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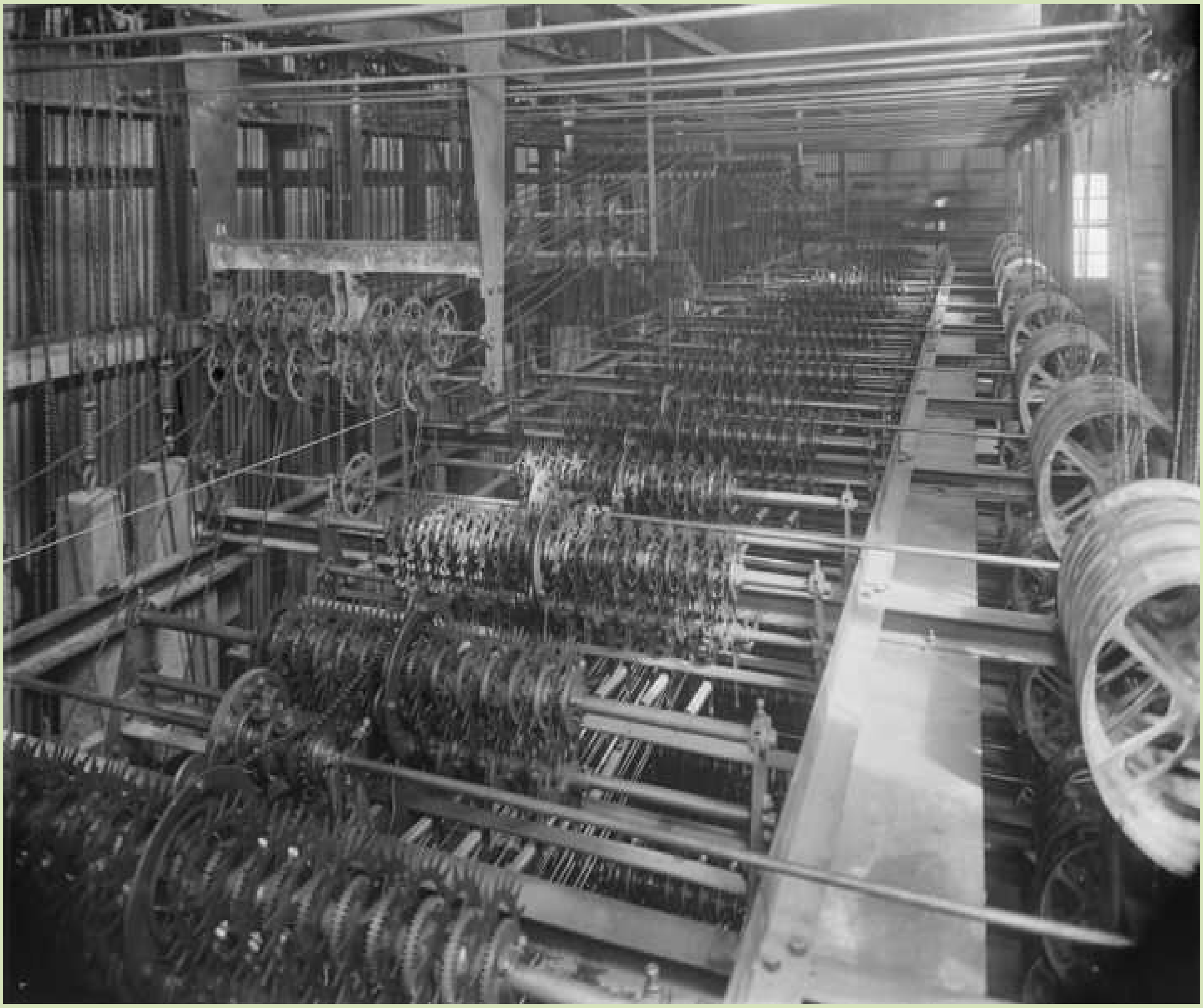
JULIUS TOTALISATOR



SEPTEMBER 2014

FRONT COVER PHOTOGRAPH CAPTION

The world's first operational computer preassembled at the Sydney Factory in 1913, prior to its installation at Ellerslie, Auckland, New Zealand.

Photographer unknown. Collection – Powerhouse Museum, Sydney

"….although it looked like a giant tangle of piano wires, pulleys and cast iron boxes and many racing officials predicted that it would not work, it was a great success."

Brian Conlon – Totalisator History – Automatic Totalisator Ltd – later ATL

Submitted by:

Engineering Heritage Queensland Panel

Prepared for E.H.Q. by Panel Member
Paul D. Coghlan

With major information supplied by:

Brian Conlon (Retired – Ex Chief Engineer of the PDP11 computer totes that superseded this and other Julius totes in Brisbane

TABLE OF CONTENTS

BASIC DATA

Item Name:	**Julius Totalisator**
Location:	**Eagle Farm Racecourse**
City:	**Brisbane**
State:	**Queensland**
Local Government Area	**Brisbane City Council**
Owner:	**The Brisbane Racing Club**
Current Use:	**Centrepiece of Eagle Farm Racing Museum**
Designer:	**Sir George Julius**
Manufacturing Firm:	**Automatic Totalisator Ltd.**
Original Eagle Farm Model:	**1917**
Updated Eagle Farm Model:	**1948**
Decommissioned:	**1979**
Physical Condition:	**All mechanical equipment in good condition as and where installed, but no electrical connection for operation**
Heritage Listing:	**Nil**

THE AUTOMATIC TOTALISATOR

INTRODUCTION

George Julius (later Sir George Julius) invented the world's first automatic totalisator in Australia in 1913. HIs original invention, a purely mechanical machine was installed in Ellerslie, Auckland, New Zealand in 1913. The second was installed in Gloucester Park, Perth in 1916, and the third in Eagle Farm, Brisbane in 1917. Julius founded the Australian company, Automatic Totalisator Ltd in 1917 to develop and export these totalisators. The present Eagle Farm Electromechanical Julius Tote, a descendant of the original invention, was installed in 1948.
By 1970, with few exceptions, every major racing centre in the world, in 29 countries, used totalisators manufactured by this Australian company.

The Julius Totalisator is an electromechanical machine which allows the simultaneous receiving of myriad numbers of win and place bets from multiple points on the racecourse, records the bets, displays win and place odds for each runner as betting proceeds and issues a ticket for each bet.

HISTORY

In 1909, in response to possible voting irregularities in elections in Western Australia, George Julius conceived the idea of a system of recording votes which would negate fraud. But Government was not interested, so he looked around for a use of his invention. (Refer *Appendix VII* (*Sir George Julius).* Although not a racing man, he turned to the racing industry where the system of pari-mutuel or pool betting existed, as opposed to bookmakers. It became known as totalisator betting, but being manually operated was open to fraud.
Refer to Appendix I "The Rutherford Journal, the First Automatic Totalisator"; and Appendix II "Totalisators: First Automatic Totalisator", for an explanation of the pari-mutuel betting system and a description of Julius's first mechanical totalisator installed in Ellerslie, Auckland, New Zealand.

For the Ellerslie 1913 unit, connection between the Ticket Issuing Machines (TIM) and mechanical adding units was by flexible wire with mechanical drive power for the adders provided by suspended concrete or cast iron blocks similar to the mechanism of a pendulum clock. Further research led to the introduction of electrical power. Miles of wire were replaced by electrical cables, and simple electric conductors operated solenoids both in the TIMs and the Adders – the system used post 1917. This eventually enabled TIMs to be installed throughout the racecourse and connected to a central totalisator.

A concise engineering description of the machine and how it works is difficult. For a description of the equipment and how it works, illustrated with drawings and photos, see *Appendix III. " A description of the Julius Totalisator in the Eagle Farm Racecourse Museum" by Brian Conlon; and Appendix IV, "Brief description Eagle Farm Julius Tote" by Brian Conlon.*

By 1920, the equipment was installed at eight race tracks, Sydney, Brisbane, Newcastle, Perth (7 in Australia) and Auckland (NZ). Initially, bets were added in one pool only with payout calculated on 60% for win and 20% each for 2nd and 3rd placed. In 1922, separate win and place pools were established with either a win or place bet being able to be placed on the same TIM. This became a big selling point for the totalisator. During the next 10 years the Company installed equipment in 27 racecourses in India, Ceylon, Malaysia, Singapore, France, New Zealand, Canada and America. A 273 terminal machine was installed in Longchamp, France in 1928. White City (Greyhounds) London had multiple installations and ended up with 320 terminals. (English horse racing clubs, the then province of the elite, initially rejected the machine as it would encourage the masses to gamble.) 1932 saw the first machine in USA in Florida. The largest order was nearly 30 years later for Caracas, Venezuela in 1957. This machine was still operating in 2005.

By 1970, with few exceptions, every major race course in the world would use the Julius Totalisator manufactured by the Australian Totalisator Company. The major exception was Japan, where until electronic totalisators were introduced they relied on a large team of employees, each using an abacus.

Another feature of the totalisator after 1927 was that win and place odds for each runner were available and displayed for the public as betting proceeded. Prior to 1927, the runner totals and grand total for each pool were displayed. Final dividend was calculated at the conclusion of betting.

A detailed account of the Company's operation is given in *Appendix V. "Automatic Totalisator Ltd – later ATL."*In the 1970's, Julius electromechanical totalisators were replaced by electronic totalisators. All the Julius Totalisators in Australia were destroyed with two exceptions. Sydney University Professor Alan Bromley kept 2/3rd of the Broadmeadow Julius Tote in his home to save it from being destroyed. Subsequently it was removed to its present location in the backup store of the Powerhouse Museum in Sydney and some of it possibly part of the Australian Computer Museum Society's collection. The part of the Julius tote in the backup store was restored to a demonstrable condition for an Expo on Gambling held at the Powerhouse Museum and generated a lot of interest. The other exception is the 1948 version of Julius Tote at Eagle Farm Racecourse. It provided for 24 runners with 128 Ticket Issuing Machines situated around the racecourse. The mechanised equipment is intact as installed in the Totalisator building. It is the centrepiece of the Queensland Racing Eagle Farm Museum which is in the Totalisator building. All the Ticket Issuing Machines (TIM's) and connecting electrical wiring have been removed, but some TIM'S are in the Museum. The Museum makes an excellent site for Engineering Heritage recognition of the Julius Totalisator.

ASSESSMENT OF SIGNIFICANCE

HISTORIC PHASE

Although Charles Babbage (1791-1871) is credited with inventing the first mechanical computer, designing the first difference and analytical engines in the 1820's, construction of his machine was never completed, being abandoned in 1833. A completed machine was built by London Science Museum in 2002. Julius completed his machine in 1913. "*The Julius Totalisator with its automatic odds machine is the earliest on line real time data processing and computation system that the Curators of the London Science Museum have identified so far*." *See Appendix VI – "A sure bet for understanding computers" by Doron Swade.*

The Eagle Farm machine is the most representative example of the Julius invention available in its country of origin.

HISTORIC ASSOCIATION

The Julius Totalisator is the invention of one man – Sir George Julius. He became a prominent engineer, a winner of many awards.

He was first Chairman of the Australia's Council for Scientific and Industrial Research (later CSIRO), and was a foundation member of Institution of Engineers Australia, and president of this organisation in 1925.

He was instrumental in establishing the organisation that became Standards Australia.

He took the initiative that led to the establishment of the International Standards Organisation.

In 1927 he was awarded the Institution of Engineers Australia, Peter Nichol Russell Memorial Medal; and the William Charles Kernot Memorial Medal from the University of Melbourne in 1935, for distinguished Engineering Achievement in Australia.

The Institution of Engineers Australia remembers George Julius, with the inaugural Sir George Julius Medal, awarded for the best publication in the field of mechanical engineering.

In 1929 he was knighted for his contribution to technology; Knighthood Medal.

In 2013 he was inducted into the Australian Racing Hall of Fame.

Refer Appendix VII "Sir George Julius."

CREATIVE AND TECHNICAL ACHIEVEMENT

Doron Swade (*Appendix VI*) considers Julius's system an extraordinary achievement both in design and information processing. *"Also a great merit of the Julius Tote is that it embodies principles fundamental to modern electronic data processing and implements them in a visual immediate way. "*

Two examples of the electronic era counterparts to this mechanical computing: First, the scanners or distributors, as they were called in the Julius Totes, are really Time Division Multiplexers and these long predated the electronic era which made TDMs a common concept. Second are the storage screws. Storage is a common concept in relation to digital computers but here is a device that was even then, called storage. These storage screws were prevalent in the early adders, as the light adding shafts with their necessarily high acceleration were required to respond instantly to bursts of bet traffic, which meant that transactions had to be stored allowing time for the slower to respond inertia limited equipment to catch up. It is similar to a delay line, a common electronics concept. Mercury delay lines were the first digital computer memories.

Andrew Keen's video of the Julius Tote ticket issuing machine in operation at Harringay, London, which was part of a study performed by GLIAS (Greater London Industrial Archaeological Society) prior to the decommissioning of that system, clearly indicates that this is a computer system in operation. And yet it was en electromechanical machine similar to the one in this nomination.

The London Science Museum has a Julius tote ticket issuing machine on display with some notes on the impact of equipment like this. They also have a significant part of the Harringay Julius Totalisator in their backup stores at Wroughton.

The French engineers who replaced the Julius tote at Longchamp were so impressed with the ingenuity and workmanship of the Julius tote that they felt compelled to donate parts of it to a Paris museum. This reaction of technologists being in awe of this equipment when they see it is common.

The fact that Julius's machine was pre-eminent and unchallenged in the field for many decades is testimony to the creative and technical achievement in his electromechanical totalisator.

RESEARCH POTENTIAL

The era of the electromechanical totalisator has passed. Much research into Julius's invention already has been documented (*Refer Appendices I-VI)* and little further detail technical research appears necessary or warranted. However the background to any subsequent usage of the Julius tote will continue to provide further ground for social fertile research. Such research will be greatly aided by the existence of the almost complete tote at Eagle Farm Museum

SOCIAL RELEVANCE

The Julius totalisator revolutionised the racing industry by enabling racing clubs to cater for large crowds of people to bet on events. Thus racing became a major industry in many countries and part of the social fabric.

For a country that stops for a horse race and one in which most citizens know what a TAB is, it is amazing how little is known of the long and rich Australian history that exists in the Totalisator industry. Punters are generally amazed to hear of it.

Professors and teachers have indicated they are so impressed discovering what an industry was created around electromechanical systems, that they have included it in their lectures on the history of computing.

The Babbage engines have generated a lot of contemporary interest with engineers building them. One such engineer has built a Babbage Difference engine in Sydney for his Precision Dynamics Discovery Shed. He has also been inspired by George Julius' totes. He manufactures Julius Tote Interactive Displays to demonstrate the workings of these systems to inspire young minds.

A Julius Tote shaft adder was donated to the Computer History Museum in Mountainview, California. A photograph was received showing the shaft adder in pride of place in the entrance hallway of the museum.

Professor Trevor Cole of Sydney University stated regarding George Julius, *"We should be aware of our engineering heroes."*

The totalisator history website http://members.ozemail.com.au/~bconlon is participating in the National Museum of Australia's PANDORA project which archives websites considered to be of Australian National interest.

RARITY REPRESENTATIVES

The Julius tote is the only machine of this nature, and the automatic Totalisators Company initially had a worldwide monopoly on its construction and installation.

INTEGRITY/ INTACTNESS

The 1948 model Julius Totalisator at Eagle Farm Racecourse is intact as installed except for the Ticket Issuing Machines and their electric wiring connections. A disconnected ticket issuing machine is in the museum.

STATEMENT OF SIGNIFICANCE

The Julius Totalisator can be considered the world's first operational computer. It was the only automatic totalisator in the world from 1913 to the start of serious competition in the 1930's. It was the personal achievement of a prominent Australian engineer, viz. Sir George Julius.

The Julius Totalisator was installed by his Australian company in the majority of racecourses in the world. It revolutionised the racing industry of the world by enabling clubs to improve security and turnover, reduce operational costs, improve public display of betting information making it more attractive to punters, and cater for large crowds, resulting in it becoming a major industry.

The Julius Tote on display at the Brisbane Racing Museum at Eagle Farm Racecourse is the most complete machine of its type known to exist in its country of origin, and, as such, occupies a significant place in Australia's engineering heritage.

Julius's invention was extensively adopted by racecourse operators internationally, and machines of his design have continued in operation until recent years, eventually being replaced by electronic computers.

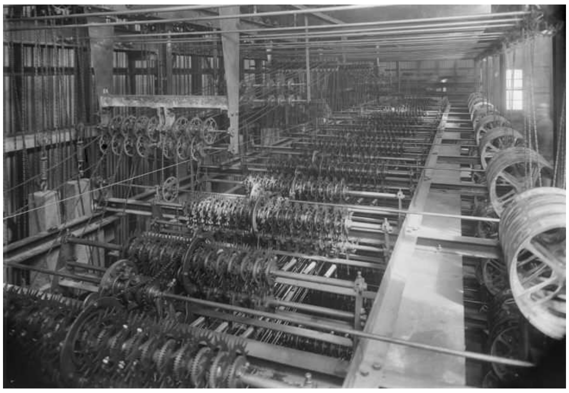
The Julius Totalisators thus can legitimately claim world engineering heritage significance.

Photos:

1. The 1913 totalisator system preassembled in Sydney for Ellerslie, NZ. (From Powerhouse Museum, Sydney)
2. Adding Machine Julius totalisator
3. Row of adding machines forming Eagle Farm Totalisator (One row of 24 machines for win bets and adjacent row of 24 machines for place bet)
4. Totalisator building for 1917 Eagle Farm totalisator.
5. Totalisator building (now Racing Museum) for 1948 Eagle Farm Totalisator illustrating odds display board for 24 runners.
6. Sir Julius inspecting Melbourne totalisator.
7. Sir George Julius

Other photos and illustrations in Appendices.

PHOTO 1.

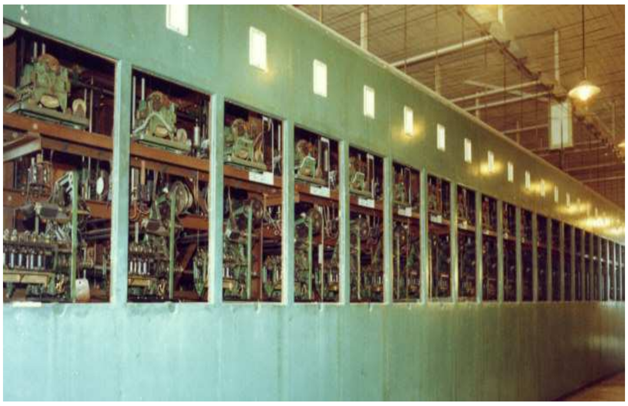


The 1913 totalisator system preassembled in Sydney for Ellerslie, NZ.

PHOTO 2.

Adding Machine Julius Totalisator

PHOTO 3.



Row of adding machines forming Eagle Farm Totalisator
(One row of 24 machines for win bets and adjacent row of 24 machines for place bet)

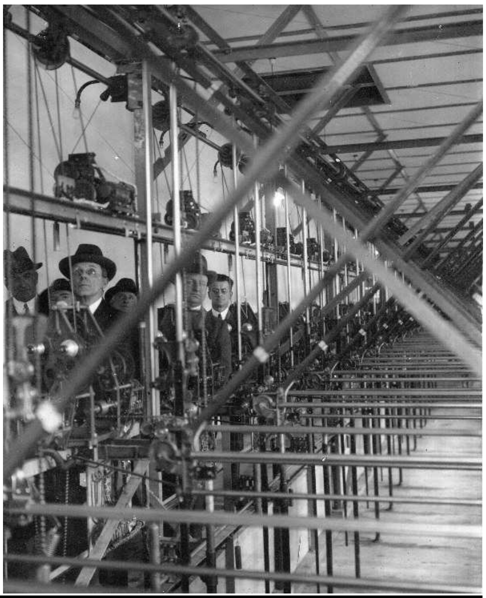
PHOTO 4.

Totalisator building for 1917 Eagle Farm Totalisator

PHOTO 5.

Totalisator Building (now Racing Museum for 1948 Eagle Farm Totalisator illustrating odds display board for 24 runners.

PHOTO 6.



Sir Julius inspecting Melbourne totalisator

PHOTO 7.

Sir George Julius

APPENDICES

Appendix I "The Rutherford Journal – The First Automatic Totalisator"
http://www.rutherfordjournal.org/article 020109.html

Appendix II "Totalisators – First Automatic Totalisator"
Computing History Displays, University of Auckland
https://www.cs.auckland.ac.nz/historydisplays/SecondFloor/Totalisators/FirstJulius/FirstJuliusMain.php

Appendix III "A description of the Julius Totalisator in the Eagle Farm Racecourse Museum" – by Brian Conlon
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http://members.ozemail.com.au/~bconlon/efmuseum.htm

Appendix IV "Brief description Eagle Farm Julius Tote" – by Brian Conlon

Appendix V "Automatic Totalisators Ltd. – later ATL"
Copyright ©1997. Email: totehis@hotmail.com
http://members.ozemail.com.au/~bconlon/efmuseum.htm

Appendix VI "A sure bet for understanding computers" by Doron Swade – New Science 29th October, 1987.

Appendix VII "Sir George Julius"
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http://members.ozemail.com.au/~bconlon/efmuseum.htm

ACKNOWLEDGMENT

Brian Conlon for his assistance with the submission, and his permission to use Appendices III,IV,VI.VII.
http://members.ozemail.com.au/~bconlon/atl.htm

Bob Doran - Auckland University, author of Appendices I & II, and his permission to use these Appendices.

Jack Copeland- Canterbury University, publisher of the Rutherford Journal and his permission to use Appendix I.

Tony Shellshear - Great Grandson of Sir Julius, for information on his Great Grandfather.

Proposed Interpretation Panel

Although the Heritage Award would be granted for the Totalisator, the proposed Interpretation Panel sets out to acknowledge the Invention, the Inventor and the Manufacturing Company – all part of Australia's Engineering Heritage

Julius Totalisator – The World's First Operational Computer

GEORGE JULIUS (later Sir George Julius) invented the world's first automatic totalisator here in Australia in 1913. The original machine, a purely mechanical machine was installed at Ellerslie, Auckland, New Zealand in 1913; the second in Gloucester, Perth, in 1916; and the third in Eagle Farm, Brisbane, in 1917. The Eagle Farm electromechanical Julius Tote in this museum, a descendant of the original invention, was installed in 1948.

The Julius Totalisator revolutionised the racing industry by enabling racing clubs to cater for large crowds to bet on events, thus racing became a major industry and part of the social fabric of the country.

HISTORY

In 1909, in response to possible voting irregularities in elections in Western Australia, George Julius conceived the system of recording votes which would negate fraud. As Governments were not interested, he developed the machine for the racing industry to mechanically record betting to replace existing fraud prone manual totalisators.

THE INVENTION

The Julius Totalisator is an electromechanical machine which allows the simultaneous receiving of myriad numbers of win and place bets from multiple points on the race course, records the bets, displays win and place odds for each runner as betting proceeds and issues a ticket for each bet. The totalisator in this museum provided for 24 runners with 128 betting ticket issuing machines located around the racecourse.

In the 1970's, Julius electromechanical totalisators were replaced by electronic totalisators.

THE INVENTOR

Sir George Julius (1873 – 1946) was born in England, raised in New Zealand, and became a prominent Australian engineer, winner of many engineering awards; a foundation member and president of Institution of Engineers Australia; first Chairman of Australia Council for Scientific and Industrial Research (later CSIRO). He was knighted in 1929 for his contribution to technology and inducted into the Australian Racing Hall of Fame

THE COMPANY

Julius founded the Australian company, Automatic Totalisators Ltd (ATL), in 1917. With its factory in Sydney, it manufactured, installed and operated Julius Totes which by 1970 were operating in 29 countries. Between 1948 and 1955 equipment was installed in 99 race tracks.

The Company developed and installed the world's first electronic computer totalisator for the New York Racing Club. It also designed and manufactured the first mobile computer unit for electronic totalisator operations.

RECOGNITION

The Julius Totalisator with its automatic odds machine is the earliest on line real time data and computation system that the Curators of the London Museum have identified.

A Julius Tote shaft adder has pride of place in the entrance hallway of Computer History Museum in Mountainview, California.

Parts of the replaced Langechamps, France, totalisator were donated to the Paris Museum.

The Institution of Engineers Australia Engineering Heritage Award.

PHOTOS

Photos for the Interpretation Panel will be selected from photos 1 to 7 in the submission.

LOGOS

Brisbane Racing Club; EA; Heritage Plaque; Web page.

The Rutherford Journal
rutherfordjournal.org

The First Automatic Totalisator

Bob Doran

A Large-scale, Parallel, Mechanical Calculator

The world's first parallel automatic totalisator machine was set operating at the Auckland Racing Club grounds at Ellerslie for the Easter meeting in 1913. Although it was an astoundingly large and complex machine it worked well and fulfilled the purpose for which it was designed. In one sense the machine was at the end of an era as it was entirely mechanical, not making use of electricity at all. However, it was also the first of what turned out to be a line of development that continued profitably throughout the century until replaced by modern computers in the 1970s. Here we will describe the machine—what it was trying to do and how it worked.

Pari-mutuel Betting and the Totalisator

The concept behind the totalisator was conceived in the 1860s by Joseph Oller, a resident of Paris, of Catalan origin.[1] He proposed a gambling system, which became known as pari-mutuel (wagering among ourselves), where the amounts bet on all of the individual horses were totalled, reduced by a commission or fee, and distributed to the winners in proportion to the amount of each bet. Pari-mutuel gambling is an attractive alternative to fix-odds betting with a bookmaker—the gambler need have no concern that poor odds are being offered, or feel the need to 'shop around' for the best deal. However, the big disadvantage of pari-mutuel compared to the bookmaker's fixed odds is that the gambler has no understanding of the return to expect from a bet. Oller overcame this defect by displaying, as the betting was taking place, the number of bets made on each horse and the grand total of all bets made for the race. Although not as simple as 'paying 2 for 1' the gambler can easily get a 'feel' for the magnitude of expected returns.

An implementation of the pari-mutuel system has come to be called a totalisator. The totalisator was extremely successful in France, and very profitable for Oller, but it was soon banned. However, the idea continued to spread outside France. By 1880, totalisators supported by machines were operating in Adelaide and Christchurch. In Australia Siegfried Franck promoted the use of a totalisator machine that he had imported from Germany, starting in 1879 at Randwick racecourse in Sydney.[2] When pari-mutuel was again lawful in France in the 1880s it was also supported by machinery which is said to have come from Germany or Austria.

A totalisator is really a group of humans cooperating to make the pari-mutuel concept work. As such, a totalisator requires no special machinery at all. Oller's first totalisators had no machinery—the totals were displayed using chalk on a slate. Even in 1950 when the New Zealand Totalisator Agency Board (TAB) was established to allow off-course betting, the implementation was entirely manual. Why then was machinery used at all?

The initial answer seemed to be that the totalisator is easily subject to fraud. A bet with a bookmaker is a straightforward contract. The gambler and the bookmaker both have noted the contract and there is no dispute as to the outcome if the bookmaker is reputable—if there is a problem such as the bookmaker refusing to pay or being over-extended then it is gross and obvious. With the totalisator things are much less straightforward and there are many ways that the operator (in particular) can cheat. For example, inventing extra bets on unfavoured winners can reduce the payout, as can recording the bet on the horse but not on the grand total. Changing the totals while, or after, the race is run is another possibility.

Initially, totalisators were considered to be in competition with bookmakers and were operated by one man or a small team. The first machines were human sized. Some were quite small and portable, others more like the size of a piano. They were brought to the race tracks on race days and offered their form of gambling as an alternative. The initial purpose of using this machinery was to give a feeling of security to the gambler. The counts of bets were shown in large, easy-to-read, professional-looking fonts rather than handwriting. The typical machine would have levers to increment the count on each horse and to increment the grand total as well in the sight of the gamblers. Some machines would have locks set so that there could be no tampering while the race was being run.

Of course, this feeling of security is ill-founded as the machinery doesn't stop the determined cheat—in the history of the Auckland Racing Club the tale is told of the operators of the very first machine at Ellerslie racecourse in Auckland in 1880 being caught cheating by inventing extra bets on outsiders.[3] True security can only come from the totalisator being supervised or operated by a trusted authority. The way that progress was made varied from country to country but gradually the use of totalisators became restricted to racing clubs. A human system had to be set up to control each totalisator. Although some large racing clubs ran multiple totalisators there were clear advantages to expanding the small totalisators, making them as comprehensive as possible, only one for the whole race track being the goal. In the first few decades of the 20th century it became common to have a single sanctioned totalisator, often operated from a specially-designed building that included displays of the amounts being bet and special booths or windows for selling tickets. There are many of these totalisator buildings still surviving at the racetracks around New Zealand.

Having an official organization supervise the totalisator gave it confidence in the eyes of the gambling public but the increased size of the operation also led to serious new problems. It is hard nowadays to comprehend how important racing was when there were few other outlets for entertainment. In a city the size of Auckland crowds of multiple 10s of thousands were common. A single totalisator display just could not keep up with the volume of bets being made.

Totalisators, being controversial, were subject to regulation. One common rule was that, to avoid fraud, the totalisator had to be balanced before a race could start. Although this was possibly very quickly if well managed, it often was not and the start of the race had to be delayed, by up to 15 minutes in some cases. Additionally, with large numbers of gamblers and bets recorded by possession of a ticket the threat of fraud by the customer became much more serious. There was a great need for some secure method, less expensive in staff and simple to operate, of providing timely totals in the face of many thousands of gamblers.

Another aspect of regulation helped fund the solution. It was common for the racing club to be given the monopoly over betting on track. Bookmakers were banned and the only legal way of gambling was the racing club totalisator. This monopoly provided a bountiful stream of revenue for the clubs and gave them the wherewithal to pay for improvements to the totalisators themselves.

