have been restricted by the potential repair problems, because they were complex, difficult to work on, required specifically engineered spare parts (Riley 1976), and were therefore not amenable to easy bush repair. Costello (1977) said that geared bicycles were not common in the Kalgoorlie area, for example, until the 1930s, and Riley (1976) said the same of Collie, WA. He attributed this partially

to general inertia, lack of experience with multiple gears, and the fact that single gear machines 'sufficed'. A three-speed hub was fitted to at least one bicycle used by the Western Australian rabbit fence patrol (Crawford 1976).

The lack of widespread use of multiple gears in rural areas may have resulted partly from the fact that they were not as effective or necessary as might be thought. Evidence shows that given power outputs can be obtained most effectively within a given range of pedalling rates (Whitt 1974:31). High power outputs require pedalling rates in the range of 100 to 200 revolutions per minute; however, an output of 0.1 horsepower (74 J) (such as is maintained by non-competitive travellers over a prolonged period of time) would produce a speed of about 10 miles per hour (16 kph) at a pedalling rate of 50 revolutions per minute (Whitt 1974: Table 2.1) (using a gearing of 68 and a $6\frac{7}{8}$ " (17 cm) crank length). Moreover, this is the pedalling rate at which the maximum muscle efficiency is achieved. Even more importantly however, is the fact that when producing 0.1 horsepower (74 J) output, there is very little decrease in muscle efficiency between about 33 and 70 revolutions per minute (Whitt 1974:31-32). Further evidence suggests that a non-trained cyclist can produce 0.05 horsepower (37 J) for prolonged periods at pedalling rates as low as 20 revolutions per minute (Whitt 1974:18).

The conclusion is that for a rural cyclist producing 0.05 to 0.10 horsepower (37 to 74 J), pedalling rates of from 20 to 70 revolutions per minute are feasible. Hence, a range of gradients, heavy surfaces, and wind resistance can be accommodated by increasing or decreasing pedalling speeds accordingly, without a great loss of muscular efficiency. In contrast to racing cyclists, a slower traveller has great latitude in his pedalling rate. Riley's observation that a single gear 'sufficed', was probably quite accurate. Further evidence to suggest this is contained

in the comment of a modern cyclist who toured the Cooma-Adaminaby area. He was surprised that his five-speed gearing system 'seemed more handy on the bitumen than on the dirt' (Peterson 1976:9). Derailleur gearing systems, commonly fitted to machines today, were developed in France about 1909 (Caunter 1955:48). Evidence does not suggest they were used by rural Australian travellers and workers.

Rates of Travel

The speed of the cyclist was a source of much amazement. There was an ever-accumulating lore of the apparent near-invincibility of mechanically-extended man when matched against other animals; the line between fact and fiction was understandably blurred on occasion. An African cyclist in what is now Malawi won an (unexpected) race against a lion (SyMail 24/12/98:1581), and another lost a race against an ostrich ('in a mile race the bicycle wasn't in it, although in a long distance it would, no doubt, wear the bird down') (AuWh 10/96:301). Not surprisingly, the first reports of American Charles W. ('Mile-a-minute') Murphy's ride of over 60 miles per hour (96 kph) (Smith 1972:138) were not believed by many Australian newspapers (WACy 21/7/99:14). In Australia the exploitation of the man-machine combination was no less fervent and cyclists were pitted against pedestrians, horses and each other in a variety of conditions. At distances of greater than about 100 yards (91 m) the cyclist (from a standing start) could outspeed a pedestrian; over about two miles (3 km) a horse could be beaten -- the longer the distance, the greater the margin of victory for the cyclist. In Queensland a horseman with two mounts (to be used as he wished) raced a cyclist over 80 miles (129 km). The horseman was given an hour's head start; the cyclist passed him after 60 miles (Fitzpatrick 1978j). The fastest camel ride between Coolgardie and Southern Cross took 21 hours (Casey

1973:51); pedallers did it in half that time (Chapter 5).

Equally amazing was the ability of cyclists to maintain relatively high speeds for long periods of time. After one lady in the Melbourne area had journeyed some 120 miles (193 km) in one day, the Austral Wheel felt obliged to comment: 'The present craze ... is simply a result of the novelty of the new mode of travelling; the experience of covering, in rapid time, long distances by one's own unaided exertion is new, and it is no wonder perhaps that people go to extremes'. The writer suggested that 30 to 50 miles (48 to 80 km) a day was quite sensible for touring (AuWh 1/96:2). But the touring 'extremes' of 100 miles (161 km) in a day became commonplace.

Australian women clearly demonstrated the potential of the machine for personal travel. Australia's pioneering long distance lady cyclist was Mrs. E.A. Maddock, of Sydney. She first started riding in 1893 with a 300 mile (483 km) ride to Bega, NSW, averaging 60 miles (96 km) a day. Next year she completed the Sydney - Melbourne ride in nine days -- the first woman to do the journey on other than a tandem bicycle. In 1895 she and her husband covered 1,600 miles (2,570 km) on a return trip from Sydney to Brisbane. They took the coast route north and returned via the New England Highway, averaging 80 miles (129 km) per day on the southward journey (CyGaz 14/8/97:16). By 1897 the Sydney - Melbourne ladies' record was lowered to six days and 13 hours (WesMail 8/1/97:13). In late 1898 Mrs. H.P. Nicolls did it in six days and 7 hours in rain and headwinds (AuWh 11/98:331); flushed with success she ventured she would try the Nullarbor next (AuWh 1/99:15), but the ride never eventuated. As indicated in Chapter 2, in 1893 Percy Armstrong set the absolute record of four days, 4 3/4 hours for the Sydney - Melbourne route, which stood for five years.

As well, riders were proving that distances could be covered quickly on other than well-travelled roads. An 1897 Broken Hill - Adelaide cycling record attempt was abandoned by a rider because the road was too rough (MorHer 15/12/97:2); the following year another rider left the road at Cockburn (near the South Australian border) and headed straight across country to Burra, SA; he rode through the night across paddocks and along tracks (Dunfile) averaging 9.2 miles per hour (14.8 kph). An Adelaide-to-Melbourne record cycling ride in late 1897 required considerable carrying, walking and pushing of the machine along the Coorong route, but the nearly 545 mile (277 km) journey was done in less than 52 hours (AuWh 11/97:352). When a medical emergency developed, a station hand negotiated the 180 mile (290 km) return trip between 'Nonning' and Port Augusta, SA, in 24 hours (McTaggart 1977a). And Patsy Durack (1899) felt that Richardson's journey from Wave Hill to Victoria Downs, NT, in two days was a 'worthy performance, knowing as I do the state of the road'. When a group left Eucla, WA, for a party on New Year's Eve, a cyclist 'easily beat the horses and camels', and had a fire going when the other arrived (EucRec 7/1/99:7).

Bicycles established a new frame of reference for rail service. The newly opened Leonora - Malcolm, WA, line allowed one hour for the 12 mile (19 km) journey; locals complained that one 'could do it quicker on a broken down bike' (LeoMin 31/5/02, cited in McGowan 1968:182). Snell's ride of 2 hours and 3 minutes over the 33½ miles (54 km) between Niagara and Menzies, WA, was noted as 'about one mile per hour faster than the average Western Australian train runs' (MorHer 19/8/97:2). The result was not necessarily different over greater distances; in the 1897 Beverley-to-Perth cycling road race the starter and his contingent arrived back in Perth two hours after the winner, despite having taken the train over a distance some 15 miles (24 km) shorter (WAWh 1/10/97:8). Hubert Opperman's 251 mile (404 km) Albany-to-Perth ride of 12 hours

38 minutes in 1937 was 2 hours 57 minutes faster than the train, a fact pointedly noted by the press (Opperman 1977:213).

In relatively short rides men could build up an energy debt. Overland riders, in contrast, had to allow for sustained effort over a prolonged period. Consequently they provide a good indication of the limits of man and machine in cycling across rural Australia. A summary of their travel times follows; a detailed discussion of their exploits is given in Chapter 5.

The first trans-Nullarbor crossing was made in late 1896, requiring 31 days from Coolgardie to Adelaide. By 1900 nearly a score of known riders had completed the journey, all but one having gone from west to east. The roads and tracks were primitive and riders utilised paddocks and bush tracks to save time, distance, and avoid rough stretches. Without record-setting in mind, it appears that a comfortable ride required less than a month from Perth to Adelaide (about 60 to 70 miles (96 to 113 km) per day), including laying over for a half day or more at various points to recuperate from heat exhaustion, illness, rough stretches, or merely to visit with the isolated homestead occupants. One rider rode from Fremantle to Adelaide in 18½ days, averaging 103 miles (166 km) per day, and another rode from Fremantle to Rockhampton, via Melbourne, in only 60 days.

The variety of distances covered and speeds sustained by rural cyclists carrying food, water and equipment reflects the varying capacities of the men, the nature of the country traversed, and their fortunes or misfortunes concerning the machines, accidents, weather and health. Records show that distances of 60 to 70 miles (96 to 113 km) per day were reasonably and comfortably attainable under the circumstances in which most bush cyclists rode. Extremes of physical conditions and

varied motivation resulted in a range of travel from about 15 miles (24 km) to well over 200 miles (322 km) in a day.

Multiple Users of a Bicycle

'You would be surprised what distances could be covered by two mates ... by this method of transport'.

(Smith 1977a)

Men occasionally shared a bicycle during their travels. By loading their swags on the machine and alternatively riding and walking/jogging, two men could approximately double the distance travelled by a pedestrian in a given time. Duke Tritton (1964:65) noted that two men could, without difficulty, do 50 miles (80 km) a day. He described one instance in which four men utilised a horse-drawn sulky and bicycle for their travel. Dave, the owner of the sulky, rode in it exclusively during the journey. The other three loaded their swags on the sulky and 'I rode with Dave. Jack rode the bike a few miles then leaned it against a tree and started walking. Dutchy ran behind the sulky till he came to the bike. Then he mounted it and rode past Jack. When he caught him up he got in the sulky and I ran behind, till we came to the bike. Then Jack took over and the performance was repeated' (p. 65). In these situations the distance covered in a day was less than could be done on a bicycle alone, for the machine itself spent much of its time resting somewhere until someone managed to come up to it, and mount it to continue. Also, in the instance just described, the ultimate daily travel was determined by the limitations of the sulky carrying the swags. Tritton reported that the sharing of a bicycle for travel by swagmen was 'used a lot in the bush' (p. 65). Smith (1977b) recounted that in the Northern Territory, circa 1937, he and a partner used the 'ride and tie up' technique to alternately ride and walk stretches of about a mile (it was

too hot to jog). Sadly, he suggested that the same method would not be practical now in many areas because the bicycle would be pinched! (This technique was not exclusive to rural Australian travellers. After the collapse of the Nazi Party's Beer Hall Putsch in November, 1923, Rudolph Hess was left stranded in Tegernsee, 30 miles (48 km) south of Munich. He telephoned his fiancée to find some transportation to get him back to the city. She pedalled to him and they returned by alternatively riding and walking. The idea was reportedly Hess's (Toland 1977:236-237).

Tandem bicycles were used almost exclusively in Australia in higher social circles and for track racing. They normally had front-and-back seating, although the side-by-side Sunbeam model was imported (AuWh 5/96:128). The few references to their appearance in rural areas, such as at Wagga, for example, (AuWh 6/99:182) attribute them to ex-urban tourers. However a tandem was used by a pair of Western Australian cycle agents to tour their goldfields cycle shop network (MorHer 23/8/98: 2).

Distance Measurement

Many Australian cyclists used cyclometers, principally American ones. (In the 1890s even the British commonly used United States models, which were about one-third the price of English cyclometers (Pemberton 1897:120)). Although there were occasional references to their inaccuracy (AuWh 8/97:261) and 'unreliable nature' (AuWh 6/99:161-162), the lack of mile posts on most roads resulted in many riders fitting them (AuWh 6/98:166). They were used by the Blakeley (1938:191) party on their 1908 ride from White Cliffs, NSW, to Darwin; ten years earlier, Coleman (1898f:253) had counted telegraph poles to measure distances across the centre. Patsy Durack's (1899) meeting with Arthur Richardson near

Victoria Downs resulted in few comments in his diary, but the fact that the cyclist had covered 2,587 $\frac{3}{8}$ miles (4,163.1 km) since leaving Perth was one of them. Unfortunately the cyclometers were occasionally torn off the front wheel by limbs and brush, and many rural cyclists consequently never fitted them (WACy 18/8/99:6). However, the development of an American model that hung inside the spokes eliminated that problem (AuWh 8/99:266). Garratt (1899:218) was not as enamoured of the devices however; he thought that a rotameter (a small wheel used to measure directly from a map) was 'really much more useful, as they tell you how far you have to go before you start, which is much more important than telling you how far you have been when you have finished'.

The Freewheel

'... it is doubtful whether the ordinary, more or less athletic male rider will ever be much interested ...'

(Garratt 1899:201)

'The "freewheel" indeed is ... the only new development of value in recent years, and compared to it the controversies with regard to chainless machines, changeable gears ... etc. ... are of very secondary interest'.

(Austral Wheel 9/99:243)

Freewheels were not generally available in Australia until 1900. On fixed wheel machines the pedals always turned when the rear wheel rotated, and vice versa. The result was that in 'coasting' downhill a rider had to keep pedalling or else lift his legs clear of the whirring pedals. When pushing the machine the cyclist had to avoid the rotating pedal, often maintaining an uncomfortable distance between himself and the machine. Consequently, some bicycles were fitted with a pin or screw on the headset that would lock the front wheel into a straightahead position, creating one rigid unit. The cyclist could then push the

bicycle from behind the seat, beside the handlebars, or even pull it along -- well away from the constantly rotating pedals -- without having to control independent frame and front wheel assemblies.

Freewheels were apparently first fixed to standard safeties in England in 1897 (Caunter 1955:37). A freewheel was reportedly ridden by two New Zealanders in Melbourne in 1897 (Special 1899:9). Both chainless bicycles and freewheels were 'only 1-in-a-hundred' on Melbourne roads in mid-1897, although the admonition was 'wait till next season' (AuWh 7/99:201). In 1898 an American 'Eclipse' freewheel with coaster brake was available in Melbourne (AuWh 11/98:325), and in 1899 Eadie and B.S.A. freewheels were 'readily available' (AuWh 11/99:310). The first freewheel was introduced into Western Australia in September, 1899 (WACy 29/9/99:9).

The first reactions to freewheels varied, but were generally favourable. Early reports noted that there would be fewer problems from chains flying off rapidly whirring pedals on fast downhill runs (AuWh 2/99:42). The editor of the Austral Wheel reported on his first experience with one in May, 1899 (AuWh 5/99:132); he was impressed by the fact that there were none of the oscillations that resulted from the rapid leg movements in following fixed wheel pedals on a downhill coast, nor was there the 'violent swaying inseparable from vehement struggles' to hold a fixed wheel machine by 'fierce back pedalling'. While he reported an 'exhilaration' in riding it, he had doubts as to whether they would ever be cheap or dependable. A Western Australian cyclist questioned whether they would ever be of use on the roads of his colony (WACy 29/9/99:9).

The devices apparently caught on quickly. By 1900 they were being seen with increasing frequency in Melbourne (Experienced 1900:7) and in Western Australia they were 'starting to catch on' by early 1901 (WASp 25/5/01:2). Anthony Hordern and Sons advertised freewheels as

standard items in their 1907 catalogue; fixed wheels were £2 cheaper (Hordern 1907:302). However, fixed wheels were still fitted to bicycles for several decades. In the 1930s, some bicycles bought in New South Wales (Fisher 1977) and by the Western Australian police department (Western Australian Museum) had fixed wheels; Kalgoorlie pipeline patrols were still using them in the 1940s because they were not deemed an inconvenience on level stretches (Keating 1944). In hilly areas, though, where freewheels were seen to best advantage, they were quickly adopted; in Collie, WA, for example, virtually all machines were fitted with them in the 1930s (Riley 1976).

The freewheel made riding much easier by allowing relaxed coasting and the ready incorporation of a simple, reliable, and effective back pedal or coaster brake, something which had bedeviled previous cycle designers. In hilly areas, in particular, these factors were important in enhancing the machine's utility and will be discussed in detail in Chapter 4. Of lesser importance, but undoubtedly appreciated by beginners, was the fact that it made it much easier to learn to ride. Trying to learn to balance, steer, and pedal while mastering the perennially whirring pedals of a fixed wheel, and having an often poor (or no) auxiliary brake meant many falls and skinned shins and ankles that could be avoided with freewheels (Fitzpatrick 1976d).

For the rural traveller the freewheel was, aside from the pneumatic tyre, the most important advance ever -- not because it meant easier and safer riding, but because it radically altered the cargo carrying nature of the machine. The fixed wheel bicycles commonly had a small step near the rear axle which was used for mounting and dismounting when the machine was moving (Albemarle 1896:239). If a cyclist had to dismount at speed, whether from losing control of the whirring pedals, inadequate braking capacity, or a sudden obstacle looming up, he had to resort to

the step as an emergency exit and literally step off backwards. This 'rear exit' was an essential element of fixed wheel cycling and it was not sensible or tolerable that any luggage restrict its use (Garratt 1899:207). After the freewheel was introduced the pedals themselves, which could remain stationary, served as sideways dismounting steps, and loads could consequently be placed over the rear wheel.

Strangely, no discussion of this benefit of the free wheel has ever been encountered in any literature or personal discussions or interviews. Yet, the radical increase in carrying capacity of the machines is obvious and readily seen in photographs and descriptions of loads in pre- and post-freewheel periods.

Loading

'It looked like an overloaded towel-horse'.

Bean (1910:81) commenting on a
shearer's bicycle in New South
Wales

The safety bicycle's versatility as a cargo carrier was widely appreciated and an important factor in its widespread adoption throughout rural Australia.

For fixed wheel riders, loads were restricted to the front forks, handlebars and intraframe area, although small items could be hung immediately behind the seat. Swags, blankets and clothing were commonly tied to the handlebars and alongside either front fork. When down-curved handlebars came into vogue (designed for a crouched racing position), many cyclists rotated them upwards, allowing an erect riding position. This proved highly beneficial for carrying purposes, as bulky items could be secured in the forward-curving area (Plate 6.16). It was also possible to mount a rack on the front axle, and such a carrier was on the market

(AuWh 2/98:46), although there is no evidence that such carriers were ever used by rural travellers.

The area underneath the crossbar of the frame is excellent for loads in that it gives good weight distribution and a low centre of gravity. Even though the reciprocating knees mean that only items a few inches thick can be placed there, it was a popular place for carrying waterbags and heavy tools, for example. A wide variety of homemade and commercially produced cloth, metal, and leather containers, valises, and waterbags were constructed. While the loading technique was widely used throughout rural Australia, no generic term for the containers has been noted; I will refer to them as 'framebags' (Plates 3.4, 3.8, 5.11).

Framebags do not appear to have been as commonly used elsewhere in the world as in rural Australia. Although overseas cyclists did occasionally tie items to the crossbar (e.g. Life 1973:72) and a frame-bag was advertised in the 1908 Sears, Roebuck and Co. catalogue (Schroeter 1971:171), a perusal of numerous overseas cycling photographs has not turned up any instances of the use of framebags. This does not prove they were not used, of course, but a survey of comparable Australian photographs has frequently shown them in use. Because rural Australian cyclists often had to carry water, food and other equipment for long distances in isolated country, the framebags were probably more necessary here than anywhere in the cycling world at the time. That such conditions may have been crucial in encouraging their use is further indicated by the fact that photographs show that framebags were not particularly common among urban Australian cyclists. A quote from an American cycling journal, the Referee, noted that owing to the great distances in Australia 'it is even necessary to take water in a case fitted in the framework of the cycle' (AuWh 9/97:297); the tone of the article implies that the technique was uncommon in the United States. Further, all

advertisements yet found in Australian cycle journals for framebags (e.g. Plate 3.4; WAWh 2/12/98:3) indicate that they were invented and/or produced in Australia.

