The Bowker Electric Car

John Earl Bowker

Tusmore, South Australia

Design filed 1941

Patent 1944

The story of the battery

WHEELS magazine article about a second versionof this vehicle (1974)

May 2, 1944. J. E. BOWKER 2,348,053

ELECTRICALLY OPERATED MOTOR VEHICLES

Filed July 10, 1941 2 Sheets-Sheet 1

FIG. 1

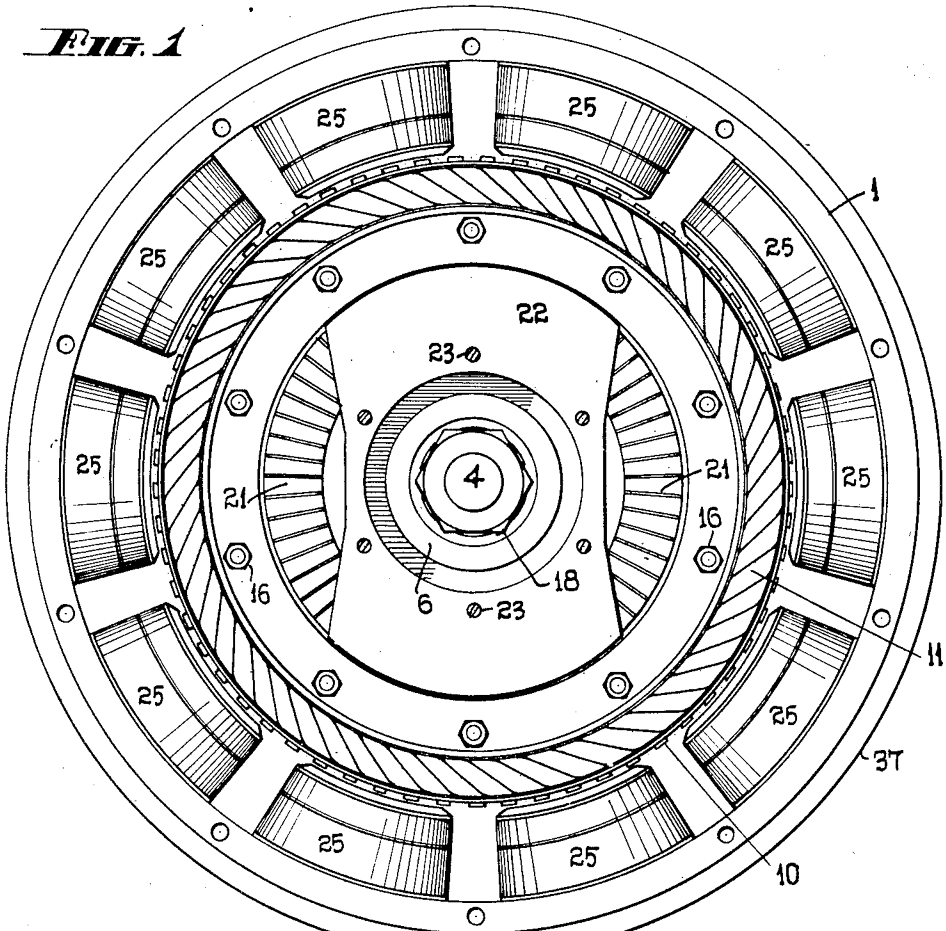
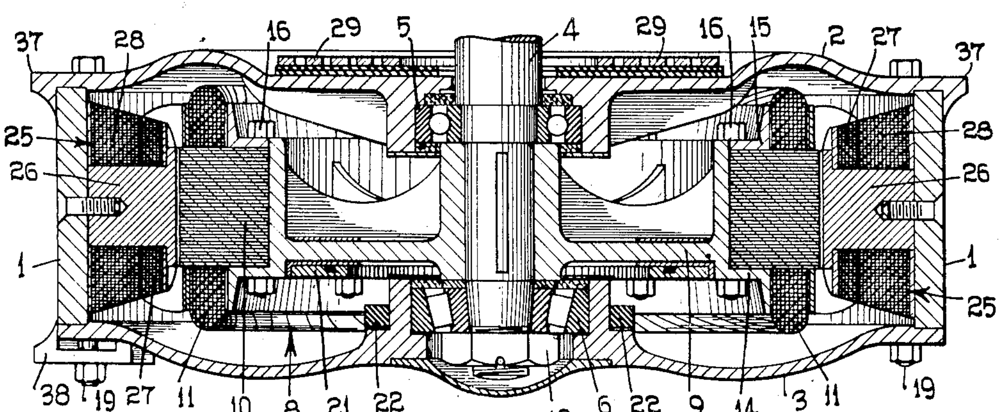