The First Automatic Totalisator

Because of the obvious need for improvement there were many attempts to automate the totalisator. One, operating in Brisbane, used marbles running in tracks to represent bets! However, there was one line of development that was much more successful than others and eventually came to dominate the business. In 1909 George Julius (later, Sir George), English born, raised and schooled in New Zealand (a graduate of Canterbury University, son of Bishop Julius), though Australian resident, filed a patent application for his totalisator machinery.[4] His ideas were first implemented as a totally mechanical machine at the Ellerslie race course in Auckland, New Zealand, in 1913. The company started by Julius, 'Automatic Totalisators Limited,' continued to refine and develop their machinery (called the Premier Totalisator) for the next 50 years.

The purpose of the totalisator machine was to display in large readable figures, in 'real time' as bets were made on the next race, the total number of 'unit bets' made on each horse in the race and the grand total of all such bets. The unit or smallest bet for the first Ellerslie machine was 10 shillings. Tickets recording a bet on any horse in the race could be purchased from any one of the ticket vending windows—for the first machine there were 30 ticket-vending stations, though some would handle only 10 shilling bets and others only double-sized bets of 20 shillings (one pound.) The totalisator design had to allow for bets to be placed on the same horse at the same instant at all 30 ticket windows without any bets being lost. The totals of bets had to be recorded completely accurately and with no significant delay so that the race could be run immediately after the totalisator was closed and the dividend for the winning bet (only simple bets on winners were catered-for) calculated accurately. Although the arithmetic performed by the totalisator was trivial—merely incrementing totals by 1 (or by 2)—handling of the parallel operation, the large number of bets made in a short time and displaying the totals in the large, were design challenges.

The Ellerslie totalisator could also handle up to 30 horses in each race. The total bets for each of the 30 horses were displayed in three rows of 10, the horse numbers being written above the displays. Each of the displays was a 4-digit mechanical counter comprising four wheels each having the 10 digits in large letters on the perimeter. Above the centre of the horse displays was a 5-digit display of the grand total of all bets made on all horses. The displays were at the front of the upper floor of a specially designed two-story building.

Behind the displays was a large room that contained the central machinery. The displays are actually part of the machine itself—this allows us to get a feel for the size of the machinery which occupied the entire first floor room. The scale is apparent in the photo taken of the machine when it was being tested and assembled in Sydney.

The race tickets were sold on the ground floor. Pre-printed tickets were issued by hand. To record the bet, the operator pulled one of 30 levers, one for each horse, referred to as 'beer pump handles.' Each lever was connected to the central machinery with a unique steel wire that communicated the 'tug' signifying a bet being made. The 900 wires had all to be kept taught and free-running over pullies. Photo 7 shows two of the ticket-issuing stations as installed at Ellerslie—the rats-nest of wires in the ceiling space can be glimpsed on the upper right.

The task of the central machinery was to keep track of bet totals for each horse, allowing for 30 bets on the one horse to be registered simultaneously by 30 wires being pulled at the same time. To solve this problem Julius introduced a device he called a 'shaft adder'. He later gave a drawing for a improved version, though based on the same principles.[5]

There are sets of epicyclic gears or differentials mounted on a shaft, each free to rotate around the shaft. Each of these differentials is fixed to a toothed escapement wheel (the thin vertical boxes in the diagram, viewed edge-on.). The differentials are prevented from rotating by an escapement mechanism (as in a clock) that may be operated to allow them to turn one step. There is another differential in the middle of the shaft that has rotational force applied to it—in the diagram this central differential is pinned to the internal shaft which is being urged to rotate—in the Ellerslie machine the central differential had an attached toothed wheel was driven by a chain. By operating any escapement its differential is allowed to rotate one step and this causes the central differential to advance one step and so the central shaft or chain also advances one step representing one bet. Any or all of the differentials may be stepped at the same time and the combined rotation comes through to the centre, thus allowing multiple bets on the same horse to be recorded simultaneously.

There is one shaft adder for each horse. To handle 30 horses the Ellerslie machine had three rows of ten adders—each adder was situated behind its display counter. To handle 30 ticket stations (the same number of horses and ticket stations is co-incidental) each shaft adder needed 30 differentials and escapements, one escapement operated by each ticket station. In fact, each adder was split into two sections—one shaft of 18 escapements that represented a 10 shilling bet as 1/20th of a revolution of the shaft and another of 12 escapements that recorded 20 shilling bets. The rotations of the two subshafts are combined, the 20 shilling rotations being doubled, to impart a final rotation to a shaft that thus represents 20 unit bets for each rotation. Nowadays, we would probably call the shaft adder a 'parallel to serial converter' in that parallel or simultaneous 'tugs' on wires are converted to a continuous rotation corresponding to the number of tugs. Photo 9 shows one of the shaft adders with the 'output' from the device being the rotation of the central shaft.

The central shaft is being driven to rotate, with the escapements permitting rotation only when a bet is to be recorded. To provide the motive force to the shafts the first machine used clockwork. The shafts are driven by heavy weights as in a grandfather clock but on a much grander scale. In the photo of the back of the machine installed at Ellerslie (Photo 10) some of the weights can be seen, as can some of the wires coming in to the machine from ticket stations on the right.

As well as total bets for each horse, it was necessary to form the grand total of all bets. In this first machine the output rotations from the horse adders are added together with special shaft adders. The central shaft of each adder pair is connected by a chain to the grand total adders. The 15 horses to the left and the 15 to the right are each totaled separately and then these are combined to form the grand total at the top of the machine. In photo 11 the left half grand total shaft adder is in the centre. The sum is carried by the chain heading up to the right to the top of the machine from the centre of the shaft.

At the top of the machine the rotations from the left and right are combined on one shaft, the rotation of which represents the grand total, again 1/20th of a rotation for each unit bet. This can be seen in photo 12.

The total bets on each horse, and the grand total bets, are represented as rotations of shafts. These rotations now have to be converted into a visible total. This was done by the counters that would increment their display by 1 for each 1/20th of a rotation on the shaft. Unlike nowadays, where a display is a remote device that receives electrical signals, these counters were actually integral parts of the machine—the public glimpsed the totals through windows exposing just a small part of the machine. In the photo, the input shaft to the grand total counter can be seen going in to the left of the counter at the units position. The other 30 counters had similar inputs directly from the shaft adders for each horse.

The counters were simple in concept. The rotation of the input shaft was used to allow the units drum to rotate—it was given a separate source of rotational power, the input shaft to the right in photo 12. Each complete revolution of the units drum would allow the tens drum to rotate one 10th of a revolution. And so on for 100s and thousands.

Although simple in concept, in practise the counters presented great difficulties. The wheels had to be large so that the totals were readable from afar. The signal coming in could have peaks that would start and end suddenly. To show all of the bets the units drum would have to be able to rotate quite quickly but it was too massive to start or stop suddenly. Julius had to invent 'buffer' mechanisms that would accept the rotation input signals without any loss while the counters built up speed. There also needed to be a means of gradually slowing the counter when the input stopped. It is unclear what exactly was this mechanism for the first machine, though it appears that the buffer was some kind of coiled spring.

Success of the Machine and its Sequel

The first Ellerslie totalisator must have been the largest mechanical calculating machine ever built. It was not until large mainframe computers arrived in the late 1960s that there was any computing device to match it in size. It was so complex that it is hard to credit that it could operate accurately and reliably.

However, although there were teething problems, the machine seems to have worked well, as detailed in the immediate newspaper reports (see appendix). The ticket issuers were not to the satisfaction of the Auckland Racing Club (ARC) and were upgraded to make them less susceptible to fraud. Julius was very loathe to make this change because he had already spent £11,000 on a machine sold to ARC for £4,000.

The machine must have been tricky to maintain. By the time it was completed Julius had a range of better ideas to try. He addressed the ARC committee in 1914 trying to get them to upgrade but he was asked to complete the machine he had contracted to build.[6]

By 1917 the advantages of the next model that connected ticket-selling machines electrically were obvious (including being able to put the ticket machines a long way from the machine) and a decision was made to purchase a new machine which was operating by the end of 1918. So the first automatic totalisator, the only one to be fully mechanical, was in use for only 5 years.

As detailed in the press report, the totalisator gathered £41,514 on its first big day. That represents 83,000 bets which corresponds to a volume of more than 10,000 bets per race at peak. The machine could handle Ellerslie but was not adequate for the much larger race tracks overseas. Julius set himself the goal of making totalisators that could handle up to one million bets in the half hour between races. With major improvements, automatic ticket issuing machines and mechanical multiplexors to share escapements between multiple ticket issuers, ATL went on to produce machines of much larger capacity. By the end of the 1920s ATL machinery was installed at race tracks throughout the world with the really big sites being Longchamps in Paris and White City in London. Longchamps had 270 ticket machines and could certainly handle multiple 100s of thousands of unit bets for each race.

The technology improvements also made it possible to make totalisators that were less expensive, making them suitable for smaller race tracks. Mobile machines on trucks, or totemobiles, brought the ATL machines to remote country sites. Widening the market further were innovations that showed expected dividends rather than horse totals (calculated with analogue dividing machines), and different types of bets were made possible, including the double and the place bets. ATL developed into a company that remained profitable and in a dominant position until computers made the electromechanical machines obsolete in the 1970s.

Appendix

This extract is from The New Zealand Herald, Tuesday, 25 March, 1913. It describes the operation of the first mechanical totalisator, initiated at the Easter meeting of the Auckland racing Club, 22nd and 24th March 1913.

THE NEW TOTALISATOR

The new totalisator machine was used for the meeting with marked success. It was installed in time for the Christmas meeting, but for various causes it was deemed inadvisable to use it until the Easter meeting. A small knowledge of the extraordinary demands that the work of a totalisator imposes upon its parts shows clearly how mechanism might have failed in a dozen ways. But in the meantime alterations have been made, the machine has become more familiar to its operators, and it worked on Saturday and yesterday with fine regularity, and to everybody's satisfaction.

The chief problem in making a purely mechanical totalisator is to arrange matters so that if two or three or a dozen of the operating clerks all issue tickets on the same horse, the full number shall be recorded in the proper place. That the problem is a difficult one is shown by the fact that this machine, the invention of Mr Julius, is believed to be the only one that achieves the object by means of gearing, instead of with falling marbles, or some such device. The aggregating is done by a very pretty association of crown wheels and epicyclic gear, which, mechanically, is infallible.

The second obstacle of importance was raised by the fact that, in view of the facility with which many investments could be put upon a single horse at a time, the machinery was apt to be run at times so fast that the starting and stopping of the rotating wheels, which, in spite of their light construction, have considerable inertia, set up almost destructive strains and shocks. This trouble has been overcome with an ingenuity altogether admirable. The counter releases a spring-driven gear, which can go as fast as it will irrespective of the motion of the wheel on which the figures are shown to the public, and the wheel simply runs leisurely and smoothly ahead until it overtakes the gear. Even then the wheel, free to make several rapid revolutions, would be difficult to stop at the right place if its speed were not controlled by a governor. There is a 'relay drive,' and a governor for each of the 30 single horse recorders, and another for the grand total mechanism. The totalisator in full operation presents a remarkable appearance from within, for the machine is an enormous structure, the greater part of which is occupied with the releasing wires and the driving gear. Every time a ticket is issued the clerk pulls a lever corresponding with the number of the horse. The lever pulls a long wire cord; the cord releases the counter. The gearing revolves a little, and the counter wheels turn. Sometimes the wheels move at long intervals; and then, as a horse becomes popular, its set of wheels will commence to spin frantically, so that one might imagine the count terribly apt to fail. But the 'tens' tot up the units, the 'hundreds' go up in their turn; and grand total wheels turn phlegmatic somersaults, and perform mathematical prodigies. The machine was originally intended to punch the tickets with the number of the horse upon which they are issued, but so far the punching mechanism is not in use, and it is probable that an addition will be made so that tickets will be issued from magazines, operated by the levers simultaneously with the recording of the investments.

Speculation was very brisk during the afternoon, with investments reaching to £41,514 10s, compared with £38,026 10s on the concluding day of last year, and making £74,053 for the meeting, against £68,947 10s in 1912, an increase of £5,105 10s.

Acknowledgements

Thanks to Brian Conlon for information from his website devoted to Automatic Totalisators Ltd. (http://members.ozemail.com.au/~bconlon/), to Matthew Connell for providing access to ATL archives at the Power House Museum and to Auckland Racing Club for access to their records.

Image Credits

Images 4, 7 and 10 appear courtesy of Brian Conlon's ‘Totalisator History’. Images 6, 9, 11, and 12 appear courtesy of the ATL archives, Power House Museum, Sydney.

Notes

1 ‘*L’Homme de la belle époque*’ by Ferran Canymeres, Les Editions Universelles, Paris, 1946

2 Martin Painter and Richard Waterhouse. ‘The Principal Club. A History of the Australian Jockey Club’

3 The history of the Auckland Racing Club ‘A Noble Breed’ by William Mackie

4 Julius Specifications and Drawings. Totalling etc. Apparatus ‘Automatic Type’ 1909. From Automatic Totalisators Ltd. Archives held at the Power House Museum. Sydney

5 Julius, George Alfred. ‘Mechanical Aids to Calculation’ Institution of Engineers, Australia. Sydney. 1920

6 The minutes of the Auckland Racing Club Committee, 1912–1919

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Figure 1: Joseph Oller. Inventor of the totalisator. Also impresario and entrepreneur, founder of the Folies Bergere—see 'L'homme de la belle époque'. (Click to enlarge)

Figure 2: Early totalisator machine used at Auckland by Harry H Hayr. (From J. Chadwick 'Men of Mark in the world of sport in New Zealand' Auckland 1906).

Figure 3: Totalisator building at Addington, 1913. (From Ron Bisman 'Salute to Trotting. A History of Harness Racing in New Zealand')

Figure 4: Sir George Julius

Figure 5: Ellerslie Totalisator house (From The history of the Auckland Racing Club 'A Noble Breed' by William Mackie)

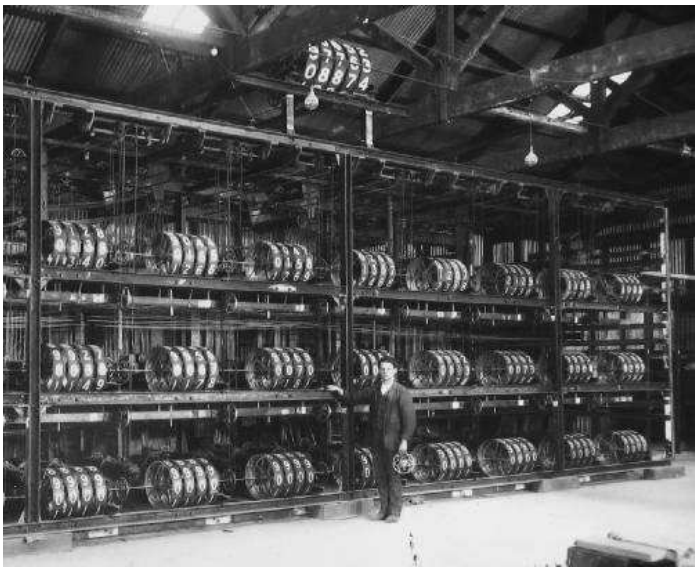


Figure 6: Ellerslie Totalisator—front view during assembly

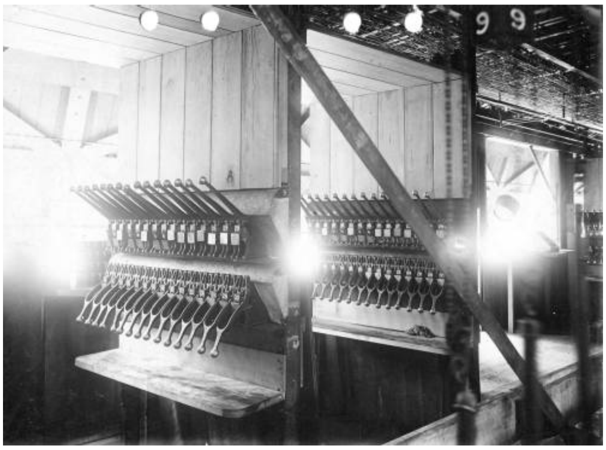


Figure 7: Ticket selling stations at Ellerslie

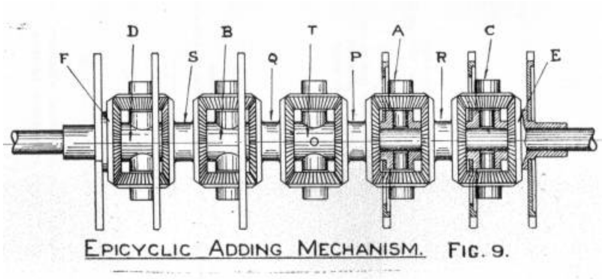


Figure 8: Diagram of 'Shaft Adders' (From G Julius, 'Mechanical Aids to Calculation))

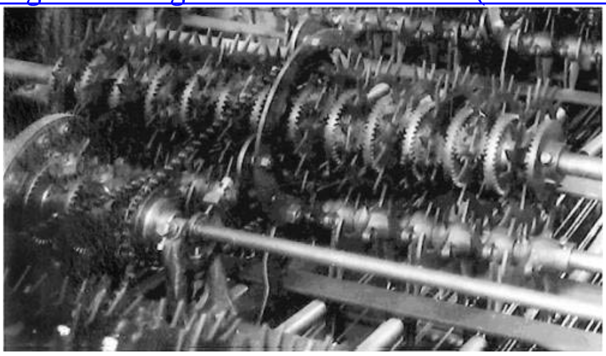


Figure 9: Close view of part of a shaft adder in the Ellerslie machine

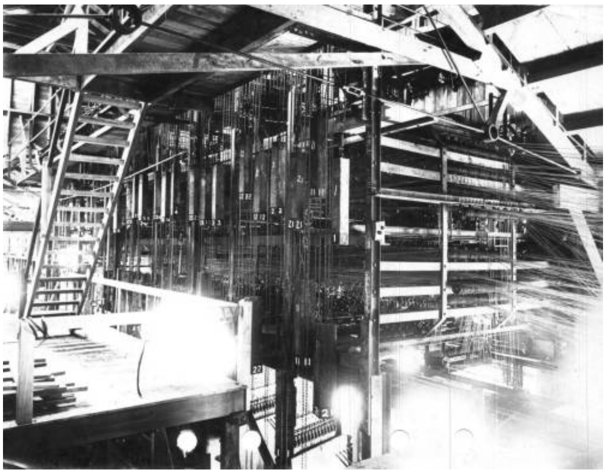


Figure 10: Rear view of machine at Ellerslie

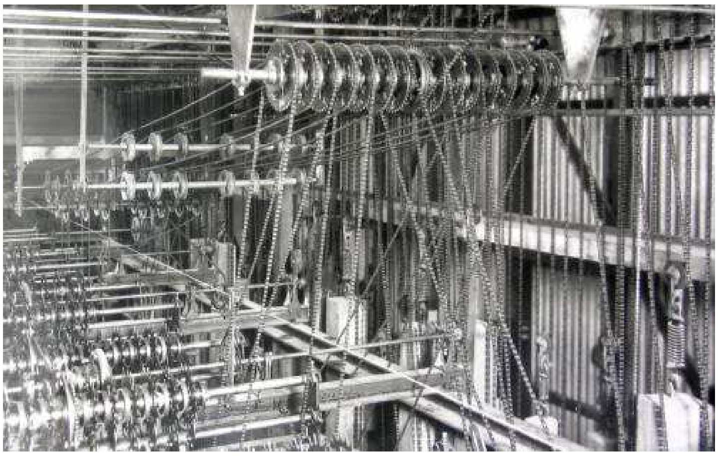


Figure 11: Left half of grand total shaft adder

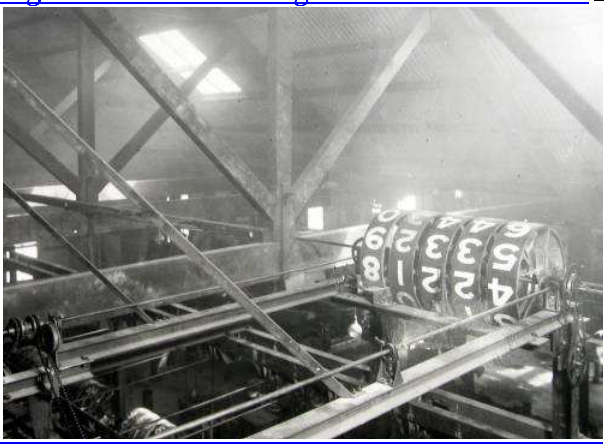
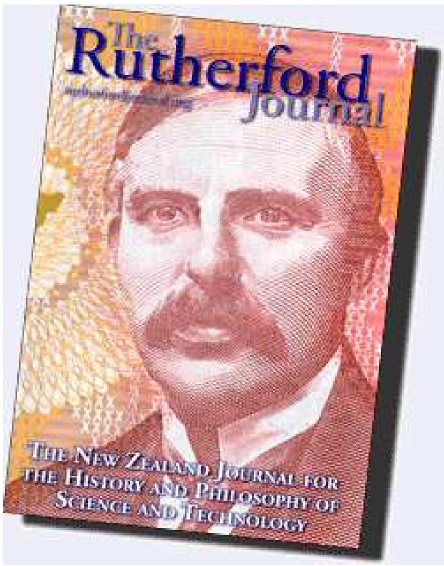


Figure 12: Final stage of grand total addition and grand total counter



Appendix II - *"Totalisators-First Automatic Totalisator"*
Computer History Displays, University of Auckland.

Computer Science

Totalisators: First Automatic Totalisator

The world's first automatic totalisator machine was set operating in 1913 at the Auckland Racing Club's grounds in the Ellerslie suburb of Auckland. The machine was designed by Sir George Julius, the founder of the Australian company "Automatic Totalisators Limited." There is no known detailed description of the machine and no portion of the machine has been preserved. Here we attempt to describe the machine as best that we can - what it did, how it worked.

This description is based on the information that is still available. We have a set of photographs taken as the machine was being assembled and tested in Sydney before being shipped to Auckland. There are also some photos of the machine taken when it was installed and operating. There are patent documents filed by Julius, particularly one lodged in 1915. This patent doesn't describe the Ellerslie machine specifically, but some parts definitely apply

- also there are some improvements mentioned in the patent that can be read as implying some negative aspects of the 1913 machine.

We can be very clear about many aspects of the machine from study of these photos and patents. However, because there is no detailed description it sometimes takes a lot of reasoning to decide what the machine was like. This detail might perhaps be of interest to one or two enthusiasts but not to the majority of readers. Hence, this description is written on two levels. This top-level overview should be understandable by any reader but it links to more-detailed descriptions of some parts of the machine that might be harder going.

Some Background

The Ellerslie machine was a mechanisation of the process of "pari-mutuel" betting invented by Joseph Oller. Oller conceived the concept of pool betting that may be applied where there is a single winner from a field of competitors. Totals are kept of the amount bet on each competitor together with the grand total of money bet on all competitors. When the winner is known, those with bets on the winner are awarded a share of the grand total (after deduction of a commision) proportional to the size of their bet. Oller enhanced the excitement and interest of horse-race gambling by displaying the totals on each horse and the grand total in "real time" as the bets were lodged - potential punters could see what other gamblers were backing and could estimate returns if they won.

Until the arrival of the 1913 Ellerslie machine, pari-mutuel gambling, which had become known as the totalisator, was run manually. As bets were made the totals were counted and displayed - at the start on chalk boards but later with large impressive numerical displays. Manual operation could work well if organised properly and continued at small race courses into the 1960s. However, the totalisator was highly subject to fraud and had to be rigorously controlled. One criterion imposed by authorities was that the totalisator must be closed with complete and final totals before any race was run. At bigger race courses, where there were tens of thousands of gamblers, this could result in unacceptable delays. It was a problem crying out for mechanical solution. Happily, when the race course clubs were given, by legislation, the monopoly on gambling they had the funds to pay for novel solutions. This happened relatively early in New Zealand which explains why the Auckland Racing Club was able to pay for the first automatic totalisator in 1913.

More detail on background

Top

The Totalisator Exterior

The new machine was housed in its own building - this was an existing structure built for operating the prior manual totalisator and adapted for the new purpose. In this photo of the "tote house" you can see displayed in the middle section of the building the number of 10-shilling bets on each horse (from horse number 1 to horse number 30) with the grand total of all bets shown in a larger display dead-centre. Notice that there are three rows of horse totals, 10 per row.

(from "The Noble Breed")

The gamblers are queued up in front of the ticket selling stations which are under the shutters. There are 7 shutters in the wing to the left, 6 in the wing to the right and 4 in the middle, so at two stations per shutter there is room for 34 ticket stations, but only 30 were provided. The fence (topped with barbed wire!) running to the middle of the tote house was used to separate the members of the racing club from the general public.

Nowadays, we are used to data being displayed remotely. However, that was not yet possible in 1913. The totals displayed are actually, as we will see, represented on "wheels" in the machine itself. You are looking through small windows at the totals displayed on the machine - the machine occupies the entire space behind the central part of the tote house.

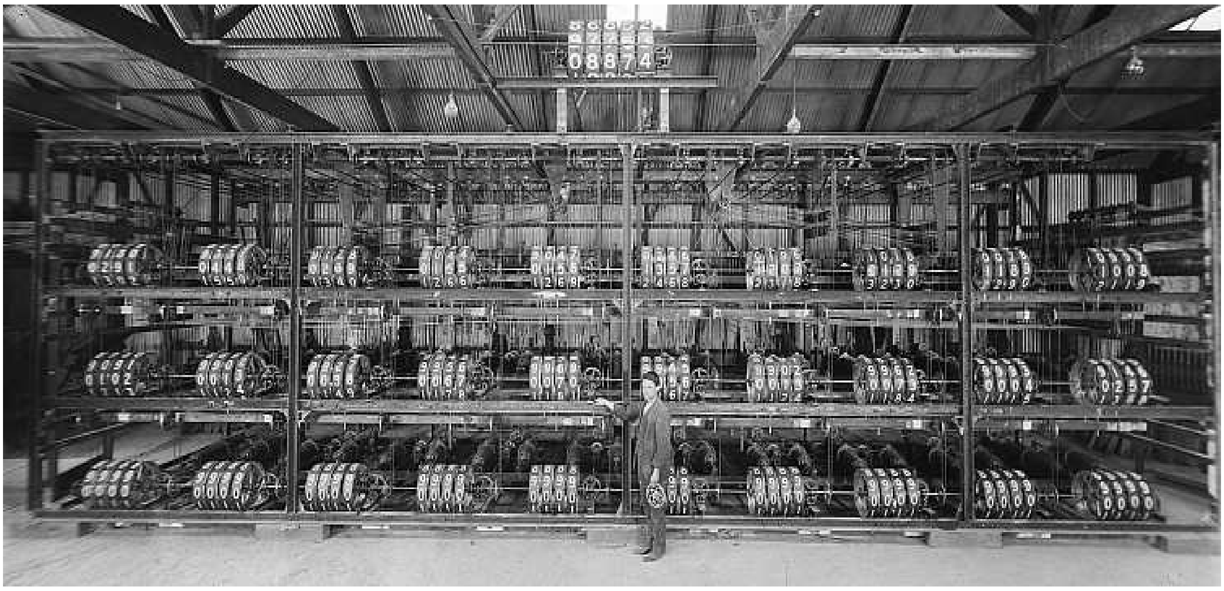
The exterior photo shows the way the machine worked from the punter's point-of-view. There were two values of tickets sold at different stations but all could handle bets on any horse. Most sold tickets of 10 shillings value and some sold tickets of 20 shillings (one pound.) (Even the minimum bet was a lot of money in those days but if you wanted to bet more you could buy multiple tickets, though there was, apparently, one station that sold tickets of 5 pounds value.) You queued at a ticket selling station that corresponded to your intended bet value. For every 10 shillings you wagered on a particular horse number you should see the total displayed for that horse number increased by 1 and the grand total also increased by 1. From the punter's view it seems a fairly simple process, but, as we will see, it was very difficult to make a machine do this work with the technology of the time. The central problem to be solved was how to register the correct total when all 30 ticket stations sold tickets for the same horse at exactly the same time, but there were also many other practical problems that needed resolution.

More detail on the tote house.