I am unaware of any commercial production of framebags today, and have not noticed their use among modern cyclists. Certainly, the cables and gear levers often found today about the frame area would make the technique inconvenient on many machines. Nonetheless, given that so many parents and grandparents of current Australian cycle tourers would have used framebags, and that they can occasionally be seen on old bicycles, it is a bit strange that their use has not been revived in the current cycle craze.

Cyclists also carried equipment on their backs, although it was apparently less common than might be expected. The discomfort, fatigue and balance problems were principal objections, a sentiment echoed by bicycle-mounted postmen in Melbourne: in response to a complaint the Secretary of the Public Service Commissioner judged that a regular daily journey of 30 miles (48 km) with mail upon their backs was 'undoubtedly heavy upon the men' (PSC 1905). Some cyclists carried equipment on the back when they could get no more on the machine; McTaggart (1977a) noted that shearers in South Australia did so, and a Dunlop advertisement suggests likewise (Plate 4.11). An accountant and his assistant carrying out stocktaking on the Western Australian goldfields between 1909 and 1920 carried backpacks (Tate 1976a) and a weekly commuter between Margaret River and Collie, WA, slipped a sugar bag of items around his shoulder when his rear rack was full (McKenzie 1977a). However, Witt (1977) said that it was not an especially common practise in Western Australia during most of this century, being generally confined to -- and usually a sure giveaway of -- inexperienced rural travellers. There are only a handful of visual or literary references to the practise. Some suggested putting

repair outfits and oil cans in the handlebars (MorHer 27/4/98:2) and one man carried spokes in the seat stay (AuWh 4/96:84).

The loads carried by fixed wheel travellers were relatively light. Richardson, for example, carried an estimated 25 pounds (11.3 kg) on his circum-Australian ride (Durack 1899). White carried 40 pounds (18.1 kg) on his overland trip from Perth to Rockhampton (MorHer 10/5/98:2), and in 1894 during a rush in the Western Australian goldfields one cyclist had blankets, pick and shovel on his handlebars, riddle and dish at his back, and tucker and billy, a total of 'fully fifty pounds' (Prospector 1896:208). Cycle messenger riders on the fields carried up to 80 pounds (36.3 kg) of mail (AusPhil 25/1/97:63). In estimating total weights few people noted whether they included water. As it weighs ten pounds per Imperial gallon (1 kilogram per litre) it can represent a substantial proportion of a cyclist's load. An otherwise 25 pound (11.3 kg) load would weigh 45 pounds (20.4 kg) if a couple of gallons were added (although water evaporates and is drunk during the course of the day).

With the advent of the freewheel the cargo carrying capacity of the bicycle was dramatically increased. In addition to using the handlebars and framebags, tremendous loads could be placed over the back wheels. Since the machine is structurally capable of carrying a great weight, the upper load limit was essentially determined by what the rider was willing to pedal. As heavier loads required more pedalling effort (and the unit might have to be pushed through heavy conditions) the rider was apt to think carefully before loading it unduly. However, judging by what rural cyclists did carry, their assessment of an 'undue' load appears to have been considerably different from what most modern cyclists would imagine. In addition to the rider's own weight, from 50 to 80 pounds (22.7 to 36.3 kg) were commonly carried for sustained periods over long distances, with heavier loads sometimes mounted.

An example of the nature and extent of items carried is given in the description provided by a shearer who travelled about western New South Wales:

they were all fitted up to carry a fair load of the articles and blankets and things that we needed. We always had a tentfly or a tarpaulin, rolled over the front handles and tied down the front forks. We had a carrier on the back of the bike and that had a tuckerbox on it, with tea and sugar, and perhaps tinned stuff, perhaps a bit of salt meat, when we could get it. Under the seat down to the centre bracket and the heads of the bike, we had a double sided sugar bag sown in down there, and we used to put our clothes, our shirts and change of clothing, and boots and other articles we wanted, and then we used to sling a water bag. We had two school bags, one each side of the carrier on the back of the bike, and our small articles such as shaving kit, and your brush and comb and soap, and things like that went in one school bag. On the other side we used to have our towel, perhaps your cigarettes and matches and your pipe; things like that would all go in the other bag. Also we used to carry a water bag with about two gallons of water. Very often the trips you had to make from the nearest railway station out to your shearing shed would be a great number of miles (Ford 1976).

Witt (1976) normally carried the following load during his travels in Western Australia between 1914 and 1929:

My swag consisted of 2 blankets and a tarp 7 ft. by 9 ft. rolled up about 3 ft. 6" and tied loosely. This fitted over the carrier behind and was tied down on the back forks. On top of this would be the flour and meat - either in sugar bags or calico flourbags. A 3 ft. piece of strong canvas was used as a wash basin laid over a shallow hole kicked in the ground. A gallon water bag hung on front from the handle bars, and one's spare clothing, if any, was carried across the handlebars. Between the frame, a bag made from rawhide or canvas, about 6 inches in width and as deep as possible attached to the top bar with a buckled flap. One would have such gear as a spare chain, tube, sheath knife, bullets, tools, matches, jam or treacle, and a host of other little things. I also carried a spare tyre, and a rifle strapped under the saddle and along the top bar. When riding along on the lookout for game a man would hold the rifle across the handle bar for quick use. A tin plate, knife, fork and spoon were also carried; also salt, which was a must for dry salting either beef or mutton.

He occasionally carried his dog on the handlebars when it was tired (Witt 1977). Similar loads (Plates 3.1, 3.2) are described by Wheatley (1977), and Schroeter (1977) and the commonness of them is attested to by Bean (1910:81).

Plate 3.1
A CYCLIST'S CAMP IN WESTERN AUSTRALIA
(Birtles 1910:515)

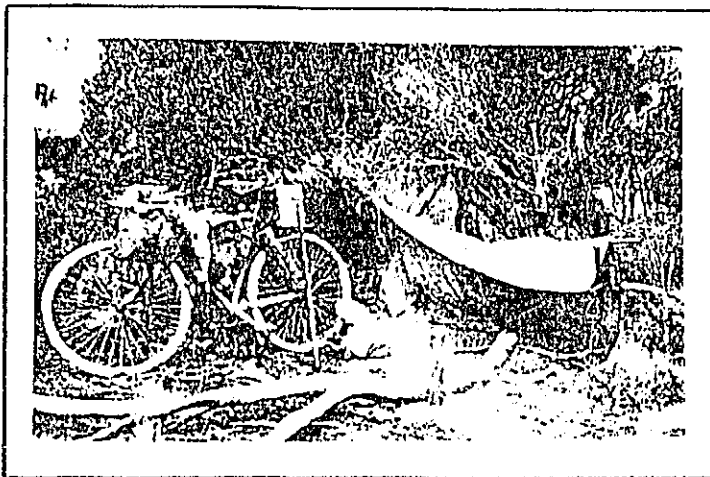


Plate 3.2
ON THE QUEENSLAND/NORTHERN TERRITORY BORDER
(Birtles 1911:366)

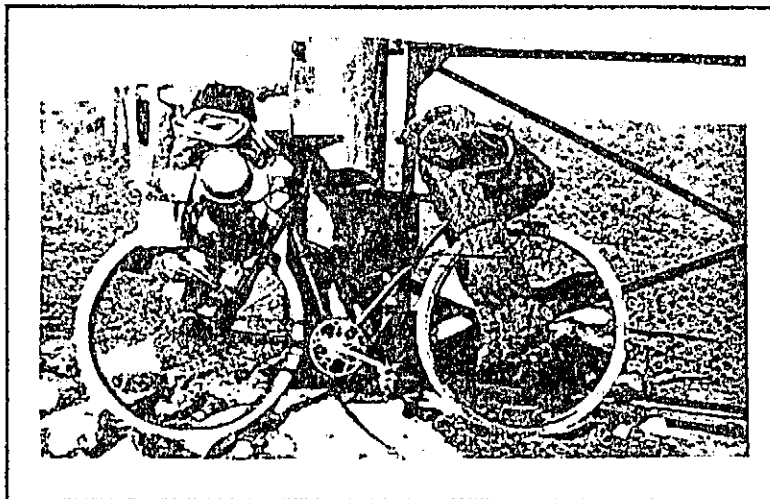


Plate 3.3
AN ADVERTISEMENT FOR BROOKS' SADDLES
(CyGaz 1/98:381)

BROOKS' SADDLES
EXCEL ALL OTHERS.

Numerous Varieties to suit all classes of Riders.

No High-Grade Machine is complete without a Brooks Saddle.
Insist upon having one fitted on your new mount.

J. B. BROOKS & CO., Ltd., Birmingham, England,
Sole Agents for Australasia—
The AUSTRAL CYCLE AGENCY,
Elizabeth St., Melbourne,
and Branches.

Admittedly unrivalled.

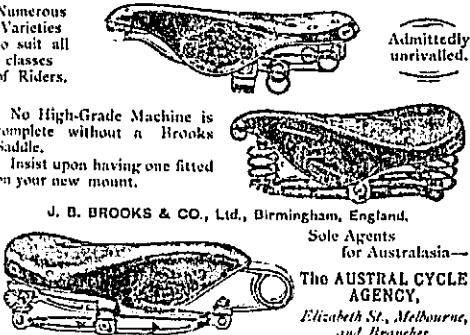


Plate 3.4
ADVERTISEMENT FOR BICYCLE VALISES
(AuCy 8/10/96:3)

AN INDISPENSABLE REQUISITE TO THE TOURIST.

PARSONS' BICYCLE TOURIST'S VALISE
(REGISTERED)

With them on your bicycle.

Light, Strong, Waterproof.

Why Not Buy One?

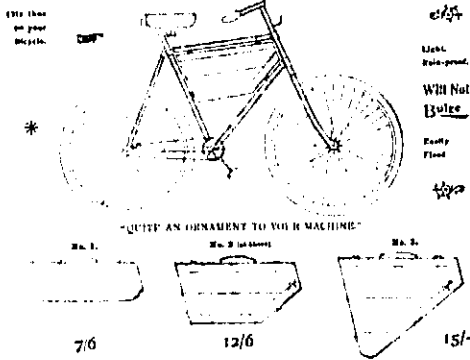
Ready Fold.

—QUITE AN ORNAMENT TO YOUR MACHINE—

No. 1. 7/6

No. 2 (up to 30 in). 12/6

No. 3. 15/-



While the freewheel did allow the packing of much more diverse and heavier loads, it also meant that if the cyclist were forced to push or carry his bicycle his problem was compounded. Birtles had this point forcefully impressed upon him in the Northern Territory when he had to carry first his cargo and then his bicycle out of a morass (1935:28).

Rural cyclists frequently carried water in a bag hung under the frame, an ideal place to hang the relatively soft but heavy bag, keeping the centre of gravity low and being easy on the knees if struck. Some cyclists used metal containers designed specifically for the cycle frame. Some preferred a tank because it eliminated the problem of evaporation common to porous bags; Blakeley (1938:84) found that a waterbag would dry up in seven hours in summertime. John Lane had a tank fitted with a spigot, the subject of much discussion and use by interested viewers (Souter 1968:200). O'Dea (1977b) had his tank stolen during an 1898 ride from Cue to Perth. Metal tanks could be hard to repair without access to proper facilities. Virgin suffered from this problem in his trans-Nullarbor ride (MorHer 24/2/98:2), and the White/MacKay party found at one stage in the Northern Territory that their metal containers were more 'useful for irrigation purposes' (Clune 1942:145). The amount of water carried by various riders ran to several gallons on occasion, a radical increase in the riding load.

Some used the bicycle as a 'workhorse' for short distance cartage. A Tasmanian farmer adapted his machine to carry cans of cream on the crossbar, and used it for some years on a four mile (6 km) route (Berry 1977). Another tied together large jute bags of vegetables, swung them over the crossbar, and pushed the load along (Fisher 1977). Kelly (1977) managed to balance crates of tomatoes or bales of hay on the handlebars for short distances. Lord (1977) found the bicycle excellent for hauling sacks of coals; after removing the chain he placed the sacks inside the

frame across the sprocket and pedals and pushed them along.

Tricycles and Carts

Tricycle carts were sold by a few cycle dealers and an 'Electra' (Plate 3.5) was discussed in one cycle journal in 1897 for the benefit of country readers who had never seen one (AuWh 2/97:48). However, tricycles and tricycle carts were rarely used in rural Australia. The machines' increased weight and multiple wheel tracks required additional pedalling effort (in comparison to a bicycle) even on the best surface, and severely inhibited their use on rough or soft surfaces.

Whitt (1974:113) reports that for a given power output a tricycle's additional wheel and axle will give a 5 to 10 percent slowing effect as compared to a bicycle. However, these figures are based upon modern tricycles with 1½ inch (3.2 cm) tyres on smooth, firm surfaces; the greater tyre widths and often rough surfaces formerly used undoubtedly would have slowed tricyclists even more. For one thing rough surfaces result in considerable loss of momentum through bouncing the wheels off the ground (see Chapter 4 for details). The tricyclist, with three tyres on different tracks, has an almost impossible task on rough surfaces of trying to find three smooth tracks simultaneously. As well, the frontal area offered by a tricycle cart can increase power requirements at speed or in a headwind (see Chapter 4 for details). Overall, the power required to propel a tricycle cart can be considerable. It is no surprise that they were neither popular nor widely used.

Post office trials of tricycles give a good indication of the problems. As early as 1880 (PMG 1881:17) it was 'suggested that delivery of telegrams in Melbourne and the suburbs might be expedited if messengers were provided with tricycles'. However, after consideration it was decided

Plate 3.5
AN 'ELECTRA' TRICYCLE
(AuWh 2/97:48)

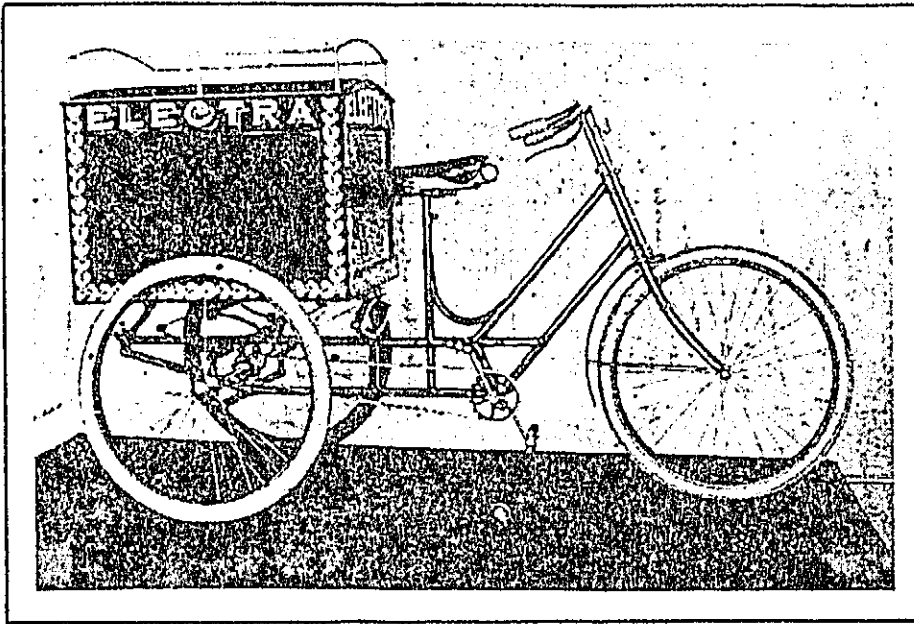
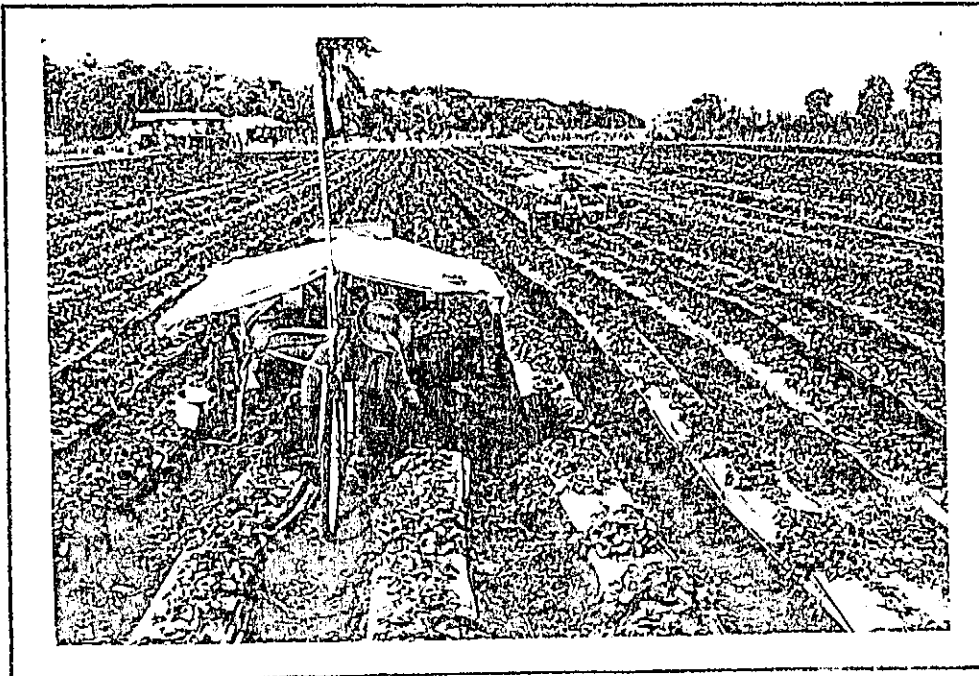


Plate 3.6
HUMAN-POWERED STRAWBERRY PICKING MACHINE, TOLGA, QLD, 1978
(Personal Collection)



'that such a course would prove both expensive and objectionable', although no explanation was given. A letter from Triumph (1902a), a major tricycle manufacturer in Coventry, describing the extensive use made of the machine by the English postal authorities resulted in the New South Wales Postmaster General's Department importing and testing the machine. A Senior Inspector (Bofsley 1903) suggested that the tricycle should do satisfactory work provided that 'the roads or streets are fairly level and in good order but in my opinion the latter condition is imperative to their successful use, as if the thoroughfares are rough the labor of propulsion when loaded will be very heavy'. Triumph (1904) described the machines as 'remarkably light considering their size', but shrewdly neglected to cite their weight in an otherwise very detailed technical description (Triumph 1902b). In Sydney two of the machines were tested 'in the more level part of the city' (AWB 1904). Three experienced cyclists tried them on their rounds. The first 'found it altogether too heavy to drive along', had to push it up hills (Robbins 1904), and upon return was 'wet through with perspiration', despite being an 'athlete of note' (Pilders 1904). A second rider could 'without hesitation say, it was too heavy so far as my efforts were concerned' -- and he had no mail in it during his trial! On the gradient from the A.M.P. Building on Pitt Street to the G.P.O., he 'experienced much difficulty' and thought that with a headwind it would be very hard to pedal at all (Genders 1904). The third rider found the tricycle too heavy and was unable to keep to the schedule set for his route. He felt that it would have been impossible to use the machine for any length of time (Read 1904).

The manager of the Post Office Stables concluded that the tricycles could not be successfully used in Sydney as a result of the 'uneven nature of the City'. However, he suggested that there was 'nothing to prevent

them from being a success in some of our towns on the level country, like, say, Cootamundra or Bourke' (Pilders 1904). Burnett (1904), the Superintendent of the Sydney Mail services finally tried the machines; he found them 'hard to propel on fairly level roads, and it is impossible to ride them up steep grades' such as Hunter, King, Bridge and Bathurst streets. They were not adopted for use in Sydney.

Two-wheeled carts trailing behind a bicycle were occasionally used in rural Australia. Although having a fourth wheel, the combination still has only three tracks and generally offers less wind resistance than does a tricycle cart with a front-mounted basket. However, when one cart wheel strikes an obstacle the cart will not only be partially raised off the ground (resulting in a direct loss of forward momentum), but will tend to yaw as well, meaning a degree of lateral tyre drag that has to be overcome.