FIG. 2



INVENTOR

John Earl Bowker

BY *Munn, Anderson & Liddy*

ATTORNEYS

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FIG. 3

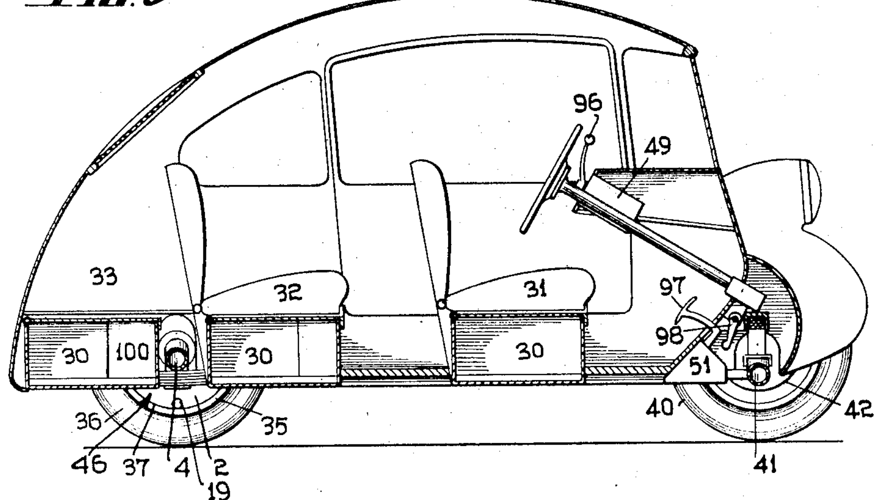
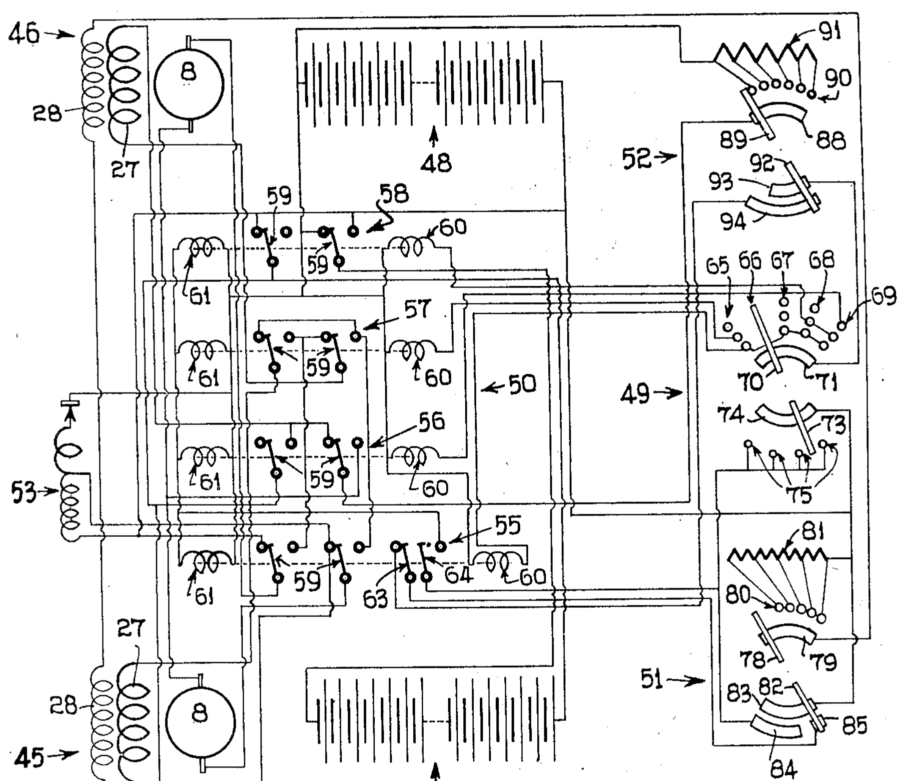


FIG. 4



INVENTOR

John Earl Bowker

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ATTORNEYS

Patented May 2, 1944 2,348,053

UNITED STATES PATENT OFFICE

2,348,053

ELECTRICALLY OPERATED MOTOR VEHICLE

John Earl Bowker, Tusmore, South Australia, Australia

Application July 10, 1941, Serial No. 401,793
In Australia July 26, 1940

3 Claims. (Cl. 171—313)

This invention relates to improvements in and to electrically-operated motor vehicles. There are in electrically-operated motor vehicles a number of features which it is necessary to study closely if such a vehicle is to be a success, the chief of which features is probably the conservation of energy by utilising as much power as possible which would normally be wasted in overcoming the resistance to propulsion of the vehicle.

The object of this invention therefore is to provide a battery-driven vehicle wherein a substantial reduction of losses is effected.

According to my invention each wheel which is to be driven is provided with an independent dynamotor which is, when the vehicle is being driven forward, supplied with the necessary driving current and which operates when the vehicle is running free to charge the batteries, to act as a brake, or to do other useful work.

A feature of the invention is the incorporation of a dynamotor within each wheel which is to be driven. A further feature is a particularly arranged electrical control arrangement whereby the regenerating effect is brought into circuit when the dynamotor is to act as a brake. Further features of the invention will be apparent from the following description which is to be made with reference to the accompanying drawings in which is shown an embodiment of the invention showing it applied to a battery-driven road car.

In the drawings

Fig. 1 is a view of the driving part of a wheel with the front cover and supporting plate and the tyre and tyre carrying rim removed but leaving the brush-carrying block which revolves with the cover plate in place.

Fig. 2 is a central horizontal cross section of the driving part of the wheel.

Fig. 3 is a somewhat schematic sectional view showing a vehicle incorporating the invention, and

Fig. 4 is a circuit diagram of the vehicle illustrated in Fig. 3 showing electrical drive applied to the two rear wheels only.

The wheel as illustrated particularly in Figs. 1 and 2 comprises an outer revolvable rim or field yoke 1 over which the tyre-carrying rim of the wheel is adapted to be positioned. A rear plate 2 and a front plate 3 locate the rim 1 about a fixed axle 4, a bearing 5 being disposed between the plate 2 and the axle 4, and a bearing 6 being disposed between the front plate 3 and the axle 4.

Fixed upon the axle 4 so it cannot revolve thereon is an armature 8 comprising a support 9 which carries upon it laminations 10 which are slotted to take the armature windings 11. The laminations are clamped in place between a flange 14 upon the support 9 and a flange 15 held upon such support by means of the bolts 16.

The armature support 9 together with the inner bearings 5 and 6 are locked in place upon the axle 4 by means of a key and lock nut 18.

The plates 2 and 3 are locked securely to the field yoke 1 by means of bolts 19.

Carried upon the support 9 is a commutator 21 which is associated with the armature, this commutator taking any usual or approved form and being adapted to be engaged by brushes carried upon a plate 22 which is secured by means of bolts 23 to the front plate 3 of the wheel.

The field coils 25 of which there are ten each comprises a core 26 and two windings 27 and 28 respectively the windings 27 being a series field winding and the winding 28 being a regeneration winding.