Top

Principles of operation

The machine comprised a number of different types of specialised device each replicated many times. We have seen the *counters* through the windows - their purpose is to count the number of bets on each horse individually, and on all horses (the "grand total"), and also to display the totals so that they are visible to the punters gathered below the machine. You can better see the size of the machine and its counters in this image of the machine being assembled in Sydney



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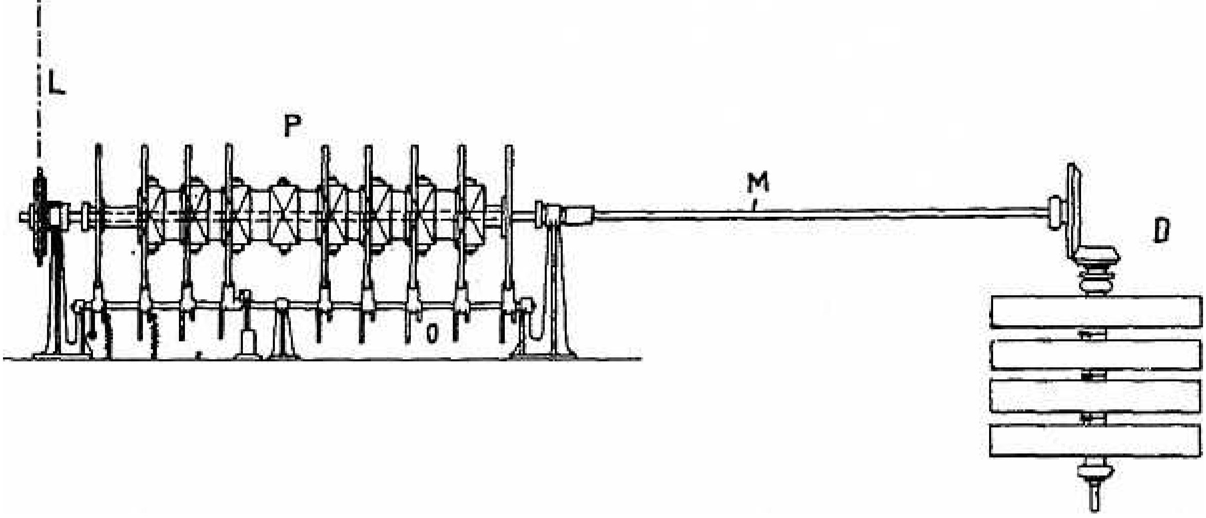
Machine assembled for testing at Sydney (from Power House Museum)

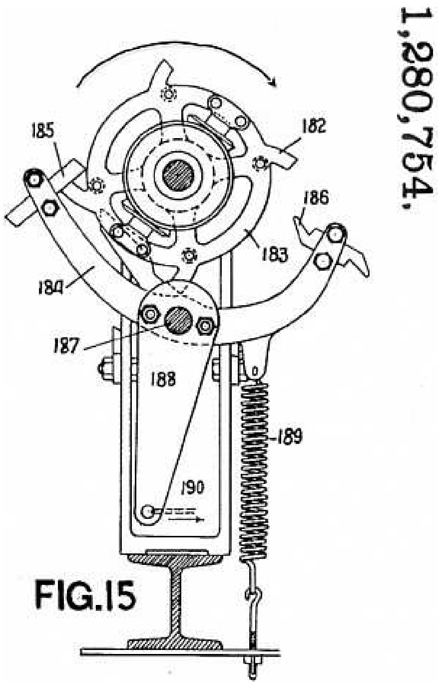
The counters are in three layers of 10 with the larger grand total counter on top. The counters display totals as conventional decimal numbers. However, internally totals are represented by the amount of rotation, from the commencement of betting, of shafts. Each rotation of a shaft represents 20 unit bets, so at any time a particular shaft represents a total given by 20 times it's number of full rotations, plus whatever fraction of the current rotation. Every display counter has a rotating input shaft as may be seen in this diagram from the 1915 patent application:

FIG. I



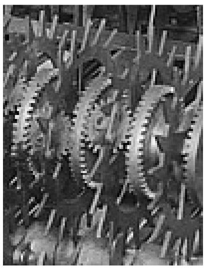
The counter (D) is designed so that it increments its displayed total by 1 for every 1/20 of a rotation of the shaft (M). When a unit ticket is sold for a particular horse number, the machine ensures that the input shaft to the counter for that horse number is rotated by precisely 18 degrees. The basic way that this is achieved is that the display counter input shafts are continuously placed under "pressure" to rotate but only allowed to rotate when

a bet is issued. This is assured by the use of an escapement mechanism from the design of clocks.



To explain how this works we can modify a diagram from the 1915 patent application. At the top is a wheel with four teeth that is pinned to a central shaft represented by the black circle (the shaft is perpendicular to the diagram.) The shaft and wheel are being impelled to rotate in the direction shown. However, the wheel is stopped rotating by the pawl (185) connected to the rocker arm (184). The rocker arm can turn around a pivot (187) and can be made to move by tugging the "string" (190) attached to the middle arm of the rocker(188).

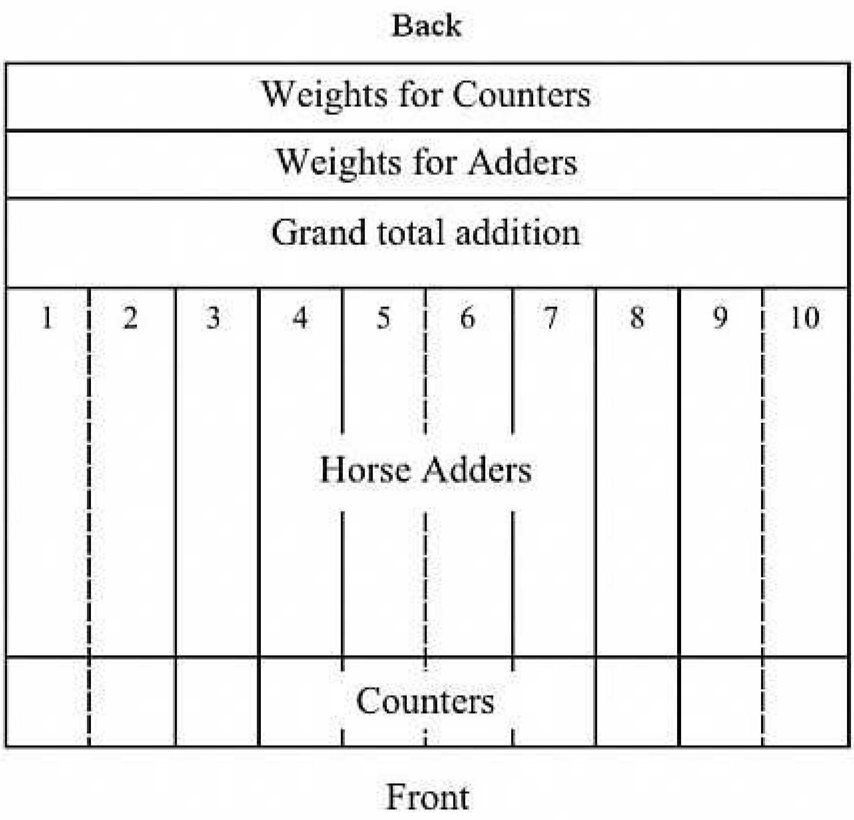
The machine ensures that a bet on a horse causes a tug on the string (190) which moves the rocker. This removes the pawl (185) from the tooth of the wheel and allows the wheel and shaft to rotate. However, the movement of the rocker puts the other pawl (186) in the path of the tooth (182) and allows only a limited rotation. When the string is released the spring (189) causes the rocker to return to its original position, removing the second pawl (186) allowing further rotation which is checked by the first pawl (185).



In this example, the issuing of a ticket on a horse allows the shaft to rotate precisely 90 degrees. In our machine the principle is the same but, as seen here, the escapement wheels have 20 teeth so a unit bet allows a rotation of 18 degrees. Let's summarise the main components that we need to describe in more detail:

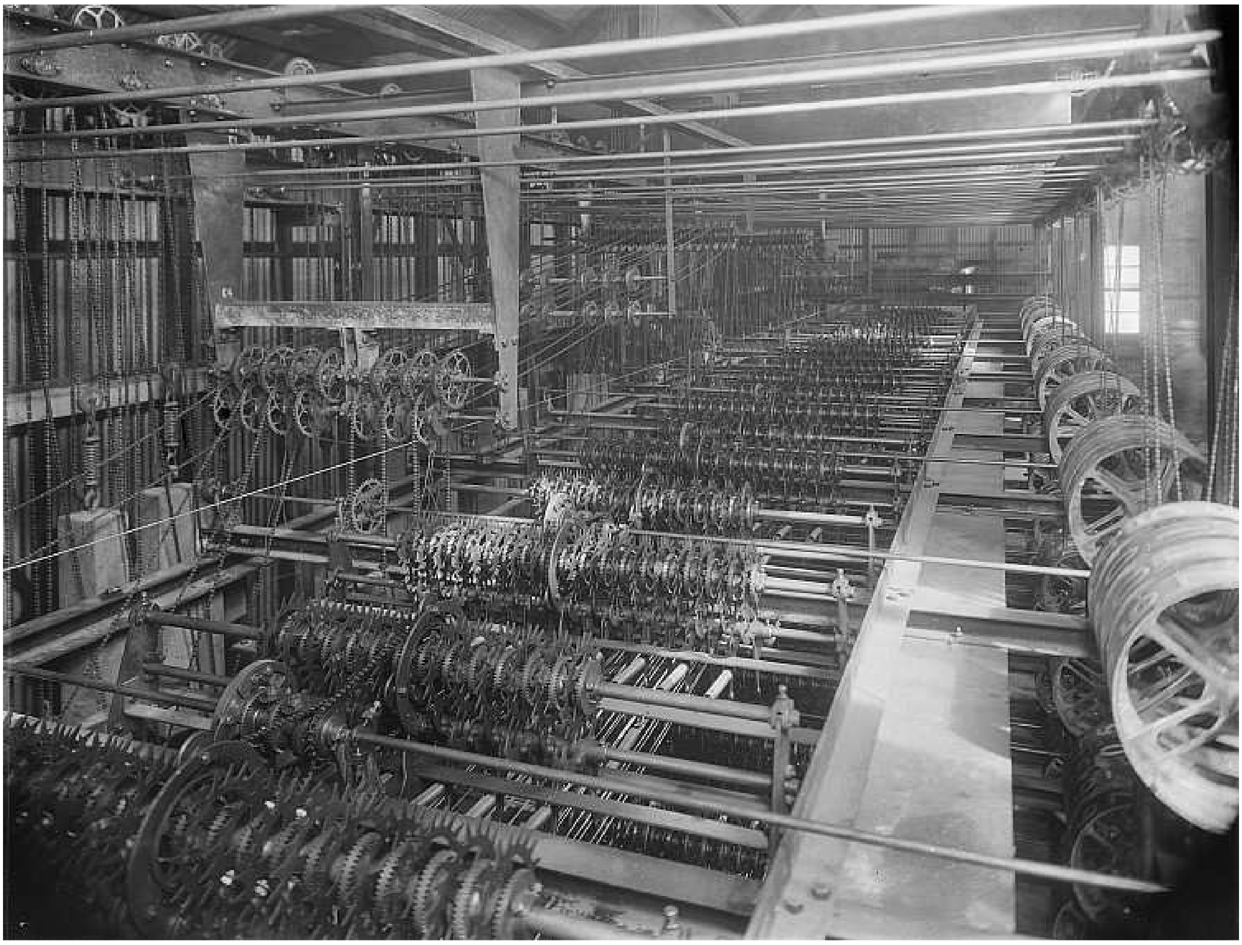
- There has to be some *power supply* mechanism impelling the shafts to rotate.
- There has to be an *input mechanism* that makes the sale of a ticket move the rocker arm on the appropriate escapement.
- We have shown how one ticket sale can allow a counter input shaft to rotate but the problem is that there are many (30) ticket selling stations that could potentially issue tickets for the same horse at the same time. So, there needs to be a device that ensures that all of the ticket sales are registered - we will use the later ATL name of *shaft adder* for this device, though in 1915 Julius called it a "computer". (The adders for horse totals incorporate the escapements mentioned above.)
- Finally, there needs to be a device to count the total number of bets on all horses - we will call this the *grand total adder*. In later machines the grand total adder and the horse adders were identical devices - in this first Julius totalisator the grand total adder was quite different.

The general plan of the central part of the machine is as follows:



Ellerslie Totalisator Central Machinery – Plan
(The horse adders and counters were in 3 planes, top horses 1-10, middle 11-20, bottom 21-30.)

Here is a photo looking across the top plane of the machine. Most of the components are visible in this picture:



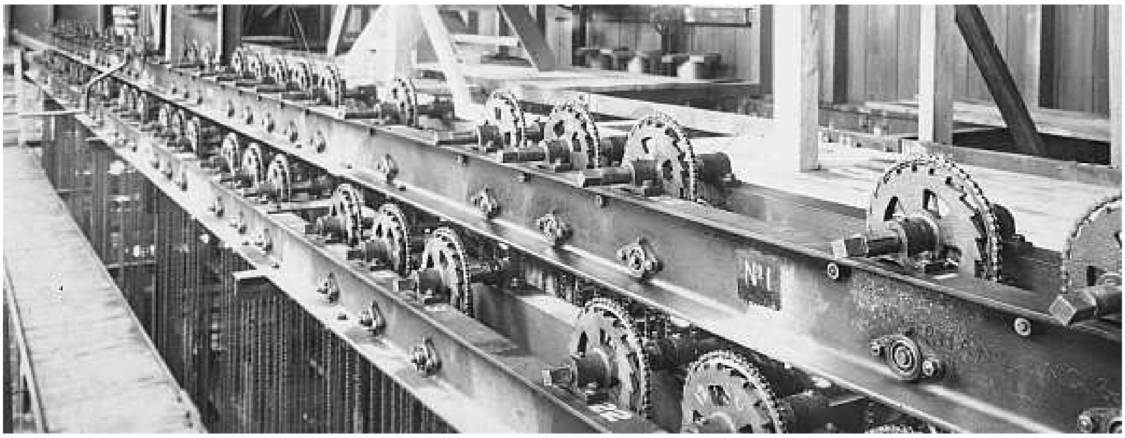
Top plane of machine (from Power house Museum)

Top

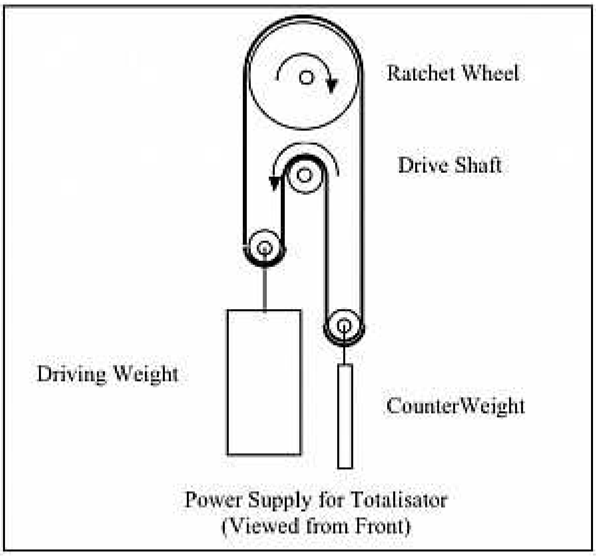
Power Supply

What impels the shafts to turn? In the "Fig. 1" diagram above you can see a sprocket wheel being driven by a chain (L) but that just changes the question to "what powers the chain?" It is its power supply that puts the first Ellerslie machine in the category of late 19th century rather than the 20th century. The machine is entirely driven by clockwork - there is no use of electricity in the machine at all!

At the top back of the machine there are two rows of ratchet wheels.



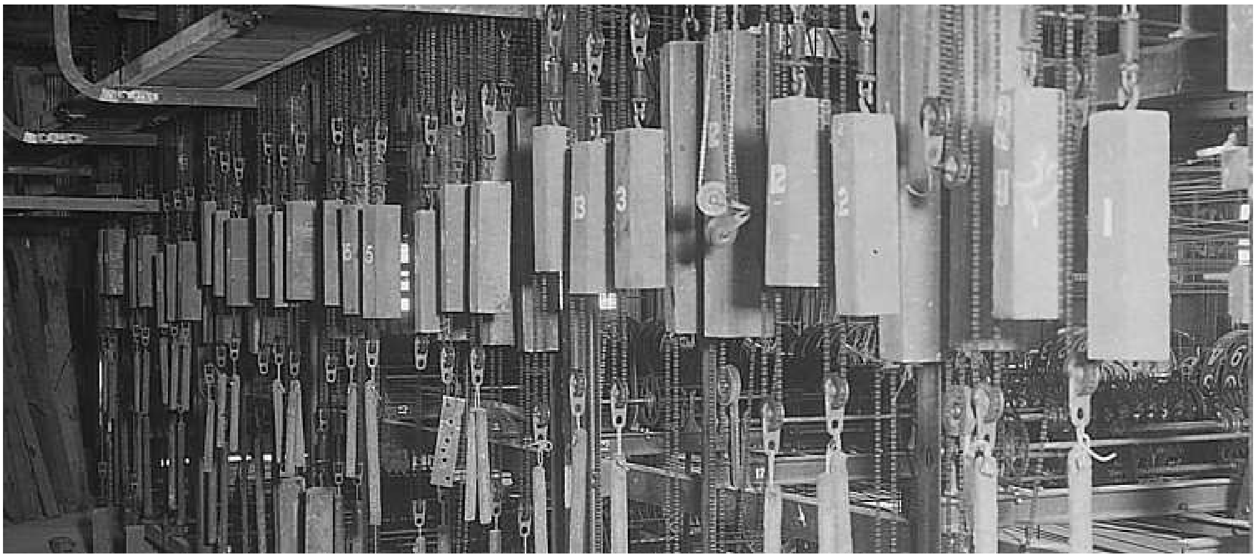
Ratchet Wheels (from Power house Museum)



Running over each ratchet wheel is a chain to which is connected, via a heavy driving weight, to another wheel that turns a drive shaft (which in turn has a wheel that connects by a chain to an adder shaft (L)). The chain is kept taught by a smaller counter weight. The driving weight impels the drive shaft to turn, gradually lowering as it does so. As long as the driving weight does not fall too far the drive shaft is provided with a steady driving force.

It was necessary to raise the driving weights between each race. There were about 62 weights needing raising, depending on how many horses were in the previous race. The weights were raised using a hand-crank - you can see the squared end of the ratchet wheel shafts above and a hand crank to the left. There was a platform for the weight-raiser to stand on. The weights could be raised while the machine was in operation without altering the motive force - presumably somebody had to keep an eye on the weights for the favourite horses and raise them before they hit bottom.

The weights were pieces of concrete of substantial mass. It must have been quite an effort to keep them raised. In the image below you can see the array of weights and counter-weights as the machine was assembled in Sydney.



(from Power House Museum)

More detail on the weights

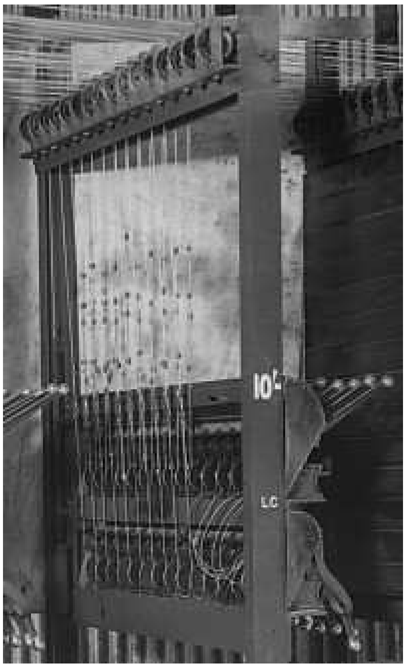
Top

Ticket issuing and "input"

Any ticket issuing station must be able to accept a bet on any horse. As we have seen, in this machine, a bet is registered by pulling the lever on an escapement. As there were no electrical connections there had to be steel wire or cable connecting each escapement to a ticket station. The cable was physically pulled by the ticket issuing station to register the bet.

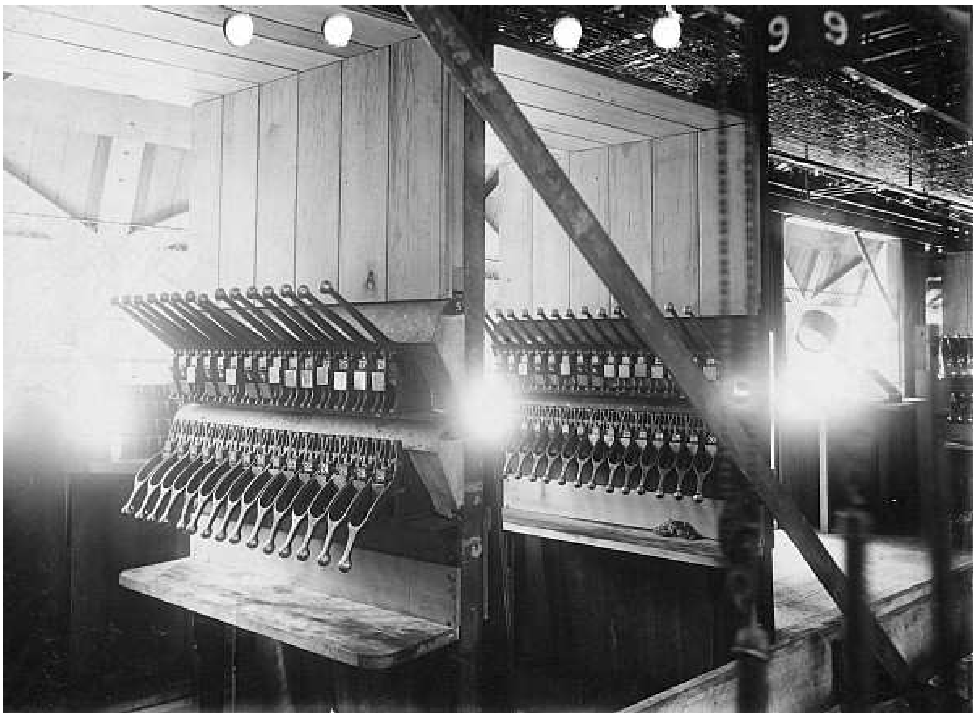
In the final machine there were 30 cables from each of the 30 ticket selling stations, one cable from each station running to each of 30 "shaft adders" that totaled the bets for a particular horse. So there were 900 cables to be accommodated in the machine! Large numbers of wires carrying electrical signals are relatively easy to handle as they are flexible and can be stowed out of the way because their length and positioning are not very important. However, the cables in this machine had to be strong, inflexible, and kept taut, so the pull on the handle would be transferred reliably up to an adder in the machine. In the image you can see some of the cables running over pullies into the machine being assembled in Sydney.

The ideal for ticket issuing is that the ticket is only issued after the bet has been registered in the machine. At Ellerslie, to start with, pre-printed tickets were selected by hand. The operator pulled one of 30 levers, referred to as "beer pump handles," to record the bet and the lever mechanism also perforated the ticket to validate its issue.



Here is a photo of one of the ticket issuing stations being tested - note the wires running over pullies up into the ceiling space. Each station had two banks of 15 levers, the top for the odd numbered horses and the bottom for the even. To record a bet, the operator would pull down the lever for that horse. This would release an escapement on the shaft adder corresponding to that horse in the central machine.

We have one photo that shows the ticket machines in place at Ellerslie. The wires are hidden in the panelling (but there is a real rats' nest of wires up above.) The ticket window shutters are here seen from the inside.



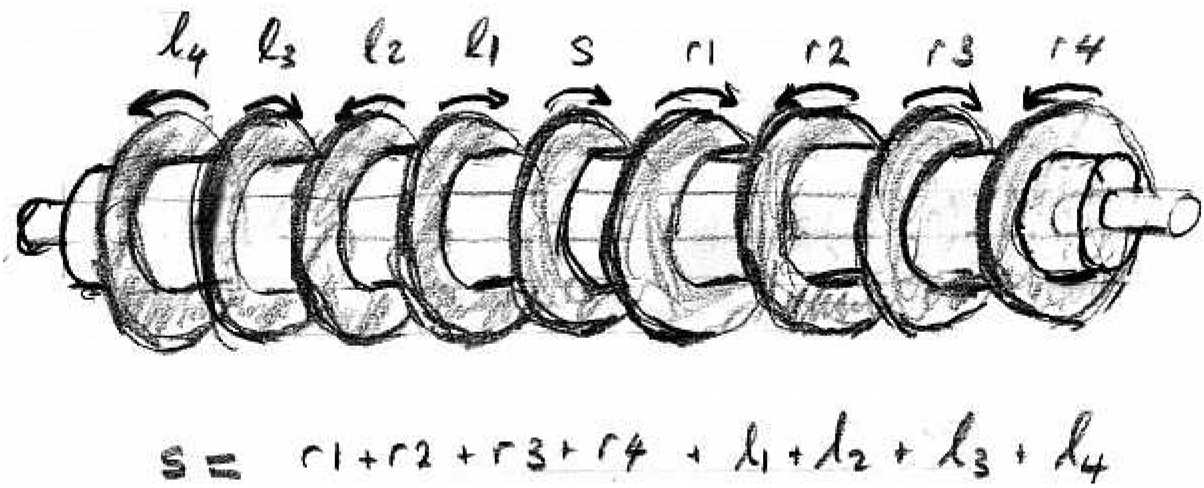
(from Brian Conlon)

More detail on ticket issuing

Top

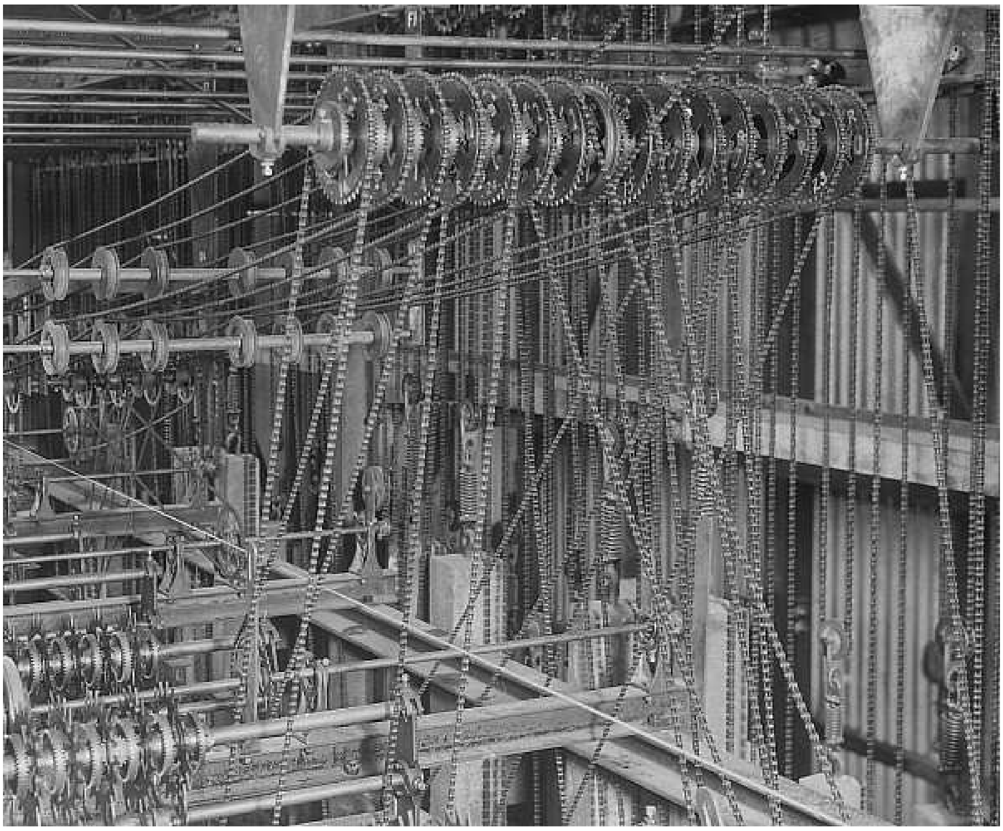
Grand total adder

We have seen that the number of bets on any horse is given by the rotation of a shaft that feeds the counter for that horse. The Grand Total counter needs to be fed by a shaft that represents the sum of the rotations of all of the horse shafts. We must now introduce the device that does this job, what was later called a "shaft adder". These are not too hard to understand if you can actually see one working but what we will do for now is just assume that they can be made. Consider the following diagram:



Here we have an archetype shaft adder. Around a central shaft is a cylinder that contains cogs etc. that do the work. Around the cylinder is a series of wheels that are free to rotate. The mechanism ensures that the rotations obey the equation shown i.e. the rotation of the central wheel must always be the sum of the rotations of the other wheels as shown - though some wheels must rotate in the opposite direction to others. These shaft adders can have any number of wheels with the sum equation following the same pattern as this example. If you would like to see how these shaft adders work there is more detail here.

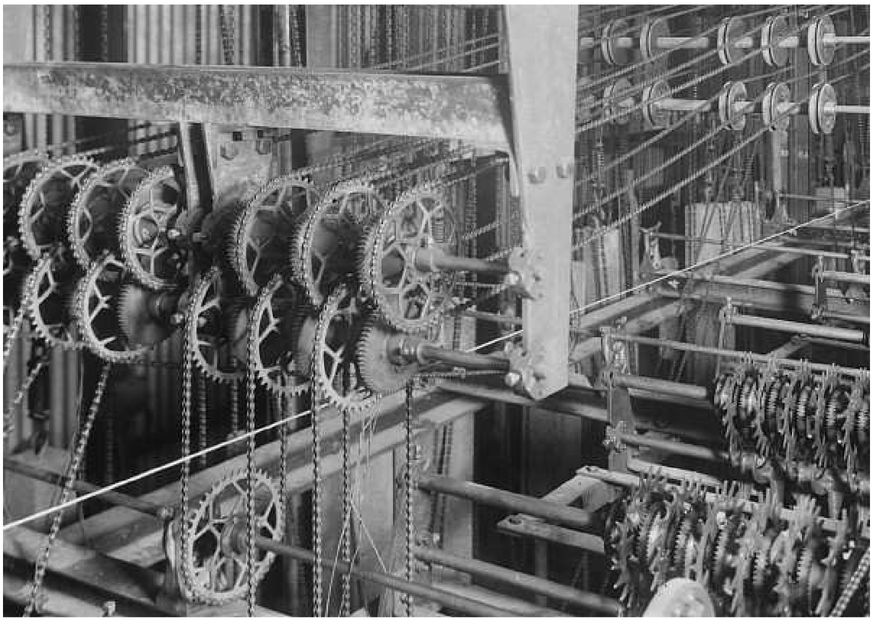
To form the grand total our machine uses two shaft adders to add separately the rotations for the 15 horses totalled in each half of the machine. The one for the left side is:



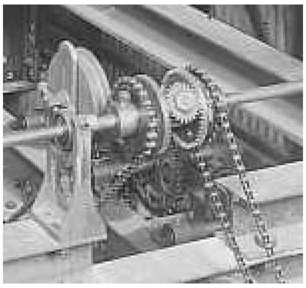
(from Power House Museum)

The line of wheels at the top is an implementation of a shaft adder - in this case the wheels have sprockets to which are connected chains to transfer rotation inputs. In the centre of the adder is the wheel that represents the sum - its rotation is transfered by chain up to the right to the top of the machine. The other wheels are rotated by their chains to reflect the rotation of each horse shaft. For example, at the bottom you can see the shafts for horses, 1, 2, 3, 4, and the chain connecting the shaft in the foreground for horse 4 to the adder wheel up above that is marked "4". Other chains disappear down to the lower levels of the machine to pick up the rotations for other horses.