Lord (1977) employed a cart for carrying his traps and other equipment during some of his rabbiting travels in New South Wales. Berry (1977) regularly used one in Tasmania to transport butter and milk about three-quarters of a mile (1.2 km). Taylor (1978) encountered a prospector in western New South Wales who trailed a cart so heavily laden with equipment that he had to push the combination most of the time. However, once the cart was unhooked and camp established, the bicycle was used to ride to various communities and stations for supplies or social purposes. The combination allowed considerable goods to be transported (without the liabilities associated with animals in such arid country), while permitting the bicycle to be used alone when necessary; this was the great advantage of the bicycle and cart over the tricycle. Faulkner (1977a) built a sidecar for carrying his children during a Guyra-to-the-coast return trip in 1936 and later found it useful for hauling wood, water, and groceries. Overall neither tricycle nor bicycle

carts were widely employed in rural Australia because any alterations to the basic safety bicycle format were at the cyclist's expense in terms of riding effort required.

Tricycle carts have been employed for many years in urban areas for such purposes as ice cream vending, for example. As well, bicycles with a small front wheel and a large cart above it have been used for a variety of delivery services; they were adopted by the N.R.M.A. during the Second World War (Open Road 31/10/40) for road service patrols in Sydney when petrol was in short supply. They represent the only known case of bicycles being used by that organisation (Giuliano 1976), in contrast to England, where the bicycle played a crucial role in the origins of the Automobile Association (Cooke 1931; Keir 1955).

A Human-Powered Strawberry Picker

More recently, a highly specialised tricycle arrangement for strawberry picking was designed a decade ago by Jeff Bowcock, of Tolga, QLD, and has been used continuously since (Plate 3.6). Pickers in the large fields owned by Bowcock (1978) spent a substantial amount of time carrying pallets of picked strawberries to the ends of the rows and returning with empty ones. As well, stooping and picking in the hot sun of the Atherton Tableland was very tiring. Consequently, Bowcock devised a tricycle in which the front wheel runs between two raised, parallel rows of strawberries. The rear wheels, mounted on an axle, track on the outside of the rows. The picker sits slightly above the height of the strawberries in a seat suspended from the upper frame of the machine. The rider powers the tricycle by pushing either or both of two independent levers which turn the rear wheels via a chain and cogs. The front wheel can be locked into several positions by a handle slipped into various notches, and the machine steers itself between the rows.

The rider picks the strawberries from the rows on either side without having to lean forward or to the side; the rows are just below hip height and only slightly to each side of the picker. Punnets are hung in wire carriers on both sides of the rider; when full, they are placed on pallets located over the rear axle behind the rider. Rotten strawberries are placed in a separate bucket and disposed of later to keep down the number of ants in the fields. A transistor radio is commonly carried as well. A cover over the entire machine protects both the rider and freshly picked strawberries (which dessicate quickly in the heat) from the direct sunlight, a great benefit to both.

At the end of a row the rider dismounts and by means of two handles on the rear of the machine lifts it up and turns it around like a wheelbarrow. Originally the machine was turned by lifting the front wheel. However, without a differential on the rear axle, the pivoting wheels did not turn at appropriate rates, and the light bicycle wheels occasionally buckled from the lateral force when the machine was heavily loaded. Bowcock has experimented with fitting a differential, but no satisfactory arrangement has yet been worked out. Although the machine weighs about 80-90 pounds (36 to 40 kg) pickers have no trouble lifting and turning it because of its balance and the wheelbarrow handles.

The benefits of the machines are multiple. They eliminate the need for any travel up and down the rows other than for picking. All loading and unloading of pallets is done at the end of a run; a machine can carry all the strawberries picked during a run across even the longest field. As Bowcock noted, the greatest advantage is that his workers pick nearly the entire day. From the workers' perspective it is difficult to imagine a more comfortable way to pick strawberries: they literally do it from a chair (the seats, inner tube sections stretched between metal tubes, are extremely comfortable). The pickers

are almost completely shaded. Because of the comfort and ease of picking there is less turnover of staff; as one employee told me, 'I wouldn't be here if it weren't for it'. The machines are used for planting as well, again eliminating all the walking and carrying of plant pallets and stooping and bending formerly required.

Bowcock has found it surprisingly difficult to find a satisfactory sun cover; canvas and similar materials are too heavy, and plastics are destroyed by winds and deteriorate in the sun. Tyres last only about a year, both puncturing and deteriorating from the sunlight. A half dozen machines have been built but not patented, since he feels the \$1,000 patenting costs are not worth it.

Interestingly, when the machines were first built, they were fitted with small engines, which Bowcock presumed would make the picker's task easier. However, users found the engines a nuisance because of the need to constantly vary the throttling, and the noise and vibration of the whole cart was very irritating and fatiguing over a several hour period. The foot treadle propulsion system has proved entirely satisfactory. I found the machines surprisingly easy to pedal.

The machines are ingenious, eminently suited to the task, and potentially applicable to a wide variety of situations. They prove that human-powered devices still have a place in the commercial agricultural scene of Australia, and what is more, can be occasionally superior to powered versions.

The Riding Position

'This is a delicate subject'.

(Garratt 1899:180)

The riding position was of great importance to rural travellers, as long hours on rough surfaces meant potential injury, fatigue and discomfort.

The seat was the crux of the matter: 'More adversity of opinion exists among tourists with reference to saddles than as regards anything else about a bicycle' (AuWh 6/96:145). Doctors and engineers were clear on the requirements, however: the basic need was to minimise shock and vibration. Sharp (1896:520) emphasised the need for good vertical springing. Early bicycle seats incorporated very long saddles, essentially hung between a pair of coils, and these were satisfactory (Plate 3.3); such models were often 18 to 20 inches (46 to 51 cm) long. There can also be a lot of horizontal movement and shock as a result of the pitching of the machine when hitting obstacles; if the saddle can not yield horizontally, the result is saddle slip for the rider. In this respect Sharp (1896:520) pointed out that a seat with vertical spiral springs -- allowing lateral movement -- was superior to other varieties.

'With regard to the shape of the leather seat, much might be said by a doctor, though the author has observed that doctors who ride much have very little to say on the subject' (Garratt 1899:195). One Australian doctor, however, emphasised the need for a broad seat to support the buttocks; narrow seats that supported the rider on the perineum could cause 'serious local trouble' (Springthorpe 1895:589). Broad saddles providing trans-ischial support were commonly available. Interviewees with long experience testify to the relative comfort of well-

sprung seats; one Brooks' model, for example, accounted for an estimated 80 percent of sales until World War II in Collie, WA, because it was 'so comfortable and everlasting' (Riley 1976). A broken spring reminded Williams (1977b) all too clearly of the seat's function: the subsequent standing ride of several miles on a rough road was 'very tiring'. The relatively long, narrow, hard seats commonly fitted to modern bicycles were uncomfortable in rough conditions, left numb buttocks (Harries 1977) and were not generally used.

One very important, but rarely recognised, function of a well-sprung seat -- conserving forward momentum on a rough surface -- will be discussed in Chapter 4.

At first, handlebars were pivoted at the headset, with no gooseneck to move them forward, and were not adjustable in terms of height or rake. An appreciated innovation on United States bicycles was their allowance for adjustment (AuWh 2/96:43) and British bicycles eventually included this feature (Pemberton 1897:100; Sharp 1896:299). Among the first adjustable handlebars seen by many Australians were those used by 'Major Taylor', the legendary American negro racer who toured Australia near the turn of the century. He so popularised their use that for the next several decades in Australia the phrase 'Major Taylors' was, for many persons, a synonym for adjustable handlebars. Many bicycles sold and used early this century did not include the variety of adjustments taken for granted today.

On the racing track, where wind resistance was crucial, the trend to keep the arms close to the body by narrowing the handlebars was a logical development during the 1890s. Unfortunately the track racing machines influenced the 'design' and merchandising of touring bicycles, and the width of standard handlebars on some road machines

decreased progressively to 15 inches (38 cm) (WAWh 31/12/97:7) and even 12 inches (31 cm) (WAWh 18/3/98:11). Touring cyclists raised an outcry, for the narrow handlebars, which provided little leverage, posed serious steering and control problems on rough roads (Morller 25/2/98:2), and the narrow sweptback ones hit the knees on sharp turns (AuWh 5/96:122). Hickory handlebars were advocated because of their ability to temper shock, and were occasionally stocked (WAWh 4/11/98:7), but there is no evidence that they were generally used.

A wide variety of handgrips were available: cork, leather, compressed leather, rubber, felt, celluloid, ribbed celluloid, horn and wood. Those most effective at absorbing sweat and shocks would presumably have been the choice of rural travellers, although no comments in this regard have been noted.

The pedals used on the bicycles were all metal (rat-traps) or metal and rubber pads. Advocates of rubber pedals argued that they were more comfortable. However, the users of rat-traps (which generally had serrated edges) felt that they provided surer footing and were stronger and less susceptible to damage when hitting obstacles. Photographs indicate that rat-traps were used on most men's bicycles. There was a reported invention of folding pedals, which would prevent shins being knocked while walking alongside the bicycle (AuWh 6/97:191), but no record of their being made or used.

Toe clips (over the end of the foot) and stirrups (lateral straps as much as two inches (5 cm) wide) were widely used by rural cyclists. However, foot restraints were not popular with many riders because of the risk of losing control with feet strapped to the pedals. While a bicycle is not a self-propelled machine that can drag a rider along like a horse, the fixed wheel machines could be dangerous if a rider fell while travelling quickly or on a steep slope. The kinetic energy had to

be expended somehow. If the foot remained strapped to a pedal it could result in injury. On the other hand, foot restraints are of great value, especially on fixed wheel machines. On a rough road or while coasting rapidly downhill, a rider could lose his footing on the whirring pedals. This often meant the loss of braking capacity (see Chapter 4). Also the foot restraints helped the cyclist maintain his footing while raising off the seat to allow the legs to absorb severe jolts -- a potentially very unstable situation.

Some writers have erroneously claimed that foot restraints can double pedalling efficiency by allowing the rider to lift the pedal as well as push it down (e.g. Ballantine 1975:149). However, Whitt (1974: 34) points out that the vertical thrust component is the predominant source of the propulsion: little additional power is gained by 'ankling', 'kicking forward' at the top of the rotation, or 'lifting'. However, foot straps can be helpful in kicking through the zero torque range (when the pedals are up and down respectively). With multiple gears the cyclist is able to choose a ratio that permits him to maintain a pedalling rate of, say, 70 revolutions per minute, and the pedals are quickly rotated through the zero torque range. On a single-gear machine, however, on an increased gradient the cyclist may be forced to pedal at, say, 35 revolutions per minute. The pedals will spend twice as long within the zero torque range and this may mean the difference between being able to keep the machine moving or not. In this situation stirrups may be of some benefit, although not to the extent assumed by many writers. An alternative is to use oval chainwheels (Whitt 1974:78-79), although there is no evidence to indicate they were ever used by rural Australian cyclists.

The riding position of rural cyclists had to minimise fatigue, soreness, and injury resulting from long hours on rough riding surfaces.

Cyclists with extensive rural experience indicated that they found a relatively upright position on a well sprung seat the best. Costello (1977) found the crouched racing position tiring and hard on his hands and wrists during long rides in the Western Australian goldfields. Harries (1977) found that the crouched position caused his back to ache and, importantly for him, he did not watch the scenery as much when bent low. He, as did innumerable cyclists, rotated the dropped handlebars upward to allow erect pedalling. During his 1908 ride to Darwin, Blakeley (1938:190) noted the physical relief at being able to sit upright when he had no headwinds. Coleman, a noted Victorian racing cyclist familiar with the crouched position, selected a very erect posture for his 1898 Darwin-to-Adelaide record ride (AuWh 3/98:73). The lower position is not practical on rough surfaces, as the hands, wrists, elbows and shoulders are not effective shock absorption joints (Furnass 1978; Pang 1978). Also, at the relatively low speeds most rural cyclists travelled, wind resistance was not a crucial factor; the benefit of a decreased frontal area did not outweigh the liabilities of the crouched position. Even with smooth surfaces such as most cyclists use today, doctors are noting complaints about hand and lower back problems resulting from the crouched position (Time 21/8/78:64-65). Reichenbach, who had dropped handlebars fitted to his bicycle for his central Australian ride, heavily padded the upper portion of the handlebars and, from the look of the padding, spent a lot of time using it (Plate 6.3).

The crouched position which many modern cyclists assume, or are forced into by bicycle 'styles', is probably neither necessary nor comfortable for most of the riding they do, a contention supported by the frequency with which riders with dropped handlebars use the upper portion of the bar. If bicycles were sold with seats and handlebars allowing more erect pedalling, even more might find the current cycling

boom to their liking. The words of a 19th century cyclist could well be repeated today in most respects:

I have lately changed my mount, weighing 37 pounds, 2-in. back tyre, a heavy saddle, rubber pedals, etc., for an up-to-date machine, with narrow handles and tread, light chain, small tires, and light saddle, and I find a great difference in comfort - in favour of my old machine'

(AuWh 5/96:111)

Clothing

Clothing worn by rural cyclists reflected social mores, cycling practicalities, rural necessities and personal proclivities. Tourists, especially members of cycling clubs, often wore a cycling 'uniform', consisting of a shirt (occasionally with a removable collar (AuWh 1/97:20)), vest, jacket, knickerbockers, stockings, cycling shoes, and cap; there was considerable debate over the most practical cut, material, and the amount to be worn. Knickerbockers and stockings were very sensible as they avoided material tangling in the chain and cog, and minimised snagging on limbs and brush. Rural cyclists sometimes wore them, particularly those undertaking weeks or months of continuous riding, such as the White/MacKay party on the second around-Australia journey, and the first trans-Nullarbor cyclist (Plate 5.11). However, such dress was ridiculed in some areas; in referring to the knickerbockers of one local 'dandy cyclist', the Coolgardie Review (14/9/95:15) noted that the clothes 'may suit the sweet shady sides of Pall Mall, but they are too fine, far too fine, for the dusty highways of Coolgardie'.

Some riders ignored social custom and adopted comfortable riding clothing. Murif, for example, did his 1897 trip from Adelaide to Darwin in a pair of pyjamas; he carried a spare pair which he changed into prior to arriving at the telegraph and pastoral stations enroute. O'Dea rode from Fremantle to Melbourne in 1898 in a snug fitting full body suit

normally used for track racing. Thiselton described his clothing arrangements for a ride from Coolgardie to Israelite Bay:

My pedal extremities were encased only in a pair of worn-out India-rubber slippers tied up sandal-fashion. All I took with me was an extra flannel shirt, a pair of tweed trousers and flannel underpants and a calicobag seven feet long, lined on one side with a strip of waterproof sheeting which proved to be not waterproof. I put all these things on and got into the bag and lay by the fire; in short I dressed up to go to bed and undressed in the morning to travel. The necessity of rekindling the fire during the night and drying my clothes was a bother; it robbed me of sleep (Broughton 1977:157).

Some commercial travellers found that they had to have their trouser seams double-sewn to withstand the strain of constant pedalling, and the occasional false (or double) seat was sewn in. Some cyclists experimented with various saddle materials in an effort to minimise the wear on trouser seats and Reichstein (1977) wore old leggings and trousers over his good clothes to prevent soiling and wear. Williams (1977b) felt it risky to carry items in his hip pockets, as they occasionally worked out during the course of riding.

Cyclists had to avoid tangling clothing in the chain and gear cogs. Aside from knickerbockers and stockings, pedallers made use of a variety of clips, cords, bands, pins, and their socks to wrap, tie, pull or tuck their loose pantlegs closely about the leg. Riders along the Western Australian rabbit fence (Plate 6.8) and Francis Birtles (Falk 1912) wore puttees, which also protected the lower legs from scratches.

As with most other activities at the time, shirts, jackets, and long pants were commonly worn while cycling, even in hot conditions. As Whitt (1974:62) points out, 'the heat removal capacity of the air around a moving bicyclist at most speeds on the level is such that much more heat can be lost than that produced by the bicyclist's effort. Hence quite an amount of clothing can be worn compared with that tolerable to

a static worker giving out the same mechanical power'. Early cyclists were aware of the fact that in comparison to walking they created a 'certain amount of breeze' (AuWh 2/98:46). John Lane, on a ride to Glen Innes, NSW, (via White Cliffs, Broken Hill and Bourke), left Adelaide in January, 1902, wearing a polo-necked jumper. He claimed that as a result of sweating it kept him cool on the same evaporative principle as the 'Coolgardie Safe' (Souter 1968:200).

However, excessive clothing does have disadvantages. A rider has to overcome wind resistance, which is felt as both direct pressure against the body and less noticeably as drag ('skin friction'). Whitt (1974:92) has indicated that with respect to racing cyclists, loose clothing increased the drag area by 30 percent. This is significant in that drag force is proportional approximately to the square of the velocity and the power to overcome drag is approximately proportional to the cube of the velocity (Whitt 1974:91). Hence at high relative windspeeds (such as encountered in a headwind by a slow moving cyclist) the propulsive power required becomes disproportionately great, and the bulky clothing can be a distinct hindrance to easy cycling. In addition, when a well-clothed cyclist suddenly encounters little or no relative wind (such as during a tailwind, travelling slowly in heavy conditions, or pushing the machine), he will resemble an overdressed static worker or labouring walker.

An intriguing question that has arisen during the course of this study is the extent to which cyclists influenced the introduction and adoption of shorts in Australia. As late as 1898 riders were being occasionally criticised and fined for wearing obscene and indecent shorts on the racing track (Fitzpatrick 1978j), where circumstances should have been most conducive to wearing functional dress. However, within a few years shorts were being worn by overland cyclists. The

first reference I am aware of depicting rural workers or travellers in shorts is a photograph taken in Eucla in 1907 (Plate 3.7), showing Birtles, Warren and Lennie wearing them. Warren and Lennie (engaged in a Perth-to-Sydney record attempt), wore tights with thigh-length legs, a definite product of the cycle tracks. Birtle's shorts, though, appear to have been British Army shorts (he had served in the Boer War and for several years afterward as a member of the South African Police, and had only been back in Australia for two years (Birtles 1935)). He wore shorts on many subsequent cycle trips about Australia and was photographed in them then as well (Falk 1912). His popularity (he published numerous articles and filmed documentary movies (Chapter 6 and Bertrand 1964)) may have gone far toward encouraging the concept of men wearing shorts for other than sporting purposes. Unfortunately there is no history of Australian clothing that enables the matter to be placed in perspective at this time.

Lightweight, lowcut shoes specifically designed for cycling were part of the social cycling scene, and some overland riders and rural travellers wore them. However, as most bush cyclists had to have shoes serviceable for a variety of conditions and activities, a separate set of cycling shoes were not commonly used; for cyclists frequently dismounting to work, such as rabbit fence or pipeline patrol workers, or cyclists forced to push or carry their machines through rough conditions, strong, durable shoes or boots were essential. Murif was grateful to have worn high-topped boots rather than shoes, as the former prevented sand getting inside when he was pushing the bicycle across sand dunes and plains.