A wheel constructed as described can operate as a self-contained unit, the armature 8 being non-rotational and the field yoke 1 revolving about same and providing the drive and when applied to a vehicle as shown in Fig. 3 such wheel is simply secured over the axle 4 and connected into an appropriate electrical circuit for instance that shown in Fig. 4 of the drawings. The current is taken to and from the wheel through slip rings 29.

In the vehicle shown in Fig. 3 the battery cradles are designated 30 these being disposed beneath the front seat 31, the back seat 32 and the luggage space 33.

The rim 35 upon which the tyre 36 of the wheel is secured is positioned over the field yoke 1 of the dynamotor and fits back against the flange 37 of the rear plate 2, the rim being locked in place by suitable clips such as that shown in Fig. 2 and designated 38.

The front wheels 40 are supported upon a suitable axle 41 and are provided with friction brakes 42.

Referring now to the circuit shown in Fig. 4. In this the one dynamotor is designated 45 and the other 46, each comprising an armature 8, series winding 27 and regeneration winding 28. The batteries which are arranged in two sets are designated respectively 47 and 48. A selector switch 49 controls a main switch gear 50 which effects the necessary changes in the circuits to provide for different running speeds and for the regenerative braking, while an electrical braking controller 51 controls the amount and time of regeneration, and a clutch control 52 permits the dynamotors to be started off slowly or otherwise run at intermediate speeds when such is required for short periods. 53 represents a cut-out which prevents the batteries from driving the dynamotors when insufficient regeneration voltage is available to cause charging of the batteries.

The switch gear 50 comprises four banks of solenoid-operated switch means 55, 56, 57, and 58, the movable arms 59 of all of these being linked in any usual manner to be operated by means of their respective solenoids 60 and 61, the solenoids 60 moving the arms 59 in one direction and the solenoids 61 moving them in the opposite direction, the switches being of the type which automatically retain the position into which they are moved by the solenoids without the necessity of maintaining a current flow through the winding 60 or 61. The switch bank 55 includes a double pole section 63—64 which serves to cut off the solenoids 60 or 61 immediately they have moved the switch banks to position.

The selector switch 49 has five positions designated 65, 66, 67, 68 and 69, these positions giving the following motor connections.

When the slider 70 is set to connect the circuit member 71 with the contacts at the position 65 the solenoids 60 of the switch banks 55 and 57 are momentarily energised to cause the arms of such banks to move over to the opposite position to that shown in Fig. 4 whereupon it will be seen that the two motors 45 and 46 have their field windings 27 in series with the armatures 8 while such motors are themselves in series and connected across the batteries 47 and 48 which are in parallel.

When the slider 70 is set to position 66 the switches are as shown in Fig. 4, this position corresponding to neutral in which no drive is being applied to the motors.

In passing from the position 65 to 66 the further slider 73 which moves in synchronism with the slider 70 has momentarily coupled the circuit member 74 to one of the contacts 75 this resulting in an impulse being transmitted through the member 64 of the switch bank 55 to all of the solenoids 61 pulling the switch arms 59, 63 and 64 over to their neutral position.

In the position designated 67 only the switch bank 55 is pulled over so that the circuit remains the same as that referred to in the first drive with the exception that the direction of the current through the armatures is reversed relatively to the series fields so that the means are driven forwardly. Owing to the two motors being in series and the batteries in parallel a low power drive only results which is suitable for starting or for slow running.

When the selector is set to the position indicated by 68 the switch bank 58 is pulled over as well as the switch bank 55, thus while maintaining the series connection of the two motors the battery connection has been changed from parallel to series, this applying a double voltage to the motors and resulting in greater power being developed by them.

In the final position, that indicated by 69, the switch bank 56 is also moved over, this changing the connection of the motors 45 and 46 to a parallel connection with the result that the motors in parallel are across the batteries which are in series, thereby developing the maximum power of the unit.

It will be appreciated that each time the slider 70 of the selector switch 49 is moved from one to another of its positions the synchronously moving slider 73 engages one of the contacts 75 and returns the arms of any of the displaced banks of switches 55, 56, 57 and 58 to their neutral position which is the position in which regeneration can take place.

For regeneration to take place the slider 78 of the switch 51 must be moved to couple the circuit member 79 to one of the series of contacts 80, this completing the circuit through the regeneration windings 28 of the two motors 45 and 46, the output being regulated by the position of the slider 78 relative to the resistance 81 which decreases in value as the slider 78 progresses along the contacts 80. In this way the amount of braking and consequently the amount of current returned to the batteries can be progressively controlled so that the effect of the braking is very similar to the usual mechanical braking.

When the switch is in the braking position the batteries are in parallel while the armatures 8 of the two motors 45 and 46 are themselves in series and across the batteries, the one winding of the cut-out 53 being across the armatures. The regeneration windings 28 of the two motors 45 and 46 themselves are in series and are connected across the batteries through the other winding of the cut-out 53, the cut-out being arranged to prevent discharging of the batteries through the motors when the output of the motors then acting as generators is too low to provide the correct potential difference between the motors and the batteries.

Moving synchronously with the slider 78 is a slider 82 which when regeneration is to take place, that is to say when the slider 78 is moved to engage one of the contacts 80, connects the circuit member 83 to the member 84 which is in parallel with the aforesaid contacts 75 so that if regeneration is desired at a time at which the selector switch 49 is in any of its driving positions the switch banks 55, 56, 57 and 58 are automatically returned to their neutral position by movement of the control 51. When the control 51 is in its inoperative position which is that shown in the drawings the slider 82 contacts with the segment 85 and completes the circuit to the switch arm 63.

The resistance control 52, which will be herein referred to as a clutch, and which comprises a circuit member 88, slider 89, contacts 90 and resistance 91 serves to increase the circuit resistance when the slider 89 is moved over from the position shown in Fig. 4 in which the resistance is bridged out. Movement of the slider in a clockwise direction includes more of the resistance 91 in the circuit.