With a shaft adder every alternate wheel has to rotate in the opposite direction but with this machine all horse shafts actually rotate in the same direction. You can see chains for some wheels being relayed from the distant left. We have a close-up below of the other end of those chains. Here, the rotation from each of 7 horse shafts is picked up then reversed by gearing before being relayed to the shaft adder.



(from Power House Museum)



The right side of the machine has a mirror image set-up which sums the rotations for the other 15 horses. Chains from the right and from the left appear on the top layer of the machine. Here they are added by a minimal variation on a shaft adder. The grand total shaft is made to rotate as the sum of rotations from the left and right. (Actually, 1/2 the sum of the rotations, but this is compensated by the diameters of the input wheels being 1/2 that of the wheels in the shaft adders down below.)

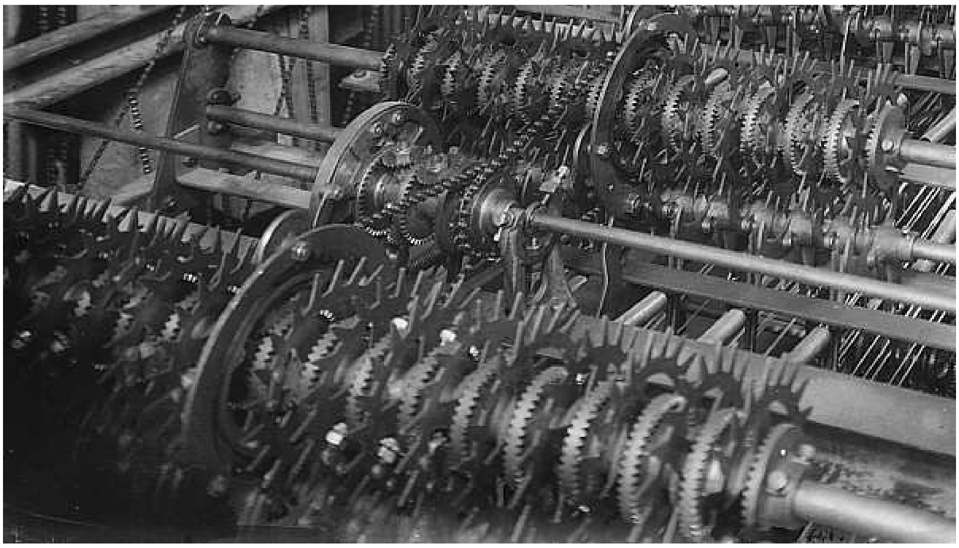
Top

Horse Adders

The Grand Total adder sums the rotations representing the bets on each horse. Similarly, each horse total must be formed by summing the bets placed on that horse at each and every ticket selling station. We have seen how the bets from a particular station can be represented by the rotation of wheel that is only allowed to move by an escapement mechanism responding to the sale of a ticket on that horse. For each horse there has to be one escapement wheel for each ticket station. The next trick is to add the rotations for each escapement wheel.

Not surprisingly, shaft adders can be used for this purpose as well. The Grand Total adder works in a positive manner - chains move its input wheels and force its output wheel to turn. For the horse adders the process is kind-of reversed. The output wheel is being driven forward and drives all of the input wheels forward. But nothing can move because all of the input wheels are held in check by escapements. When any escapements are released their input wheels are allowed to move 18 degrees forward and so the output wheel is also caused to move by the sum of all input wheel rotations.

You can see most of the adder for horse number 1 in the image below. As with the Grand Total adder the summing is split into stages. In the foreground is a shaft adder that has 17 escapement wheels, in the background another with 12 wheels, making for 29 ticket stations in total. (There was another 30th ticket station for 5 pound bets - we do not know how these bets were counted.) In the middle is the actual shaft that represents the number of bets placed on this horse. This is being driven forward by the weights at the rear. The shaft, via chains, drives forward both the 12-wheel shaft and the 17-wheel shaft.



Whenever escapements are released in either of the component shaft adders the output movements are conveyed back to the central shaft by the chains. The central shaft also contains a cut-down shaft adder capable of adding the two rotations. The output of the small adder is pinned to the horse shaft so that the shaft is forced to rotate by the amount representing the new sum.

It seems that the reason for there being two shaft adders is that the 12-wheel shaft represents bets of 20 shillings whereas the 17-wheel shaft is for bets of 10 shillings. The 2-input central adder is designed so that the 20 shilling bets cause double the rotation of 10 shilling bets.

More detail on the horse adders

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Counters

The counters were the parts of the machine that we saw first. Unfortunately they are also the parts about which we know the least. There are no photos of the inner workings of the counters and the 1915 patent application describes in detail improved counters that are unlike those of our machine.

Perhaps it doesn't matter too much at this level of description. The counters comprise a set of wheels on which are written the digits from 0 to 9. From the front, the rightmost wheel shows the units digit of a total, the next left, the 10s digit, then the 100s etc. We do know that each counter has an input shaft and that for every rotation of the shaft by 18 degrees the units wheel should be rotated so the next bigger digit is displayed - a full turn of the input shaft should cause the digits wheel to rotate fully twice.

The real tricky concept is the propagation of carries. When the displayed digit of the units wheel goes from 9 to 0 the 10s wheel should rotate to show the next 10s digit; when the displayed digit of the 10s wheel goes from 9 to 0 the 100s wheel should rotate to show the next 100s digit; etc. If the counter displays e.g. 3999 it should next display 4000. The mechanism for causing this to happen lies within the counter, between digit wheels, which is why we cannot see it.

Matters are made more difficult for our machine by the counters having to display the totals in large readable letters. This makes the counter wheels very large and their relatively large mass causes serious practical problems. It is difficult to start the counters moving (which is why all of the counters have an additional source of power.) Worse, if there is a run of betting on a horse the counter wheels might start to rotate quickly and, when the run stops, it will be difficult to stop the wheels suddenly without causing mechanical stress on the mechanism. It is clear that Julius had addressed these problems even in the 1913 machine but we do not know the details.

More discussion of the counters

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Summary

We have to bear in mind in our discussion that, although it may seem hard to believe, the 1913 machine did actually work as expected. You can read a transcription of a report on the machine's operation in the local newspaper, the New Zealand Herald.

However, although the machine did perform its work until 1918, it is not clear that it always performed reliably. We know that when it was first operated it was only used to display, totals being maintained manually - we do not know whether it was ever reliable enough to be used to maintain actual totals (as was the case with the later ATL machines.) The fact that the 1915 patent detailed important improvements indicates that there were problems that needed solving. The minutes of the Auckland Racing Club mention problems with the machine, but it must be noted that the ARC and ATL were continually "sparring" because ATL operated the machine for a percentage of the takings and was always looking for a bigger slice of the action.

We have seen that the machine was very much the end of 19th century technology, although developed in the 20th century. It is likely that the improvements of the 1915 patent were included in the next machine installed in Perth in 1915, but nothing is known of that. There were also improvements retro-fitted at Ellerslie, though we have no details. There was a hiatus in the production of the machines because of WW1 but it is certain that the next big group of machines in 1918, including those at Randwick in Sydney, incorporated major improvements. Perhaps the significance of the 1913 machine was in showing that a totalisator machine could be made to work. It certainly formed the basis for a remarkable line of development that continued for 50 years.

Appendix III - *"A description of the Julius Totalisator in the Eagle Farm Racecourse Museum" – by Brian Conlon*

Brief description Eagle Farm Julius tote by Brian Conlon

Introduction

George Julius (later Sir George Julius) invented the world's first automatic totalisator here in Australia in 1913. This original invention was installed in Ellerslie New Zealand. He founded the Australian company Automatic Totalisators in 1917 to develop and export these totalisators. This electromechanical Julius tote is a descendant of that original invention and was manufactured by Automatic Totalisators in the 1940s. By 1970 with few exceptions, every major racing centre in the world used totalisators manufactured by this Australian company, which were in service in 29 countries.

This is the machine room or in contemporary parlance the computer room. This is a large scale, multi user, real-time system. These systems existed long before the invention of the world's first electronic computer. This one had 128 electromechanical Ticket Issuing Machines attached to it distributed in totes around the track.

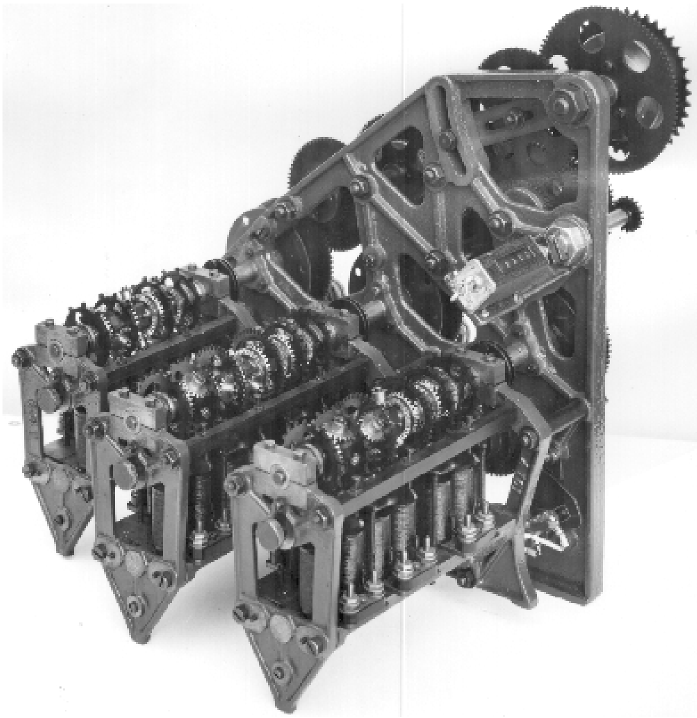
A Julius tote was installed in Longchamps France in 1928 with 273 terminals and the one in White City London was upgraded to support 320 terminals. One of these systems was demonstrated in Sydney in 1920 capable of supporting 1000 terminals and a sell rate of 250,000 tickets per minute.

There is a school of thought that these early Australian totalisators were the first computers. The director of the London Science Museum wrote in his New Scientist article dated 29 October 1987 titled “A sure bet for understanding computers”; “The Julius tote with its automatic odds machine is the earliest on-line, real-time, data processing and computation system that the curators of the museum have identified so far”.

This frame houses a Win and Place totalisator. The front totalled the Win pool and the rear is duplicated for the Place pool. It supported a field of 24 runners. Inside the windows there are electromechanical shaft adders one for each runner plus one for the grand total. The adders have odds calculating devices attached to them which drive barometer indicators on the outside of the East and West walls of the building, for public display. These indicators have two vertical channels for each runner one for the Win pool and one for the Place pool marked with imperial odds. Metal bands rise up from each runner’s odds calculator, win and place, through the roof of the frame and across the ceiling in both directions to the Eastern and Western indicators, then outside to move visible indicating strips in the channels mentioned above. A commission gearbox at each end of the frame subtracted the commission from the pool for the displays.

The electromechanical shaft adder

These shaft adders; one in each of the windows in the main frame, totalled the investments on each of the runners and one at the end of each row kept a grand total of all investments on the associated pool.



An electromechanical shaft adder

This shaft adder is of a similar vintage to the ones used in the Eagle Farm system the main difference is that this is a 3 shaft adder and the ones on display are a 2 shaft adder

The heart of the shaft adder is the epicyclic gear train. These adders have two horizontal shafts with epicyclic gears visible near the top of the adder. The adders were powered by a horizontal drive shaft running the length of this frame driven by DC motors at the northern end. The adding shafts have escapement wheels on them, 6 on the front shaft and 2 on the rear. These wheels moved one tooth at a time when the associated solenoids visible underneath the adding shafts were activated by a ticket-issuing machine recording a transaction. The number of teeth on the escapement wheel determines the value of the bet. The more teeth, the lower the value. This system supported £5 £1 10s 5s bets which was translated to $10 $2 $1 and 50c when decimal currency was introduced.

Any combination or all of the solenoids on a shaft adder could be activated at the same time. The epicyclic gear train took the different value bets resulting from the different escapement wheels rotating and activated the display counter to keep a running total of investment. In the event of a drive failure to an adder, all adders were fitted with automatic cut outs, activated by a mercury switch, to prevent loss of bet registrations and raise alarms, illuminating one of the lights above the adder window for attention. Automatic Totalisators even manufactured its own plastic plugs and sockets visible on the right hand side at the bottom rear of each adder.

The Odds Calculators

At the end of each row were the grand total shaft adders (which for some reason are missing) with the associated winding gear for raising the vertical lift sliders on every runner's odds calculator to represent the grand total. The horizontal component for each runner was produced via the adder odds chain sprocket wheels, at the very top of the adder, which let their horizontal sliders out in accordance with the investment on that runner. The horizontal and vertical sliders connected via the hypotenuse arms create a right angled triangle for each runner. The angle at the top between the vertical slider and the hypotenuse arm represents the odds for its associated runner. Mathematically the trigonometric ratio Cotangent of this angle is the odd for the associated runner. On this angle is a pulley arrangement, which drove some cams operating a small motor, which in turn powered the large barometer style odds displays mentioned previously. The hypotenuse arms mentioned above can be easily seen behind the adders or by looking down the length of the frame at either end. They can then be used to identify the vertical and horizontal sliders.

The Public Odds indicator drives

The device above each adder is the barometer indicator drive for the runner associated with the adder below. Behind this unit, the angle between the hypotenuse arm and the adjacent side of the right angled triangle mentioned above is sensed by a pulley located on a projection of the hypotenuse arm past the pivot point. A light cable anchored to the frame behind the adder runs up from the anchor, through a guide pulley located on the vertical slider, around the sensing pulley back to a third pulley on the vertical slider above the first and then up near the roof of the frame. The action of the sensing pulley is to either release or pull the cable depending on the odds changes. The cable is then directed from its roof location to above the upper pulley in this device it descends under this pulley, up again over another pulley and ends dangling with a weight attached next to the odds scale on the right hand side.

One of the Barometer Indicator Drive Units in the Eagle Farm Racing Museum

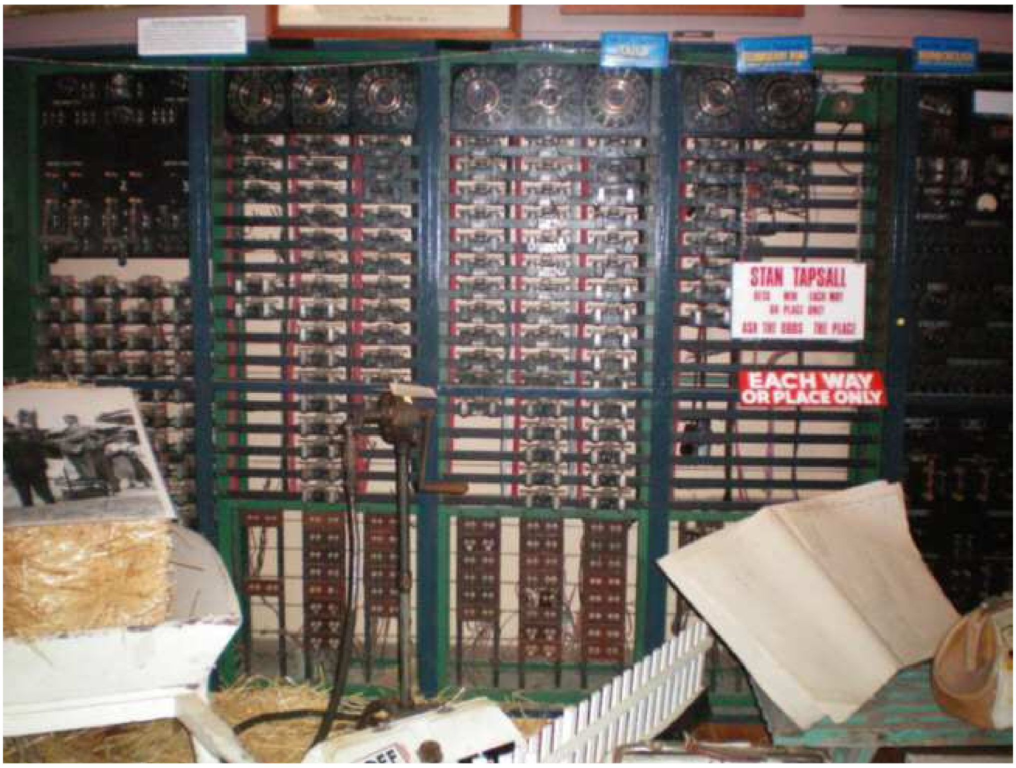
The scale and weight provide a local indication of the odds. The more the sensing pulley pulls the cable the more it lifts this weight and vice versa. There is a corresponding rotation of the pulley at the top of this device. This light cable mechanism is only capable of rotating this low resistance pulley. It is not capable of moving the heavy indicator band and weight, in the associated runner channel of the indicator on the outside wall, the distance required. This rotary motion of the top pulley on this device turns the cam wheel with the red line across it. When the odds on the outside indicator match the odds displayed by the cable weight here the line is horizontal. As the odds calculating mechanism changes the odds the micro-switches attached each side of the cam wheel are activated by cam movement sensing the required direction and amount of movement required causing the motor to drive accordingly. The motor which is capable of driving the external indicator ribbon and weight drives a second pulley in this device, an arc of which is visible near the base. This pulley has two metal bands attached to it that run through the roof of this frame then split across the ceiling in both directions to other pulleys on top of the east and west walls. These pulleys in turn move wider, coloured, metal bands with weights at the end, which are moved up and down the respective runner channels. The coloured part of the band visible from the outside of the building, gives a barometer style indication of the odds.

The Distributor Cubicle

These racks house the Distributors (Scanners), the overlap relays and ancillary control equipment. They are located up against the eastern wall. They originally were located standing away from the wall and further south giving access to the rear of the racks.

These systems have analogies to modern computing systems and these scanners are a good example of this. They are Time Division Multiplexers that existed long before the electronic signalling methods that made this concept commonplace.

The distributors are at the top of racks 2, 3 and 4. They are a circular piece of equipment with four concentric rings. Two studded metal contact rings surround two continuous ring contacts with a rotating arm spanning the diameter of the outer set of studs. This arm rotated when the equipment was in operation and electrically connected one of the continuous rings with the inner circle of studs one at a time and the other continuous ring connected with the outer set of studs in sequence. One set of studs serviced the Win pool and the other the Place pool. The function this performed was to allow multiple Ticket Issuing Machines (TIMs) to be attached to a single escapement wheel solenoid in the adders. This was achieved by sequencing the supply voltage in the continuous rings to each stud and consequently the stud’s attached TIM, which provided a circuit to the attached solenoid, in the runner handle selected adder, if the pool selection knob on the TIM was pushed down indicating a sale. In contemporary terminology the scanner provides an enabling pulse, which will allow a transaction cycle if the TIM has a sale pending. The Win/Place knob on the TIM selected the appropriate inner or outer set of studs in the distributor. In the event that multiple TIMs attached to the same adder solenoid, in every runner’s adder, selected the same runner, meaning multiple TIMs were now attempting to trip the same physical solenoid, the scanner serialised access to the associated solenoid, into the appropriate number of activations, so every bet was registered. There are 16 studs on each of these scanners allowing 16 TIMs to be attached to one shaft adder solenoid. Each of the 8 scanners is associated with one of the 8 solenoids in all the shaft adders, the actual adder being selected by the TIM’s runner handle. This provided a capacity for this system of 16 X 8 giving 128 TIMs. Optimum scanner rotation was between 90 to 120 RPM.



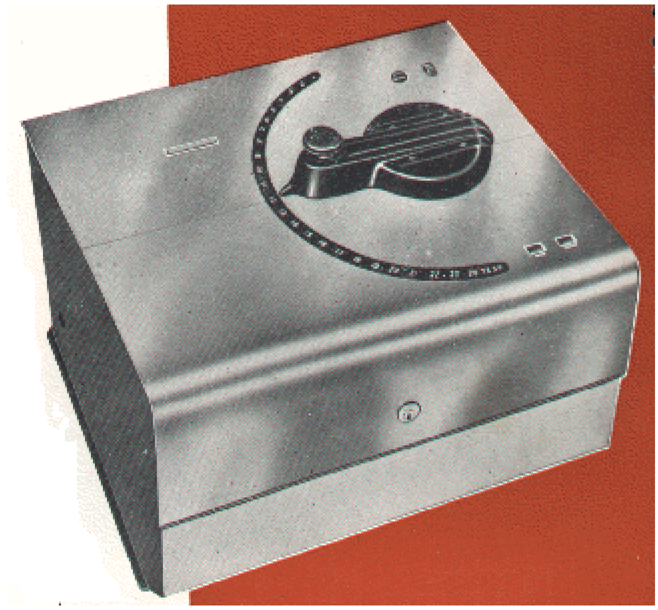
There are overlap relays beneath the scanners connected to the scanner studs. Once a sell transaction was started by the TIM and when the distributor selected that TIM, a set of contacts in the overlap relay connected the supply voltage to the transaction circuit and its own coil, keeping itself activated, which held the supply voltage, after the distributor arm had passed its stud, to the TIM and associated adder solenoid, until the machine cycle completed. Beneath the overlap relays are switch banks, which could isolate a TIM in the event that it had a fault and did not release the transaction circuit.

The Ticket Issuing Machine J8

This was the working end of the system, also manufactured by the Australian company Automatic Totalisators.

This system had 128 of these Ticket Issuing Machines (TIMs) distributed in totes around this track as follows. Main house 48 Ledger Stand 6 Sub House12 Jackpot tote 8 Members 28 Lady Members 10 Front Public Stand 6 Top Public Stand 10. The Main house mentioned above is the downstairs of this building.

It was at these windows where these TIMs were installed that the punters queued up to place their bets.



A J8 Ticket Issuing Machine

The handle rotates in an arc and is positioned at the required runner number. The knob on the top of this handle moves backwards and forwards along the longitudinal axis of the handle. The forward position selected the Win pool and the backward position selected the Place pool. When the same knob is pushed down the transaction was recorded and a ticket printed which was ejected from the machine at the slot in the top. A J8 ticket is shown below.

A ticket printed on a J8

The HAGUT printed on the ticket shown, is a security code, which was different for every race and was automatically selected at race increment. Barrels with the code type were installed in the machines for the meeting. The L down the right hand side of the ticket is an added security feature and was different for each race as was the ticket colour.

A trip relay in the TIM terminated the transaction cycle. Its coil and the transaction circuit are in series with a normally closed set of its own contacts so when these contacts open they cut the supply to its coil, resetting itself and the overlap relay heralding the end of the transaction cycle.

The Tote Control Console

The Tote Control Console was used to set and display variables such as race number, field size, scratchings and the number of place dividends. It also provides operational coordination between the machine room staff and the operations control staff.

A Julius Tote Control Console

The console above is at Harold Park in 1958 however it is the same as the one at Eagle Farm.

When the large knob in the middle of the Tote Control Console control panel was rotated clockwise the race number was incremented. This caused a barrel with the race number type to be rotated to the next number in every TIM. The scratching switches introduced an open circuit in the escapement coil circuits in the adder corresponding to a scratched runner.

A description of the Julius totalisator in the Eagle Farm Racecourse Museum

Introduction

In 2007 The Queensland Turf Club converted the old Julius tote machine room into a museum. I was asked to write some descriptions of the equipment. As I have never worked on these systems, I wrote the following 6 A4 pages for display on the equipment based on what I have been told about these systems over the years since I became aware of their existence, advice of people who have worked on them and examination to determine function of the system being described. Actually the "J8 assembly drawings" section is a seventh page however the one in the museum differs from the one presented here for the Internet. As I have not seen a technical description of a Julius tote anywhere I have presented these descriptions here. Some of the introductory information here is provided elsewhere on this site however I have left these pages as they appear on the actual equipment. The images on this page except for the J8 ticket do not appear on the original pages as they are attached to the actual equipment.

The Eagle Farm Racing Museum Julius Tote
Page 1 First and Last can be seen in the centre of the tote frame under the sign protruding above the top.

Page 2 An electromechanical shaft adder can be seen on the third adder window from the right hand side.
The description of the public odds indicator drive can be seen in the tenth window from the right hand side.
The RESET READY ON indicators above the frame are described in the "Place Pool Reset and Ready Switches" section below

Charles Barton, the last Chief Engineer of this system would have loved to see this!

The Oldest Automatic Totalisator in Australia

Page 1 First and Last

George Julius (later Sir George Julius) invented the world's first automatic totalisator here in Australia in 1913. This original invention was installed in Ellerslie New Zealand. He founded the Australian company Automatic Totalisators in 1917 to develop and export these totalisators. This electromechanical Julius tote is a descendant of that original invention and was manufactured by Automatic Totalisators in the 1940s. By 1970 with few exceptions, every major racing centre in the world used totalisators manufactured by this Australian company, which were in service in 29 countries.

This is the machine room or in contemporary parlance the computer room. This is a large scale, multi user, real-time system. These systems existed long before the invention of the world's first electronic computer. This one had 128 electromechanical Ticket Issuing Machines attached to it distributed in totes around the track.

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This frame houses a Win and Place totalisator. The front totalled the Win pool and the rear is duplicated for the Place pool. It supported a field of 24 runners. Inside the windows there are electromechanical shaft adders one for each runner plus one for the grand total. The adders have odds calculating devices attached to them which drive barometer indicators on the outside of the East and West walls of this building for public display. These indicators have two vertical channels for each runner one for the Win and one for the Place marked with imperial odds. Metal bands rise up from each runner's odds calculator, win and place, through the roof of the frame and across the ceiling in both directions to the Eastern and

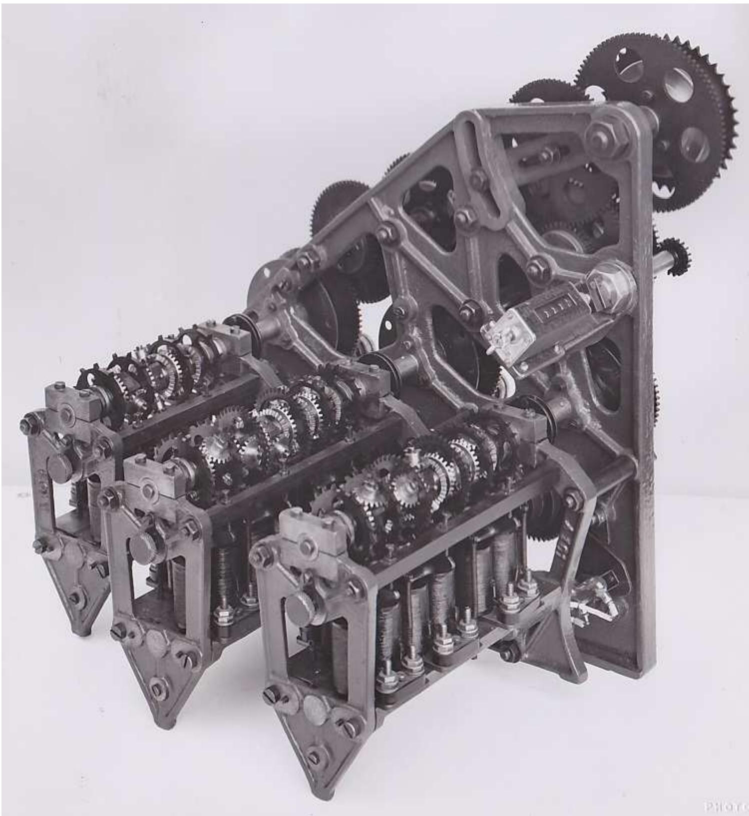
Western indicators, then outside to move visible indicating strips in the channels mentioned above. A commission gearbox subtracted the commission from the pool for the displays.

This system was superseded in 1979 by a PDP11 based digital computer totalisator also manufactured by Automatic Totalisators. It was long thought that the last of these Julius electromechanical totalisators to cease operation was at Harringay London in 1987 until an email was received in 2005 from Caracas asking how to make adjustments to their Julius tote to bring it up to modern day standards. At the time of the email, that system had been in operation for 48 years. The lifespan of computing systems has certainly changed over the years!

These once common Australian Totalisators have disappeared mainly under bulldozer tracks. We are fortunate that this example still remains, a reminder of an Australian achievement, courtesy of the Queensland Turf Club.

Page 2 The electromechanical shaft adder

The shaft adders, one in each of these windows, totalled the investments on each of the runners and one at the end of each row kept a grand total of all investments on the associated pool.



An electromechanical shaft adder

This shaft adder is of a similar vintage to the ones used in the Eagle Farm system the main difference is that this is a 3 shaft adder and the ones on display are 2 shaft adders

The heart of the shaft adder is the epicyclic gear train. These adders have two horizontal shafts with epicyclic gears visible near the top of the adder. The adders were powered by a horizontal drive shaft running the length of this frame driven by DC motors at the northern end. The adding shafts in the adders were driven by a spring for each shaft, which was wound up by the drive shaft. When the adding shaft spring was fully tensioned a clutch disengaged the shaft from the main drive. As energy was removed from the spring by escapement wheel movement resulting from bet traffic, the clutch engaged again to wind the adding shaft's spring back up. The adding shafts have escapement wheels on them, 6 on the front shaft and 2 on the rear. These wheels moved one tooth at a time when the associated solenoids visible underneath the adding shafts were activated by a ticket-issuing machine recording a transaction. The number of teeth on the escapement wheel determines the value of the bet. The more teeth the lower the value. This system supported £5 £1 10s 5s bets which was translated to $10 $2 $1 and 50c when decimal currency was introduced.