For the cyclist, bush flies could be especially troublesome; when he had to keep both hands on the handlebars to steer and control the machine he was unable to swat flies from his face. Murif's eyes were so

Plate 3.7
BIRTLES, WARREN AND LENNIE AT EUCLA, WA, 1907
(Mrs. Jack Easter - Doubleview, WA)

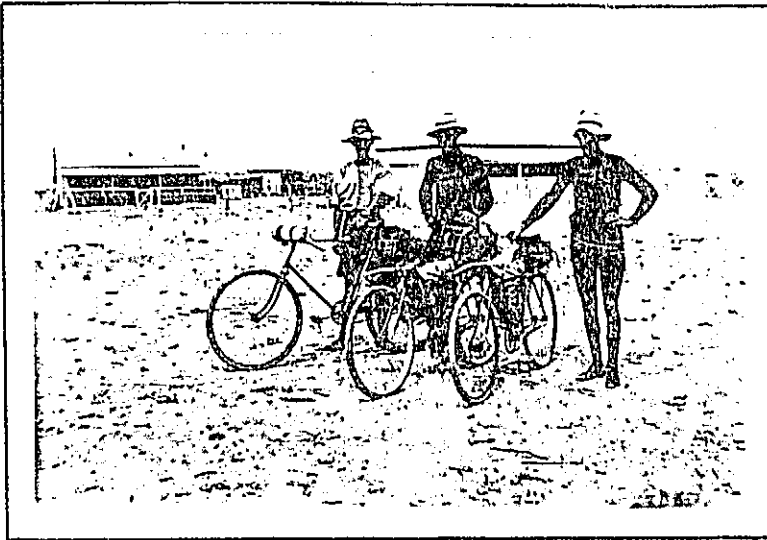
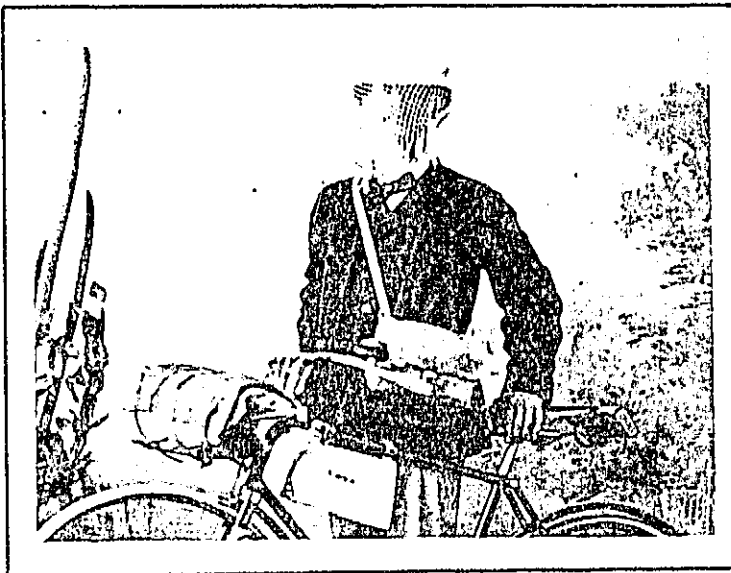


Plate 3.8
ARCHIBALD SANDERSON, c. 1900
(Battye Library)



affected by flies that he spent three days in Oodnadatta, SA, recuperating; Birtles (1935:22) had to spend two days recovering from an attack of March flies. Fly nets and goggles were tried (Plate 3.8) (Murif 1897:36), but Blakeley (1938:36) noted that his breath kept the inside of the fly net moist and flies congregated on the exterior to such an extent that on occasion he had to swish them away to see where he was going; Birtles (1935:24) tried a cheesecloth at one stage. Bush cyclists, like other travellers, had to live with the irritation.

Chapter 4
ENVIRONMENT AND ADAPTATION

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Climate and Weather

'You have a splendid climate, a climate that enables the cyclist to wheel every month in the year ...'

A Canadian Massey-Harris
representative in Melbourne
(AuWh 6/98:164)

In contrast to much of North America and Europe where winter forces a curtailment of cycling, the climate throughout most of Australia is conducive to year-round riding. There is significant snow or ice only in the Australian Alps, although short-lived snowfalls occur in other areas occasionally and frosts are common across much of the continent in winter. While cycling in the early morning or in a brisk, cold breeze in such conditions can be uncomfortable, the generally mild winter daytime temperatures over most of the continent are excellent for riding. Indeed, 'while cycling is probably most appreciated in summer in Victoria, we on Westralian goldfields perhaps prefer winter' ('Mac' 1896:175).

At the other extreme, temperatures in summer exceed 95°F (35°C) over much of the continent (AusYrBk 1969:33) and some areas experience temperatures over 100°F (37.8°C) for days, even weeks, on end: Marble Bar, WA, had over 100°F (37.8°C) for 160 consecutive days in 1923 - 1924 (WAYrBk 1970:40). Cyclists suffered severe sunstroke and even death from exhaustion (AuWh 1/98:14). During a Nullarbor crossing Richardson (1897:5) felt as if it were '1,000 in the shade' and he, like others, occasionally sought relief by riding at night.

Over 70 percent of Australia receives less than 20 inches (508 mm) of rainfall annually (AusYrBk 1969:29). The tendency over much of the continent is for several years of below average rain followed by a year or two above average; at Whim Creek, WA, for example, as much as 29.41 inches (747 mm) have been received in one day and as little as

0.17 inches (43 mm) during an entire year (AusYrBk 1970:30). Australian cyclists can generally count on long periods of dry weather, interrupted by sporadic, but often intense rain. During the latter, riding was often impossible over wide areas and cyclists had to camp for several days at a time (Birtles 1910:514). During a long ride in southeastern Western Australia in 1895 Thiselton 'became tired of lonely camps, of wet couches with insufficient protection. The great part of the time there was just "mizzling" rain to make one miserable' (Broughton 1977:157). The results could be fatal. In mid-1899 Robert Kirkpatrick, a 'sheep overseer' at Dunlop Station, NSW, was caught in a heavy storm while bound for Bourke. He exhausted himself trying to ride and push his bicycle through the mud and was found dead less than four miles (6 km) from Toorale Station (AuWh 7/99:201).

Periodic droughts and scarcity of water throughout much of Australia contributed substantially to the adoption of bicycles. A lack of drinking water made horses and camels liabilities in many areas at certain periods. At a shilling a gallon in the Western Australian goldfields in the early 1890s, for example, 'a man has sometimes to pay five shillings for a single drink for his horse' (Broughton 1977:158). Camels could go for long periods without water, but eventually had to drink. And when they did ... 'Little had I imagined what four pence per gallon meant, when I told the man to give the animals "as much as they could drink" ... my kindly feelings went down to a very low ebb indeed as I stood there - watching gallon after gallon disappear down the apparently insatiable throat of the animals. I forget for the moment how many sovereigns this long drink cost me, but it certainly was the biggest teetotal drink I ever paid for' (Price 1896:115). On occasion water was not available at all.

The lack of rainfall also meant a local shortage of stock feed. During the early years on the Western Australian goldfields 'chaff and oats were then almost unprocurable' (Carnegie 1898:16). Reichstein (1977), who normally used a horse and sulky in his travels about South Australia, switched to a bicycle during the severe drought of 1912 - 1914 as he was unable to afford imported feed for his ponies. The high cost of imported chaff was a heavy burden upon stock owners during droughts in western New South Wales (Bean 1911:182), and Barker (1964:198) estimated that it cost £2-10-0 per week to feed a horse in some parts of Western Australia early this century. It is understandable that the bicycle, that 'ever-saddled horse which eats nothing' (Snow 1975:61), was popular with many rural travellers.

For cyclists, as with other travellers, drought and heat meant that 'time had to be measured by water' (Blakeley 1938:33). Because the bicycle increased a rider's rate of travel, cyclists were able to pedal across stretches they might otherwise not have attempted. For the same expenditure of energy and water consumption that allowed a pedestrian to walk 25 kilometres, for example, a cyclist could cover 50 to 100 kilometres, depending upon surface conditions. However, if the machine broke down the rider might suddenly be placed in a situation from which, without his technological extension, he was unable to extricate himself. For some, both time and water ran out. Not long before Bean's (1911:49) tour of western New South Wales a 'cyclist had missed his way on the left bank, struck inland along a road which petered out in a back paddock, and had been found later lying dead of thirst with his clothes around him'.

There are no permanent streams in much of Australia and cyclists could pedal over most of the country without concern for the location of punts or bridges. But there were disadvantages: Coleman (1898b:124)

found himself in the Northern Territory 'ploughing through the soft, flour-like' dry Hugh riverbed seven times in 14 miles (22 km), as a result of its meandering course across the countryside. Cyclists waded across shallow rivers, as did the White/MacKay party at the lower Burdekin in Queensland (Clune 1942:125). In deeper streams extra tubes and containers were used to float the bicycles across. Cyclists resorted to railway bridges, where available, to cross temporarily impassable fords (WAWh 8/1/97:13) or major channels (Blakeley 1938:121) and rivers (Clune 1942:121). Along the Murray-Darling system shearers pedalled to where punts operated or were given lifts across by riverboat operators (Bean 1911:49-50). Some cyclists took the riverboats for a portion of their journeys (Wigmore 1968:84).

The Wind

'The wind too has its destination, but in the opposite direction'.

(Wendell Berry, Harper's, 9/77:65)

Aside from sandy surfaces, the 'most disheartening drawback to cycling' (Murif 1897:27) in Australia is the wind. Below speeds of about five miles per hour (8 kph) in still air, wind resistance is very low in comparison to the rolling resistance of tyres (Whitt 1974:4). For modern crouched racing cyclists at ten miles per hour (16 kph) effort is applied about equally to overcoming rolling and wind resistance (Whitt 1974: Table 1.2). The more erect riding position generally assumed by bush cyclists would suggest that wind resistance was a relatively greater factor for them than for modern crouched riders. However, the greater rolling resistance provided by the formerly wider, 'heavier' tyres on unsealed surfaces countered the tendency of the riding position to alter the relationship between tyre and wind resistance. The bush cyclists required more energy to maintain a given relative wind

speed than do modern cyclists.

As speeds increase, aerodynamic drag becomes formidable. For cyclists drag is mostly a result of direct pressure resistance created by frontal area; surface drag, or 'skin friction', is relatively minor. Since the power required to overcome drag is approximately proportional to the cube of the cyclist's velocity (Whitt 1974:91-92), the cost to a cyclist of maintaining a fast pace in still air, or even a moderate pace in a headwind, is high. At 20 miles per hour (32 kph) nearly 80 percent of the rider's power is used to overcome wind resistance, and at 40 miles per hour (64 kph) about 93 percent (Whitt 1974: Table 1.2).

Early perceptions as to the nature of the problem of cycling into the wind were not always well founded. The Austral Wheel editor (AuWh 1/97:16) had to disagree with the Queensland Wheel's assessment that spoke friction was the major cause of resistance. Another writer asked for a cycle design that could be ridden not faster, but with 'less effort up hill, and against a headwind' (AuWh 1/96:4).

Cyclists' laments about the wind are legion. For Reverend Sussex (1903) the 'romance was rather taken out of the trip by the wind that buffeted me right through' a 54 mile (87 km) ride to Peak Hill, WA. Ford (1976) often had to push his heavily loaded bicycle against headwinds: it was 'very, very unpleasant, I can tell you, if we had boisterous or wet weather'. Coleman's and Mather's Darwin-to-Adelaide ride of 1897 was continually plagued by southerly winds. Murif (1897: 64) found that the only time a headwind was of no consequence was when he was pushing the bicycle over 'interminable wastes' of sand -- a case of the lesser of two evils. Cyclists would occasionally ride in the evenings if the winds died down.

Tailwinds, however, can be of tremendous assistance to a cyclist.

As with downhill slopes, he benefits disproportionately with respect to horses and pedestrians. In strong tailwinds a rider can merely sit on the bicycle and be pushed along; in combination with pedalling it can be highly productive, providing a 'great riding day' (Blakeley 1938: 190). Ford (1976) appreciated the opportunity to 'make up a bit of time' that tailwinds provided. During a westerly wind Birtles (1910:514) covered 170 miles (274 km) in one day in Western Australia. MacDonald (ACA 1898:35), with strong winds behind him, rode the 180 miles (290 km) from Wilmington to Adelaide in one day: his main concern was keeping his feet on the fixed wheel pedals during high speeds attained on downhill stretches.

* * *

As an envious Englishman emphasised, the cycling climate was 'certainly unsurpassed in Australia' (WAWh 15/4/98:6). In their ability to use the machines year-round, Australians were among the most fortunate cyclists in the world. The bicycle was an excellent personal transport investment anywhere in Australia, but in the context of recurring droughts and scarcity of water and feed, the value of that investment took on new dimensions in rural areas.

Riding Surfaces

The nature of bicycling meant that cyclists applied new standards to road and riding surfaces. Cyclists -- who could maintain from ten to 20 miles per hour (16 to 32 kph) and attain 40 miles per hour (64 kph) or more downhill -- found that rough surfaces, potholes, ruts or limbs were not merely uncomfortable or inconvenient. They could be fatal. As well, any obstacle that lifted the bicycle meant a direct loss of the rider's energy. While the pneumatic tyre was effective at providing a smooth ride and avoiding energy loss for small-scale roughness (about

2 cm or less), the cyclist was likely to suffer the effects of moderate obstacles more so than the heavier, slower moving waggons and coaches with their larger diameter wheels. Cycle touring organisations were eventually formed to lobby for better roads (Chapter 5). Their concerns were those of many other travellers -- better roads meant easier, more comfortable, faster and cheaper travel. But what was adequate for the bullock team, stagecoach, pedestrian or horseman was not necessarily so for the pedaller.

Yet the bicycle did not require better roads than existed at the time. The pneumatic tyre permitted the cyclist to cross soft or crusted soil, sand, and lakebeds that would have collapsed under the weight of heavier vehicles or the sharp hooves of animals. In his ability to lift the machine over fences, logs and the like and to utilise narrow camel and sheep pads, the cyclist found opportunities for rapid travel that were denied other modes of transport. And when necessary the rider could push or carry the bicycle until riding was again feasible; if riding conditions were not always as desired, at least the bicyclist was rarely worse off than anyone else. The great advantage of the pneumatic tyred machine was that it allowed the rider to make more effective use of both existing roads and off-road conditions. He could travel at a greater rate of speed across more varied terrain and surfaces than any other transport mode in Australia. While better roads certainly made for more comfortable riding, the bicycle's real serviceability lay in its versatility over a variety of surfaces.

Roads and Tracks

'... more like a ploughed field than a road-way'.

A cyclist's view of a Mullengandra,
Victoria, road (One 1897:115)

The general state of Australian roads was commonly disparaged. An English manager of the Perth Austral Cycle Agency felt that Western Australia's already-booming cycle business would have gone ahead with further leaps and bounds if 'there were but good roads' (WAWh 15/4/98:6). There was little local dissent. One editor had refrained from discussing the roads because they were 'too bad to be mentioned'; the few good roads that existed in some districts were, he felt, attributable more to nature than anything done by the authorities (WAWh 12/2/97:3). The roads around Perth were so bad that metropolitan cycle clubs' road races were held in the eastern hills and wheatbelt (WASpJ 6/8/98:8); there were similar problems in finding a suitable route for the first goldfields road race (WASpJ 23/7/98:9). The Reverend Sussex (1902), after riding 250 miles (402 km) in three days on Western Australian roads, 'could not write yesterday. My hand was quite numbed with the vibration of the bike through travelling over rough roads. Took me all my time to hold the knife and fork at meals'.

The litany of complaints is similar for all of Australia. The first six Adelaide-to-Melbourne bicycle record attempts were each made over a different route. As a result of the roads' varying susceptibilities to weather, each rider surveyed and selected his own punishment (AuWh 11/97:352). Tasmania was criticised for allowing its roads to suffer from careless maintenance and 'economy' (Fink 1897:57). In the Dubbo - Orange area Davitt (1898:231) noted that the routes 'through all this country are often mere tracks, made by teamsters and boundary riders,

and are deeply furrowed here and there, and must be muddy and dangerous in certain seasons'. Comments like these were typical, frequent and endless.

In isolated and thinly settled areas roads were often only a 'line of rough trails', as Birtles (1910?:4) found between 'Alexandria' and 'Anthony Lagoon', in the Northern Territory. The Darwin - Adelaide track was deemed 'unfit for bicycles, and the journey is merely a test of strength' (MorHer 7/10/97:2). The White and MacKay party required 49 days to cover 900 miles (1450 km) between Katherine River, NT, and Derby, WA, much of it unrideable (Clune 1942:163). Earlier they had managed the 450 miles (725 km) from Charters Towers to Normanton, QLD, in a comfortable nine days. However, over the subsequent stretch from Normanton to Burketown they suffered many punctures on the crude track: if 'the road to hell was as rough the traveller would be too weary to care what happened by the time he arrived' (Clune 1942:133-135).

Not all comments were negative. The Austral Wheel (1897:5), for example, noted that the area between the Murray, Ovens and Kiewa rivers had 'indisputably the best cycling roads in Victoria', a larger proportion good for all-weather riding than in almost any other part of the state. Parts of the Alexandra-Yea road were described as 'like a billiard table' ('Columbia' 1899:7). Schwaebisch (1899b:221) highly recommended some of the convict-built roads about Port Macquarie, NSW, and noted that good gravel roads allowed easy cycling through swampy areas along the northern coast.

In 1897 the Massey-Harris representative in Australia felt that the Australian roads (allowing for the winter unrideability of North American roads) did not 'average as well as the Canadian or American roads' (AuWh 6/98:164). Australian roads do not appear to have improved

quickly. In Western Australia in 1904, for example (Table 4.1), there were 10,518 miles (16,923 km) of roads (excluding tracks), but 62 per cent were 'cleared only' and another 25 percent 'formed only' (WAYrBk 1908:549). Although total milcage tripled by 1918, still 66 percent were 'cleared only', and another 20 percent merely 'cleared and formed' (WAYrBk 1921:558). In 1918 in New South Wales two-thirds of the state's 99,481 miles (160,065 km) of roads were either 'natural surface' or 'cleared only' (NSWYrBk 1921:553). In the 1930s in South Australia Doecke (1977a) found that many roads were still in an 'atrocious' state as a result of a lack of maintenance. The Western Australian roads of the 1920s and 1930s were severely criticised by Witt (1977), Costello (1977), and Barker (1964). During the course of extensive road racing, training, and commercial travelling by bicycle throughout much of Australia up to World War II, Opperman (1977) found that surfaces all too often were a series of ruts, sharp stones, and rocks.

Pedallers quickly learned that the judgement of many non-cyclists as to the suitability of a particular road for the pneumatic-tyred machines was suspect. In the Northern Territory Murif (1897:128) was advised to take 'nice soft flats' and to avoid 'hard, gritty rises'; the former turned out to be sandy and fine for cattle, but hard on the cyclist, while the latter was barren and excellent for riding. One cyclist, assured that the sandy Mandurah - Rockingham, WA, road was rideable by bicycle, ended up pushing and carrying his machine most of the way. At the rabbit fence inquiry in Perth in 1901 one witness, an experienced bushman, assessed the proposed fence route from the south coast to Burracoppin as suitable for cycle patrols, except for a few miles (R&pRC 1901:38). Experience showed that it was much 'heavier' going than anticipated, and the 'gentle' slopes were far steeper than realised (JDepAgWa 1904:487).

Table 4.1
ROAD SURFACES IN WESTERN AUSTRALIA AND NEW SOUTH WALES
(WAYrBk 1908:549, 1921:558; NSWYrBk 1921:553)

<u>Miles / Kilometres</u>	<u>Surface¹</u>	<u>Per Cent of Total</u>
<u>Western Australia: 1904</u>		
6,498 / 10,455	'cleared only'	61.8
2,625 / 4,224	'formed only'	25.0
1,395 / 2,244	'metalled or otherwise'	13.3
Total 10,518 / 16,923		
<u>Western Australia: 1918</u>		
22,936 / 36,904	'cleared only'	66.2
6,926 / 11,144	'cleared and formed'	20.0
4,770 / 7,675	'metalled or otherwise'	13.8
Total 34,632 / 55,723		
<u>New South Wales: 1918</u>		
34,978 / 56,280	'natural surface'	35.2
30,641 / 49,301	'cleared only'	30.8
13,997 / 22,521	'formed only'	14.1
19,865 / 31,963	'metalled, ballasted, gravelled'	20.0
Total 99,481 / 160,065		
¹ Surface classifications were not further explained.		