The slider 92 which moves synchronously with the slider 89 normally bridges the two circuit members 93 and 94 but serves the purpose of allowing the selection of any position for the slider 70 of the selector switch 49 without energising the motors, this being effected by moving the clutch to its fully out position that is its clockwise rotation whereby the slider 92 ceases to bridge the circuit members 93 and 94 and cuts off the power from the circuit members 71 and consequently from the solenoids 60 of the control switch 50.

The selector switch 49 which may be of any usual construction is preferably mounted adjacent the steering column and is provided with a lever 96 whereby the positions may be selected. The regeneration control 51 is preferably operated by means of a brake pedal 97 which has the same location as the normal brake pedal in a vehicle. The pedal 97 can be associated with an arm 98 which operates the ordinary mechanical brake 42 of the wheels when the maximum or nearly the maximum electrical braking in is operation.

The clutch 52 is also operated by a foot pedal having a position corresponding to that of the normal clutch pedal in a vehicle.

The switch gear 50 is carried in the box 100. By the use of a plurality of dynamotors a number of advantages are achieved the first being that each wheel is provided with independent operation so that a differential effect may obtain between the wheels but with the advantage that when one wheel is retarded the other still maintains its drive, another advantage being the possibility of utilising the dynamotors as controlling means such as by connecting them in series or in parallel or by connecting the fields in series or in parallel, the arrangement thus making the control of the units very flexible and permitting a high efficiency to be obtained by eliminating normal controlling resistances or other similar means which are in some systems essential to enable effective power and speed control to be obtained.

The use of dynamotors in electrically-operated vehicles wherein the driving power is wholly or chiefly supplied by batteries is of the greatest importance and results in a substantial saving of electrical power and also a reduction of normal mechanical wear which would take place if the vehicle did not use dynamotors.

The saving in power is effected principally by the use of the dynamotors for regenerative braking purposes according to which the momentum of the vehicle is used on all possible occasions to feed back generated current to the batteries which normally drive the vehicle. It is found when operating a regenerative electric vehicle that a much increased performance can be obtained firstly in that greater range is possible owing to the recovery of power which would otherwise be dissipated, and secondly that higher speeds can be obtained because it is possible to draw more current for peak loading periods if such is required, the additional current draw being compensated by the recovered power during the regenerative operation.

The reduction of mechanical wear and inefficiency results chiefly by the elimination of the usual differential gear which it is necessary to use when driving two wheels of a vehicle from a single motor. The gear losses in a differential are considerable particularly once wear of the gear faces has taken place, and losses are also occasioned by the number of additional bearings and the length of the shafts which require to be driven. If the motor runs at a higher speed than the wheels, as is customary in the electrical practice used heretofore, regeneration would not take place at the same efficiency as happens when dynamotors directly coupled to wheels are used for the reason that gear losses when driving from a larger crown wheel to a gear pinion are much higher than when driving a smaller pinion by the motor.

The reduction of mechanical wear also results by the elimination of the ordinary friction braking means which it is necessary to utilise when no dynamotors are used. Friction braking is of course well known as a source of high loss in motor vehicles whereas regenerative braking which is itself of a more conveniently used nature has the effect of effecting a saving when in operation by feeding power back to the driving batteries of the vehicle.

The incorporation of the dynamotors in the wheel itself results in a low speed unit of high efficiency and low wear.

Instead of applying the invention to a motor vehicle of the type shown in the drawings its use may be extended to a vehicle in which more than two of the wheels are driven or in which only one of the wheels requires to be driven, for instance a cycle.

The dynamotor instead of being built directly into the wheel may be built as a separate unit and be coupled thereto by a shaft or other means with or without flexible couplings between the dynamotor and the wheel.

A factor which it is necessary to remember when considering battery-operated vehicles is that the total amount of power available from a battery of given capacity is higher as the current consumption is lowered so that any saving in propulsion power not only has the effect of reducing the amperage draw during the run of the vehicle but also renders the battery operation more efficient owing to such lower draw and consequently in this way further increasing the mileage which can be obtained on a battery charge.

What I claim is:

1. In electrically-operated motor vehicles improvements comprising; a plurality of wheels arranged to be driven, a dynamotor forming an integral part of each such wheel, batteries associated with the said dynamotors, switch banks connecting the dynamotors with the batteries, solenoids actuating the switch banks, a selector switch to energize the solenoids, switch members to disconnect the solenoids from the batteries immediately the switch banks have been moved to any position, a braking control to also energize the solenoids, electrical circuit connections between the switch banks and dynamotors and batteries to control the operation of the dynamotors as motors according to the position of the selector switch or as dynamos to charge the batteries according to the position of the brake control, and resistance means adjusted by the braking control to control the extent of the braking.

2. In electrically-operated motor vehicles improvements comprising; a plurality of dynamotors arranged one in each wheel which is to be driven, batteries associated with the said dynamotors, electrically-operated switch banks arranged to have a neutral position in which the dynamotors may act as dynamos each switch bank in its other position controlling the dynamotors as driving motors for the vehicle, selector means to actuate the switch banks to give different driving speeds of the dynamotors, a braking control associated with the switch banks to return all switch banks to their neutral position immediately the braking control is actuated and to complete the dynamo circuit to effect braking and charging of the batteries, and resistance means actuated by the braking control to increase the braking effect as the braking control is progressively moved from its off to its on position.

3. In electrically-operated motor vehicles improvements comprising; a plurality of dynamotors arranged one in each wheel which is to be driven, batteries associated with the said dynamotors, electrically-operated switch banks arranged to have a neutral position in which the dynamotors may act as dynamos each switch bank in its other position controlling the dynamotors as driving means for the vehicle by arranging the motors in series or in parallel and sections of the batteries in series or in parallel for controlling the driving speed of the dynamotors and reversing the drive, selector means to actuate the switch banks to give the different driving speeds, and a braking control associated with the switch banks to return all switch banks to their neutral position immediately the braking control is actuated and to complete the dynamo circuit to effect increased braking and charging of the batteries as the braking control is progressively moved.