Proponents of the electromechanical systems would boast that this system could do something that the next generation computer tote could not. It could record multiple bets simultaneously whilst the new computer tote which existed prior to the days of multiprocessing had to record bets sequentially albeit at a rate that made it all look instantaneous. In other words any combination or all of the solenoids on a shaft adder could be activated at the same time. The epicyclic gear train took the different value bets resulting from the different escapement wheels rotating and activated the display counter to keep a running total of investment. In the event of a drive failure to an adder, all adders were fitted with automatic cut outs, activated by a mercury switch, to prevent loss of bet registrations and raise alarms, illuminating one of the lights above the adder window for attention. Automatic Totalisators even manufactured its own plastic plugs and sockets visible on the right hand side at the bottom rear of each adder.

Behind each runner's adder is an odds calculating device. Each odds calculator consists of a vertical and horizontal slider that moves on a transport mechanism consisting of two rods each. At the end of each row were the grand total shaft adders with the associated commission gearbox and winding gear for raising the vertical lift sliders on every runner's adder to represent the net pool grand total. The horizontal component for each runner was produced via the associated adder's odds chain sprocket wheel, at the very top of the adder, which let the associated horizontal slider out in accordance with the investment on that runner. Hypotenuse arms formed right triangles for each runner by connecting the vertical and horizontal sliders. The angle at the top between the vertical slider and the hypotenuse arm represents the odd for its associated runner. Mathematically the trigonometric ratio Cotangent of this angle is the odd for the associated runner. In other words, what is being measured is the gradient of the hypotenuse arm $\Delta Y / \Delta X$ or Rise/Run. On this angle between the vertical slider and the hypotenuse arm, or in other words the adjacent and hypotenuse sides of the right triangle, is a pulley arrangement. This drove some cams via a wire, operating some switches, to drive a small motor, which in turn powered the large barometer style odds displays mentioned on page 1. The hypotenuse arms mentioned above can be easily seen behind the adders or by looking down the length of the frame at either end. They can then be used to identify the vertical and horizontal sliders.

For remote locations such as the centre of the racetrack or a loft, odds transmissions were achieved by the use of a variable resistance, mounted at the important angle mentioned and utilising the Wheatstone bridge principles. The remote receiver sensed any out of balance transmitted by the adder unit and drove itself and the odds display until the bridge centre leg potential was once again null and therefore equaling the transmitted odds.

Page 3 The Distributor Cubicle

These racks house the Distributors (Scanners), the overlap relays and ancillary control equipment.

The distributors are at the top of racks 2, 3 and 4. They are a circular piece of equipment with four concentric rings. Two studded metal contact rings surround two continuous ring contacts with a rotating arm spanning the diameter of the outer set of studs. This arm rotated when the equipment was in operation and electrically connected one of the continuous rings with the inner circle of studs one at a time and the other continuous ring connected with the outer set of studs in sequence. One set of studs serviced the Win pool and the other the Place pool. The function this performed was to allow multiple Ticket Issuing Machines (TIMs) to be attached to a single escapement wheel solenoid in the adders. This was achieved by sequencing the supply voltage in the continuous rings to each stud and consequently the stud's attached TIM, which provided a circuit to the attached solenoid, in the runner handle selected adder, if the pool selection knob on the TIM was pushed down indicating a sale. In contemporary terminology the scanner provides an enabling pulse, which will allow a transaction cycle if the TIM has a sale pending. The Win/Place knob on the TIM selected the appropriate inner or outer set of studs in the distributor. In the event that multiple TIMs attached to the same adder solenoid, in every runner's adder, selected the same runner, meaning the multiple TIMs were now attempting to trip the same physical solenoid, the scanner serialised access to the associated solenoid, into the appropriate number of activations, so every bet was registered. There are 16 studs on each of these scanners allowing 16 TIMs to be attached to one shaft adder solenoid. Each of the 8 scanners is associated with one of the 8 solenoids in all the shaft adders, the actual adder being selected by the TIM's runner handle. This provided a capacity for this system of 16 X 8 giving 128 TIMs. Optimum scanner rotation was between 90 to 120 RPM.

There are overlap relays beneath the scanners connected to the scanner studs. Once a sell transaction was initiated by the TIM and when the distributor selected that TIM, a set of contacts in the overlap relay connected the supply voltage to the transaction circuit and its own coil, keeping itself activated, which held the supply voltage, after the distributor arm had passed its stud, to the TIM and associated adder solenoid, until the machine cycle completed. Beneath the overlap relays are switch banks, which could isolate a TIM in the event that it had a fault and did not release the transaction circuit.

These old systems have analogies to modern computing systems and these scanners are a good example of this. They are Time Division Multiplexers that existed long before the electronic signalling methods that made this concept commonplace.The functionality of these devices was replaced in their successor by a polled protocol operating on tri-state lines, which curiously also supported 16 TIMs per line.

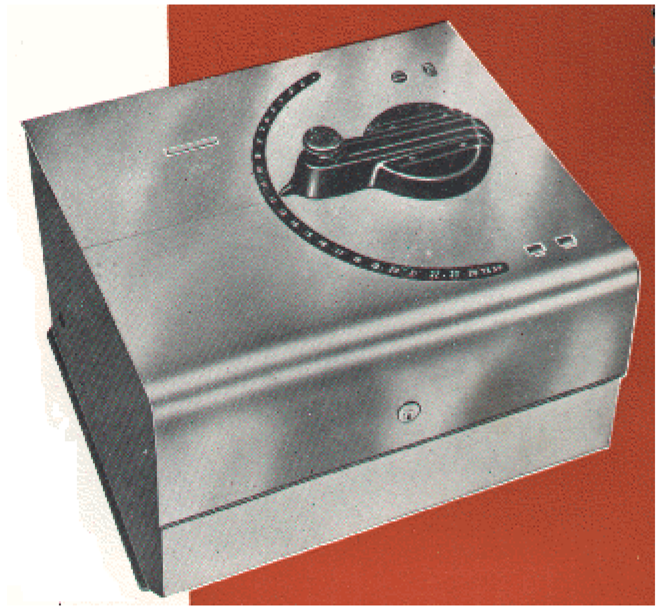
It is interesting to note that the Sales Bell relay in the right hand rack at the top, along with two other relays are implemented using Mercury switches. This bell marked the start and stop of betting. Mercury is a metallic element and consequently a good conductor. It is a liquid at room temperature. An arced tube of glass contains mercury and a central electrical contact and a contact at each end of the tube. If the tube is oriented past the horizontal in either direction the mercury pours to the low side and makes a circuit between the low-end contact and the center contact. A restriction in the flow implemented a delay ensuring the bell always rang for the same length of time.

Page 4 The Ticket Issuing Machine J8

This was the working end of the system, also manufactured by the Australian company Automatic Totalisators.

This system had 128 of these Ticket Issuing Machines (TIMs) distributed in totes around this track as follows. Main house 48 Ledger Stand 6 Sub House12 Jackpot tote 8 Members 28 Lady Members 10 Front Public Stand 6 Top Public Stand 10. The Main house mentioned above is the downstairs of this building.

It was at these windows where these TIMs were installed that the punters queued up to place their bets. The word queued, used above, is used rather liberally, photographs of Brisbane racetrack tote outlets in the era that these totes were in operation often had a standing room only crowd swamping the totes. There is half a century of totalisator history based on machines like this one before the inception of the TABs, which diminished the racetrack attendance in conjunction with the introduction of other forms of gambling.



A J8 Ticket Issuing Machine

The handle rotates in an arc and is positioned at the required runner number. The knob on the top of this handle moves backwards and forwards along the longitudinal axis of the handle. The forward position selected the Win pool and the backward position selected the Place pool. When the same knob is pushed down the transaction was recorded and a ticket printed which was ejected from the machine at the slot in the top. A J8 ticket is shown below.

A ticket printed on a J8 (Animation above)

The value of the bet was fixed in this system, determined by which escapement wheel solenoid the TIM was attached to. Later Julius totes supported selectable value at the TIM. The HAGUT printed on the ticket shown, is a security code, which was different for every race and was automatically selected at race increment. Barrels with the code type were installed in the machines for the meeting. The L down the right hand side of the ticket is an added security feature and was different for each race as was the ticket colour. For this reason the printer paper in every TIM had to be changed every race. The code words and ticket paper security letters were kept secret until the race day manager instructed the tote house managers to open the race day code security envelope.

A trip relay in the TIM terminated the transaction cycle. Its coil and the transaction circuit are in series with a normally closed set of its own contacts so when these contacts open they cut the supply to its coil, resetting itself and the overlap relay heralding the end of the transaction cycle. The trip relay is adjusted to trip after the adder solenoid has tripped by adjusting the tension on the trip relay swing arm.

Page 5 The Ticket Issuing Machine J8 Part 2

The Win and Place counters visible at the bottom right corner of the TIM were recorded each race for every TIM. The Win and Place race investments for every TIM were then manually added to produce a grand total investment on the Win and Place pools and this was compared with the GT adder registrations providing a means of error detection.

Internally, the runner handle moved two contacts over two sets of studs arranged in the same arc with 24 studs in each set. Each outer arc stud is connected to the associated Win adder solenoid for this TIM bank, in the runner's shaft adder with a number matching the number of the stud. Hence stud one attaches to runner one's Win shaft adder and stud two attaches to runner two's Win shaft adder etc. There is the same arrangement for the inner arc studs and the associated Place adders. If runner 15 was selected with the handle, the knob pushed forward for the Win pool and the knob pushed down to indicate a sale, the Win contact attached to the knob, contacted stud 15 on the Win arc completing a circuit enabling the scanner pulse to travel to the solenoid associated with this TIM bank in shaft adder 15. There is a lot more to this transaction circuit however that is well beyond the scope of this introduction.

The switch on the top of the TIM was used to turn it on and off. The last position on the runner handle arc was used to print a test ticket.

When a transaction was registered on the TIM by pushing the Win/Place selector knob down the runner selection handle and this knob were locked in place until the transaction cycle was complete. If there was a fault and the transaction cycle did not terminate correctly the handle release button on the top of the TIM was used to release this lock, after the problem had been investigated, so that the TIM could continue operation.

These machines had to be moved between the Eagle Farm and Doomben gallops, Albion Park trots, Gabba greyhounds and Ipswich gallops as there were insufficient machines to populate all the tracks. Today's TIMs are still moved for the same reason. Sometimes during the Winter Carnival we feel exhausted moving the large number of PC based modular TIMs; after having to use a hydraulic wheelbarrow to move the J8 recently I will only consider ourselves fortunate in future.

I lament that Charlie Barton, Chief Engineer of this and other Julius totalisator systems in Brisbane is no longer with us to see this system preserved. It was his dream to preserve and possibly restore one to an operational condition for public display. Alas, it was my fate to be Chief Engineer of the first on course digital computer based totalisator systems for the Brisbane metropolitan clubs, which brought an end to the operation of these magnificent machines. I find it ironic that someone who never worked on these electromechanical totalisators nor indeed saw one working is left to write about it. This would have been very different just 10 years ago. It is now 2007, 29 years since this system last operated.

Acknowledgement: Thanks to Ron Findlay for assisting me with questions I had regarding the J8. Ron used to work on the J8s and continues to work on the current generation of TIMs.

Page 6 The Tote Control Console + The Human factor

The Tote Control Console was used to set and display variables such as race number, field size, scratchings and the number of place dividends. It also provides operational coordination between the machine room staff and the operations control staff.

A Julius Tote Control Console

The console above is at Harold Park in 1958 however it is the same as the one at Eagle Farm.

When the large knob in the middle of the Tote Control Console control panel was rotated clockwise the race number was incremented. This caused a barrel with the race number type to be rotated to the next number in every TIM. All the TIMs clanked in unison as this selection was made. The scratching switches introduced an open circuit in the escapement coil circuits in the adder corresponding to the scratched runner.

There is an emblem on the large knob mentioned above with Premier on it. This was the product name that George Julius gave to his totalisator. This emblem is also visible on the J8 TIM. Automatic Totalisators is visible engraved below the Knob.

To give some idea what it was like in this room when the system operated the following paragraph is an extract from a company magazine called Tote Topics. This article was written in 1968 and compares electromechanical totes with the then new computer based ones.

In the machine room of an electromechanical totalisator there is motion, constant motion, and noise. With betting in progress, the constant chatter of the escapements blends with the purring of the counters and the low rumble of the drives to give a quite characteristic sound. This sound, both in intensity and pitch, indicates to the experienced totalisator operator, even more clearly than his eyes, the state of the queues outside and the conditions around the selling houses. He scarcely needs a clock, so accurately is he able to predict from the betting pattern the time to the start of the next race. The equipment consists of row upon row of shafts and gears and escapement wheels and mechanical counters. At first sight it seems entirely mechanical as the electrical portions are buried deep inside.

It is interesting to contemplate the human side of this system. The following is a transcription from an audiotape recorded by Neville Mitchell, a long serving Automatic Totalisators Manager and excellent source of information about these systems.

The mystique of the machines was something I experienced, particularly in Melbourne, not so much in Sydney. The men who operated the four major tracks there had been with these machines since 1936 and on the decommissioning day, I saw emotions that were quite unbelievable. They were seeing the last day of operations with this sort of gear. The strictness with which the engineers ran these systems was somewhat akin to a military operation; they really had a lot of power. They had a lot of routines set down and to be an apprentice in those days was a lot of sweeping the floors and making the tea for a long long time before you actually got your hands on any piece of equipment. And I believe in the early days in Melbourne, if an apprentice was seen with his hands out of his pockets in the machine room, he would get a swift slap around the ears. The same thing applied in New Zealand. I read some stories from there and I actually knew a couple of the engineers and they applied the same very very strict mode of operation on their set-ups. They were extremely proud of these machines and some of them spent all of their, what you would call, idle time in routine maintenance and polishing of brass and things like that, that made these machines absolute showrooms.

Go back to the index Go to the bottom of the page

Page 7 J8 assembly drawings

This set of drawings is an extract of some pages from a document detailing the assembly, wiring and test procedure for J8 Tims for Randall Park in Ohio. Essentially these are the same machines used on this totalisator except that they supported an additional pool called Show. As this historical documentation is now very scarce this is the closest fit that could be found and gives an insight into what was involved in manufacturing this type of equipment.

You will notice GAJ part numbers on these drawings. These are George Alfred Julius' initials. Additionally the draughtsman's name is Noble. This is Norm Noble, a long serving Automatic Totalisators employee. I remember him well. As the company supported operations, engineers in the field would often require urgent shipment of replacement parts out of the normal working hours of the Head Office and Factory. Long before the days of mobile phones there were times when it was not possible to contact the people responsible for providing support. As these parts requirements were usually urgent it is fortunate that there always seemed to be people willing to go the extra mile and help out in areas for which they were not responsible as they realized that operations was the coal face of the company and was the place our products were judged. Norm was one of these people. I could always rely on him to go to work in Sydney on weekends, public holidays, or otherwise out of hours to send me anything I needed. There is a photo of the ATL drawing office in the "Memories of the Factory" chapter that predates my time which has Norm Noble in it, unfortunately he is facing away from the camera.

These drawings were made at a time long predating computer drawing, CAD and CAM applications. I recall draftsmen in the 1960s in their drawing offices standing, or sitting on bar stools, in rows, at their large drawing stations with their angled drawing surfaces and spring loaded large setsquares that could sweep across the whole drawing area. Earlier photographs indicate that the drawing office draftsmen who made these older drawings sat at normal office desks. It is interesting to note, that documentation for these old systems, seems to always have been released to a particular person. The document from which these drawings are extracted has a title page indicating that it was released to S.Huss in the Assembly section on 12/9/1950. I have seen other manuals in the form of bound books with the name of the employee to whom it was released embossed on the cover.

Following is a transcription of a page from this document to save clarity and download time.

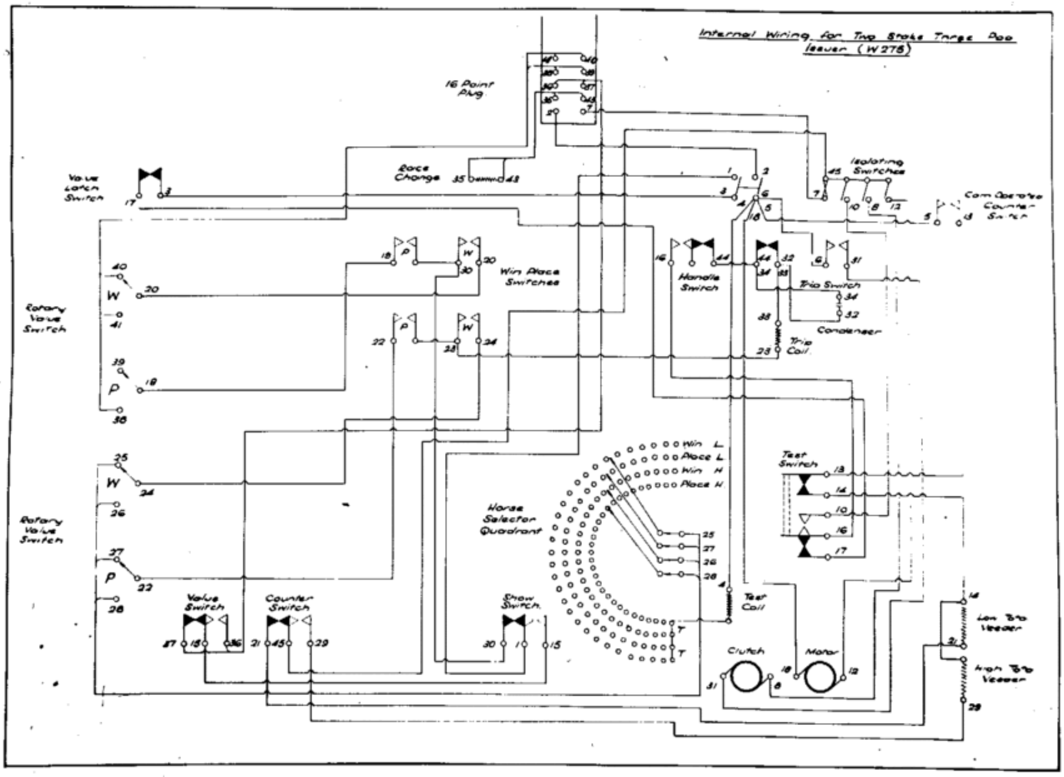
General Assembly of Randall Park issuer

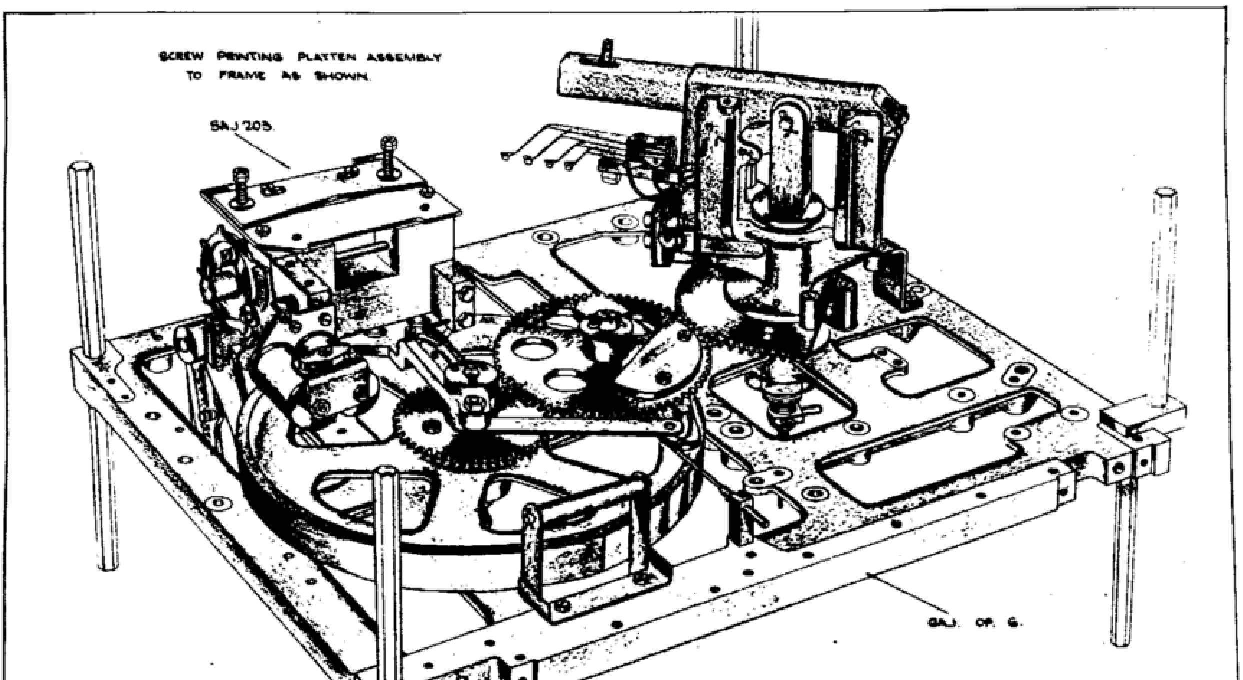
Sequence of Operations & Parts Fitted

1 Type Wheel Peg & Frame	23 Other Side of Issuer Wiring Former
2 Type Wheel & Win, Place, Show Arm Assembly	24 Selector Quadrant & Wiring
3 Locking Rod Assembly & Ribbon Bracket	25 Win, Place, Show Arm, Anchor & Spring. Show Switch Bumper Assembly. Pool Selection & Bracket.
4 Intermediate Gear Bracket & Gear	26 Condenser & Clips
5 Handle Assembly. Handle Stop & Brush Holder	27 Motor & Brushes, Chain & Split Link.
6 Taper Pinning Operation	28 Ribbon Feeding Operation
7 Platen Assembly	29 Issuer Box & Hinge &Wiring Clips
8 Win Place, Switch Assembly & Slide Rod	30 Plastic Issuer Handle , Pin & Circlip
9 Paper Feeding Assembly	31 Electrical Setting Details

10 Trip Coil Assembly	32 First Test
11 Ribbon Rewind	33 Taper Pinning Operation
12 Quadrant Supports, Issuer lifting Handle & Posts & Cover posts	33A Ticket Issuer Chute
13 Handle Release, Double Pole Switch & posts, Test Switch, Handle Release Lever & Spring	34 Covers & Horse Number Segments.
14 Test Coils, Wiring Brackets & Cover Catches	35 Final Test
15 Latch switch & Show switch	36 Spray Finish issuer Box.
16 Cam operated Counter switch	37 Attach Nameplate
17 Guillotine Lever, Anchor & Spring Printing Lever, Anchor & Spring	38 Clean & Inspect Box
18 Value Slide Lever & Spring	
19 Rotary Switch, Retaining Posts & Value Leaf Switch Assembly	
20 Value Release & Spring	
21 Veeder Assembly	
22 Issuer Wiring Former & Brushes	

Following are image extracts from the document.

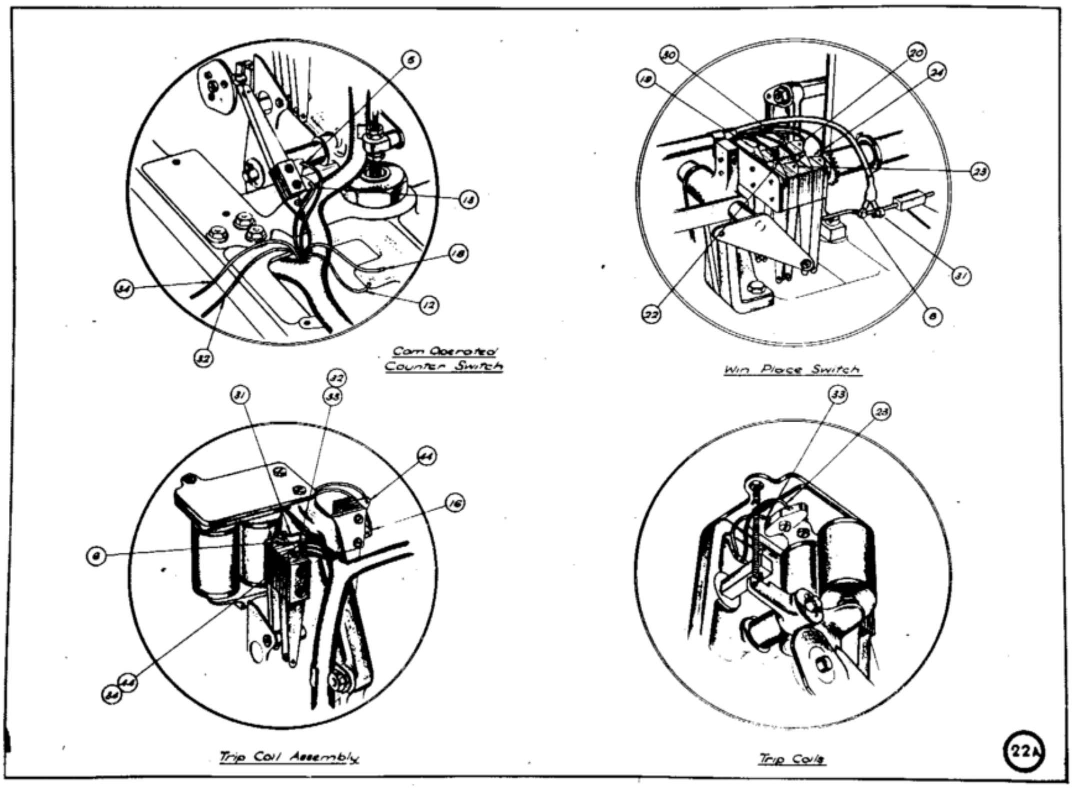




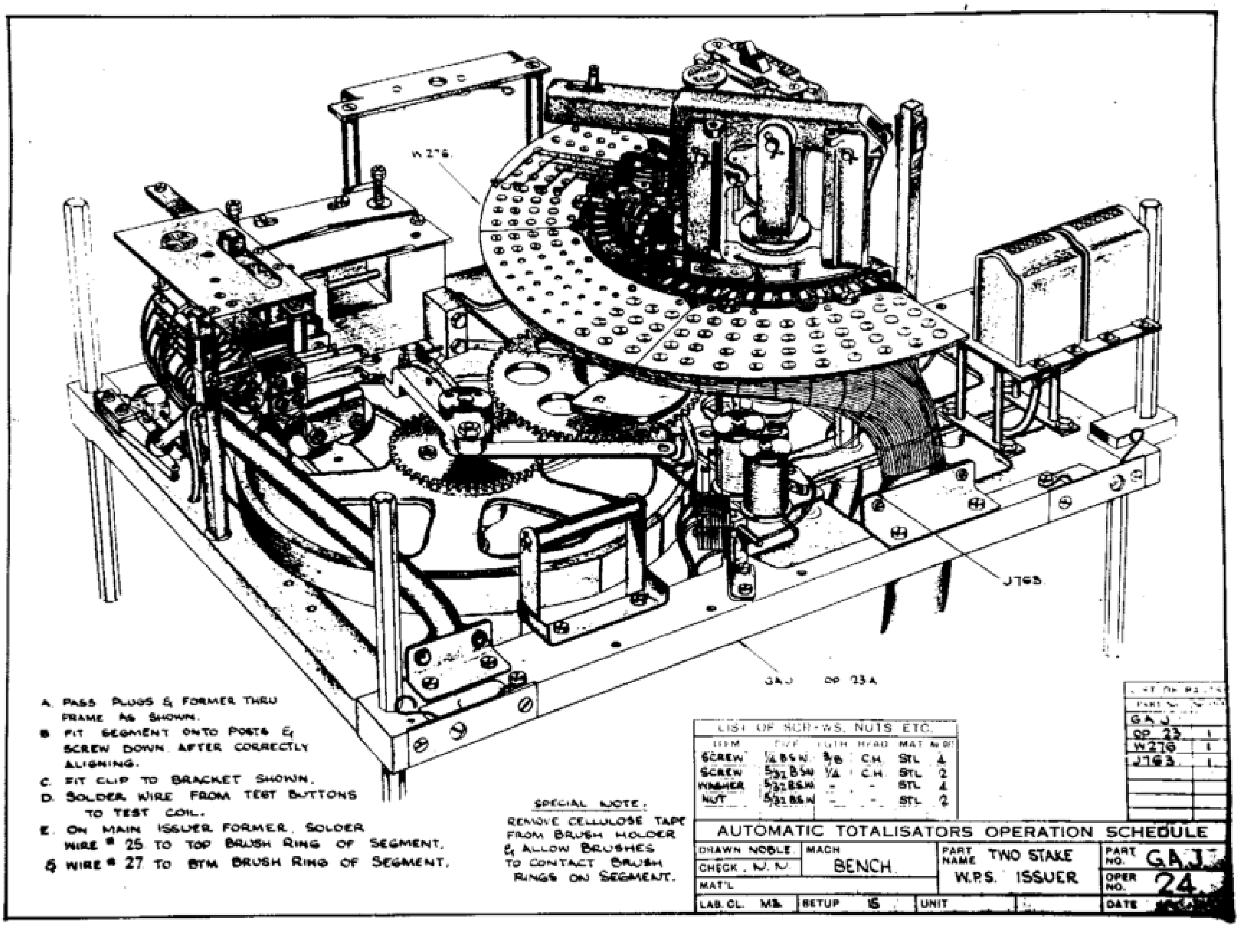
LIST OF SCREWS, NUTS ETC.					
ITEM	SIZE	LGTH	HEAD	MAT	No. off
SCREW	¼ B.S.W	1½	C.H	STL	2
SCREW	¼ B.S.W	¾	C.H	STL	2
NUT	¼ B.S.W	.	-	STL	4