Teamsters and Motor Vehicles

Animal teams, carts and drays created some of the worst road conditions facing rural cyclists. A rider in the Blue Mountains indicated that the greatest problem was not the long climb, but the abominable roads at the top; 'teams have cut up, what was once a lovely road, into a sand track. It is common to see waggons drawn by nine horses along the road. You can imagine the effect'. If not, he quickly went on to describe it, and pointed out that other cyclists were rarely encountered along the road as it was 'only looking for harder work than was ever intended to befall a human being' (AuCy 14/3/95:8). On the roads about Bourke, Ford (1976) found the tracks of bullock and horse teams 'very, very hard going'. Along the Southern Cross - Coolgardie track in early 1895 there were an estimated 200 teams operating at any one time (WesMail 5/1/95:3). To bicycle in such circumstances must have been extremely difficult. Roads used by teamsters were probably most discouraging in mountainous and heavily wooded country where cyclists had no option but to use the same route. After heavy rainfall many were impassable. Although advised to use the packed pads of wheels, especially in sandy country (Borelli 1896:58; AuWh 1/96:4), cyclists found that animals led along behind waggons or later driven over the route made such attempts impractical. Where feasible, riders took to adjacent trails (W.F.L. 1897:82).

Motor vehicles brought more problems. The rotating treaded, powered wheels tore up previously compacted dirt and stones (Barker 1964:204) and the recoil of the motor vehicle suspension systems created corrugations. Barker (1964:206) noted that these rarely formed on bush tracks, but after a road had been properly formed and built up they would quickly develop. Williams (1977b) noted that corrugations in the

Orange area, generally confined to the central area of roads, could be ridden around. On narrower roads this was not always possible; on the Western Australian goldfields in the 1930s corrugations forced Costello (1977) to ride through the adjacent bush; they would 'shake your eyeballs out'. The complaint was echoed by McKenzie (1977b) and Doecke (1977b). Clouds of dust raised by passing vehicles caused some cyclists to prefer winter riding (McKenzie 1977b). At Moonee Ponds, VIC, one cyclist who swerved from behind a lorry to avoid the dust was killed when he collided with an oncoming cyclist (Argus 9/11/10:5). Another was severely injured when he fell after hitting a rut obscured by the dust of a passing vehicle (Argus 6/5/11:17).

Rough Roads and Energy Loss

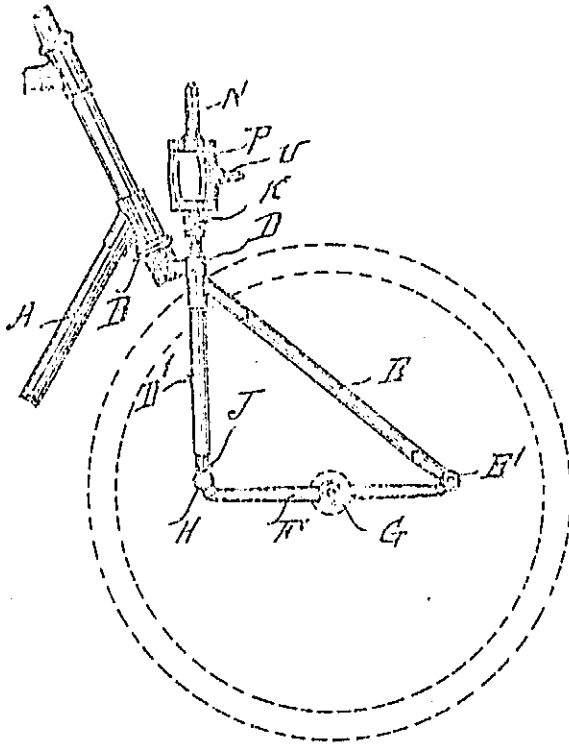
All of the kinetic energy expended perpendicular to the road surface can be considered lost when a bicycle and rider bounce over an obstacle (Whitt 1974:123). Scott (Whitt 1974:124-125) suggested that a solid rubber tyred machine lost fully one half of its forward momentum in bouncing over a four inch (10 cm) obstacle. Bourlet (Sharp 1896:252) estimated that probably one sixth of the rider's total effort on solid rubber tyred bicycles was dissipated in vibratory effects. The pneumatic tyres were a great salvation in this regard. In 'giving' around an obstacle only a small part of the tread and tube is lifted vertically and hence the loss of kinetic energy is small. However, the pneumatic bicycle tyre and tube is not able to insulate the rider and machine from obstacles of more than about two centimetres and kinetic energy losses again come into play (Whitt 1974:123). Corrugations, rocks and potholes, then, increase the total effort required to ride a given distance (quite aside from the fatigue resulting from the shock and vibration).

Any part of the man-machine combination that can be effectively isolated from vertical lifting represents a saving of energy. Technically the goal is to minimise the amount of unsprung weight, or to make the 'natural frequency' of the unsprung mass (the rider and machine) high in comparison to the forced vibrations imposed by the surface (Whitt 1974: 123). A well sprung bicycle seat can play an important role. While the machine jolts up and down the rider may remain relatively stationary as the seat springs alternately compress and extend. The heavily sprung seats of early riders (Plate 3.3) were, then, more than mere comfort devices; they preserved forward momentum. The rider can obtain a similar effect through flexing his legs while standing on the pedals. This technique, however, was not as easy on fixed wheel bicycles as on freewheels, and it ultimately requires additional energy (via contracting the leg muscles) to 'preserve' energy (bodily momentum).

In attempts to minimise energy loss and provide more comfortable rides, a variety of spring frame, articulated machines, some of them highly ingenious, were built by various cycle inventors and companies around the world (Caunter 1955:35-36; Oliver 1974:76-79; Wallis 1897: 90-92). Spring frame bicycles, designed by Englishmen, were patented in Australia (Green 1898; Harnett 1899) (Figures 4.1, 4.2) but there is no evidence to suggest that any models were ever readily available locally. The few that were seen in Australia were almost certainly specially ordered from abroad (Riley 1976; Tate 1976b; Crawford 1976).

Unfortunately the spring frame bicycle requires flexible or pivoting joints and occasionally sliding or telescoping tubes. As these loosen, wear, or are damaged they allow so much lateral movement that the bicycle wobbles unsafely. This fact, coupled with the greater complexity and cost, more than negated the advantage of a smoother ride.

Figure 4.2
'IMPROVEMENTS IN VELOCIPEDES OR OTHER VEHICLES'
(Green 1898)



They were rare curiosities in Australia. Only two of the former bush bikers and cycle dealers interviewed for this study had even heard of them (Crawford 1976; Taylor 1978), although the discovery of a cast-off frame (Harrop 1978) and descriptions of them (Curtis 1978; Taylor 1978) suggest that they were used. The only confirmed use of a spring frame was along the Western Australian rabbit fence early this century (Chapter 6). Although another Western Australian did weld the front fork of a lightweight motorcycle on to his bicycle at one stage, no indication of its performance was given (Witt 1977).

Surface Materials

Bicyclists encountered a variety of surface materials, whether naturally occurring, formed as roads, or altered by hooves, feet, or wheels. Some materials covered extensive areas; others were patchy in their distribution. Various materials and the effect of rain upon them meant that riding conditions in a given locale could be quite different from one point to another, and could change radically from season to season, even hour to hour. One cycling proverb was that a 'good summer road is generally a bad winter road, and vice versa' (Austral Wheel 1897:6), a sentiment expressed by others (Nicolls 1897:290; McKenzie 1977b).

* * *

'Presently riding became impossible. Sand, sand everywhere ... It rose in a fine impalpable dust, which made the nostrils and throat feel as if on fire'.

(Coleman 1898a:93)

Sand was the most common surface rural cyclists had to contend with. One-third of the continent is covered with aeolian sands, approximately evenly divided between sand ridges and plains (Mabbut 1970:

5-6). While much of this is found in the sparsely settled and travelled western shield and central Australia, extensive sandy areas and soils elsewhere (formed in situ or by fluvial deposition) bedevilled innumerable travellers (Plate 4.1). When sand was encountered, riders sometimes undertook long detours to avoid it, preferring 'any sort of surface, in fact, in preference to sand' (Murif 1897:140). Unfortunately there were often no alternatives.

Much of southeastern South Australia was considered unsuitable for cycling (Pressman 1897:80) and McTaggart (1977a) feels that the Pilbara area, WA, was not cycled more intensively partly because of the sandy conditions. On the trans-Nullarbor route the Eyre Sand Patch was a well-known, dreaded obstacle. Richardson (1897:4) felt it was the worst such stretch in Australia; Virgin managed only 15 miles (24 km) one day during his traverse of it (MorHer 24/2/98:2). McKenzie (1977b), in her daily travels in southwestern Western Australia, walked an average of one out of ten miles (1.6 of 16 km) because of sand. Where sand forced extensive walking and pushing of bicycles the daily travel rate could be as little as 15 to 30 miles (24 to 48 km).

Sand hills proved formidable. Murif walked most of the 300 miles (483 km) south of Alice Springs. He 'tacked' back and forth across the face of the linear dunes, as did Coleman and Mather the following year (AuWh 11/97:358). Ten years later Blakeley (1938:126) and the O'Neill brothers did not ride at all over one 60 mile (96 km) stretch through the Depot sandhills south of Alice Springs. They trudged up the long slopes and slid themselves and bicycles down the steep faces.

The rideability of many sandy surfaces is greatly improved by rain. Nicolls (1897:290) noted that early spring was the best time for cycling the western districts of Victoria, as the winter rains 'set'

Plate 4.1
A SANDY ROAD IN VICTORIA, DATE UNKNOWN
(La Trobe Library)



the sand. L.R. (1896:18) suggested that the fine, sandy dust which lay so deep in the Mornington Peninsula 'would, I suspect, be excellent after a day's rain'. After pushing through much of central Australia Murif (1897:58) judged that 'only after a heavy rainfall could much riding be done in those sandy districts'. MacDonald was able to shatter the Darwin - Adelaide cycling record in 1898 partly because rain allowed him to ride extensive sandy areas that had been pushed through by previous cyclists (ACA 1898:31). Murif (1897:84) found that some sandy soils had a thin crust, resulting from previous rainfalls, which could be ridden with deflated tyres. However, since passing animals and waggons destroyed the crust he often had to meander in search of rideable remnants.

Some beach sands can be cycled. The Albany bicycle races were held on hard, flat beaches nearby (WAWh 2/12/98:6). At Apollo Bay, VIC, Andrews (1898:9) rode on the beach to avoid a bushfire. The James (1897a:7) brothers stuck to the coast near Eyre Station, WA, to avoid part of the notorious sand patch. In north-western Western Australia White and MacKay pedalled from La Grange to Wallal in two days along the Eighty Mile Beach and again took to the coast further south between Bulla Bulla and Roebourne (Clune 1942:166). However, to their dismay some cyclists found that many beach sands are too steep or soft to be ridden (WAWh 15/1/97:8).

Sand probably caused cyclists more walking, pushing, sweating and swearing than any other factor in rural Australia. Yet extensive sandy areas were regularly cycled, sometimes at remarkably fast rates. Solo cycle express messengers, for example, crossed the 110 mile (177 km) sand plain between Southern Cross and Coolgardie in as little as 12 hours (AusPhil 25/1/97:63), and another rider, despite occasionally heavy sand, managed the 165 miles (265 km) between Menzies and Leonora (via Lawlers),

WA, in 16 hours (MorHer 22/2/00:2). The regular use of the bicycle in sandy areas is evidence of it's practicality and serviceability in such conditions, whatever the drawbacks.

* * *

Clay surfaces could seriously impede, even stop, cyclists (Plate 4.2). When wet, clay would stick to the tyres and 'whilst very amusing to a spectator, it is quite the reverse to an unfortunate wheelman who should happen to be caught by a shower of rain whilst out on the plains' (AuWh 6/96:143). The black soil along the Darling River 'when wet will stick like glue and set as hard', and forced riders to take an alternative route in certain seasons or after heavy rains (Blakeley 1938: 47). When jammed into the forks it could quickly immobilise the wheels (Costello 1977). The White/MacKay party were forced to carry their bicycles through clay both north of Charters Towers, QLD, and west of Katherine, NT (Clune 1942:128, 158). Sharp (1896:256) reprinted the tests of Ravenshaw (Engineering 10/1/96) which showed that with an all-up weight of 200 pounds (90.7 kg), it took three times the force to maintain five miles per hour (8 kph) on mud as on flint or flag pavement surfaces.

Smooth, dry clay could provide some of the best cycling surfaces to be found. But where cattle or other animals had trod on wet clay, the kneaded state left the surface unfit for cycling, both while wet and after drying into a rock hard roughness. Waggon tracks made bicycling along clay tracks very tedious (AuWh 10/96:299) and at times cyclists had to forego such routes (Fergusson 1977). The most spectacular areas appear to have been the 'Bay of Biscay' formations in the Northern Territory. Murif described it as a blue-black clay lumped about the roots of a thick and wiry grass, forming an extremely lumpy

Plate 4.2
THE 'GLUE POT', DATE UNKNOWN
(Battye Library)

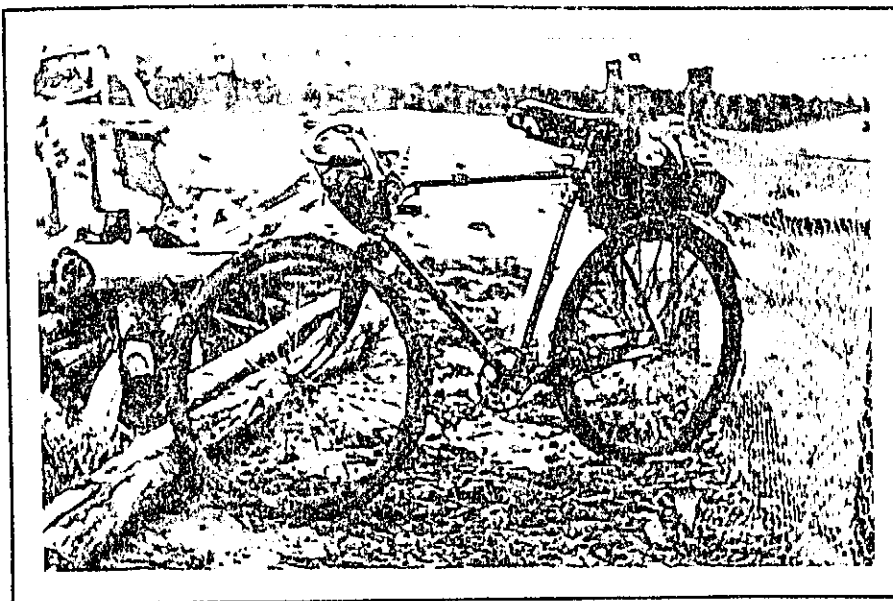
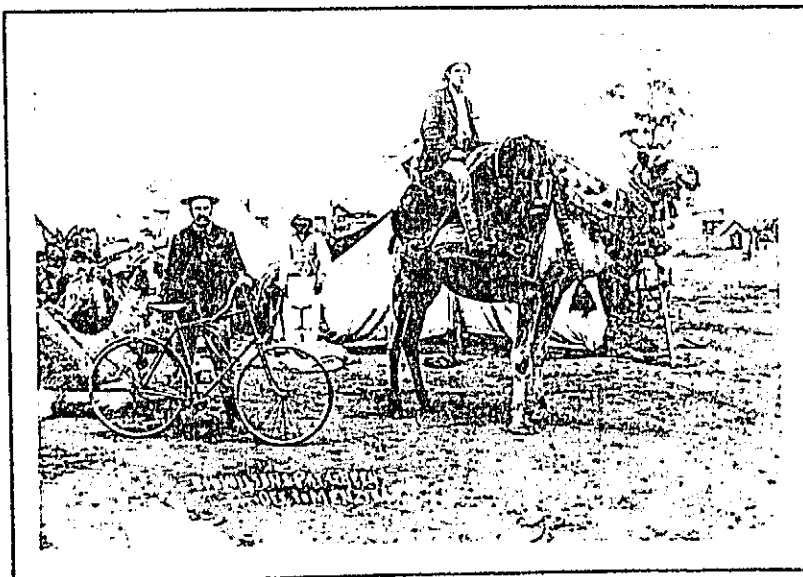


Plate 4.3
'BOB WILSON & PAT GREEN OFF TO MENZIES', WA, DATE UNKNOWN
(Battye Library)



surface. The formations were found in flat country subject to heavy flooding, at which time the Bay of Biscay plains were converted into shallow, muddy lagoons and impassable lakes. Until a path had been worn through after rains, the surface offered a jolting ride destructive to machine and rider: it was like 'cycling up and down a stairway, with the stairs of unequal heights and width, blindfolded' (Murif 1897:142). After the 'swelling soil' of the Bay of Biscay (Blakeley 1938:108) dried and contracted it was laced 'with huge yawning fissures down which a house might be dropped. Lovely country for cycling' (Coleman 1898c: 157).

* * *

Stones and gravel posed a variety of problems. Gravel, in particular, affected traction and made cycling treacherous at times. In the notorious gravel country of southwestern Western Australia nearly-spherical lateritic pisolites create the effect of riding on small marbles. On steep gradients the driving wheel can slip (Hartley 1976); when negotiating curves at speed or turning on to the gravel from a firm surface, the rider can easily lose control (from my own experience); and hard braking results in sliding. Understandably some cyclists welcomed wet weather, which allowed heavier traffic to compact the gravel (McKenzie 1977b).

Stones damaged equipment, particularly tyres and tubes (discussed later in this chapter). Riding over stony ground could be uncomfortable, tiring, and resulted in a loss of forward momentum, and riders occasionally elected to walk instead. Murif (1897:124), approaching Tennant Creek, NT, rejoiced at encountering the best cycling surface he had seen for some time: a 'firm, loamy nature, covered in places with gravelly quartz and ironstone'. Only after days of sand did such a surface look inviting.

* * *

Dry lake beds furnished probably the smoothest natural riding surfaces on the Australian continent; 'In many cases the salt lakes are hard on the surface, and are as level as a billiard table' ('Mac' 1896:174). Murif (1897:68) rode a 'splendidly smooth' clay flat for some 20 miles (32 km) toward the MacDonnell Ranges, NT; and Blakeley (1938:87) appreciated those about Lake Callabonna, SA. Unfortunately most of them are in isolated areas and were not heavily utilised. Even when found in frequently cycled areas, such as in Western Australia, their often long, linear patterns did not commonly coincide with normal travel routes. They were used, gratefully, where possible, but cyclists did not go out of their way to ride them (Witt 1977).

If covered with water the lakes could be a quagmire. In his overland ride Murif (1897:27) had one of his worst spells when he had to carry his machine on his shoulder mile after mile through a soft, marshy lake. Between it and a gibber plain he managed only 21 miles (34 km) for a hard day's work. As the lakes dry they develop crusts and tend to remain boggy around the edge, making access difficult. Blakeley (1938:86) provides an excellent description of the problem of crossing a dry lake in which the crust continually threatened to give way. They required three hours to slowly feel their way across a 5 to 6 mile (8 to 10 km) stretch which normally would have been ridden in half an hour. However, the time was well spent, as the alternative was a 40 mile (64 km) ride around the periphery. Another problem was the intense glare (Murif:1897:31) and heat, which Price (1896:138) found overpowering.

Road Hazards

Sticks, limbs, roots, stumps, fallen timbers, anthills, ruts, rocks and potholes were a frequent source of spills and damage. Between Normanton and Bourketown, QLD, White and MacKay lost 12 spokes in three

days from sticks being flipped into the wheels (AuWh 9/99:254). Dick O'Neill had 18 spokes torn loose by a mulga limb in one incident (Blakeley 1938:183); Plate 4.7 illustrates the cumulative results of the trip. A stick jammed in the rear cog broke James' (1897a:6) axle, and fencing wire entangled around cogs could bend and break spokes (A.B.C. 1897:345). Riders occasionally walked rather than risk damage ('Columbia' 1899:7).