JOHN EARL BOWKER.

The Story of the Battery.

by John E. Bowker.

It is difficult to know where to begin this story, because events which happened many years before had a most important bearing on this ~~xx~~ work. However I will cover these events briefly so that sufficient will be lnown to see the connection.

Around 1930 I was invited to Paris as the guest of a large X-Ray Establishment. During my stay there I had the privilege of meeting Madame Curie. In the course of a discussion concerning Australian Radium, I gathered that Madame was concerned with radium solely for medical purposes. The subject was somewhat involved, but it is sufficien to say that I retained a distinct impression that the use of atomic energy for any other purpose was unthinkable.

When I returned to Australia I commenced the production of X-Ray Equipment. Despite terrific opposition from overseas import companies, we managed to get a footing. After several years,all seemed well, when, out of the blue, we were raided by the customs, acting, as they said,on information from an un-named source. They removed all of our papers and we were left with an impossible situation. After months of wrangling with their officers, we were finally told that we had been ~~xxx~~ cleared, and would not hear from them again. However, my business was ruined, as was my health, for I developed duodenal ulcers, which incidentally I carried with me for the next 25 years, when a surgeon removed part of the stomach containing the ulcers. I was told that my physical condition was so bad that it was not likely that the operation would be successful. But fortunately for me, I can say 15 years later that it was successful.

When the war started my health was very bad. I went to doctors and was told that I had developed an x-ray aenemia, and had to leave the x-ray field. In fact they gave me twelve months to live. I had a young family and was wondering what to do when a man came from Adelaide to supervise the conversion of petrol cars to electric. I knew little of the subject but "beggars can't be choosers", so I decided to give it a go.My health was poor, but, somehow, I didn't believe the doctors' verdict. I arrived and soon learned that the project was hopeless. I viewed the batteries available - size, weight and cost - and when I measured the energy required to drive their cars at 25 m.p.h., I found that to travel for 30 miles at that speed, would require a ~~xxxxxx~~ traction battery of 2,000 lbs weight, and about £200 in cost. Weight, size and cost ruled it out completely. I selected automotive batteries; they weighed 1,000 lbs, were half the size, and cost about £50.

But even with this set-up the results were unsatisfactory, so I reluctantly informed my backers that the project was still-born. Whereupon they asked if it would be better if I built a car specially for electricity. I told them it would be twice as good.. So I began the task of building ~~xxxxxxx~~ a car in a milking shed, with the help of three fine chaps. Before many people, including representatives of the Adelaide University and the RACV, the car was finished and tested. It gave a performance of 100 miles at 30 m.p.h. The claim to a world record was never challenged.

But after some months of testing we learned the sad truth; the car batteries were useless, as they had a life of only a couple of ~~xxxxx~~ months, when used for traction.

When I examined them, and found that the deep cycling had just "melted" the plates, I had to inform my backers that we had really come to the end. I returned to Melbourne in 1945 and did some more work on the battery. The atomic bomb went off and the war ended.

So did all interest in electric cars. It was at this point where I made a vital decision. I decided that the future would bring an energy crisis, because of the wasteful use of fuels, and that the petrol car would prove unsuitable. Having previously investigated all possible alternatives, I believed the electric car with a suitable battery was the answer. Not long before this, General Motors of America, had offered £10,000 to anyone who could make a battery with 40 watt hours to the pound, with a life of three years. But when I looked up the best book on batteries, I found that the highest capacity possible from a car-type battery was only 21.4 watt hours to the pound.

Only a new type of reaction could win that £10,000. However, one thing puzzled me. I had built a cell for the Army Inventions Directorate. When tested, it gave over 30 watt hours to the pound. It used different x; type of plates and separators from the conventional cell. Later, when I saw a Japanese Midget submarine, which had been captured, and was on show in Melbourne, I noted that the batteries which had busted and spilled out their plates, were based on the same principle as mine. The life of my cell was only a few cycles, but I had learnt that capacity was influenced by many things not included in standard batteries or text-books.

And so had someone in Japan, but only in two aspects of those used in my cell.

Then came the wave of atomic forecasts of power for industry. A Utopia was promised, and even world-ranking scientists were joining in the clamour. Then I saw something which frightened me - a world shortage of safe fuels turning to atomic power and thereby bringing into the world a danger which could not be overstated.

As the petrol car was the big waster of fuels, if we had an electric car we would divert attention away from dangerous nuclear power.

So, on this kind of reasoning, I decided to tackle the battery problem with all the effort I could make. I had successfully developed a medical, infra-red lamp, which was to provide me with the means to continue to work on the battery for 30 years. During that time, we sold over one hundred thousand of these lamps. My first success was when I built a cell for Dunlops to test. They did so, but were not very impressed.

I brought the cells home and put them away in a corner. Twelve months later I found that they were still alive. Why had they held their charge? I believed I knew.

Here was my first break-through! In the meantime I had built a six-xxx volt battery. I tested it at the Melbourne Technical School. (now the Royal Melbourne Institute of Technology). It was about half the weight and size of the standard six-volt car battery of the period. I took it to Dunlops and Mr Blackwood (later Sir Robert) was impressed but his technical manager was not, so again I had drawn a blank.

I remember saying to him, "Plastic boxes are lighter and more practi- xxxxx -cal than rubber", which he countered with, "Our boxes are made from rubbish and you can't get anything cheaper than that".

Ten years later they were making them with plastic boxes. I tried to get a Sydney firm to make up plastic separators; they were not impressed, but their manager was, as he went to England, and later returned with a plastic separator which spelt the doom of the wooden separator.

Around this time, Lucas (Vic.) became interested in my work, and gave me a workshop and an assistant to make up my plates. After a couple of years they called it a day. Around 1967 I was invited to Sydney by a friend, Dr Wickham Lawes, to meet a Director of an English Battery firm who were interested in my work. I took some plates with me, and he readily agreed to test them for me.