LIST OF PARTS	
PART No.	No. Off
GAJ	
OP. G.	1
SAJ 203	1

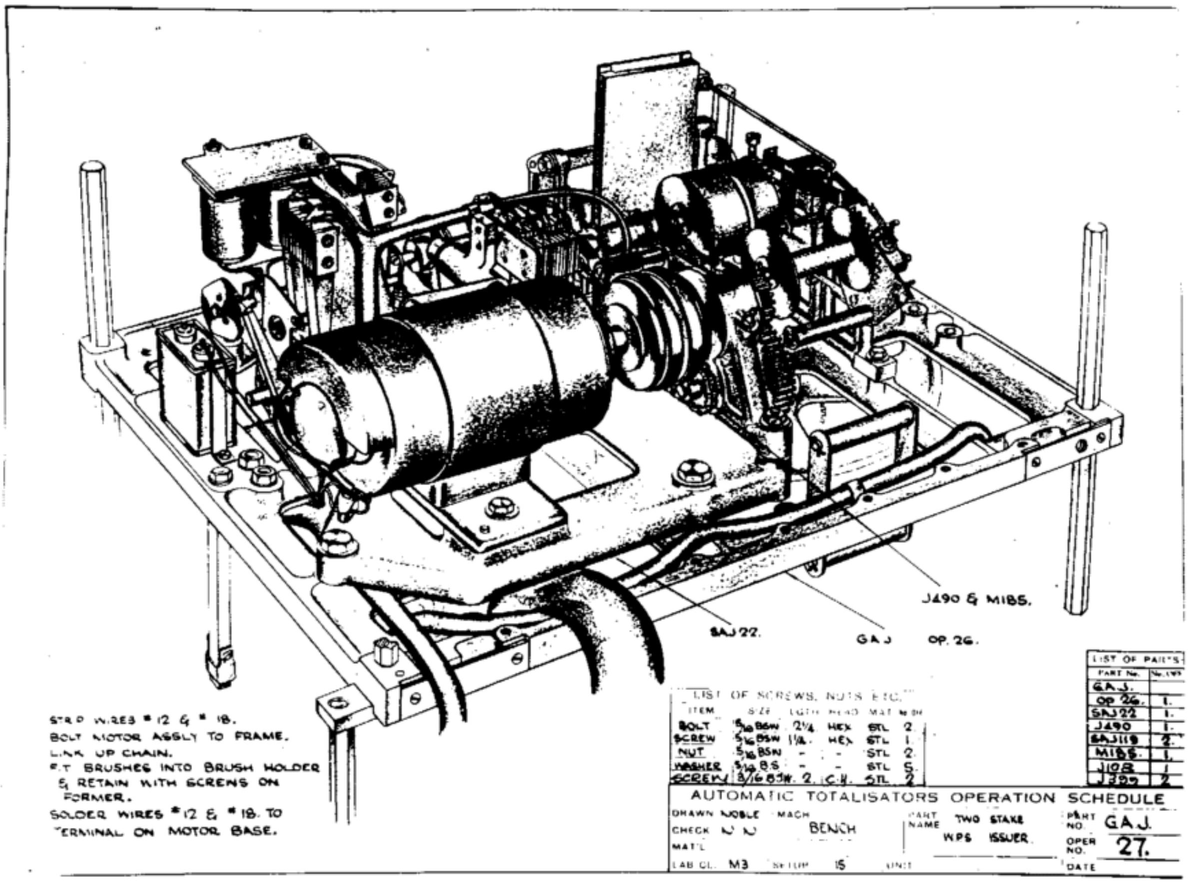
AUTOMATIC TOTALISATORS OPERATION SCHEDULE			
DRAWN NOBLE	MACH BENCH.	PART NAME TWO STAKE W.P.S. ISSUER	PART NO. G.A.J.
CHECK N.N.			OPER NO. 7
MAT'L			
LAB. CL. MB.	SETUP 15	UNIT	DATE

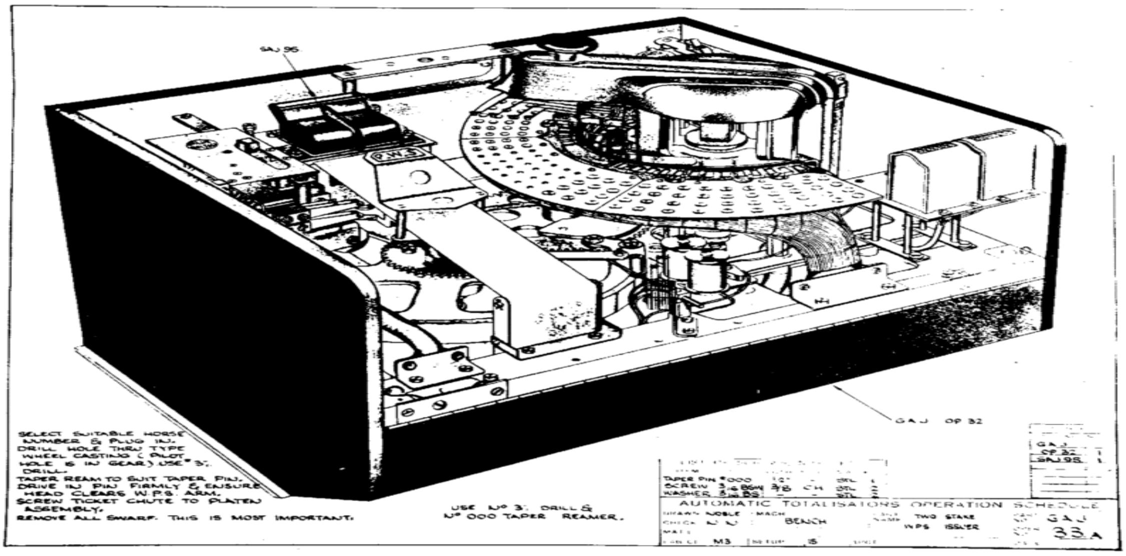


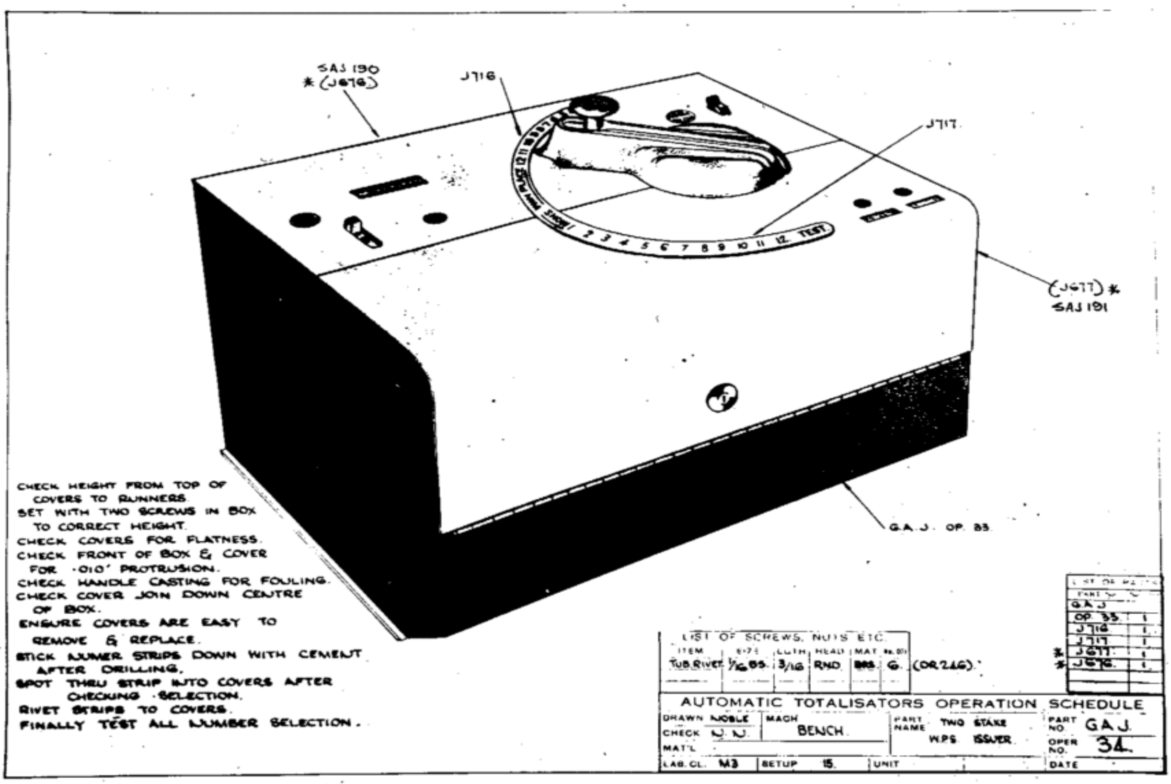
Coin Operated Counter Switch
Win Place Switch
Trip Coil Assembly
Trip Coils
22A



W 276.
J763.
GAJ OP 23A
A. PASS PLUGS & FORMER THRU FRAME AS SHOWN.
B. FIT SEGMENT ONTO POSTS & SCREW DOWN AFTER CORRECTLY ALIGNING.
C. FIT CLIP TO BRACKET SHOWN.
D. SOLDER WIRE FROM TEST BUTTONS TO TEST COIL.
E. ON MAIN ISSUER FORMER, SOLDER WIRE # 25 TO TOP BRUSH RING OF SEGMENT, & WIRE # 27 TO BTM BRUSH RING OF SEGMENT.
SPECIAL NOTE:
REMOVE CELLULOSE TAPE FROM BRUSH HOLDER & ALLOW BRUSHES TO CONTACT BRUSH RINGS ON SEGMENT.
LIST OF SCREWS, NUTS ETC.
SCREW 1/4 BSW 3/8 C.H. STL 4
SCREW 5/32 BSW 1/4 C.H. STL 2
WASHER 5/32 BSW - - STL 4
NUT 5/32 BSW - - STL 2
GAJ
OP 23 1
W276 1
J763 1
AUTOMATIC TOTALISATORS OPERATION SCHEDULE
DRAWN NOBLE.
CHECK. N. N.
MAT'L
LAB. CL. M3
MACH BENCH
SETUP 15
UNIT
PART NAME TWO STAKE W.P.S. ISSUER
PART NO. GAJ
OPER NO. 24
DATE


J490 & M185.
SAJ 22.
G A J OP. 26.
STRIP WIRES #12 & #18.
BOLT MOTOR ASSLY TO FRAME.
LINK UP CHAIN.
FIT BRUSHES INTO BRUSH HOLDER & RETAIN WITH SCREWS ON FORMER.
SOLDER WIRES #12 & #18. TO TERMINAL ON MOTOR BASE.
LIST OF SCREWS, NUTS ETC.
ITEM SIZE LGTH HEAD MAT NO OFF
BOLT 5/16 BSW 2¼ HEX STL 2
SCREW 5/16 BSW 1⅛ HEX STL 1
NUT 5/16 BSW - - STL 2
WASHER 5/16 BS - - STL 5
SCREW 3/16 BSW 2 C.H. STL 2
LIST OF PARTS
PART No. No. OFF
GAJ.
OP 26. 1.
SAJ22 1.
J490 1.
SAJ119 2.
M185. 1.
J108 1
J399 2
AUTOMATIC TOTALISATORS OPERATION SCHEDULE
DRAWN NOBLE
CHECK
MAT'L
LAB CL. M3
MACH BENCH
SETUP 15
PART NAME TWO STAKE WPS ISSUER.
PART NO. GAJ.
OPER NO. 27.
DATE


SAJ 95
G A J OP 32
SELECT SUITABLE HORSE NUMBER & PLUG IN.
DRILL HOLE THRU TYPE WHEEL CASTING (PILOT HOLE IS IN GEAR) USE #3. DRILL.
TAPER REAM TO SUIT TAPER PIN.
DRIVE IN PIN FIRMLY & ENSURE HEAD CLEARS W.P.S. ARM.
SCREW TICKET CHUTE TO PLATEN ASSEMBLY.
REMOVE ALL SWARF. THIS IS MOST IMPORTANT.
USE No 3. DRILL & No 000 TAPER REAMER.
GAJ
OP 32 1
SAJ 95 1
AUTOMATIC TOTALISATORS OPERATION SCHEDULE
DRAWN NOBLE
MACH BENCH
TWO STAKE WPS ISSUER
LAB CL M3
SETUP 15
GAJ
33A



Description of one of the public odds indicator drives

NB: remember the following text is attached to the base of one of the indicator drive units in the museum. One of these indicator drives is shown in the photo below. The device above this note is the barometer indicator drive for the runner associated with the adder below. The odds calculating mechanism has been described in the adder description attached to one of the windows in this row and the Place Commission Gearbox description at the right hand end of this frame. Behind this unit, the angle between the hypotenuse arm and the vertical is sensed by a pulley located on a projection of the hypotenuse arm past the pivot point. A light cable anchored to the frame behind the adder runs up from the anchor, through a guide pulley located on the vertical slider, around the sensing pulley back to a third pulley on the vertical slider above the first and then up near the roof of the frame. The action of the sensing pulley is to either release or pull the cable depending on the odds changes. The cable is then directed from its roof location to above the upper pulley in this device it descends under this pulley, up again over another pulley and ends dangling with a weight attached next to the odds scale on the right hand side of this note.

One of the Barometer Indicator Drive Units in the Eagle Farm Racing Museum

The scale and weight provide a local indication of the odds. The more the sensing pulley pulls the cable the more it lifts this weight and vice versa. There is a corresponding rotation of the pulley at the top of this device. This light cable mechanism is only capable of rotating this low resistance pulley. It is not capable of moving the heavy indicator band and weight, in the associated runner channel of the indicator on the outside wall, the distance required. This rotary motion of the top pulley on this device turns the cam wheel with the red line across it. When the odds on the outside indicator match the odds displayed by the cable weight here the line is horizontal. As the odds calculating mechanism changes the odds the microswitches attached each side of the cam wheel are activated by cam movement sensing the required direction and amount of movement required causing the motor to drive accordingly. The motor which is capable of driving the external indicator ribbons and weights, drives a second pulley in this device, an arc of which is visible near the base. This pulley has two metal bands attached to it that run through the roof of this frame then split across the ceiling in both directions to other pulleys on top of the east and west walls. These pulleys in turn move wider, coloured metal bands with weights at the end which are moved up and down the respective runner channels. The coloured part of the band visible from the outside of the building, gives a barometer style indication of the odds. You may have noticed the circular variable resistances located near the top of the hypotenuse arms. These were used to drive an infield indicator.

A postscript not included in the text displayed in the museum. This is just to provide additional information relating to the photograph provided. The two aluminium vertical bars visible behind the indicator drive unit are the transport mechanism for the vertical slider. The upper pulley visible near these bars is the third pulley attached to the vertical slider as described above. The pulley visible below and behind the third pulley is the angle sensing *pulley attached to the extension of the hypotenuse arm as described above. For the particularly astute the cable that should be running around these pulleys has been pulled out of the third pulley and should not be running directly to the ceiling from the sensing pulley on the extension of the hypotenuse arm. This is probably why the wheight on this unit is dangling below the bottom of the scale.*

A note next to the Place Pool Reset and Ready Switches

The switches where this note is attached are on the Julius Tote frame out of sight off the far right hand side of the first image on this page and around the top left hand corner of the end of the frame image below. Whilst researching the workings and operation of this machine, Del Linkhorn a long serving ATL Manager in New Zealand and later South Africa wrote the following paragraphs in answer to my questions. It relates to the switches next to this page, the indicators on top of this frame and embedded in both ends and the Win and Place Max/Min, the Place Two/Three, the Win Units On/Off and the Place Units On/Off switches and status displays on the Tote Control Console on display in this room. The gearbox settings mentioned refer to the Win and Place Commission Gearboxes visible inside the windows at each end of this frame. The Win Pool Reset and Ready Switches are on the diagonally opposite corner of this frame.

The indicator panels located on the centre of each side of the Win/Place machine frame were to indicate the status of each betting pool. The "Win" or "Place", "Reset", "Ready" and "On" lamps were operated from control switches located on each end of the machine frame and on the remote control console unit. When the engineers had reset the adder counters to zero for each race they would turn on the "Reset" switches. The senior engineer would then check the counters, gearboxes, indicators, etc to ensure that the machine was ready to open and, if satisfied, would turn on the "Ready" switches. The person allocated the responsibility to set the field, scratchings, gearbox settings, etc on the remote control console unit for each race, (sometimes the Tote Manager or the Secretary), after checking all status lamps were indicating the correct settings, would then open the betting by turning on the Win and the Place pool switches. The machine room staff would then know that the betting was "On" from the machine frame centre panels.

The two indicator lamp units, located on each side of and at the end of the machine frame, were to indicate the settings of the automatic display gearbox settings. On the Win gearbox end, "Minimum' or "Maximum" and on the Place end, "Minimum" or "Maximum" and "Two Dividends" or "Three Dividends". Some frames also indicated "Win" or "Place", "Reset", "Ready" and "On" as a second status display on each end of the machine frame. On some systems they had a "Mean" gearbox setting in addition to the normal "Maximum" and “Minimum" ratios.

Another note that appears beneath one of the white framed panels

These white framed panels can be seen above each adder window in the Julius tote shown in the first image on this page. The panel above this description and above each adder in this frame contains two status indicators. The top indicator is an alarm which illuminated if the associated adder lost drive power. The mercury switch at the bottom right hand corner of the associated adder raised the alarm when it detected that either of the adding shaft springs in the adder was unwound indicating that it was no longer being wound up by the main drive shaft. The bottom indicator shows the runner number if the associated runner is not a scratching. These lights are illuminated if the runner is not selected as a scratching on the Tote Control Console scratching switches. There is a tote control console on display in this room

The Eagle Farm Racing Museum end view of the Julius Tote

The Place Commission Gearbox description following can be seen in the window in the door of the frame.
The paragraphs titled "Page 7 The J8 assembly drawings" above, can be seen in the image above the window.
The J8 assembly drawing images above can be seen below the black indicators.
The 2div 3div and "pla max" and "pla min" status indicators are described in "Place Pool Reset and Ready Switches" section

A note attached to the Place Commission Gearbox

This was driven by the Place grand total adder and the Place main drive shaft and drove the Place pool grand total shaft high up on the left hand side. This shaft transmitted the Place pool total minus the commission to each runner's Place odds calculating mechanism. The silver-gray hypotenuse arms, seen projecting near each runner's adder into the space between the 2 rows of adders ahead, at different angles, are each positioned by a vertical slider controlled by the grand total shaft and a horizontal slider driven by each runner's adder. The resulting angles between the vertical and the hypotenuse arms represent the odds for their respective runners and this is sensed and transmitted to the indicators. The Win Pool Commission Gearbox is at the far end. Below this gearbox are the Place and Win rheostats used to start and control the speed of the Place and Win main drive shafts. Below these and to the sides are the Place and Win main drive shaft motors. These are 120V DC.

Acknowledgements

- Thanks to Neville Mitchell for providing information on the working of the Julius tote.
- Thanks to Ron Findlay for providing information on the J8 and Julius installation.
- Thanks to Gary Elliot for providing the J8 assembly drawing document.
- Thanks to Del Linkhorn for providing operational details of switches and displayed text in status signs.

Comments and suggestions welcome to totehis@hotmail.com

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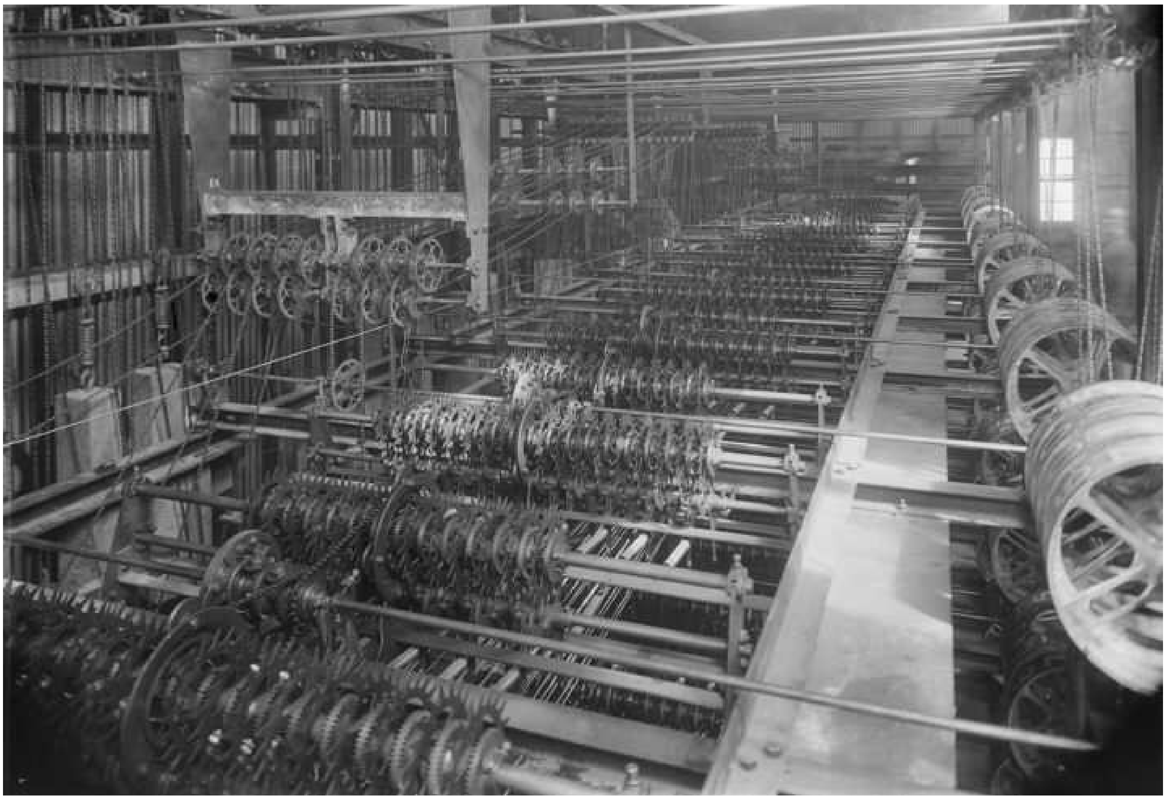
Appendix V - *"Automatic Totalisators Ltd. – later ATL"*

This is one of several pages relating to the history of the automatic totalisator, its invention in 1913, the inventor George Julius and the Australian company he founded in 1917 which became a monopoly (later an oligopoly) in this field. This page relates the history of the company mentioned above, Automatic Totalisators. This is a history only non commercial page. If you wish to start from the beginning then go to the index .

Automatic Totalisators Limited - later ATL

Automatic Totalisators Ltd., a public Company was formed in 1917 to manufacture, install and operate Totalizators throughout the world. By 1970 with few exceptions, every major racing centre in the world used these Australian Totalizators, which were in service in 29 countries. The Automatic Totalizator was invented by the late Mr. George Julius (later Sir George). In 1913 he installed his first totalizator on Ellerslie Racecourse in N.Z. and the second at Gloucester Park in Western Australia in 1916. The installation at Ellerslie was the first automatic totalizator in the world and although it looked like a giant tangle of piano wires, pulleys and cast iron boxes and many racing officials predicted that it would not work, it was a great success.

The Worlds first automatic totalisator.



These early automatic totalizators were completely mechanical and consisted of Ticket Issuing Machines coupled to Drum Indicator Adder Units, all housed in the one building for one pool only. Miles of flexible wire cables connected the Ticket Issuing Machines to the Indicator/Adder Units. A considerable length of bicycle chain ran over sprockets and heavy cast iron weights were used for drive power.

In 1917, after the Company was formed further research led to the introduction of electrical power and the miles of flexible wire cable were replaced by simple electrical conductors which operated solenoids both in the Ticket

Issuing Machine and the Indicator/Adders. This was a major development because now the Ticket Issuing Machines no longer had to be close to the Indicators.

By 1920 equipment was installed on a total of seven racetracks in Sydney, Brisbane and Newcastle in Australia, and Auckland in New Zealand. The equipment was very bulky , employing the principle of one Ticket Issuing Machine to one Escapement Wheel, which limited the number of Ticket Issuing Machines to the number of Escapement Wheels it was possible to build into the combined Adder Drum Indicator Unit. Invariably these installations were confined to one building and no attempt was made to connect buildings by underground cable. The Indicators provided for one Pool only, but the fields were large. For example, at Randwick, the equipment provided for 42 starters. At this stage all the equipment was manufactured at Mr. Julius' home in Darling Point, Sydney, or in a backyard garage nearby.

Until the early 1920s the equipment was made for one Pool only and when you went on a racetrack you bet on the "Tote". The net Pool was divided up into three parts giving the winner 60 % and each of the 2nd and 3rd horses 20 %. At this stage there was a separate tote in each enclosure, not connected in any way with each other, so that, where three enclosures existed, as at Randwick, three different sets of dividends were declared.

In 1922 the old single "Tote" was superseded when Win & Place pools were created and the same year the first Totalizator equipment for Win & Place betting was installed in Perth, Western Australia. From then on, with few exceptions, all racecourses installed Win & Place equipment. The Ticket Issuing Machines were divided so that some sold Win and others sold Place. The method of calculating the dividend for the Place pool was such that the total money invested on the placed horses was taken out of the net pool and the remainder was divided by the number of dividends to be declared and this figure was divided by the units bet on each placed horse. During the next ten years the Company installed equipment on 27 racecourses in India, Ceylon, Malaysia, Singapore, France, New Zealand and Canada. The biggest order during this period was equipment for Longchamp, Paris, in 1926, and this was the largest order undertaken by the Company until the order for Caracas, Venezuela in 1957, over 30 years later.

The French order meant considerable design work, as now, for the first time, the Adders were to be divorced from the Indicators. The Adders had to have a capacity of a minimum of 273 Ticket Issuing Machines through a Distributor connected to one Escapement Wheel, over 35 Escapement Wheels where needed on each Adder. The Adder design was a feat of mechanical engineering, all values and transfers being mechanically linked. The Ticket Issuing Machine design also was a remarkable piece of engineering and saw the introduction of a machine to sell both Win & Place tickets from the one machine. This was a big step forward and proved to be one of the main features for many years to come. The equipment for Longchamp was manufactured in the factory at Alice Street, Newtown, N.S.W. except for the Ticket Issuing Machines, which were made in Paris under supervision.

Up till this time, only pool figures were displayed to the public but, in 1927, Mr. Julius came to light with automatic odds, which was probably the biggest milestone in the Company's existence. Models of this type of equipment were taken to London and North and South America. In 1930, Automatic Odds Equipment was installed at Harringay Dog Track in London, and the following year Automatic Odds Barometer Indicators were installed at Flemington, Caulfield, Moonee Valley and at Williamstown Racecourses in Victoria, Australia. It is as well to point out here that at this stage legislation had only just been passed to permit totalizator betting in the State of Victoria and that these installations were done in the middle of the depression years and represented the largest single bulk order from a group of racecourses. During this period an associate company, Totalisators Ltd, was formed in London to manufacture, install and operate totalisators in the United Kingdom, Europe and Africa.

On the first installation at Harringay Dog Track, in London, odds were displayed on a Digital Indicator and a pointer, like the hands of a watch, indicating the odds on the particular starter. The mechanical analogue Odds Computer was an ingenious device which undoubtedly put the company in the forefront as Totalizator Engineers.

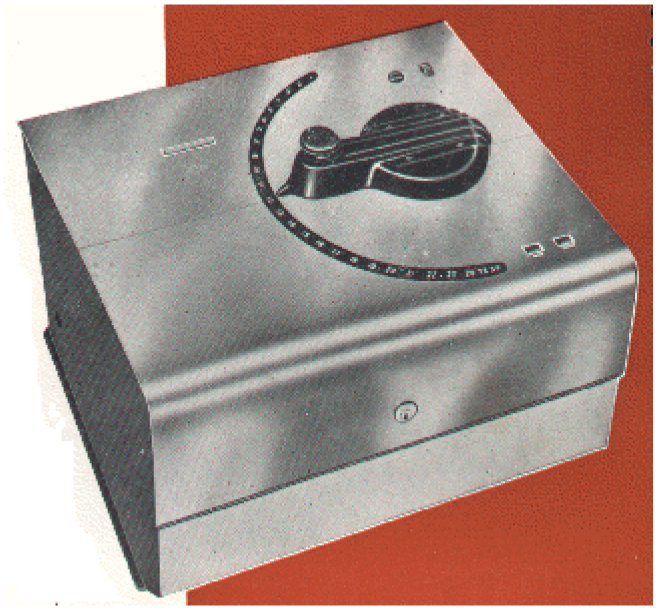
Immediately after the depression, Automatic Odds installations went to India, New Zealand and right throughout Australia. The first installation in the United States was made in 1932, when equipment was installed at Hialeah Racetrack in Miami, Florida. The second world war in the late 1930s put an end to totalizator manufacture and installation for almost 10 years. During the war years the factory, which had moved to

Chalmers Street Sydney in 1933, went into full production for the Department of Defence and later the company expanded the munitions work to include tooling.

The knowledge gained in general manufacture and tooling during the war years was to serve the company in good stead immediately after the war, when it threw all its resources into tooling and manufacture of new totalizator equipment. In later years, when tote tooling work eased off, the toolroom turned to commercial work. This side of the business expanded rapidly until, the company had one of the largest commercial tool rooms in the southern hemisphere established on their premises at Meadowbank.

The Meadowbank Factory

In late 1945, the company started in earnest to design totalizator equipment for post war use and, at this time, the J8 ticket issuing machine was born. The J8 proved to be a durable addition to the Automatic Totalisators terminal range. Up until October 1995, The Royal Turf Club of Thailand continued to use J8s as the on-course ticket issuing machine. Along with the ticket issuing machines, there was need for new designs in Mechanical Analogue Computers, Adders, Odds Relay Units and Indicators. The factory therefore, continued on at war time tempo for many years, in an attempt to fulfill the orders that kept rolling in. The company moved to the factory at Meadowbank in 1947.