With fixed wheel bicycles cyclists could not backpedal to lift pedals out of the way of obstacles, and pedals and cranks took a tremendous pounding. One fast moving cyclist who slipped into a deep rut had his pedal broken off by the ground (WASp 6/7/01:4). Murif smashed his pedals against numerous stumps and anthills (suffering a severe fall on one occasion) and after considerable bending and straightening finally had to replace a portion of one; Coleman (1898f: 253) suffered a bad fall after catching a pedal on a log; Virgin bent a pedal and crank which, after an interim repair, finally broke off entirely (MorHer 24/2/98:2); and one rider suffered a bent fork and wheel after hitting a stump head on (MorHer 14/1/96:2). Such incidents led one wag to suggest that a 'stump-jumping bicycle would be a great acquisition' (AuWh 5/96:119).

Railway Lines

Australian cyclists used railway lines, where available, on many occasions. One resorted to a pad alongside the railway line near Naracoorte, SA, to cross a sandy plain; Murif (1897:176) found the line into Darwin the only feasible route and alternated pedalling on the ballasted embankment, cleared ground adjacent, and a parallel pad. Eleven years later Blakeley's (1938:247) party found the line still the only practical route from Pine Creek, although railway regulations forbade its

use. Railway gradients were an attractive factor; an early South Australian road map for cyclists (SACy 5/8/98) indicates the rail line to the southeast as the principal cycling route over the Adelaide hills. Even where parallel roads existed they were occasionally so rough that railway lines were preferable (Hogan 1977). Despite railway employees taking their names for trespass, the White/MacKay party used the rail line almost exclusively along the Queensland coast because rains had left most roads impassable (Clune 1942:120). Rail lines could be rough and hazardous. Near Bowen one of the White party buckled a wheel in a partially hidden drain (Clune 1942:126). Murif (1897:20) found that between Hergott (Marree) and Oodnadatta, SA, the ballast was 'destructively sharp cornered', the steep embankments and culverts were unsafe, and 'tyre-tearing levelling pegs' were located every chain (20 m) or so. He finally resorted to riding between the rails when sandhills near Strangways presented the greater of two evils; fortunately the ballast metal was rounded.

I have found no reference to Australian cyclists having ridden on the steel rails. Overseas, units were available that enabled the bicycle to ride on one rail while a flanged wheel, acting as an outrigger, rolled on the parallel rail. They ranged from light devices with a single outrigger wheel to heavier ones with additional wheels before and behind the bicycle itself (Schroeder 1971:173). They were not practical for travel involving frequent shifting between rails and roads, because of the weight, bulk and the nuisance of having to assemble, disassemble and carry them. However, seats for extra passengers could be mounted on the outrigger frame (Oliver 1974:21), and smooth, low-friction rides (remarkably so, if the bicycle were supported on steel wheels (Whitt 1974:104-105)) were provided. They appear to have been used in reasonable numbers in the United States (Oliver 1974:21), and were nationally advertised by Sears, Roebuck and Company (Schroeder 1971:173). In

Australia the scarcity of railway lines in rural areas, varying rail gauges, and railway authorities' antipathy to trespassers would have discouraged their use.

Camel Pads

Nothing is more fascinating about the use of bicycles in rural Australia than the relationship between cyclists and camels. The camel was used in many parts of Australia (McKnight 1969b), but the cyclist/camel interaction was most significant in Western Australia (Plate 4.3).

There

scores of West Australian gold towns depended on the Afghans' pack camels for all but heavy mining machinery and building materials. The strings of pack camels formed smooth tracks which delighted people on bicycles ... They spoke very highly of camel pads for bicycle tracks and I can quite believe it. On stony country, pack camels in single file very soon ... swept loose stones away, or if the ground was damp and the camels were heavily loaded their broad feet pressed the stones into the soil. On sandy country their feet tamped the sand, making it firm enough for a bicycle (Barker 1964:96-97).

In the 1930s Costello (1977) found that the passage of a single string of only 12 camels notably improved a riding surface. Where broad waggon tyres had been used in conjunction with camels the resultant tracks, even on hard, stony roads, were often 'so smooth that you could walk barefooted along them' and remained firm even when covered with water (Barker 1964:200). The pads could last for a long time. In 1894 Carnegie (1898:37) struck 'an old camel pad (Lindsay's in 1892, formed by a caravan of over fifty animals)'.

Riders extolled the virtues of the camel pads and went out of their way to use them (Prospector 1896:208; Costello 1977). A Coolgardie resident stated that 'nothing in life here can surpass a spin along one of our good camel pads' (WAWh 17/6/98:7). Another described them as 'a wheelman's riding luxury' ('Mac' 1896:173). Shearers along the Strzelecki

Track made use of them (Keatley 1977) and in New South Wales early this century Ford (1976) found it 'a pleasure to get on these camel team tracks'. The quality of the pads is illustrated by the results of a road race at Mt. Magnet, WA, in September, 1899. Using camel pads a rider broke both the 25 and 40 mile (40 and 64 km) Australasian unpaced road records. First reports of the race were not believed in Perth, and the W.A. Cyclist (22/9/99:3) commented that 'personally we think there is a mistake somewhere'. However, after checking further the journal aided in the formal submission of the record claim (WACy 29/9/99:9).

Because the pad was so smooth, subsequent camel drivers and cyclists tended to use the same narrow path. In contrast to other roads and tracks, camel pads were frequently nothing more than narrow tunnels through the bush. The situation frustrated organisers of goldfields road races. The roads on the fields were unsuitable; yet the superbly surfaced camel pads were so narrow that races would have become linear processions much of the time, with passing only possible intermittently (WAWh 24/6/98:6).

Early camel tracks (and other routes as well) were often circuitous because the first person to pass through was not clear as to exact directions, or deviated from one water source to another; subsequent travellers tended to follow the original tracks (Figure 4.3). One road leading to a point 220 miles (354 km) north of Coolgardie, for example, actually traversed a distance of nearly 300 miles (483 km); eventually travellers took shortcuts and improvements were made by surveyors (Carnegie 1898:18-19). One cyclist (Prospector 1896:208) observed that 'the best pads run along the telegraph lines, thus being the shortest as well as the best routes'.

The cyclist/camel interaction, especially on the Western Australian goldfields, was an important factor in encouraging the adoption of the

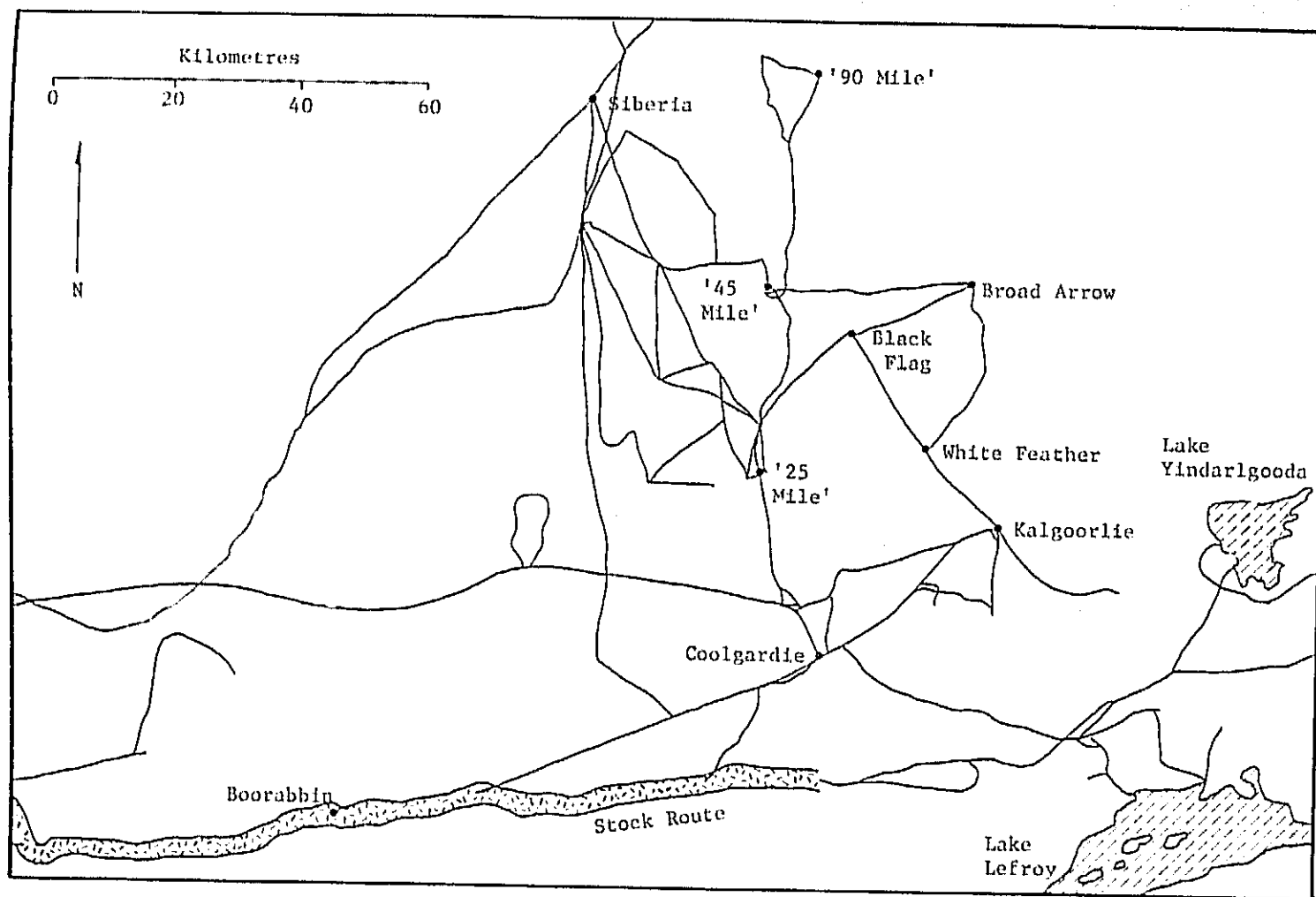


Figure 4.3
EARLY TRACKS ON THE COOLGARDIE GOLDFIELD, WA
(Calvert 1894:54)

bicycle. Whether a similar situation occurred elsewhere in the world is not known. Bulliet's (1975) study, The Camel and the Wheel, does not mention anything like it. For cyclists, the relationship, a form of commensalistic, or unidirectional, symbiosis was fortuitous. The camels, however, were disturbed by cyclists. Near Yardea Station, SA, the James (1897a:9) brothers reported that a string of camels stampeded at the sight of the machines and riders, even though they were pedalling slowly. A Western Australian rider (Prospector 1896:208) noted that the 'usually stolid and indifferent beasts' were frightened of bicycles. When approached from behind the camels would rush about, snap lines, and create chaos generally; the Afghans were quite polite, however, and would 'only curse and swear in their own language'.

There were parallels to the camel/cyclist interaction. In East Africa Churchill (1908:137-138) was surprised to find that

In the dry season the paths through the bush, smoothed by the feet of natives, afford an excellent surface ... the track is only two feet wide, and ... the bicycle skims along ... at a fine pace; and although at every few hundred yards sharp rocks, loose stones, a water-course, or a steep hill compel dismounting, a good seven miles an hour can usually be maintained.

Australian cyclists reported that sheep pads occasionally provided good surfaces (Doecke 1977a) and gentle gradients on slopes (Crawford 1976). However, along fence lines the constant padding of sheep left tracks so deep that bicycle pedals would hit the adjacent ground (Witt 1977). In the Flinders Ranges, where donkeys were used, Blakeley (1938:94) found that nothing 'could be finer from the bike-man's point of view, for their little feet make good smooth riding pads ... they seem bent principally on pressing firm each inch of soil'.

Rural Bicycle Paths

Bicycle paths aside from incidental animal pads were established in rural areas. Often it was no more than the informal removal of a limb or other obstacle from a frequented route (Gooding 1976). On the other hand a contract was specifically let (unfortunately it is not known by whom) for the cutting of a cycle path between Mulline and Menzies, WA (MenMin 30/7/98:6). Grants for cycle paths were sporadically promised to district Roads Boards, but appear to have remained merely promises in almost all instances; money ostensibly marked for the Kalgoorlie area in 1901 was never made available (WASp 29/6/01:4). The Yalgoo Roads Board suggested a five shillings annual cycle tax, with a disc to be issued to those who paid. However, after it was pointed out that drays only paid 10 shillings, and bicycles did no harm to the roads in comparison, the proposed tax was lowered to two shillings and six pence (WACy 23/6/99:122). Proposals for cycle taxes met strenuous opposition. Cyclists felt, and probably rightly, that the taxes would not be applied to cycle path construction, but would be lost in general revenue. One writer, opposing a proposed cycle tax, argued that wheelmen would not be so vigorous in their opposition if the Roads Board would permit the election of its members, would provide 'proper cycle bicycle paths throughout the country districts', and would levy the tax on such wheeled vehicles as prams and wheelbarrows as well (WAWh 11/2/98:13).

As late as the 1930s there were still a few cycle pads in use about the Western Australian goldfields. Costello (1977), a reporter based in Kalgoorlie, pedalled along them to Golden Ridge, Broad Arrow, Kanowna, Bulong and Kookynie (Plate 4.4). Some of the pads still had boards and sleepers over small watercourses. A few routes can still be detected

Plate 4.4
A CYCLE PAD SOUTHEAST OF KALGOORLIE, WA, c. 1930
(Jack Costello - Toorak, WA)

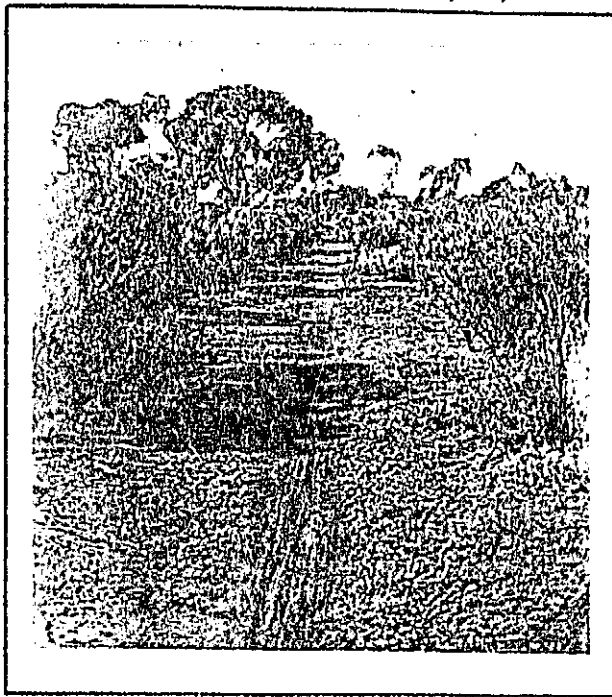


Plate 4.5
A ROAD IN THE GOULBURN VALLEY, VIC, DATE UNKNOWN
(La Trobe Library)



about Coolgardie (Proserjohn 1977), between Bulong and Kalgoorlie (Jones 1977; Hocking 1977), and near some of the old mining settlements in the Murchison area (White 1976). Before long, however, plant growth and wind and water erosion will have erased all vestiges.

The Goldfields Bicycle Pad Protection League

The importance of, and problems associated with, goldfields cyclists' pads were perhaps best manifested in the formation of the Goldfields Bicycle Pad Protection League. It is unquestionably one of the more unusual bicycle action groups ever seen -- if not in its objectives, at least in its circumstances. It had its origins in a letter written by C.H.A. Stone, secretary of the Broad Arrow Cyclists' Association (a small community 24 miles (37 km) north of Kalgoorlie), and published in the Broad Arrow Standard on 30 June, 1897:

permit me to air the grievance of goldfield cyclists in your valuable paper ... What cyclist has not bitterly felt cruel and unjust destruction of our pads, and longed for the time when they should be protected from general traffic. Who can deny that our pad from Broad Arrow to Kalgoorlie was made by ourselves, is in nobody's way, yet has been cruelly cut up from end to end. That is our longest pad. All the shorter ones have suffered likewise; ... we are a large and powerful body, embracing all classes, from the miner who rides to work, to the parson who rides to church. We are not merely pleasure seekers, we have come to look on our bicycles as indispensable for business ... considering that we make our own pads, it is only just and right that we should have the exclusive right of them. ... Barring a few main roads almost every existing track is on the site of one of our pads ... A new pad is made; a horseman comes along (most likely a mounted trooper), sees the pad going in his direction, and follows it, leaving large hoof marks for us to bump over. Along comes the baker, the butcher, and mining expert likewise, and the track is then ready for the water cart or heavy team; our pad, of course, disappears; we make a fresh one, and along comes the procession again. I notice that Kanowna cyclists have decided to form a new pad to Kalgoorlie, logging it in various places to stop the general traffic, and they propose to post printed notices along it asking horsemen to keep off it. To my mind the logging may to some extent keep buggies off, but the posting of notices seems to me like filling the

manager with good hay and posting a notice asking the steed to eat his straw bed ... I think, for a start, we might get a bill introduced into Parliament, reserving a strip of, say, three yards on each side of all telegraph lines outside Coolgardie for cyclists alone, and making it punishable by heavy penalty for any horseman or driver of horses found within that area (except of course crossing it) ... the trouble I write of has rankled in our bosoms quite long enough. A monster petition to Parliament, or even perhaps to the Government, backed up by the various Road Boards, and certainly backed up by the League of West Australian Wheelmen, might be successful. Concerted action is necessary ...

Stone's grievance quickly reached F.C.B. Vosper, the local Member of the Legislative Assembly. In a letter to Stone, Vosper apparently promised to bring the question forward in Parliament if properly briefed, but suggested that first a 'unified expression of opinion should be obtained from the cyclists of the fields' (BrArSt 17/7/97:2). Stone's cause was noted by others. The West Australian Wheelman (16/7/97:6), based in Perth, printed Stone's letter in mid-July. The Kalgoorlie Miner (31/7/97:4), reporting on the movement two weeks later, pointed out that cycling on the fields was

the principal means of inter-communication between centres where the railway has not penetrated. As a matter of fact, on the fields it has come to be regarded as essential, and of course under the conditions just mentioned it forms the one and only mode of rapid transit ... the army of cyclists in respect of their numbers, if nothing else, should command respect when they give utterance to grievance, suggestion or request.

In Perth four days later the Morning Herald (4/8/97:4), after summarising the situation for metropolitan readers, suggested that if the matter reached Parliament 'it is likely that their request for protection and encouragement will be favorably considered'. It also indicated that goldfields cyclists would receive cooperation and support from cyclists in other parts of the colony. Goldfields clergymen, many of whom relied on the cycle for travel, supported the movement; the Reverend Hay declared that the cyclists' pads 'had been destroyed by those who had no

right to use them' (MorHer 18/8/97:2). Percy Armstrong, a highly respected former cycle express messenger rider and founder of the colony's largest cycle agency, noted widespread enthusiasm for the movement during his recent tour of the goldfields (MorHer 1/9/97:2).

Buoyed by the widespread support and publicity a meeting was held in Broad Arrow and a petition initiated. More names were collected from nearby Bulong (BrArSt 28/8/97:4), Paddington (BrArSt 21/8/97:3) and Black Flag (BrArSt 4/9/97:4), and support was received from centres in the Murchison area (BrArSt 28/8/97:4). Stone had undoubtedly voiced the sentiments of many when he stated that 'I feel confident that we only have to ask Government or Parliament for protection of our just rights and we shall receive it' (BrArSt 4/8/97:3).

The Broad Arrow Standard (4/8/97:3) found it necessary to admonish other newspapers for attempting to take the credit for initiating the movement. And the publicity unerringly resurrected an old, touchy issue: the use of bicycles within goldfields communities. One writer to the Kalgoorlie Miner (2/8/97:2) reiterated a complaint about cyclists who, the majority carrying 'neither bell nor lamp', endangered pedestrians and threatened to monopolise the footpaths (the outside of most footpaths in Kalgoorlie were already given over to cyclists (MorHer 1/9/97:2)). He recommended local legislation and a bicycle tax to improve streets and construct separate cycle paths in town. A cyclist countered tit-for-tat that while some riders were admittedly at fault, pedestrians also used pads formed by and for cyclists (KalMin 3/8/97:2).