X

I wanted a life test. This is a long and expensive undertaking. After a first failure, I finally obtained what I had claimed was possible - a battery with the capacity of an automotive battery for weight, but with the life of a traction cell.

So, once more I returned to Dunlops. This time they were really interested, and bought my patent and commenced to carry out tests, but after a couple of years they decided to back out. It was at this time that Mr James King became interested in my electric car. But the car was useless without the battery. Dunlops abdication enabled him to take over the battery, so all was well.

It was not long after this that I made my final break-through. In one stroke I was able to double the capacity and double the life. This was completely opposite to accepted ideas on the subject.

I built a cell and had it tested at the Monash University. The test confirmed my claims, but when we wanted Monash to continue, they put up impossible conditions. I had to disclose the secret of my battery. We had to pay for equipment worth some thousands. Mr King agreed to the purchase of the equipment, but refused to have me divulge the reasons for my high capacity.

Then, Divine-like Providence came to our aid! Broken Hill, with the finest Research Laboratory in the Commonwealth, offered to do the tests for nothing. Doctor Johnston was placed in charge, and we commenced about three months' testing. We used standard batteries for comparison with my cells. Dr Johnston's report was to fully support my work, and later, Dr Ward sent a letter confirming the report. It certainly looked as if we had broken through, when I was informed that certain elements at the BHP had expressed opposition. A meeting was arranged with three experts representing B.H.P. and with Mr King and myself. At the conclusion of a 3-hour meeting, I was informed that the meeting was quite satisfied that I could double the capacity of the B.H.P. test.

Ten commenced a series of letters between Mr King and the B.H.P. to determine how much B.H.P. would be prepared to pay us for 50% interest after we had proven our claims by tests. B.H.P. refused to say what they were prepared to do until the actual time came to assess the battery.

Sensing a breakdown in the negotiations, I wrote to Dr Ward, pointing out my views, and deploring the delays which had already cost many months.

I asked them to declare their intentions within a stated period. I received a reply that as we didn't trust them they would withdraw from the project.

By a remarkable co-incidence, I received a reply from a Government Department who were going to help me, a few days later, in reply to my letter of 22nd January. It took them nearly 4 months to reply to my letter, which, when it did come, was a request for all the information on my battery, requested by Monash and B.H.P. I realise that it is difficult to assess the value of something you have unless you have all the information, but does this preclude interested people from stating in advance what they are prepared to pay if all our claims are proven?

However, Mr King was so impressed with the B.H.P. tests that he mounted a P.R. campaign to have my work recognised. Requests came from all over the world for information. When it was sent, back came a further request, "Please send some more".

Finally it began to dawn on us that no matter how good my battery was no matter how good it made the electric car, the world was not interested in paying for it. They wanted it for nothing, and were prepared to wait until they learnt how it was done, for nothing. In short, Governments and Big Business, here and all over the Western world, are so involved in the petrol car economy, that no matter if the petrol car poisons you, or the nuclear reactors spread radio-active materials all over the world, they prefer this to changing their approach to power.

I tried to explain this in my book, published in 1948, entitled "THIS ATOMIC AGE ~~XQM~~ AND YOU". One example of this is shown by the remarkable similarity of attitude to my work by the establishment of all countries. They all insisted that they were to be told how it was done. It never seemed to occur to anyone of them that knowledge is not patentable, but only the manner in which it is applied.

Let it be remembered that we were discussing this invention with the biggest firms in this country as well as overseas. It did not occur to one of them that this was the reason for our reluctance to part with the knowledge that it had taken me thirty years to acquire; the application of this knowledge to the storage cell would enable these big firms to apply themselves to invent possibly better applications of the principle, than I, with my very limited resources, could.

I am not saying that Big Business is dishonest, because I have never thought this; that is why I have worked with them for so many years. But, when I reached the stage where I had accomplished my long search, and that this was made possible by the entry of Mr King, to ~~xxpx~~ impart the knowledge, even with patents covering our means of using the knowledge, could have made his investment worthless.

It was my purpose in life to build a battery which would meet the requirements of the electric car. Capacity, life, size, weight and cost. I have done so. The fact that it was considered impossible without the discovery of a new reaction, is only another indication of the restricted vision of science. As I said in my book, the application of relativity to any problem may produce solutions quite impossible from a 3-dimensional approach. This, I believe, applies to everything. I don't think that Einstein had a monopoly of relativity to any restricted field. In conclusion I have to say that time does not stand still, and I now find myself too old to see the conclusion of this work.

My son~~s~~, ~~John and~~ Paul, ha~~ve~~s learnt ~~between them~~ all that I have learnt on the battery and the car. ~~They~~ He will be able to complete the task, providing ~~they~~ receives the help, from the Government and the public, that I failed to get.

Or, as a friend and supporter, Dr Wickham Lawes, of Syndney, in a recent letter to Dr Ward of B.H.P. said, "In lighter vein, you may be influenced by the fact that though Mr Bowker finds it hard to make headway with his ideas, an electric car based on his 1939 model, sits on the moon."

694 Warrigal Rd. Chadstone.
Melbourne. 3148

23rd May, 1975

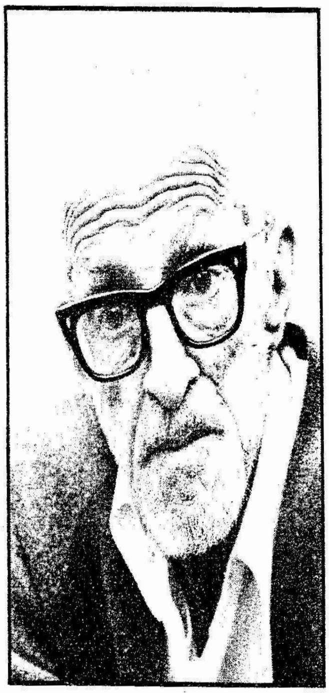
((I have ~~not~~ verified Dr Lawes last Sentence, ~~but this could easily be done. A.V.~~

When last he could speak to me, John Bowker told me Paul Oral Surgeon at Melbourne & Preston Hospitals, would be taking charge of the battery. I have a nice letter from Paul. written since his father died.
The book, the author hopes I will make known, but I dont think people are ready for his 4th dimension ideas. This does not include the battery, I think. A.V.