A J8 Ticket Issuing Machine

A ticket printed on a J8 (Animation above)

The first batch of J8 Win, Place ticket issuing machines was installed on Randwick Race Course in 1948. The delivery of these ticket issuing machines to Randwick released a quantity of the existing J6 ticket issuing machines for despatch, along with some 2-shaft adding units, to the United States for use at Randall Park Racetrack. This was a stop gap move and in 1950 the company installed new equipment on this racetrack. That same year an associate company, Automatic Totalisators (U.S.A.) Ltd. was formed to purchase equipment from the parent company and lease it to racetrack operations in the U.S.A. This Company became a subsidiary and by 1967 the company had 23 operations in the United States and Canada.

In 1948 the first mobile tote was manufactured, and was used in the Sydney metropolitan and near country areas. In later years many more of these units were manufactured.

At this time the company entered the busiest period of manufacture and installation in its life. Simultaneously it was manufacturing and installing equipment for racetracks in India, South Africa, Australia, New Zealand, North and South America. In all, it installed equipment in 99 race tracks throughout the world between 1948 and 1955. The bulk of this equipment was for Win, Place pools only. At this stage, it catered for doubles and quinella pools with small fields only, but very soon after was confronted with the possibility of having to provide equipment for 24 starter fields.

The first real challenge came when all the Melbourne racetracks wanted combination pool equipment. In 1955 the company conceived the idea of using the principle of punched tape for recording investments on these pools and, in 1956 the company provided equipment in Melbourne using newly designed J10 24 starter ticket issuing machines, along with punched tape recorder and electronic readers. This equipment marked another milestone in the history of progress and within several years, this punched tape combination betting equipment was installed in South Africa, Malaysia, Singapore, and every capital city in Australia.

The company advanced into the sixties installing conventional equipment throughout the world, with the betting trend swinging more towards the combination betting pools than ever. Public indication of the state of betting in these pools had always been a problem. At Harold Park, the company installed a quinella indicator with 66 combinations, that is, quinella odds for 12 starters.

In 1964 the company took over Bell Punch New Zealand Ltd purchasing all their equipment in the field, taking over the operation of all their installations and this company was later known as New Zealand Totalisators Limited.

Automatic infield lamp box odds indicators were installed in 1965 on all the Melbourne metropolitan racecourses, including the new racecourse at Sandown Park. In some cases the barometer indicators were retained, and the company designed the equipment to allow these indicators to work in parallel with the lamp box indicators. Here the company had a link of the old with the new, namely the 1931 barometer indicators and the 1965 odds lamp boxes.

New control, access and aggregating equipment was also supplied to Melbourne and installed in an air conditioned van which moved from track to track. At the race track, the equipment was plugged into the racetrack facilities, plus an off-course console which allowed the off-course investments to be stored in the van so that, for odds and dividend calculations, the off-course investments could be added to the on-course investments.

In 1966 Automatic Totalisators Ltd took the racing industry into the electronic era with the development of the World's First Computer Totalizator System, for the New York Racing Association, which handled a totalizator turnover each season of over $700 million. This system had 550 type J11 Ticket Issuing Machines, two Infield Lamp Box type Indicators and twenty Auxiliary Odds Lamp Box Indicators. This installation was the culmination of many years of research and development. The equipment was portable and was moved from Aqueduct to Belmont Park and Saratoga, the northern tip of New York State, where a smaller operation was conducted making a total of 234 race day operations per year. Premier Equipment Pty Ltd, a subsidiary maintained and operated the equipment for all 234 race meetings.

Inspired by the success at Aqueduct, further research and development led to a more compact and economical Electronic Totalizator System using small General Purpose Computers with all the features of the Aqueduct system. This new electronic totalizator made its debut in November,1968 at a harness track in Georgetown, Delaware, U.S.A., and at Happy Valley racecourse, Hong Kong.

The last Julius Totalizator ceased operation at Harringay London in 1987.

Postscript - It is now June 2005 and I have just received mail from Caracas. I was informed that the Julius tote there is still in operation. After 48 years of operation I have been asked if I have any information on how to make adjustments to the system to bring it up-to-date!

There is some ATL equipment at the heart of every great racecourse

This is a small segment from a company booklet titled ATL International Name In Totalisator Betting Systems presenting a sales oriented view of the company written when ATL was still manufacturing electromechanical totalisators.

ATL makes Electronic Totalisators, Electro-mechanical Totalisators, Portable Counter Totalisators, Punched Tape Combination Betting Equipment, Odds and Dividend Computers, Totemobiles, Ticket issuing Machines, Display Indicators, Coded Ticket Paper, Photo-finish and Race Timing Equipment, Consoles, Totalisator Power Supply Equipment, Turnstiles, Tools and provides specialised services.

It has more than 200 installations on racecourses in 30 countries ...
Philippines, South Africa, United States, New Zealand, Hong Kong, Venezuela, Singapore, Indonesia, Australia, Scotland, Thailand, Columbia, Malaysia, Rhodesia, Trinidad, England, Pakistan, Jamaica, Nigeria, Canada, France, Ceylon, Burma, Brazil, Spain, Iraq, Eire (Ireland), Ghana, Sweden and India.
But for all this, ATL has a lot to learn ... about dissatisfied customers.
It has never had one yet!

The Toolmaking Division Of Automatic Totalisators Limited

Part of the ATL Toolroom

Following is an article from Tote Topics magazine number 18 dated June 1968

The name Automatic Totalisators Limited, quite naturally, sells to the majority of the general public the fact that we are a company whose interests revolve around the racing world, thus embracing our four legged friends, racetracks and the human elements of gambling. But, how many, with the exception of those who are engaged in or have been associated with, the business of volume production, would associate this name with something seemingly as foreign as the manufacture of precision tools and gauges for commercial use.

The fact is, we are commercial toolmakers and to explain this somewhat surprising set of circumstances, let us look back into the history of A.T.L., in particular, the period during and after the last war.

During the war, the toolroom was employed in the manufacture of tooling for Munitions, a factor which proved of considerable value in post war years, when the accrued knowledge and machinery we used to considerable advantage in the manufacture of Totalisator Tooling. At this period, it was also found that the production requirements of industry were increasing and it was this factor which prompted the move into an additional field to the Totalisator Market and Automatic Totalisators Limited this became toolmakers to the trade.

To the uninitiated, a toolroom is a place where hammers, spanners etc., are manufactured. This obviously is not the case, for while these items could be made quite adequately in the toolroom the individual cost would be astronomical as these items are basically volume production. However, the tools from which these items are produced, could be, and are made quite successfully and economically in our toolroom.

To describe our facilities and function in detail, would be both lengthy and boring, but as a starter, let us say we are specialists in the manufacture of high class tooling such as Press Tools, Mould, Jigs, Fixtures and Gauges. Those who are familiar with tooling will readily see that this modest statement virtually covers the entire range of tooling requirements anyway.

The tooling from which everyday items are produced is employed by the manufacturer in the production of items whether they be from plastic or metal. Items such as body panels for cars are produced from a press tool.

The telephone handset is produced from a plastic mould and high precision gauges are used to ensure the intricate dial mechanisms, incorporated in the phone, comply with specifications laid down by the P.M.G.

To facilitate the efficient manufacture of this type of high class tooling, good quality machine tools are a necessity. These fall into two basic classes, namely:

(a) The conventional or basic machine, such as lathes, milling machines, surface and cylindrical grinding machines and drilling machines etc.

(b) The more sophisticated machine tool which is used for the specialised operation, so necessary to enable compliance with today's requirements. Our range of this type of equipment includes machines such as Jig Borers, Jig Grinders, 3 Dimensional Pantographs, Electrical Discharge Machines and Optical Profile Grinders.

The need for this type of specialised equipment has increased dramatically over the past ten years, a condition which can be more readily appreciated if we look at the everyday items such as the modern motor car and its associated fitting, lawnmowers, T.V. sets, the telephone with its associated switchgear. All these items, and many more too numerous to mention, have been accepted as part of our way of life, but very few people, quite naturally, would appreciate the problems associated in producing these items, or to be more exact, give any thought as to how they are produced.

To ensure we produce the desired result in the manufacture of all types of quality tooling we have a Metrology Section,k through which all work must pass and be certified as correct to drawing dimension. This section is approved by the National Association of Testing Authorities and Department of Civil Aviation, to certify that work performed in the tool-room or for that matter, work performed by anyone is acceptable at the standards laid down by these various departments.

All inspection work is carried out in air conditioned surroundings, utilising the most modern metrology equipment available. The Commonwealth Government would be our largest customer in this field, and constantly request our certification of various types of gauges, whether we have made them originally or not.

The combination of skill, high precision equipment, and the reputation of being able to produce a quality tool, whether it be press tool, mould, jig and fixture or gauge, has given us the right to add the bi-line of *Tool-craftsmen to Modern Industry* to the name of Automatic Totalisators Limited.

Display Equipment

A.T.L's Computer Totalisator System is built around the concept of total service to the betting public. It fulfils this concept with the ultimate in speed, accuracy and reliability. A.T.L.'s Totalisator Systems reach out to the racecourse public through a superb range of display equipment. A.T.L Odds Indication equipment provides up to the minute betting information instantaneously, clearly and with the complete precision necessary to build up the billion dollar turnover which the combined A.T.L computer systems around the world handle each racing season.

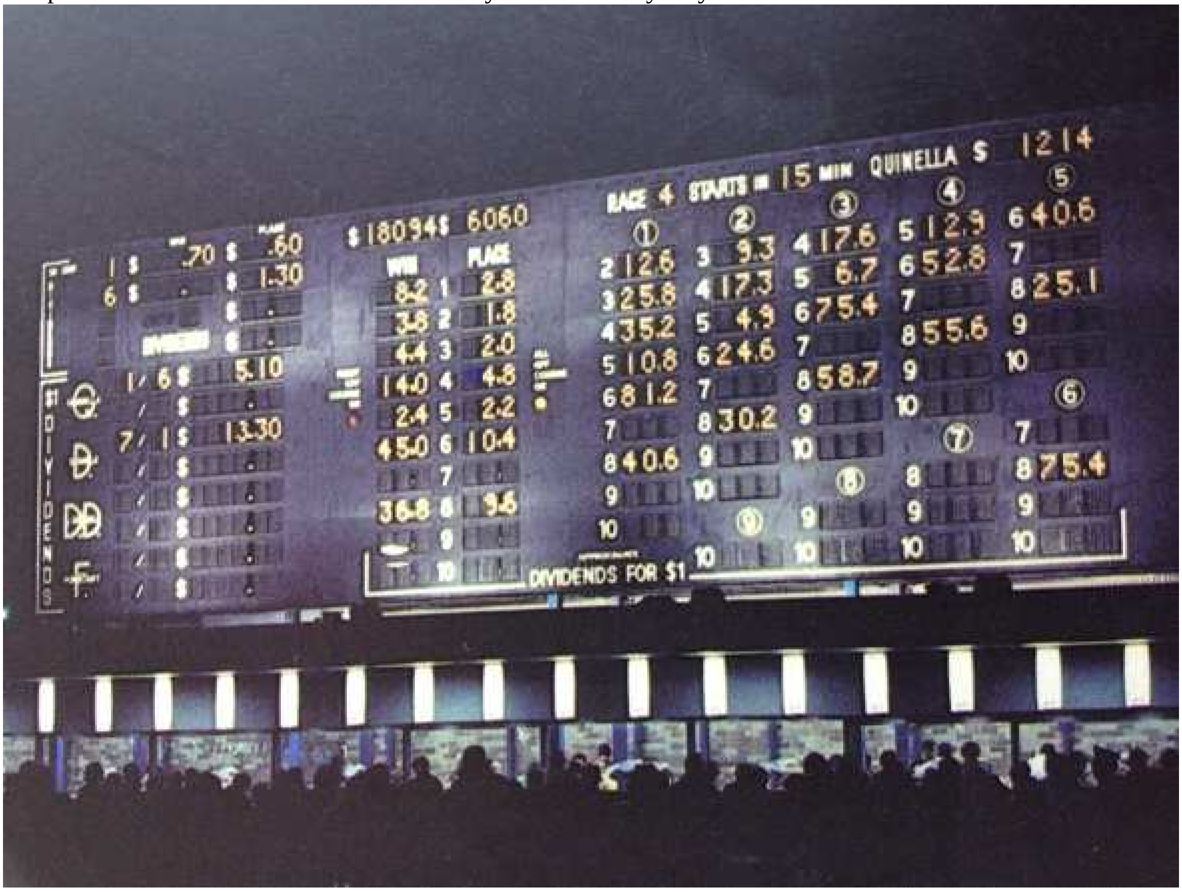
Automatic Totalisators Limited has developed three main types of Odds Indicators:

- Lamp Displays
- Seven Segment Displays
- Closed Circuit Television

A.T.L Lamp Box Indicators, the most suitable form of indication for mass public viewing are attractive landmarks among the top racecourses of the world.

Intensive racecourse surveys by A.T.L technical staff ensure they are strategically situated for the maximum convenience of the public and where they will blend most effectively into the course surroundings and traffic pattern.

Lamp Panel Indicator at Wentworth Park Greyhound track Sydney



A.T.L Seven Segment and Closed Circuit TV indicators provide an efficient and economical display in confined areas such as betting halls, and restaurants.

A.T.L's Computer Totalisator Systems demand the most speedy, reliable and accurate indication possible to meet the greatly increased turnovers they can handle.

That is why the Company developed its own display equipment.

After 58 years of indicator design and production it continues to have the best.

Experience has shown that only the best is good enough.

Totalisator Indicators - Tote Topics number 27 - March 1969

Since racing began indicators have been used on racecourses and, in the early days prior to the introduction of the totalisator, indicators were used mainly for the display of horse and jockey information. The requirements then were entirely different because information had to be changed only once each race, whereas a totalisator display is changing throughout the whole of the betting period.

The first totalisator betting system was invented in 1872 by a Frenchman, Monsieur Oller, and it was known then as the Pari-Mutuel. His system was completely manual without any form of indication of the betting trend and even to-day similar manual operations are still in use.

Eight years later, in 1880, the first totalisator indicator was introduced in Christchurch, New Zealand. This was the first mechanism introduced to the Pari-Mutuel System of betting and the equipment included an indicator which was operated by hand and displayed information on the progress of sales of tickets on various horses. The main disadvantage with this system was that it was very slow and was always much behind the actual betting. It was not uncommon to see the horses delayed at the start for 10 minutes or longer to allow all tickets to be displayed on the indicator. This delay presented many problems to the Race Clubs and while many attempts were made to overcome these difficulties it was not until 1912 that Mr. Julius (later Sir George) invented a machine that was the answer to this and many other problems. His machine revolutionised totalisator betting. Not only could it automatically and instantaneously record and display the number of tickets sold on each horse right throughout the progress of betting; it could also aggregate the number of tickets sold. This was the first successful form of indication and was known as the Drum Type Indicator and till about 1930 this form of indication was installed on most of the leading racecourses in Australia,

New Zealand, the East and in Europe, notably at Longchamps, Paris. .
Contemporary note: regarding the 10 minute delay posting dividends, in the 1980s, well into the computer era, I recall attending a meeting where we discussed a proposed solution to reduce the too often occurring problem of delays being incurred with calculating dividends due to the TAB's transaction processors having to wait for final collations to be received from the multiple on course totalisator systems supplied by different tote companies. Some problems persist!

Displaying the number of tickets or units sold on each horse and the grand total allowed the public to follow the trend of betting, and some alert punters could even calculate the approximate dividend. It was not easy to calculate this dividend, particularly with the first totalisators, because not only was it necessary to take into consideration the Government Tax and Club deduction but the pool had to be divided into three lots, 60% for the winner and 20% for each second and third.

The equipment still did not display the most vital information to the better - how much will I collect if my horse wins? Further research led to the development of the clock dial type indicator and the big breakthrough came in 1927 with the introduction of the automatic odds equipment and the barometer type indicator. For the first time the public could see the expected dividend or odds without having to make any calculations. The final dividend could not be calculated until the betting had stopped but, this is a feature inseparable from the Pari-Mutuel or Totalisator System. In practice this does not cause any real inconvenience because years of experience have shown that, after the betting has settled down, the odds on each horse change very little during the betting period and the final order of popularity becomes obvious very early.

Examples of Clock Dial indicators are visible in the image below. They are the Win and Place grand totals visible at the top of this building. The Clock Face indicator could be used for displaying odds as well.

An example of a barometer style indicator

The barometer odd indication for each runner is visible below each runner number 1 to 24. Neville Mitchell informs me that this indicator was in the paddock at Rosehill Sydney. The building is gone now, it was the main tote building with the machine room in the upstairs area.

The design of the barometer indicator was such that it could be mechanically or electrically driven from the aggregating equipment. It was usual to have one indicator mechanically coupled to the aggregating equipment and the others electrically coupled by Selsyn control for remote operation. This feature was also possible in the later model drum indicators.

The barometer indicator was installed extensively around the world until about 1950, when the shutter type indicator was introduced. The name of this indicator, unlike its predecessors, does not give a graphic picture of its method of operation. It is, in fact, similar to the printed cloth destination blind used in buses. The shutter refers to a metal plate which is used to cover the aperture and hide the blind during setup and between races. This type of indicator was electrically coupled to the aggregating equipment. It held the field for a comparatively short time until 1955 when the lamp box indicator was introduced.

The indicator at Wentworth Park, shown in the second image above is an example of a lamp box indicator.

During the period when the shutter indicator held sway another type, the projector, was introduced for indoor use. These projected the numbers onto a ground glass screen from a photographically prepared plate. Like the shutter indicator it was superseded by the lamp box.

At payout time. The indicator shown below is an example of a projector indicator mentioned in the above text. This is not part of the Tote Topics article however it is a description by Neville Mitchell of the indicator in the image below: I dismantled this indicator in 1978 during the construction of the QE2 Grandstand I rescued the two large power transformers which Ron Hood sent to his friends at the Eveleigh Railway Work Shops to be turned into stick welders one for each of us. I also removed some of the projector focusing lenses as they made great magnifying glasses. The indicator was replaced by the 3 1/4 inch 6 x 4 lamp panel indicator that was used to display Win and Place Odds via the AWA/ATL CCTV system.

Working in the Lady Members on race day, was an experience. You had to be properly dressed reefer jacket, tie Members pass Tag. The overhead projector was very hot. When working each projector lamp was 100 watts. The projector device used the Wheatstone balance principal to rotate the projectors positive glass disc which had the odds printed on them. A set of glass lenses were used to focus the image onto the back of the frosted glass screens at the front of the indicator housing. The devices made a interesting noise as they searched for new odds postings. Some would oscillate between two settings before settling down. The heat from the unit was felt by the girls working the J8 terminals. As the heat built up in the display units the projectors became more erratic in operation, so we would open the back doors to allow some cooling, thus even more heat blew onto the already complaining girls. This was OK until there was a gust of cool wind that would cool down the Resistor fans in the bridge circuit causing a flurry of oscillations. One of the senior technicians told me he would turn off the system and then watch the infield Blind Indicator, noting when there was an odds change then re-enable the projectors to read the same as the Infield then disable the system again. I was afraid of doing this as I had seen some pretty awful scenes involving mink clad ladies when the Odds were wrong

A Projector Indicator in the Lady Members Randwick

The first A.T.L. lamp box indicator was installed at Randall Park, U.S.A., in 1955, and since then lamp boxes have gradually replaced all previous types of indicator. They are flexible, reliable and virtually maintenance free and can be manufactured to display any information such as odds, approximate dividends, results, final dividends, margins, state of track, race time, minutes to race, time of day, signs, photo, etc.

A great deal of research has gone into the design of lamp-boxes and the operating relay set, and indeed the whole lamp box, can be made to plug in for ease of maintenance or portability. A recent design change has been the introduction of a printed circuit card with cradle type relays to replace the conventional telephone type relays.

Lamp Boxes can be made in any size to suit the viewing distance and, as the brilliance of the lamps can be adjusted for the prevailing light conditions, they can truly be described as the most versatile of all the types of indicator available. With this is coupled the high speed of change of information, up to 25 figures a second, which makes them the most suitable and economic display device for use with electronic totalisators.

J.F.P.

In 2011, we were still maintaining an ATL Lamp Box indicator at Eagle Farm racecourse. It had been operating for approximately 30 years in a very hostile environment for electronic equipment. The only significant problem, which was signalling the end of the indicator's life, was the waning source of replacement bulbs for the lamp panels.

In December 2012 I visited my eldest son in Perth. I visited the Cannington Greyhound track as it is mentioned in the Tote Topics chapter of this website. As a result, I met with Graeme Collins who I remembered from the ATL years. We did some serious reminiscing. I learnt that, like us, he was still maintaining an ATL Lamp Box indicator at Cannington. It was interesting to find that, despite the fact that we had not worked for the same organisation for over a quarter of a century, our opinions regarding the industry were so perfectly aligned.

One more observation of ATL Lamp Box indicators. In 2008 I went to Hong Kong for a holiday. Of course I could not resist visiting the racetracks at Happy Valley and Sha Tin. The Hong Kong Jockey club technologists pride themselves on being technological leaders. I recall reading much about their large screen display. At the time it was regarded as the largest television in the world. It is located in the infield and is watched by punters in the stand and on the ground in the outfield. When I saw it I was amazed to find that this large indicator sized television display was right next to their ATL Lamp Box indicator which they had maintained in perfect working condition. The latest and the oldest working well together!

Neville Mitchell recalls the following regarding the Lamp Box Indicators: When I did the calculations for indicator power transformers, my calculations of the power loading always annoyed the older engineers, as I allowed for an all-lamps-on test at full voltage. They were used to loads of maximum lamps on per numeral/character, which is great for the budget but hell for the maintenance personnel. The Melbourne Metro Racing Clubs was where I found that standing in front of an indicator, while it cycled the lamps, you were supposed to note the dud lamps! This was a great waste of time. My scheme with all lamps on made it easy to detect the duds for repair.

I can attest to Neville's observation above. As indicated above, we had one of these lamp box indicators at Eagle Farm. I have personally wasted a lot of time, waiting for diagnostics to cycle through all the lamp boxes in the indicator and it has wasted much more time of my staff who had to work on it over the decades. One observation I will make is that the lamp boxes were great heaters. Even in normal operation, with the required number of lamps illuminated to represent the required alphanumerics on the indicator, they would raise the temperature inside the indicator building well above the ambient temperature and during summer this made the inside of this building uncomfortable to say the least.

Go back to the index Go to the bottom of the page

On the subject of ATL indicators, following is an interesting description from Neville Mitchell of a novel pup up indicator installation at Randwick Racecourse.

Randwick Results Indicator by Neville Mitchell

The saga of an interesting construction

Early 1978 the Australian Jockey Club began construction at their premier race track Randwick, of a new Grand Stand to be known as the Queen Elizabeth. Eleven stories high, with extensive viewing areas and many unique features designed to make a day at the races a great occasion.

Automatic Totalisators had the operational contract which dated back to the early days of oncourse totalisators and was invited to offer an upgrade of the facilities, to provide new modern open fronted tote selling lines. The offer was accepted

Included in the upgrade was the first oncourse CCTV system using cameras to display the odds and dividends on multiple television receivers installed in the new stand and other areas. A three inch lamp box, win and place odds indicator for the Lady Members was to be the source for the display. Also in the upgrade was a new infield Results indicator it was to be built in the Flat area of the race track directly in front of the members viewing area. {The Flat was the cheapest entry area for race goers and located on the inside of the racetrack.}

The design of the results indicator was by ATL's executive engineers and oncourse staff with agreement with the AJC. The main concept was devised by ATL executive engineers Don Hardy and Talis Bachmanis, involving a six metre by four metre box housing one metre thick and mounted atop a building with hydraulic rams to raise and lower the structure. This allowed the members to observe the race start from the seven furlong barrier position on the far side of the race track.

My office staff did all the mechanical detail for the housing including glazing and service access. The design of the supporting building was by the AJC's architects. The hydraulics design and construction was by Joseph Lucas Engineering a well established British company.

It fell to me to design all of the electrics for the lamp panel digital and alpha numerical displays, including the Judges and Stewards control Consoles. All the electrics were contained in a standard ATL six foot cubicle. This included all the switching for the hydraulic lifting rams and each of the lamp panels had long flexible connecting leads that moved with the indicator. Each lead terminated in a 104 way connector so that installation time would be reduced.

At this stage ATL was very busy with computer tote installations running at a rate of three a year. When the AJC results indicator designs were complete and production was to start there was no capacity to do the task in house. At that time I was doing contract work at home, employing women to assemble printed circuit boards and general electronic work. I was asked to quote for the assembly and wiring of the AJC control rack, some 200 hours of work. I was awarded the job and as the control rack was too large for my workshop I upgraded the garage lighting and began work each evening until midnight. As I had designed the rack I knew it backwards so it was easy to set the work for the wirers. We completed the rack and I ran a complete inspection and, where possible, live testing of each lamp panel's relay drivers.

The project begins

I had been doing small installation projects on Sydney tracks and I knew the AJC tote system as I had worked race meetings over the preceding years. I was given the task of project managing the whole AJC upgrade including the main tote improvements and the CCTV system including the results indicator.

With a staff of four, I began the work on the tote upgrade first, while overseeing the CCTV installation. AWA provided the CCTV equipment. The oncourse electricians did the hard wiring of power and co-axial cabling. This work proceeded without too many problems.

Working oncourse with factory provided staff meant a very short working day. We would leave Meadowbank at eight o'clock for the one hour drive to Randwick, start work at nine, knock off for morning tea at ten, then work through to noon, then stop for lunch, at two o'clock afternoon tea, leave Randwick at three thirty and drive back to Meadowbank. So, not a real lot was achieved on each day. Already the bean counters (Accountants) were alarmed at the overrun on track labour costs.

My onsite crew consisted of three women and a man. Wilfred and Janet were a married middle aged couple who migrated to Australia from England. They were good workers except for their dread of anything that crawled, notably cockroaches. Racecourses are a favourite haunt of cockroaches, and it was not too long before Wilfred encountered a large nest hidden behind a Terminal frame cubicle. As he removed the cover the roaches changed sides getting away from the sudden light. They crawled up his arms to the accompaniment of loud screams and much jumping around trying to wipe the beasties off. He would not return to work until he had showered and Janet had rinsed his shirt clean of "The filthy things". Randwick cockroaches were unusual as they were white, maybe this was because they lived in dark cable ducting both above and below ground level.

Another event while we were working on the upgrade of the J8 ticket machine selling line occurred when "Skippy The Bush Kangaroo" TV film crew turned up to shoot a episode named of course "Skippy goes to the races". We watched the production as we were where the "action was". The film producer asked if a scene could be arranged where Skippy bought a betting ticket. I agreed as long as it was done during our lunch break. A J8 machine with one of my staff playing the part of the race day tote ticket seller was set up and we all stood around to look like racegoers while a pair of kangaroo paws on long sticks bought a ticket from a smiling ticket seller. A later scene involved a kangaroo hopping to the finishing post. Several kangaroos were emptied out of Hessian bags and all manner of methods tried all afternoon, to get just one of them to hop rapidly down the track, much to our amusement.

The upgrade of the J8 win and place tote selling lines was completed, the new Lady Members odds indicator installed and the infield results indicator built and ready for the hydraulics and my lamp panel installation. Joseph Lucas's engineers arrived on site and connected the hydraulic rams to the indicator housing completing the work about lunch time. They operated the system and the housing rose to its upright position. Job well done! So it was off to the pub they went, leaving the housing in the raised position. A sudden gust of wind from the easterly direction struck the back of the housing smashing the hinges that held the hydraulic arms allowing the housing to topple forward smashing into the face of the supporting building. Luckily no one was nearby; two utility trucks missed being squashed by inches. This incident started a drawn out row as to who was to blame and who would pay for the damage. Eventually Joseph Lucas admitted responsibility and rectified the faults, and then we could start to install our equipment.

It was late spring and the morning sun would heat the black painted housing to a level where it was not possible to work inside. ATL had not foreseen this, so large Vent Axia fans had to be installed to exhaust the super heated air before my men could get inside and secure the lamp panels and lay the cabling. The cabling to the Judges Tower and the Stewards room was completed and their control consoles were installed. Initial testing was excellent as my pre testing proved that there were no design faults or wiring errors.

After the indicator housing was raised and lowered a few times we noticed that the safety glass glazing was cracking, because the housing was being twisted by the uneven thrust of the rams. The northern ram had a 10 metre flexible hose from the hydraulic pump where the south ram had only 4 metres of flexible hose, thus there was considerable loss of pressure in the longer hose. Joseph Lucas replaced the long hose with high pressure steel pipe leaving the 4 metre flexible hose. Now the housing rose and fell evenly. The broken glass panels were replaced. Not long after I noticed further cracking of the glass panels. Close examination showed that the cracks took the shape of a digit. The heat from the lamp panel lamps was causing the cracking. This was ATL's problem and it was decided to ignore the cracking as the wire mesh embedded in the safety glass would hold the panel and not drop broken glass on the public. However water did seep through the cracked glass windows. Now that the housing was not totally waterproof more modifications had to be made to drain the seepage water. Final testing was carried out and a check of all functions of the indicator was now completed.

As mentioned before, the CCTV system not only displayed the win / place odds, it also showed the race results. This was achieved by situating a TV camera high up in the members grandstand focused on the above indicator. To get a good picture a long focus lens was required. It was critical that the focal distance was measured and the details sent to Bausch & Lomb in London so the CCTV camera lens could be manufactured. To ensure that the measure of focal distance was correct it was done twice by apprentices from the factory. In due course, the lens arrived in time for the impending trial of all the new facilities. I was issued with the lens, carefully enclosed in a special felt lined case and took it to Randwick to check the system. When the system came on line the infield results indicator was very out of focus. There was no adjustment facility provided. A witch hunt began to find who had screwed up the focal length measurements. All concerned said there was no way they had erred. A new measure was ordered. Then the penny dropped. Each of the two measures had been taken using the ATL tool stores, 100 foot tape measure. On inspection it was discovered that the first 10 feet of the tape was missing so it was 10 feet short. Someone had damaged the tape and repaired it by cutting off a 10 foot section and carefully replacing the tape's end clip. An urgent Telex to Bausch and Lomb requested a correction lens to be despatched immediately. In a week we had the correction adaptor and the system then worked very well.