But more crucially, apparently no goldfields bicycle club or their parent organisation took up the issue publicly. Certainly the rapidity with which the movement developed (only six weeks elapsed from Stone's letter to the forwarding of the petition) and the fact that it

arose in the off-season minimised opportunities for official involvement. But a survey of various cycle club meetings and activities that did occur indicates that they were only interested in obtaining cycle racing facilities and assigning racing dates; the broader interests of the cycling contingent were of no apparent concern. Also there was hostility between the goldfields parent cycling organisation and the metropolitan-based League of Wheelmen. This resulted partly from jealousy because the goldfields races were more widely known across Australia, had larger attendances, and paid larger purses than Perth ones (Fitzpatrick 1978j). But even had the two organisations been on friendly terms the League of Wheelmen also had no interest in such non-racing matters as better roads (they were criticised about this for years, but to no avail). The unfortunate result for the Bicycle Pad Protection League was a complete lack of assistance or support from any cycling organisation or formal bicycle club in the colony -- the kind of 'united expression of opinion' Vospers probably had in mind.

Politically there was antagonism between the emerging goldfields towns and established coastal communities. This was reflected in, and intensified by, the disproportionately low representation of the goldfields residents in Parliament. With nearly half of the colony's population at the time, the goldfields had only six of 44 Legislative Assembly seats and three of 24 Council seats (Crowley 1960:113). The disunity was inimical to the interests of the state in many respects (Battye 1924:424-425) and it is not hard to imagine it as a detriment to the Pad Protection movement. General support for the movement appears not to have been nearly so strong as Stone and his followers were led to believe -- certainly not to the extent of their merely having to ask for their 'just rights' to receive them. The cyclists' request was undoubtedly insignificant within the broader context of Parliamentary

representation and colonial affairs.

The petition was forwarded to Vosper by late August (WAWh 2/8/97: 19). However, he had not ventilated the matter in Parliament by mid-December (BrArSt 15/12/97:3) and Parliamentary records do not indicate that he ever did. Inexplicably, the issue seems to have died suddenly in mid-September. Aside from a brief note in the Broad Arrow Standard (15/12/97:3) in December, no publication -- not even the specialised bicycle journals -- ever again mentioned the movement or the fate of the petition. The treatment accorded the petition, however, was hinted at obliquely by the Broad Arrow Standard in a brief, somewhat bitter news item on 20 November, noting the visit of Mr. and Mrs. Vosper to Bulong and Kanowna, but not Broad Arrow:

unless Mr. Vosper had very strong reasons to stop him coming this way he slurred us ... As a matter of fact we have a strong suspicion of the why and wherefore that Mr. Vosper temporarily gave Broad Arrow the cold shoulder (BrArSt 20/11/97:3)

As is often the case in political matters, the full story of the Goldfields Bicycle Pad Protection League will probably never be known.

Although not legally enforceable, the cyclists' right to the exclusive use of the tracks they had established and maintained was, however, recognised and honoured by most horsemen and teamsters in many situations. An excellent example of this was the heavily cycled pad between Coolgardie and Londonderry/Burbanks (Scahill 1976).

Cyclists and Animals

Cyclists faced numerous problems from animals, ranging from direct attacks, and punctures from dropped horseshoe nails, to wheels damaged in rabbit holes.

'... man's best friend, and the cycle's worst enemy'.

(AuWh 10/96:281)

Many riders were attacked and injured by dogs, some severely (MorHer 24/2/98:2; Leithead 1977). One rider was violently thrown when two dogs crashed into his bicycle (AuWh 6/96:143), and a Victorian rider, after hitting a dog, lost control and fractured his skull in a fall (Argus 1/4/11:20). A Fremantle cyclist, while dodging a dog, ran into a cart and was killed (MorHer 27/2/99:2). Eleven years later a Queenslander was killed when he hit a cart while being attacked by a dog (Argus 15/10/10:20). The problem was widely recognised and numerous articles, poems, cartoons and letters-to-the-editor were published on the matter. 'To run over a dog - not too large - is the ambition of every cyclist possessed of any self respect' (AuWh 8/96:210); a description of how to do so without losing control was written: 'ride directly at the dog so as to strike him with the steering wheel straight on. The handlebars must be held rigidly, and the pressure of the foot which is uppermost should be increased' (AuWh 8/98:232). Some riders took to carrying ammonia-filled squirt guns (AuWh 9/98:255). Unfortunately early cyclists were rendered partially defenceless as they could not readily remove their feet from whirring fixed wheel pedals to kick at the animals. If for no other reason than self defence, the freewheel was a blessing.

The following is from John Marshall's 1903 book, Battling for Gold. The subtitle, 'Stirring Incidents of Goldfields Life in Western Australia', was certainly indicative of the contents.

The only recorded instance in which a cyclist was attacked by animals took place in the latter part of '94, between Dundas and Coolgardie. Probably few men on the field were better known than J.H.C. Bamblett, who was special cyclist, and carried the special mails to Dundas. When nearing the

"Forty-Mile Rocks" on one of his trips he thought he heard a peculiar noise behind him. At last he stopped his bicycle to find out what this noise was, and, to his intense astonishment and horror, discovered that he was being followed by a pack of dingoes, which were close to his heels by the time he had mounted his bike. He was quite taken aback, and could scarcely believe that he saw aright, as such an experience was entirely new on the fields; but the snarling of the brutes soon roused him to a sense of the danger of his position. Mr. Bamblett was an expert rider, with an extraordinary development of "calf", and he soon got going in good style. The road was smooth, and the dingoes did their best also, as the cyclist often had them close to his pedals. The race went on between cyclist and dingoes for several miles, and it seemed to the former that the latter would have a decent meal out of his lunch-bag, if not off himself. At last that part of the track was reached which crosses the end of Lake Cowan - a great saltwater lake when rain falls, but which, at this time, was perfectly dry, with a smooth, hard surface admirably adapted for cycling, and Bamblett went on at a rate he had never previously attained. The going appeared to be equally good for the dingoes, as they kept up the pace, although it was a regular cracker. For a few miles this terrific speed was kept up, until one by one the dingoes got tired out and had to retire baffled and beaten.

During the whole of the race the cyclist knew that, barring accidents -- such as his tyres getting punctured, or a stick getting into his wheel, or losing his pedals or his balance -- he could easily win the race for life in which he was engaged. When he was well away from the brutes Bamblett got off his bike, nearly done up with his tremendous exertions. By this time night was rapidly approaching, but there was a good full moon, and he did the last twenty miles of his journey by moonlight, reaching his rendezvous for the night after a most exciting and trying day's work, the like of which had never been previously experienced on the Coolgardie goldfields.

Scientists who have studied dingos intensively consider the account implausible. Catling (1977) feels there may have been an element of curiosity involved in which a dingo or two trotted near for a brief inquiry. However, he does not think it remotely probable that they would have chased the cyclist or snarled. Ride (1977) said that dingos 'do not chase people', but suggested an alternative of a pack of feral dogs. Everyone agrees that whatever the basis for the episode, Marshall's account is a case of extreme literary licence; certainly other descriptions in his book support this contention. It was probably tales

such as these that led one writer to state that the 'liar, the d----d liar, and the mining expert' had been replaced by the 'liar, the d----d liar, and the "special cyclist"' ('Spokesman' 1896:129).

Some cyclists suffered the predations of dingos. In the Northern Territory Blakeley's (1938:228) party left their bicycles to explore some adjacent countryside. When they returned they found their tucker bags torn apart. This surprised them as previous experience had led them to believe dingos would not approach bicycles. Birtles (1935:24) experienced a similar incident.

Cattle could be dangerous to cyclists, and riders were warned by some drovers to get out of sight with their machines (Schwaebisch 1899a: 191). Two Victorian cyclists were chased and one gored by a bull (Argus 16/4/97:18) and a herd was hit by road racers the same year (Bul 11/9/97: 24). Dunlop used the theme of a bull chasing a cyclist for an advertisement -- Dunlop tyres ostensibly provided the requisite 'safety, comfort and reliability' for such circumstances (Dunfile). During his overland ride Murif reported that his bicycle bell, an obviously novel sound, frightened away a bull, an experience similar to that of another rider earlier in the year in Victoria (AuWh 4/97:117).

There was little direct danger to cyclists from horses, although the Inspector-General of Schools in South Australia was severely injured in a collision with one (AuWh 9/96:249). The greatest problems were punctures resulting from dropped horseshoe nails and the rough surfaces left by the hooves. There was often hostility between horsemen and cyclists. This resulted in part because horses were often frightened by bicycles; cyclists were advised to 'dismount when they perceived a horse to be showing unmistakeable signs of restiveness and fright' (Williams 1896:86). Also that the bicyclist was faster than a horse apparently

irritated many horsemen. And by the turn of the century the bicycle was clearly a herald of much faster and more important forms of transport that threatened the horse's role and status; in a society as enamoured of the horse as was Australia, that may have been especially galling. Many horsemen were distinctly inconsiderate of cyclists and made life difficult for them wherever possible. In Fremantle, for example, one teamster allowed his horse to step on a bicycle left on an embankment and the cyclist subsequently sued for damages. To the undoubted satisfaction of many, the judge ruled that the quadruped had no right on the embankment, whereas the bicycle had. He awarded 25 shillings repair costs and five shillings for the lost interim services of the 'useful wheel' (MorHer 18/12/97:2).

The hazards of cycling led several insurance companies to offer policies. For 15 shillings annually one firm insured the cyclist for £100 in the event of death and £1 per week for temporary total disablement -- including injuries incurred while racing and training (AuWh 8/98:218). How many subscribed is not known. Non-riders needed cover at times; A Geelong man, who in a drunken stupor lay on a roadway to sleep, was hit by a cyclist and died from a skull fracture (Argus 31/7/12:4).

Elevation and gradients

There is little high altitude cycling in Australia; some three quarters of the land area lies between 600 and 1,500 feet (183 and 457 m) (AusYrBk 1969:27), and the eastern central lowlands allow one to travel throughout much of western New South Wales, Queensland and Victoria without exceeding 600 feet (183 m). Only five percent of the country lies over 2,000 feet (610 m) (Sale 1967:21); unfortunately, most of this is found in the Great Dividing Range of the east and southeast and separates the majority of the population from the low, relatively flat central and

western regions. Even so, most routes across the highlands utilise passes of less than 3,000 feet (914 m).

Throughout most of Australia the local relief is relatively small. Over extensive areas such as the Riverina and Yilgarn Plateau rises of only a few centimetres per kilometre are common. On the other hand, the escarpments, steep slopes and extensive hilly areas of the eastern highlands, Flinders Range, and southeastern coast pose some of the most difficult cycling conditions in the country. Being near to the major cities and incorporating much of the rural and small town population of Australia, such features are probably familiar to more cyclists than the flat central and western regions. Yet, even in these areas relatively gentle slopes and little local relief are common over extensive, densely settled areas such as the Darling Downs, New England and Monaro Tablelands, the Hunter, Goulburn and Barossa valleys, and Gippsland; thus cyclists are not faced with difficult terrain in much of the eastern highlands and coastal areas. Nevertheless they must cope with varying gradients and their ability to do so is influenced by several factors.

A major element is the rate of a cyclist's heat generation and dissipation. With an expenditure of 0.11 horsepower (82 J) a cyclist can travel at about 14 miles per hour (22 kph) on level ground in still air. The relative windspeed provides a sufficient rate of heat dissipation to allow the power output to be maintained. But on a steep slope where, say, only $1\frac{1}{2}$ miles per hour (2.4 kph) can be attained for the same power output, the slow relative windspeed is ineffective in cooling the rider. The result is a quick heat buildup with subsequent discomfort and inability to maintain the power output for long. The importance of cooling is shown by the fact that only by keeping their power output down to about 0.2 horsepower (149 J) can very fit pedallers last more than about a half hour on a stationary ergometer (Wilkie 1960); yet, cyclists can maintain

an estimated 0.3 horsepower (224 J) output for 24 hour races (Whitt 1974:58).

On a gradient a cyclist is slowed down proportionately more than a walker. For example, a walker exerting a continuous 0.05 horsepower (37.3 J) would be slowed from a level-ground rate of about 2 miles per hour (3.2 kph) to about $1\frac{1}{2}$ miles per hour (2.0 kph) on a 1 in 4 (25%) gradient. In a similar situation a cyclist would be slowed from about 10 miles per hour (16 kph) to $2\frac{1}{2}$ miles per hour (4.0 kph). The cyclist's gradient speed is only 25 percent of his level-ground speed, the walker's 62 percent. The cyclist, then is much more aware of the relative effect of the gradient -- even though his absolute speed is still higher (Whitt 1974:42). But the above example assumes an appropriate gearing for the cyclist in both circumstances. Given only one gear and an increasing gradient, the rider, unable to vary the pedalling rate, would soon reach an inefficient rate of power delivery and not be able to maintain the $2\frac{1}{2}$ mile per hour (4.0 kph) rate of travel. The pedestrian, in contrast, can readily vary his stride and rate of walking. Not only that, but on a gentle gradient a walker is actually slightly more efficient in terms of oxygen consumption than on level ground (Whitt 1974:42).

Ultimately the cyclist must decide when it is more sensible to dismount and push rather than to continue riding. The decision is affected by several factors: air temperature, dress, and power output attempted (affecting heat dissipation and generation); absolute windspeed and direction (affecting power output required); weight of the bicycle, rider and load; the nature of the road surface, weather conditions and tyres (affecting rolling resistance); gradient; and available gearing. Whitt (1974:46-47) indicates that on a 20 percent (1 in 5) slope there is no 'really appreciable advantage in riding the cycle', even with appropriate gears. However, on a 15 percent (1 in 6.7) slope a cyclist exerting 0.1

horsepower (74.6 J) is metabolically about one third more efficient riding the machine than pushing it. However, this requires an optimum pedalling rate and hence low gearing. As well, the figures assume a relatively low rolling resistance (modern, high pressure tyres on sealed surfaces). For former rural Australian cyclists with only a single gear (generally selected for comfortable level riding) and using broader, lower pressure tyres (giving greater rolling resistance), a 15 percent slope, possibly less, was more likely the limit for effective sustained riding -- even on the best surface. On sand, mud or dirt the maximum rideable gradient would have been considerably less: in extreme circumstances such surfaces can prevent a rider from pedalling even downhill.

Brakes

Regardless of the problems encountered in bicycling uphill, a cyclist in hilly country has an important advantage over pedestrians and animals: he can coast downhill. While a pedestrian and animals must expend energy to lower themselves step by step downhill, the cyclist can roll along for comparatively little energy output. But the cyclist's advantage ultimately depends upon adequate brakes to control the machine at as little cost in human energy as possible. On a ten percent (1 in 10) gradient a freewheeling rider on a smooth surface will reach a speed of 43.8 miles per hour (70 kph). On a gentle gradient of 2.5 percent (1 in 40) the maximum speed will be 20.1 miles per hour (32 kph). The speeds are asymptotic, but 95 percent of the velocity is attained within 400 metres (Whitt 1974:235). Thus even on a moderate slope a rider quickly reaches a relatively high speed if not braked.

A brake was not a standard accessory on fixed wheel bicycles. In flat locales cyclists suggested that 'as we have no steep hills they are

hardly necessary at all' (BellWA 1/8/96:6). Another belief that deterred their use was that too hard an application caused severe tyre wear (AuWh 11/97:351). Photographs indicate that in some areas, especially Western Australia, the majority of bicycles had no auxiliary brakes.

Without brakes the fixed wheel cyclist normally backpedalled to stop. He did not actually reverse the direction of pedalling, but resisted the pedals' forward motion. Curiously a person is able to do 'negative' work more effectively than 'positive' work: 'for a given oxygen consumption a pedaler can resist power supplied by an animate or inanimate prime mover to a greater efficiency than he performs with ordinary pedaling' (Whitt 1974:168). For example, if a pair of evenly matched pedallers are on a moving tandem bicycle, with one trying to pedal forward and another trying to stop the machine by backpedalling, the backpedaller can bring the bicycle to a stop. The physiological aspects of 'negative' work are discussed by Tucker (1975).

Backpedal braking had several disadvantages. Since both motive and braking power were transmitted through the chain there was more frequent strain on it and a greater likelihood of a break (AuWh 11/96:335). If a chain broke while pedalling forward it was rarely critical; however, breaks during crucial stopping situations occasionally led to injury and death. Also sudden backpedalling exaggerated the tendency for slack chains to be thrown off rapidly spinning cogs (AuWh 3/98:76). If a rider lost his footing he had no braking capacity at all, and regaining whirring pedals was often impossible. One observer felt that backpedalling was 'against the natural revolution of the wheels' (MorHer 11/9/97:2).

Backpedalling required considerable energy and could be very tiring (AuWh 2/98:48). Much of the cyclist's energy advantage in coasting downhill was lost if he had to periodically or continually rein in the machine

by backpedalling; if unable to do so effectively, he was forced to walk. Railton (1896:110) had to dismount and push his bicycle most of the way from Hotham to Harrietville because he could not cope with the steep descent. Kopsen (1899b:188) had a similar experience from Klandra to Tumut.

Some cyclists in hilly areas tried supplemental braking techniques. One was to drag a limb behind as a land anchor (Marsh 1977a). Another was to wedge a stick within the framework of the bicycle and lever one end against the ground. However, the time needed to find adequate limbs and the strain on arms and wrists discouraged its use ('Columbia' 1899:5). Cyclists dragged their feet on the front tyre, a very common practice (Leithead 1977) that was effective, but the heat generated could be 'unpleasant' on long descents (Pemberton 1897:87). It was also a safety measure when a rider lost his footing on the pedals (AuWh 3/96:57); one rider felt that the technique was 'safer and surer than any mechanical device' and 'more sensitive in its application', but suggested caution when wearing hob-nailed boots ('Chainless' 1899:245).

A variety of auxiliary brakes were available and fitted to many fixed wheel bicycles. There were backpedal actuated brakes such as the Doolittle (WAWh 28/5/97:10), pneumatic devices (AuWh 9/96:269) and rim brakes (not the caliper style in current use), as well as other relatively exotic devices. Most were hand actuated. Foot brakes usually required the rider to remove his foot from the rotating pedal, something few were willing to do (Wallis 1897:239). The most common auxiliary brake was the plunger or 'spoon' type which forced a block of metal, rubber or leather against the rolling surface of the front tyre. Some felt this a clumsy technique (AuWh 11/96:335) and dangerous during hard braking because of the risk of catapulting over the handlebars. However, the plunger brake was quite effective, mechanically simple, and grit on the

tyre improved braking performance and wore the stationary pad rather than the tyre surface (a definite advantage on unsealed surfaces) (Whitt 1974:154). Importantly, it was hand operated and required little force, although Sharp (1896:527) reported that such a brake on the front wheel alone could not stop a bicycle on a slope of greater than 12 percent (1 in 8.3). Their efficiency was very low in wet weather.

As freewheel bicycles could not be backpedalled, some form of brake was necessary. A backpedal-actuated brake incorporated into the freewheel hub became standard; they were very effective on back wheels and according to Sharp (1896:528) could stop a bicycle on a gradient of 28 percent (1 in 3.6). Also they are not affected by wet weather. However the strength required to work them makes them impractical for hand operation on front wheels (Whitt 1974:154).

Rim stirrup, rim caliper and contracting band brakes (normally hand operated via calipers and rods) were developed and used after the turn of the century (Caunter 1955:49-50) but do not appear to have been used commonly in Australia through at least World War I. From the 1920s rim caliper brakes were occasionally fitted to front wheels to supplement the rear coaster hub brakes.