Here are the first exciting details of a revolutionary new Aussie battery. Does it promise to make for an...

Electric Car Breakthrough?

Conventional lead-acid batteries are the main factor keeping electric cars off our roads. But now the new Bowker cell promises to be lighter, smaller, more durable and more powerful. And there's even a sleek new body for engine testing.



John Bowker — after 30 years' research and development his revolutionary new lead-acid battery promises to be an immensely important breakthrough in helping make the electric car a practical everyday vehicle.

A REMARKABLE NEW battery, developed by an Australian, promises to be a tremendously important breakthrough in the design, performance and durability of the lead-acid battery.

And the battery, developed over 30 years ago by John Bowker of Melbourne, is intended for a sleek new electric car, to be used as a mobile test bed for the new power cell.

The car has a fibreglass body which is bonded to the fibreglass and steel unitary chassis and features front-wheel drive and all-independent suspension. It is basically a two-seater coupe with space for two children behind the front buckets.

No bigger than it need be for an urban runabout, the car is about 3200 mm (10 ft 6 in.) long overall, 1350 mm (53 in.) wide, and only 1020 mm (40 in.) high. So it is about as long and wide as the Morris Mini, but 330 mm (13 in.) lower.

Since good aerodynamic efficiency means that a given amount of energy will propel a car further or faster, the Bowker electric's dimensions are deliberately compact to give the best possible performance and range. With its relatively small frontal area and smooth flowing lines, the Bowker is designed to incur a minimum of wind resistance.

John Bowker is no newcomer to electrics. Achieving an international reputation for his design work on x-ray equipment during the 1920s and '30s, Bowker became interested in electric cars and built his first in Adelaide in 1940. Weighing about 914 kg (18 cwt), the car had motors built into the rear wheels. Bowker's prediction that it would travel 160 km (100 miles) at 48 km/h (30 mph) was widely scorned — until the car actually ran 157 km (98 miles) at the prescribed speed.

Today Bowker is confident of achieving more than 240 km (150 miles) at 80 km/h (50 mph) with the new car. Its projected kerb weight is only 560 kg (11 cwt), of which the Bowker battery will account for 226 kg (500 lb) and the seven kW (nine hp) motor about 45 kg (100 lb).

Bowker and his financial backer, James King (of Kings parking station empire) will probably find a long queue of prospective buyers for their electric car when it is on the road, but they have no intention of developing it as a production model — not at this stage of the project anyway.

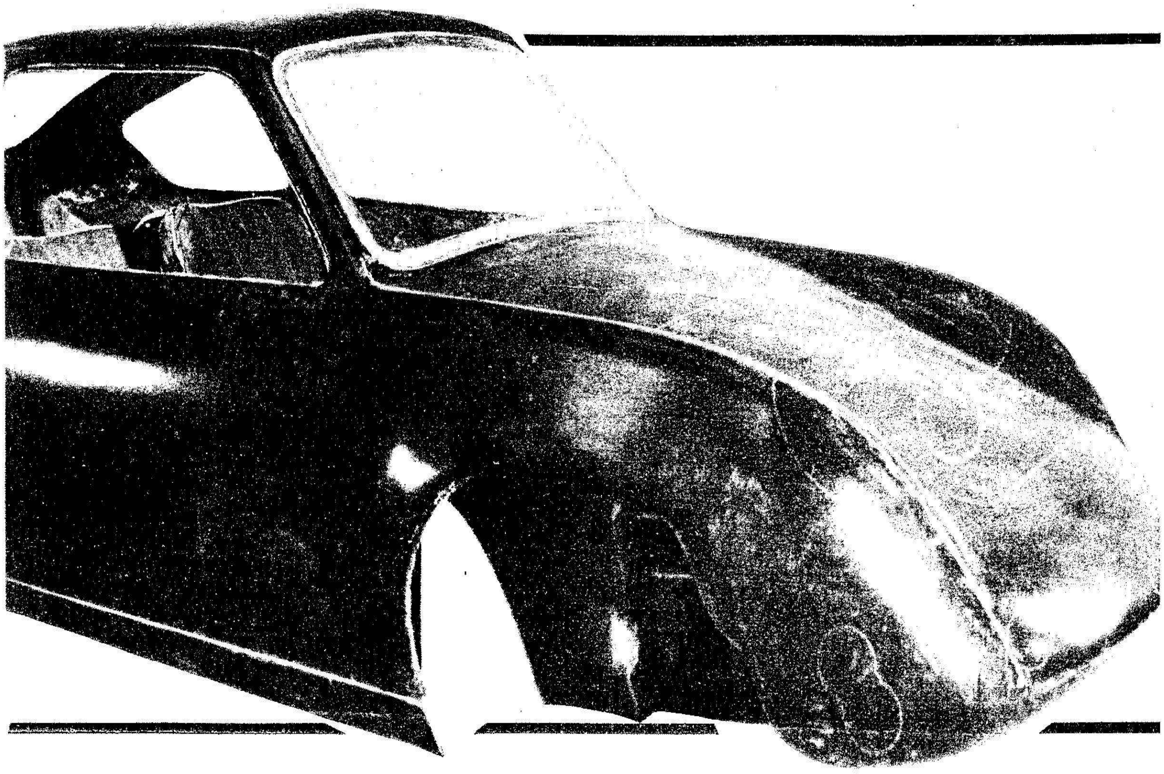
Main purpose behind the coupe, now in its final stages of construction, is to have a modern electric car — designed specifically for the job — to serve as a mobile test bed for the revolutionary Bowker battery.