As Whitt (1974:158-164) has discussed, dual rim caliper brakes result in the rear wheel tending to lock up, with the front wheel providing about 90 percent of the retarding force at 0.5 G deceleration (about 16 feet per second², or 4.9 metres per second²). This is about the limit of a cyclist's braking capability, at which point he is on the verge of being thrown over the handlebars or having the machine slue around on him. At 20 miles per hour (32 kph) the rider needs some 26 feet (7.9 m) to stop. With a rear wheel brake only (assuming a locking capability), at the limit of tyre adhesion, only about 0.256 G deceleration can be achieved, representing a minimal stopping distance of about 52 feet (15.8 m), or twice

that required with two-wheeled braking. The above figures are for sealed surfaces and must be modified for dirt or other surfaces. However, in wet weather rim brakes are only about five to ten percent as effective as when dry (Whitt 1974:156; BBC 1973). Consequently the large number of modern cyclists using dual caliper rim brakes (required with the derailleur gears now in vogue, as no hub brake can be fitted) are poorly equipped for wet weather braking. In comparison with the rear hub brake that was standard after the turn of the century (and fitted by rural Australian cyclists), the modern cyclist's all weather braking capacity has severely regressed.

Regardless of the cyclist's combination of brakes and/or back-peddalling, he could be lulled into a false sense of security. His braking capacity might, at a given speed and gradient, allow him to gradually slow and stop. But as the speed and/or gradient is increased a point is reached at which the braking resistance will equal the force of the moving machine and rider: he will no longer be able to slow down, let alone stop. Since force is proportional to the square of the velocity (Cromer 1974: 87) only a slight further increase in gradient is needed to accelerate the cyclist out of control. Under these circumstances riders suffered severe accidents (Argus 9/1/12:5), 23/1/11:8) and death (AuWh 1/98:15). Road gradients in those days were generally greater than today. Pearson (1925: 18) commented that by early this century the gradients of many roads were much improved over what they had been in the late 1880s and early 1890s and Leithead (1977) has noted the improvement of many road gradients since the 1920s and 1930s.

Cycle Touring in the Australian Alps

In his study Discovering Monaro, Hancock (1972:139) suggests that 'the first splutter of the tourist explosion in the high country' of New

South Wales occurred in 1909 when a road 'with an hotel thrown in' was completed to Mount Kosciusko. However, significant tourism appears to have begun throughout the Australian Alps in the mid-1890s, with the use of the bicycle. The machine was important in expanding Australian tourism in general (Chapter 5). In mountainous areas poorly served by railways or with infrequent coaching services to many communities, the personal mobility provided by the bicycle was invaluable. Many bicycles were owned by those who could not afford horses. For those contemplating a mountain tour, charges for rail and coach fares, or hiring horses for a several day journey, represented a substantial proportion of the outright cost of a cycle.

Even with solid rubber tyred machines, the Australian Alps (the southwestern fringes of which are within a half day's journey of Melbourne) attracted riders; the advent of pneumatic tyres brought most of the alps within reach. In 1894 George Burston became the first to cycle across the Mount Hotham area, travelling from Omeo to Bright; in 1896 J. Railton (1896:108) followed in his tracks. The next year another rider made the crossing in the opposite direction. Pushing his machine up the steep ascent from Harrietville, he concluded that 'doing this for miles uphill, one soon has enough of it'; he was glad to have two teamsters push the machine for him. Unfortunately he encountered a heat wave (105°F (40.5°C) in Harrietville) and did portions of the trip at night. Also the road to Omeo was heavily cut up by bullock teams near Bairnsdale. Notwithstanding these conditions, he completed 191 miles (307 km) in eight days (W.F.L. 1897).

Sydney bicyclists, even though they had to travel 300 miles (483 km) to reach the fringes of the high country, had also begun exploring the highlands very early. In 1889 at least one party completed a circuit from Sydney to Goulburn, Braidwood, and down Clyde Mountain to the coast

(MorEx 1/11/89:2). By 1890 many had ridden along the south coast, across the Great Divide at several points, and to Melbourne along the Hume Highway. It is not known, however, when the first cycle trips to the Snowy Mountains area were made.

The first bicycle ascent of Mount Kosciusko was made in late December, 1898. W.R. Gainford (1899a), in company with Eric Barling, took the train to Goulburn from Sydney. After a severe frame break, fitting wire stays and bindings to the frame, and waiting out intermittent storms for 18 hours in Berridale, they reached Jindabyne (where a new 'Tourist Hotel' had recently opened) on Christmas Eve. The rate for a trip to the summit of Mount Kosciusko was clearly established: £1 per day per person for the provision of riding and pack horses, a tent, food and a guide's services. Frederick Collins agreed to conduct them, despite reservations about whether the bicycle could be got up the mountain. As a precaution he provided a riding horse for Gainford. Barling was content to leave his machine in Jindabyne.

The first day they started late and camped the night at Thompsons Plain. The next morning they left very early and, taking a route near the ridge of the Rams Head Range, reached the top of Kosciusko by 4:30 that afternoon, 28 December. The tourists and bicycle were greeted by the two caretakers of the meteorological observatory who, themselves cyclists, 'enjoyed the novelty of cycling on this snowy track' (Gainford 1899b:191). The visitors briefly surveyed the observatory, witnessed a demonstration of snow-shoeing and generally admired the spectacular vista about them. At 6 p.m. they left and that night camped at Merriits Spur. The following morning Collins led the party into the Thredbo Valley via a heavily wooded track down a 'rough and precipitous' spur. They arrived back in Jindabyne 5:45 that afternoon.

Gainford said nothing about the specific problems involved in getting his bicycle up and down the mountains. However, of the estimated 60 miles (96 km) covered in the 2½ day trip, he rode horseback for five (8 km), managed to bicycle for 25 (40 km), and walked the remainder (Gainford 1899c:213). Although he can hardly be credited with having opened up an everyday cycling route for tourists, he demonstrated that the trip could be accomplished by a cyclist, and gained the laurel as the first.

Over the next few years other cyclists took their machines to the top of Mount Kosciusko. Joseph Pearson (1925:35-36) claims to have made the first 'true' cycle ascent -- he never resorted to a horse, as did Gainford. Pearson had left Sydney and rode via Yass, Gundagai, Tumut, Kiandra, and Adelong to Jindabyne. After returning from Kosciusko he passed through Dalgety and Cooma and descended Brown Mountain to Bega. Heading north along the coast to Sydney he was photographed by William H. Corkhill at Tilba Tilba (Plate 5.17). The picture appeared in the Australian National Library's 1977 Engagement Calendar but was unfortunately mis-identified as 'possibly Fred Mead of Cobargo'.

While Gainford was ascending Kosciusko, another cycling party from Sydney was touring the Kiandra area (Kopsen 1899a, 1899b). They came via Cooma and returned through Adelong and Gundagai. The riders carried an aneroid barometer and prepared a pair of elevational profiles of most of the route for the New South Wales Cycling Gazette (28/1/99:142, 24/2/99:183). In Kiandra Kopsen talked with yet another party of tourists which had just returned from Mount Kosciusko. It was their opinion that the most suitable route for a road to the summit was south from Kiandra, as the gradient was much more gradual than from Jindabyne. The returning party felt that 'a bicycle track could easily be constructed' (Kopsen 1899b:187) along the route, and that in fact the track then in use was

partially negotiable by cycles, the principal obstacle being the tussock grass.

It is impossible to estimate how many cyclists made alpine trips, but the number was probably high. The New South Wales Cycling Gazette often mentioned journeys to the southern tablelands and alpine areas in brief 'club notes' and a column or more was devoted to them on occasion (CyGaz 25/2/99:184). In Victoria the Austral Wheel contained numerous descriptions of cycle journeys in that colony's mountainous areas (Bowen 1896; 'Columbia' 1899). In the Tourist, a Victorian cyclist described his extended tour through the alpine areas of both colonies, including yet another ascent of Mount Kosciusko (Garnet 1902). In his reminiscences Pearson (1925:26-27) mentions leading several bicycle tour groups throughout the area, one of which, for example, pedalled from Sydney to Melbourne via Cooma, Dalgety, Goongerah and Orbost.

The greatest limitation to estimating the extent of alpine cycle touring is that the few cycle journals that covered touring matters were neither thorough nor representative. Published in the capital cities, they reflected mostly the activities of local metropolitan clubs. Also, by the late 1890s tens of thousands of bicycles were in use, yet only a small fraction of the owners belonged to any clubs or touring organisations. Their rides went unrecorded in cycle journals and were not newsworthy for the newspapers.

Among the best indicators of the probable extent of cycle touring in the Australian Alps in the 1890s was the publication in December 1897 of the Austral Wheel Guide to the Victorian Alps, a special supplement to the regular issue. It contained photographs and detailed descriptions of various Victorian alpine settlements and touring routes and indicated road conditions, accommodation and eating facilities, and similar matters

of interest to the intending tourist. Obviously the Victorian Alps were considered a prime goal of many cycle tourers that season; the advertisements placed by hotels and guest houses reflected that anticipation. No similar guide was ever published by the Austral Wheel for any other part of Victoria.

It does not appear that any alpine 'special' was produced for New South Wales. However, as the New South Wales Cyclists' Touring Union (CTU) Cyclists' Handbook and Guide to the Roads of New South Wales (NSW CTU 1898) listed road surfaces, distances, local CTU representatives, train schedules and fares, hotel prices and afforded discounts to CTU members, it was more useful in several respects than the Austral Wheel Guide.

Tourism in the Australian Alps, then, appears to have been common by 1900. The bicycle's role in that development during the latter 1890s is very important, if not crucial. It enabled tourists from distant urban centres to view some of the most spectacular scenery the country could offer, at minimal transport cost and in a relatively short period. By the turn of the century cyclists had pedalled or pushed over most of the major roads of the highlands and had ascended several peaks as well. If not frequently emulated, they at least inspired others to less spectacular accomplishments, such as to Kiandra, Jindabyne, Warburton, or Bright (Plate 4.5). The annual endeavours of individuals and touring groups alike accumulated information and enthusiasm that by mid-1898 resulted in detailed touring guides. These allayed many doubts about mountain touring, made tour planning straightforward, and provided a great source of 'armchair' reading for the many who could only travel there vicariously. The cumulative effect was to develop a new consciousness with regard to touring in Australia's mountains. Well before the motor vehicle, the paths had been ridden and described (often in great detail)

by cyclists. As in so many ways in rural Australia, the human-engined device had opened up new opportunities.

Night Riding

Night cycling was common. In hot weather it was often more sensible than attempting a long, difficult ride during the day (W.F.L. 1897:82). The cooler temperatures (by aiding heat dissipation) enabled a cyclist to sustain a given power output with less discomfort. On occasion cyclists rode at night to benefit from decreased winds (Morher 14/4/98:2). Commuters often had to cycle to and from work in darkness -- at 35 degrees latitude there are only ten hours of daylight in mid-winter (CAS 1977:10). A Forest Grove, WA, resident, working a 5½ day week at the Collie mines, rode to work through the Sunday night, returning home the following Saturday afternoon (McKenzie 1977a). Riders from Collie wanting to reach Perth by lunchtime left in the early morning darkness (Riley 1976).

Night riding was often undertaken without auxiliary lights. In an era when artificial lights were neither abundant nor bright there were both advantages and disadvantages. Certainly on dark nights on unsealed surfaces, the lack of street lights or reflected lights from buildings would have made safe cycling very difficult without lamps. On the other hand riders were not faced with the constant problem of having dark-adapted eyes affected by street, town or motor vehicle lights, as occurs today.

Moonlight was a great aid to cyclists, and many travellers took advantage of it (Birtles 1910:514; Coleman 1898e:226; Bowen 1896:175). The Adelaide - Melbourne record attempts commonly began in Adelaide at full moon. The riders utilised the moonlight over the early, relatively good, routes out of Adelaide. The worst sections in the Coorong and

southeastern South Australia were negotiated in daylight and the following night moonlight was again utilised on the better Victorian roads (AuWh 11/97:352). The South Australian Cyclist's (5/8/98) road map in 1898 pointed out that legally 'It is not necessary to carry lights on the four nights preceding the night of the full moon, nor on the night of the full moon; but on the nights immediately succeeding the full moon lights must be carried'. (That was because the full moon arises at sunset and approximately an hour later each succeeding night, hence early evening riding within a couple of days after the full moon was in darkness). There was a £2 penalty for failure to mount lights when required. As dark-adapted eyes can use moonlight to great advantage, weak bicycle lights were not only not required but probably of little assistance to the rider. During the course of the year the intensity of the full moon varies greatly; when nearest earth it is approximately 30 percent brighter than at apogee (Alter 1973:14), providing more riding light.

Bicycle lights were mandatory in most cities and communities. However, photos rarely show lanterns on bicycles, regardless of the era or area represented, and the lack of them was a perpetual source of conflict between cyclists and others (KalMin 2/8/97:2). Enforcement of lantern laws was generally less strict in small towns than larger centres (WAWh 14/1/98:15). Portable lights such as candles, and miners' head lamps were occasionally hung on the machine or rider (Witt 1977; Riley 1976; Boulton 1976). But Garratt probably summed it up well:

They are all more or less of a nuisance ... lucky is the man who has one that will enable him to see a cart thirty yards off when he is riding at twelve miles an hour ... as a rule the light merely dazzles the rider and makes everything around appear impenetrably dark'.

What was needed was 'a little light a long way ahead, not a very bright patch just in front of the machine' (Garratt 1899:219-220). Interviews,

correspondence and literature suggest that lights were not much used for rural travel, although in an effort to set a long distance cycling record White mounted three lamps, one on the handlebars, and one low on either front fork (AuWh 10/98:300).

Oil lamps were among the first to be adapted for cycling, although users complained about the smoke and that they served more effectively as 'an automatic lubricator to the tires' (WAWh 15/1/97:18) than for lighting. Acetylene (carbide) lamps were widely adopted in the late 1890s. They were clean, produced a bright light and, as many miners used them, fuel was generally readily available (Boulton 1976; Riley 1976). The nature of carbide lights (adding water to produce the gas) led to jokes about those who had never seen water burn. Electric lamps eventually came into use but were not popular among some because of the cost of the batteries and the corrosion of the points in long-term, foul-weather use (Riley). Stonehouse (1976a) felt that the batteries over the years became progressively poorer in quality.

Vegetation

Much of Australia's natural vegetation was quite amenable to cycling. Its xerophytic nature often resulted in a relatively sparse ground cover of low bushes, trees, shrubs and grasses. By the time the bicycle was introduced the vegetation had often been extensively modified as well, usually to the cyclist's benefit. For millenia, aboriginals had been prolific in their use of fire for hunting and had extended the open woodlands and grasslands. The Europeans continued the trend by clearing and burning to extend pastoral and agricultural areas. In forest, mallee and scrub areas that could have been relatively difficult to penetrate, bicyclists often found that roads and tracks had already been pushed through.

Cleared vegetation left cycling hazards. In the Northern Territory a broad avenue about one chain (20 m) wide had been cut through the scrub for the overland telegraph line. However, there were many stumps, logs, limbs, and decaying telegraph poles on the track. When the sun was low the shadows from standing timber often misled Murif (1897:117) into dismounting or preparing for obstacles that proved ultimately non-existent. More disconcerting, and ultimately injurious, was the occasional 'shadow' that proved to be a log.

Some cyclists took bicycles into areas of such thick vegetation that riding was impossible. In their haste to reach a purported gold strike at Israelite Bay in Western Australia in 1895, for example, several riders cut their way through thick brush and timber (CooPio 21/8/95:6). On narrow pads cyclists suffered scratches and cuts from limbs and brush (Costello 1977; Garnet 1901:8), which could sometimes be painful and slow to heal (Murif 1897:145). Vegetation was often a good guide as to cycling surfaces. Murif noted that spinifex generally meant loose or sandy soil and looked longingly for the mulga thickets where, as Coleman (1898e:226) put it, 'the going is always good'.

'Luxuriantly grassed' plains generally provided good cycling, but occasionally posed problems. Near Daly Waters, NT, Murif (1897:168) encountered wirey grass which wrapped around the spokes, hub, chain and cogs and quickly immobilised the machine. He had to frequently dismount and cut it away, sometimes every few hundred metres. The same problem was met with by the Blakeley (1938:223-224) party 11 years later, who occasionally found it easier to carry the bicycles than be bothered with having to constantly cut grass from the axles.

Bushfires plagued some cyclists. The White party met with several in Western Australia during their around Australia ride (WesMail 17/2/00:

34) and Andrews (1898:9) and a companion were forced to carry their bicycles over burning logs in the Otway Forest of Victoria. Remnant coals remained a hazard often long after the blaze itself had passed, and Birtles (1935:23) suffered two punctures from coals near Gympie, QLD. And aside from the continual need to watch out for such tyre puncturing plants as spinifex ('Mac' 1896:174), in burnt areas spikes on the stubble of coarse kangaroo grass punctured tyres as well (Blakeley 1938:222).

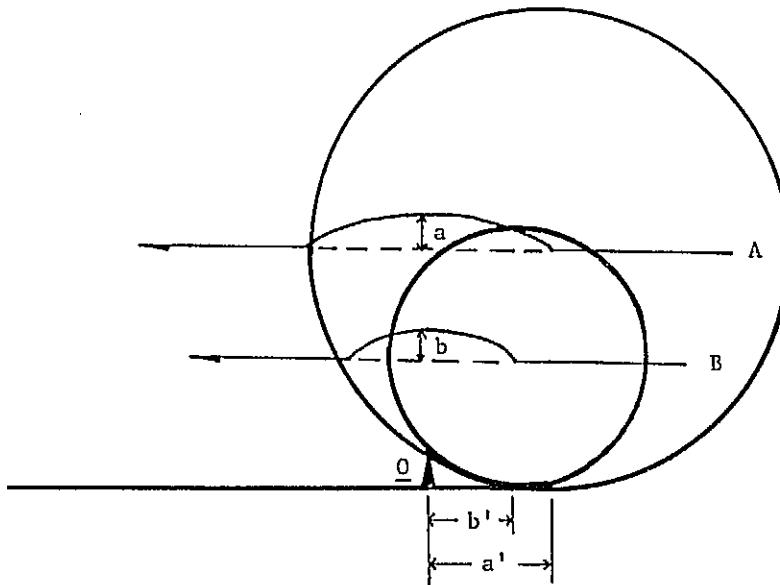
The greatest vegetational hazards for the rural cyclist, however, were the numerous thorny plants that punctured tyres. These will be discussed presently.

Wheels

The size of a wheel directly affects the ease of riding. With respect to rolling resistance, the larger the wheel the more easily it runs when supporting a given weight (Whitt 1974:112), and the effect is even greater on soft than hard surfaces. In one test it was found that if the wheel diameter was increased by 35 percent, the rolling resistance decreased by 20 percent (Whitt 1974:105-106). Large wheels roll more smoothly over surface irregularities. A larger wheel may roll 'across' the opening of a small hole, but the edge of the hole acts as an obstacle to a smaller wheel.

Large wheels are more satisfactory in riding over stones, gravel or other rises from the normal surface because a large wheel passes over a vertical obstacle more gradually than a smaller wheel (Sharp 1896:245). As shown in Figure 4.4, the 30 inch (76 cm) wheel encounters the obstacle earlier and spreads the total vertical rise and fall over a longer horizontal distance than does the smaller 16 inch (41 cm) wheel. In this example the ratio of vertical to horizontal

Figure 4.4
PATH OF WHEEL CENTRES OVER AN OBSTACLE



A = line of travel of centre of wheel A (diameter = 30 inches - 76 cm)

B = line of travel of centre of wheel B (diameter = 16 inches - 41 cm)

$a = b$ = height of obstacle $\underline{O}$ (2 inches - 5.1 cm)

$a' = 7.48''$

$b' = 5.29''$ $a' \text{ or } b' = \sqrt{2rh - h^2}$, where r = wheel radius
 $h = \underline{O}$

Ratio of total vertical lift to total horizontal travel

for A = $a/a' = 2/7.48 = 1/3.74$

for B = $b/b' = 2/5.29 = 1/2.64$