Respecting the confidences of the project team, we cannot yet publish photographs or describe the design and construction features of the prototype Bowker cells which are to remain under security wraps until further tests are completed and patent protection is finalised.

What we can reveal is that the Bowker cell is designed for large capacity and extended life while remaining within economic size and weight tolerances.

Still undergoing extensive tests by the Electrical Engineering Department of Monash University in Melbourne, the Bowker cell already promises to be an important step forward for the lead-acid concept.

Bowker claims that the battery can discharge at constant rate for much longer than usual without voltage drop; can be recharged at a rapid rate without boiling the electrolyte or damaging the plates; and can be deep-cycled (fully discharged and recharged) up to 900 times before significant cell decomposition occurs.



Although the optimum theoretical capacity of a lead-acid battery operating under near ideal conditions has been calculated as 21.4 watt hours per pound (Wh/lb), actual capacity of the average modern battery is usually less than half that figure. About 10 Wh/lb is considered the norm.

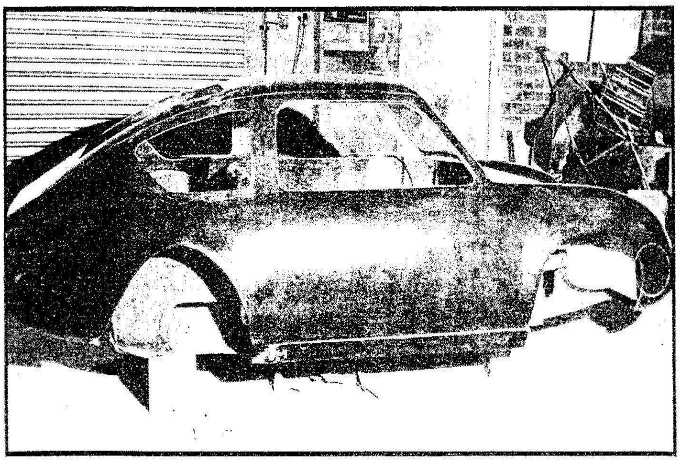
In tests already performed at Monash, prototype Bowker cells have been discharged at constant rate of 11 amps for more than eight hours. The total capacity was then computed to be 95.5 amp hours and 197.1 watt hours. As the battery weighed only 10 pounds, its effective capacity was 19.71 Wh/lb.

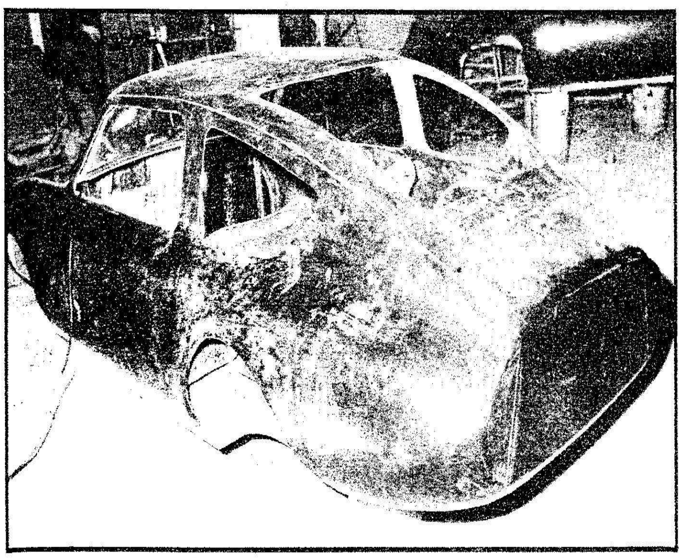
Believing that production cells will yield more efficient chemical processing than does the hand-made prototype, Bowker claims that his battery will have energy density as high as 30 Wh/lb.

Apart from having power-weight ratio about twice that of conventional batteries, and perhaps three times in production form, the Bowker design also promises substantial advantages in energy-volume ratio. The usual figure for lead-acid cells is about 2.0 kWh per cubic foot of battery. Bowker anticipates 5.0 kWh/cf for his production cell.

What it means is that, assuming the aims are fulfilled, the Bowker cell will boast from two to three times the usual energy density and up to 2.5 times the energy-volume ratio. In other words the battery will be not only more powerful and durable, but also much lighter and smaller; just the sort of thing that is needed to help make electric cars a practical reality.

The basic secret of the new design is that its plates are thinner than usual, and there are more of them. Bowker describes the unit as being a traction cell with some of the properties of automotive cells. He believes he has succeeded in combining — and greatly improving on — the characteristics of





Pictured Above:
While prototype examples of the Bowker battery are undergoing extensive testing at Monash University, the project team is constructing a sleek coupe which will serve as a mobile test bed for the new power cell. Car is about as long and wide as a Morris Mini, but much lower. Light weight and minimum wind resistance will help ensure optimum performance. The unitary-construction chassis has fibreglass body, all-independent suspension and front-wheel drive. Bowker predicts the range will be more than 240 km (150 miles) at 80 km/h (50 mph).

Bowker Electric Car

On YouTube:

https://youtu.be/ZrJejvvls0M

An early model electric car being driven through the streets of Adelaide in the early 1940s.

The car was designed by John Bowker. It is shown outside the State Library, Parliament House and Montefiore Hill where it stops near the statue of Colonel Light.

The footage is an extract of the film taken by Laurence S. Casson.

The State Library holds 48 film reels taken by Casson between 1934-1976.

Comments…

tomsto101

That's my great great uncle

JeeBeeBee

That's my Great Grandfather! We must be related

EVSA

Hi, Do you know what happened to this car?

JeeBeeBee

@EVSA Sadly the car ended up being scrapped after sitting untouched for years. The car itself wasn't what made it special, as it was just a Gogomobil that was converted to electric. The impressive part being the batteries that were modified and improved. This battery design was used in the lunar rover that is currently sitting on the moon.

EVSA
@JeeBeeBee - Thanks for that info...