More problems arose. All of the existing tote and power underground cables that went to the now demolished Members stand had been drawn back away from the new works and located in a large concrete pit about three metres square and two metres deep. The carefully coiled cables were secured in the pit by a heavy checker plate cover screwed in place then while the building progressed the area was used as a bulk sand and gravel dump right on top of the pit. When we were ready to re install our cables to a connection frame in the new grand stand the pit site was cleared and the cover removed to reveal no cables! Every one had been severed at its entry point to the pit. We estimated that one ton of copper cables had been stolen, despite all the precautions taken to secure them. It was impossible to rejoin the cables, so new cables were then installed between the paddock's terminal frame and the new grandstand. The police never traced the stolen copper. ATL had to bear the cost of the new cabling, the budgets for the whole project were woefully under estimated anyway!

Tragedy struck the project when one of the race club's contract electricians was fatally injured when a power pole he was working on collapsed. The electrician was a good friend of mine as we had worked together at the Wentworth Park greyhound track. He was a Dutchman who had survived WW2. He was also an accomplished artist delighting in drawing fighter aircraft in battle.

On a Sunday the AJC ran a phantom race meeting with the public allowed free entry. About ten thousand people turned up and all the new systems were being tested. Faults in the grandstand design became apparent with sewage spillages and many faults in the equipment rooms and the kitchens. The results indicator developed a problem that had not appeared during testing, when the judge entered the results and pressed "Display Results", the results would come up in the lamp panels then after a few minutes drop out. This was a real let down for me. On the following Monday we tested and checked every component of the Lights-on circuits with no apparent fault. Then I noticed that all of the lights-on contactors were slow to operate, and when operated were magnetically weak, you could easily pry the armatures apart. I peeled the maker's 50 volt DC label off one of the contactor's coil assemblies revealing the original coil specification as 240 volts AC, thus the weak magnets. The drop out occurred when the power load of the operating track caused a voltage drop to the results indicator. No further electrical problems appeared during the next 7 years of service.

The design of the support building had to be altered. When it rained the indicator housing collected water on its face and when raised to the display position it dumped gallons of the water on the punters who were sheltering under the front of the support building. An awning built across the front solved that problem.

Randwick Results Dividends and Judges Indicator

The above photo shows the results indicator in the old Ledger infield area. At one stage in its long life the indicator was used as the foundation for a podium built for the Pope's visit and the Mass that was held on the racecourse for 90,000 people watching from the grandstands and grassed areas in front of the podium..

Display Detail

Winner and four placed runners: 2 digits. + A i.e. 24A *(A substitute character A was used if more than 24 runners were in a race. Randwick could have a maximum of 28 horses. Two runners were coupled i.e. 24 &25 became 24A so the punter got two runners for the price of one wager)*
Alpha display: PHOTO for the win placing. Dead Heat brackets
Alpha display: PHOTO FINISH for placing's
Winning Margins: NOSE FRACTIONS, 1/4, 1/2, 3/4 HEAD, NECK, LENGTH, 1/4, 1/2, 3/4, 1 TO 19 LENGTHS
Numeric display: RACE TIME *(Time for race: minutes, seconds and tenths of seconds)*
Alpha displays: WEIGHT, DEADHEAT, PROTEST, INQUIRY, UPHELD, DISMISSED
Numerals: 9 X 6 matrix, 25 watt filament lamps max voltage 110 VAC. Normal daylight usage 80-90 volts
Alpha characters: 7 X 5 matrix. Relay logic
Average display power: 10 kilowatts

My final days at Randwick

After the opening days and the successful operation of the upgrades I was instructed to attend each race day just in case of some unexpected breakdown. I had no official duties other than to be on hand. This went on for the year following the opening of the Queen Elizabeth grandstand.

The then ATL oncourse race day Deputy Manager was Ross Jenkinson, a very staid gentleman who insisted that I attend. At this time we were having extensions done to our home so at least the extra money came in handy. The drawback was the loss of family time especially on Saturdays and public holidays. Easter time was usually an intensive racing period. I did manage to get to the Royal Easter Show with the family, but only late on a Saturday afternoon after the last race at Randwick.

During this time I had opportunity to watch the Julius Totalisator system in operation. There was never a breakdown or anything that needed engineering intervention. Usually two senior engineers were on duty in the Totalisator room. Apart from checking the race day input settings they had an easy time. The very rare adder faults were attended to immediately or after the last race so I did not get to learn very much about how to handle emergency situations.

Observing the tote selling lines was also a learning curve, I got to know the faults that occurred in the J8 ticket machines and the strict procedures used to make on line repairs without causing any stray bets to occur. And of course deal with the sellers to ensure there was no discrepancy in the tickets sold counters.

I returned to the Drawing office as Assistant Chief Draftsman and then Design Office manager. I was often called on to travel to overseas tracks to do initial surveys and later I went to the USA to assist in the design of the J22 terminals fibre optic bar code scanning device. Lastly I accompanied the sales engineers to Hong Kong prior to the awarding of the new Shatin Race Track's computer system, and that is another story.

Randwick Judges and Stewards Consoles

The above photo shows the Judges & Stewards consoles. There was also a stewards console in the Stewards Room so result changes, Protest, Dismissed, Upheld ,Weight etc., signage could be declared. I spent some time up in the judges box over a one year period as I was required to attend Randwick meetings, just in case anything went wrong - never did though. They were interesting people and I was amazed at their methods of remembering horses and jockeys. Some judges called the race under their breath.

After long service, some time after AWA won the AJC contract and the flip vane infield indicator was installed, the Results Indicator was dismantled and sent to SA where it is installed at Morphettville race track in Adelaide.

Backing Organisation

Automatic Totalisators Limited is responsible for the efficient performance of the hundreds of Totalisator Systems it has installed at racing venues around the world. Because of the Totalisator Systems each Club using them can in the future, as in the past, bank on continued efficient and uninterrupted betting operations. This is not only because of good design. It is also because of the smooth and instantaneous after-sales service and maintenance which the Company offers along with its product. A.T.L recognises its responsibility to see there is no hold up to the multi-billion dollar world racing industry its systems serve. It ensures having spares and spare parts available to every Club using its equipment. Those parts and specialist Totalisator Engineers are available immediately when and where required.

Components for all A.T.L installations are held at the Company's Research and Main Manufacturing Division at its Sydney headquarters where the plans of over 200 local and overseas Totalisator Systems are held and can be used to pinpoint a technical problem anywhere in a system, anywhere in the world.

There is another unique after sales service offered by A.T.L. It trains Totalisator management and , in many places, A.T.L staff handle the entire race-day Totalisator operation.

A.T.L service and maintenance experts have learnt a lot by operating their own equipment. In so doing the Company's policy is reflected: "It is only good enough for our customers if it's good enough for us to use ourselves."

A.T.L's staff involvement with racecourse Totalisator operations has also stood it in good stead in keeping pace with pari-mutuel betting trends.

The skilled technology and in depth A.T.L research are behind every one of its many installations. They have kept services and maintenance to a remarkable minimum.

One of the most graphic examples of this is the **46 year old A.T.L Totalisator System at the French Longchamps Racecourse...still going strong and never one serious mechanical interruption on a race-day.**

Ticket Issuing Machines

This is an extract from a company booklet titled The Computer Tote

Automatic Totalisators Limited is an international pioneer in the design and production of ticket issuing machines for betting systems of every kind.
Since the Company gave the world its first Totalisators, it has developed over 100 types and models of ticket issuing machines.

Some old ATL Ticket Issuing Machines

Above is an image from The Computer Tote booklet, which illustrates a small sample of the over 100 types and models mentioned above. These represent the era when the computer tote has been established and the first TIM in the image, the J8 is rooted in the electromechanical era whilst the following machines are transitioning to predominantly electronic machines. The image also shows the tickets produced by each model except in the case of the last one in the image, the J20 where the mark sense card it uses is shown.

Today there are **over 15,000** A.T.L designed ticket issuing machines in use throughout the world's racecourses, paceways racetracks and jaialai frontons. And practically every ticket issuing machine made by A.T.L is still in service. Their service record highlights the two main characteristics of the A.T.L ticket issuing machine - reliability and efficiency. Automatic Totalisators Limited firstly developed for use with computer totalisators, the J11 ticket issuing machine and, since then, the J17, the J18 and the J20. The latest styles incorporating up to the minute electronic techniques, like their predecessors, maintain the company tradition of reliability and accuracy.

The versatility of A.T.L's ticket issuing machines is underlined by the fact that those currently in use with an electromechanical system can be integrated into a computer Totalisator System without modification.

Research, meticulous care in design and long experience are not the only qualities behind the A.T.L ticket issuing machine. Another is thorough product-testing. Every ticket issuing machine undergoes an exhaustive test for operational reliability and is then tested in the field by A.T.L staff.

The reliability of A.T.L's ticket issuing machines is enhanced by the overall security of the Company's ticket issuing system which protects against forgery. A.T.L supplies ticket paper to race clubs throughout the world which use its equipment. A.T.L's ingenious pattern of ticket markings and the use of special inks for printing ticket backgrounds protect the Totalisator System against the counterfeiter.

A.T.L has over five decades of experience behind it in providing complete security for the multi-billion dollar turnover of its customer clubs.

1986 Australian Design Award

In June 1986 Phil White, Manager of the ATL Research and Development Department, received a letter from the Industrial Design Council of Australia. The letter was written by Joy Durston an Administrative Officer of the Council and confirmed the granting of an Australian Design Award. Following are some extracts from the letter.

I am pleased to inform you that your company's Wagering Terminal J33 and Mark Sense reader J40 have been granted an Australian Design Award.

Your Australian Design Award Certificate is being prepared. If you so desire, Mr Molnar will be pleased to arrange a public presentation of this certificate to your company.

Congratulations on these fine products. I hope that Council's recognition of their high standard will prove beneficial to your company.

Note: Wagering Terminal is a later term for Ticket Issuing Machine that was introduced to specify the type of machine from the plethora of other ticket issuing machines that came on the market after the advent of the electronic era.

ATL Sell/Pay system - Tote Topics Summer 76/77

J22s in operation Guineas Room Eagle Farm 1979

I have included this article as it relates one of the many terminals designed and manufactured by ATL. I have selected the J22 as it is the first ATL terminal I worked with after joining the company. As Chief Engineer of the Brisbane Branch the most challenging objective was keeping the transaction processors functional and this demanded the most time. I had staff who did the J22 maintenance and I helped them with the more difficult problems. My association with the J22 lasted almost a decade. Our customers in Brisbane later purchased more terminals which were J25s and J36s. After AWA took over ATL we used TIM91 terminals and when TAB Limited took over we used PCTims.

Development work on new products was increased during the year resulting in the release of a ticket issuing machine known as the J22, which incorporates some new and advanced technology. This terminal has created considerable interest amongst racing clubs, being more flexible than competitive products, and designed to achieve significant labour savings in the operation of the totalisator. Development work is continuing at a high priority on other advanced terminals for both on track and off track use as well as low cost computer systems to cater for the needs of smaller racing clubs.

The J22 terminal was the major reason for our success in winning the highly competitive contract with the Royal Hong Kong Jockey Club for a computerised totalisator system, which will be installed at their new Shatin race-track. This system will be the most advanced in the world, and will incorporate many innovative ideas for admission and crowd control, cash management, display boards, and other business information for racecourse operations. A central complex of computers are included in the contract together with the ticket issuing machines, turnstiles, display boards etc.

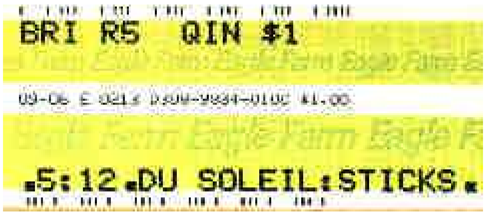
The A.T.L. Model J22 Sell/Pay Terminal is a high performance transaction terminal designed to meet the demanding criteria essential to an on-course totalisator incorporating the flexibility required by modern operations.

The J22 is capable of selling and paying simultaneously on all pools and values operating at the course. It is this feature which allows a comprehensive totalisator service to be provided throughout the course either by single terminals, operating in restricted areas such as bars and restaurants or by terminals dedicated to specific functions in the main public betting areas.

Reproductions of J22 type tickets are shown on the opposite page. A separate ticket is issued for each pool however this ticket may be of any value and can accommodate up to six runner selections. Further a single ticket is available for an 'each way' bet. A ticket may therefore accommodate equal investments on up to six runners for Win, Place and Each-Way or up to six runner selections for the combination pools, i.e. Quinella, Forecast, Double, Trio or Trifecta. There is no restriction in the number of selections in each leg of the combination pool providing the total does not exceed six. For example, a typical doubles ticket may have 6 & 9 selected in the first leg and 1,8,10 &14 selected in the second leg, which is a total of 8 combinations in the same ticket.

The major components of the J22 are:
Printer
Reader
Keyboard
Operator Display
Customer Display

The Printer is a 7 x 5 dot matrix printer which simultaneously prints 2 lines of 9 mm characters, 1 line of 3mm characters and 2 lines of bar code. The time required to print and issue a ticket is less than 0.4 seconds. A ticket printed on a J22 Terminal



Note: The bar code printed on the ticket had no checksum or CRC. The way errors in reading the ticket were detected was by the use of two bar codes written on each side of the ticket. One bar code is the one's complement of the other. During a read operation the bar code on one side is complemented and the result compared with the bar code read from the other side and if they do not match an error has occurred.

The Reader automatically reads the serial number and date recorded in bar code on the two edges of the ticket. A Ticket presented for payment is fed into the reader slot where it is read, the information is transmitted to the computer system and if a dividend is payable the ticket is mutilated by two punches and returned to the operator and the amount payable is displayed to both the operator and the customer. If for any reason the reader is unable to read the code, the serial number, which is also printed on the ticket in alpha numeric characters may be manually entered by the operator.

The Keyboard is conveniently arranged to encourage operator speed and provides a discreet button for each function. Thus avoiding the possibility of mistakes in entering coded information.

The Operator Display consists of 32 alpha numeric characters to display all information as it is entered through the keyboard. The operator may visually check the details of the transaction before it is transmitted to the computer system. Further information such as customer total and amounts payable are also automatically displayed to the operator.

A Cumulative Total for each series of customer transactions is automatically calculated and displayed to both the customer and the operator. The total is cleared before commencing with a new customer, then the value of each ticket sold is added and amounts payable are subtracted from the cumulative total.

Terminal Operation

The J22 incorporates the speed and reliability of the earlier ATL Ticket issuing Machines together with the all purpose capability necessary to the modern on-course totalisator operation.

While the J22 is capable of selling and paying on all pools simultaneously, certain terminals would be dedicated to specific pools and value to provide fast service windows in the larger betting areas. These terminals would be programme dedicated to reduce the amount of information entered for each transaction.

To sell a ticket the operator first clears the customer total then enters, the value, the pool and then the runner selections. The information may then be visually checked on the display and if correct it is then transmitted to the central computer. If it is incorrect the operator can clear the entry.

The central computer on receiving the details of the bet will check that no errors have occurred in transmission and then check that the bet is valid e.g. that the pools is operating, that betting is 'on', that the selected runners are not scratched. If the bet is invalid the computer will transmit a message to the terminal which is then displayed to the operator.

If the bet is valid the computer will assign it a unique serial number and record the details in core memory for odds and dividend calculation, on disc memory for payout, and on the daily history tape as a permanent record. The terminal cash status record is also updated. This full record of every bet is kept by both computers.

When the bet is recorded the information is then transmitted to the terminal together with the serial number and the ticket is printed. The details printed on the ticket are theretofore identical to those recorded by the central computer. The value of the ticket is added to the customer total on both the operator and customer displays.

A ticket presented for payment is inserted into the reader slot by the operator where it is then transported through the reader and the bar code on the edge of the ticket, containing the serial number and date is read and the information is transmitted to the central computer.

The computer checks that no errors have occurred in transmission and then locates the serial number on its disc files. The full details of the bet recorded with the serial number are then checked and the computer determines whether a dividend is payable, and the amount, if a dividend is due the computer records that it is paid and updates the terminal cash status file. Further, the terminal cash status is compared with the amount payable to ensure that the operator has the cash to make the payment.

The dividend is then transmitted to the terminal where it is displayed to the operator, and is subtracted from the customer total. The ticket is cancelled by mutilating the bar code with two holes and the ticket is returned to the operator. If the operator does not have the cash to pay the dividend, the nearest cashier is automatically notified so that the cash can be quickly provided.

If the reader is unable to read the ticket the operator may then manually key in the serial number to initiate the transaction.

ATL Research

When electronic data processing was in its infancy back in the early 1950s, ATL was researching ways and means of bringing electronics into its totalizator systems. ATL anticipated the day of the computerised, fully electronic totalizator System years ahead of any other Company and its planning engineers intensified their research in the dynamic new field of automatic data processing. When the racing world decided to use the computer for racecourse operations, ATL was ready. The most spectacular evidence of depth of ATL research is that it was called upon to design its very first Electronic totalizator System not for one average size racecourse - which would have been in itself a challenge - but for a circuit of three racecourses with the biggest combined totalizator turnover in the world ... Aqueduct, Saratoga and Belmont Park which are controlled by the New York Racing Association. An enormous amount of research and planning, long before being invited to submit its Electronic totalizator proposal to New York Racing Association, enabled ATL to take on this massive task and complete it so successfully. ATL Research never stops. Having now attained what some years ago would have been regarded as impossible levels of accuracy, reliability and operational speed, ATL research engineers are constantly searching the world market for the latest electronic equipment, improving methods of design and manufacture whether the equipment be electro-mechanical, partially or fully electronic.

ATL's equipment testing program is incredibly painstaking. A newly- designed ticket issuing machine, for example, will issue a million consecutive tickets without one fault as a minimum requirement of its accuracy and durability.

ATL designed and manufactured the **first Electronic Odds Computer**, the **first Electro-mechanical "Totemobile"**, the **first Mobile Computer Unit for Electronic totalizator operation** and the **first Electronic Ticket Issuing Machine**. Intensive research enabled the Company to give the racing world these innovations.

By no means the least important facet of ATL research is that which it carries out on a racecourse where its equipment is to be installed. If there is one thing unique about ATL's approach it is that every one of its totalizator installations has been specially designed for the racecourse it serves.

ATL makes a complete survey of the layout of each race course prior to the signing of the contract and its planning engineers take every aspect into consideration - the location of selling and payout windows, indicator boards, intercom systems and the totalizator Control Room Complex- so that the racing public will be served speedily, efficiently and reliably.

Over half a century of research and experience is built into every piece of equipment ATL supplies to racing clubs around the world.

ATL Notes on the company

The following is a page from Tote Topics magazine Summer 76/77. It is titled "ATL notes on the company" and it gives a later view of the company and gives an indication of the diversification it engaged in.

From small beginnings over 60 years ago Automatic Totalisators Ltd now produce the most sophisticated equipment for the control of betting on racecourses throughout the world, trotting tracks and greyhound events not to mention such events as lotteries, jai-alai and the numbers game.

Today our factories in Australia are manufacturing products that are unique from computer operated totalisators, hardware componentry and software for the typesetting, printing and newspaper industries to nurses call and communication devices to number plates and pressed metal signs.

Our tool-room is one of the best equipped factories capable of the finest procedures and qualified as a testing body for standards and performance in the most demanding industries.

Around the world there are over 60 race courses that are served by ATL Computer Tote Systems and the Mobile Computer Tote is operating at racecourses, paceways and racetracks in Australia and overseas.

ATL's years of experience in pioneering and innovation have allowed it to maintain its leadership throughout the world in the supply of equipment for betting, turnstiles, ticket printing and production and the failsafe design of procedures for the principal clubs in the world's leading cities.

One has only to take a look at the lamp-box computer controlled indicator boards which show up to the second odds results and dividends to realise the efficiency of resulting research by ATL.

Ticket issuing machines have been pioneered by ATL and are capable of handling all betting systems of every kind.

Today there are in excess of **20,000 ATL designed issuing machines** in use throughout the world and these are acclaimed for their reliability and efficiency. The electro/mechanical systems that are integrated in the Automatic Totalisator equipment are meticulous in design and have been subjected to thorough product testing for operational reliability.


Part of the Assembly Section

The above image is one of the assembly sections where the 20,000 TIMs (Ticket Issuing Machines) mentioned above were produced. This photo shows the production of an electromechanical TIM, probably the J8. Note, there is a reference to 15,000 ticket issuing machines in an article above. This previous reference pre-dates this one.

With increasing turnovers at most clubs the ATL company has engaged in long term research to maintain its leadership position in this industry. Experience has proved that only the best will do and our company policy is to retain its previous position at all costs.

The SAM System

Another example of diversification, from the back cover of Tote Topics Spring 1977.

SAM uses a small digital mini-computer, typically installed in a club's management office, to process the operation of the poker machines on a real time basis. The system provides management with security control, detailed audit of each machine, and a constant monitoring of the electro-mechanical functions.

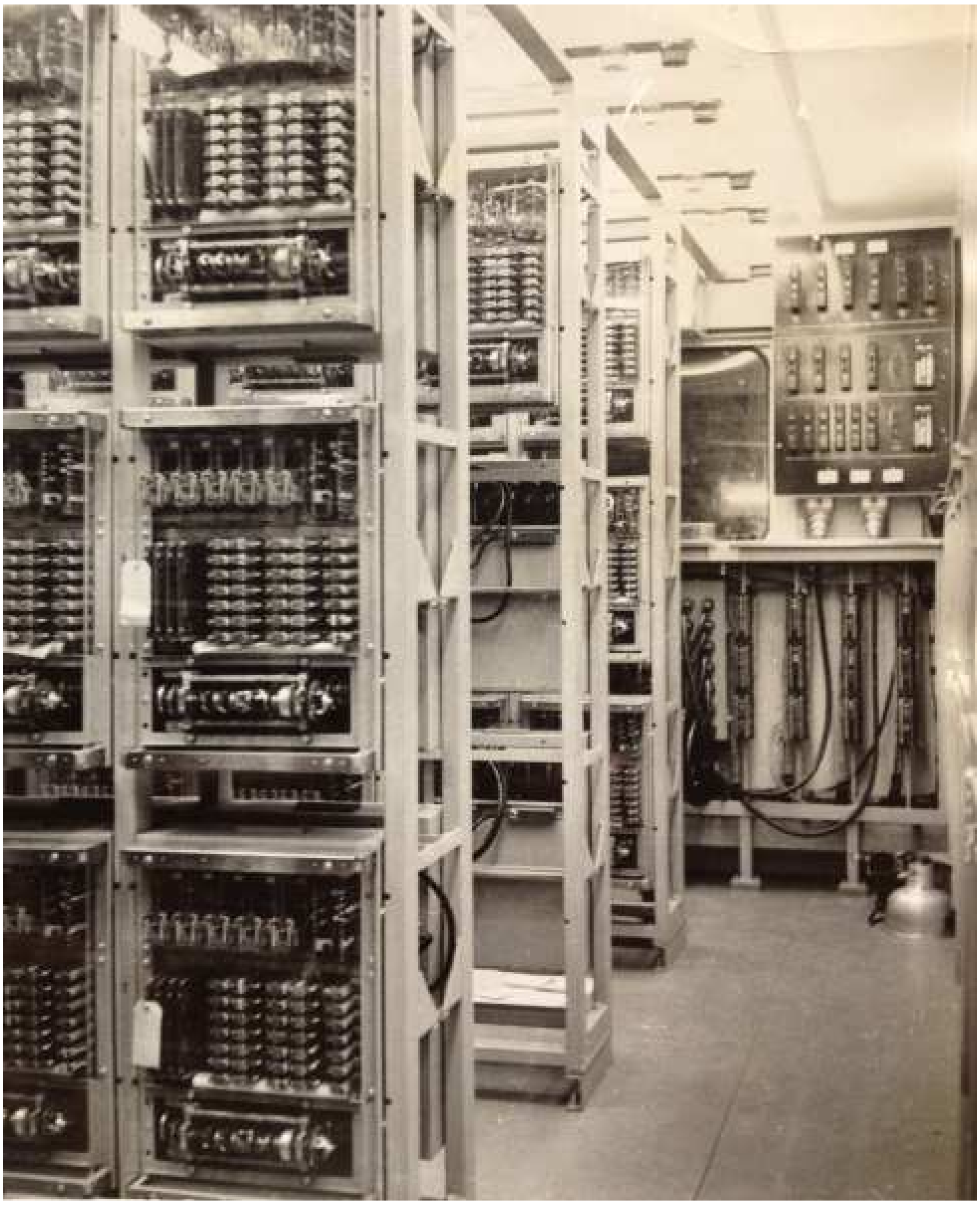
The club operating poker machines for profit has lacked a viable method of obtaining Security, Audit and Monitoring of their most significant source of revenue. SAM provides the means for an investment with genuine return.

For further details and introduction to an operating system, contact;
CLUB AND CASINO SYSTEMS PTY. LIMITED
Group Member Automatic Totalisators Limited

Neville Mitchell's career with Automatic Totalisators

Following is a transcript of part one of an audio casette recorded by Neville Mtichell a long serving Automatic Totalisators Engineer and Manager.

Hello my name is Neville Mitchell, I worked for Automatic Totalisators from May 1962 until October 1994, 32 years of work there. When I started the electromechanical totalisator systems were universal and used in some 64 countries around the world. There was a lot of them in Australia, a lot of provincial towns had win place electromechanical totalisator systems a lot of them having first been installed in the city tracks and as they were replaced by bigger machines the smaller ones were moved out to the provinces. In the early days of totes I worked on the race tracks on a Saturday or Friday night or on Saturday night depending on when I was rostered on. I started off as a payer. I was given the results of the race, the 3 placings and we only worked on win and place in those days the dividends were declared as a unit against the 5 shilling bet you had to do your own progressions and calculate the will pays on the 5 shilling ticket, the 10 shilling ticket, the 1 pound ticket and in some cases the 5 pound and 10 pound tickets which were fairly rare. When you did the summations you called them out and everyone in the pay group agreed on the tally and you then opened your pay window when the bell was rung and you paid out on the winning tickets. I progressed from that to the engineering side of the races and I assisted in operating the electromechanical systems and from 1962 to 1964 they were totally automatic the odds were automatically calculated by the main tote system and displayed by all sorts of means to the public. Mostly they showed bookmaker odds, in other countries they showed all sorts of things like ticket totals and unit totals and combinations of displays that were practiced in Asia, England and in Europe. In the first 3 years at totes I was working in the actual production area, I served in manufacturing and graduated to quality control and inspection services and in late 1963 I was invited to join the engineering staff in the drawing office and I was indoctrinated into the design of electromechanical equipment using relays and uni-selectors and the like. Late in 1964 I was appointed project manager for a new electromechanical tote system to be installed at the 4 racetracks in Melbourne along with the construction of a brand new tote system that would be installed at the newly being constructed race track at Sandown Park. The equipment was based on a wonderful piece of mechanical engineering called the mini adder and it was mobile.


One of the Melbourne mini adder systems inside the pantechnicon truck

There were two 40 foot pantechnicon trucks which were fitted out as 24 starter win place only tote equipment and had a lot of innovative features with automatic hard printout for results and dividends and end of day summations. It also had an analogue type computer system that could determine the odds, bookmaker odds, for win and place which were used to display to the public via new two and one half digit lamp-box indicators and some of the old blind and shutter indicators were also adapted at places like Caulfield and Flemington. Returning from Melbourne I was again in the engineering group and I remained there till 1968 when totes bought their first PDP8-i computer and we put that together and made up a mock totalisator system with a few input terminals or ticket machines and I designed and built the display indicator and from that start we were able to sell the idea of a computerised tote to the Royal Hong Kong Jockey club using DEC equipment and simultaneously in the United States we managed to do a deal with Honeywell and we designed a ticket issuing machine for use in North America which was multi pooled selling win place double quinella and exotic bet pools like that and we did all of the on track installation and Honeywell did the computers we did the computer terminal operations systems but the tote control consoles and judges and stewards control was involved in that as well. After the installation of the system in Hong Kong the age of the computer totalisator system was born.

The Hong Kong PDP8 Totalisator System at Happy Valley

The next 25 years we moved along with the industry all the time upgrading and updating the computer systems and as DEC grew so did we. Our expertise in making peripheral equipment that converted the computers themselves into functional equipment for the racetrack grew. Examples of this were the scanners which were used to couple groups of 64 ticket issuing machines to the computers and race-day control equipment which started off with push-button controls and graduated to slave PCs and the like as time went by. Finally we were installing large totes which were not only running on course but off course and telephone betting systems in Melbourne and Hong Kong and these were very very big tote systems. In nineteen ninety two-ish we were sold by our owners Smorgon Consolidated Industries or SCI to AWA who took over Automatic Totalisators and in a very short period of time the name and the expertise of those sorts of systems was lost.

Note: Neville mentions Automatic Totalisators growing with DEC. I have heard from multiple DEC managers in Australia that ATL was significant and in some cases essential, in getting DEC Australia established due to the number of PDP8 and PDP11 machines the company purchased. The Hong Kong PDP8 based tote system in the image above was the first of many PDP8 tote installations prior to the advent of the PDP11 based totes and finally the VAX11 based totes developed and installed by Automatic Totalisators.


An example of a PDP11 tote system

The image above shows what the PDP11 totes looked like. These superseded the PDP8 tote systems. I spent close to a decade, starting in 1979, keeping these systems operational. There were two of these systems installed in semitrailers and they serviced five tracks, Eagle Farm gallops, Doomben gallops, Albion Park Trots, The Gabba Greyhounds and Bundamba gallops. It is a stark contrast with the original purely mechanical totalisator shown at the top of the page considering this system with its massively increased functionality fits into a semitrailer and the one above as can be seen from the photo requires a building.

Totalling Mechanisms Ltd

I received an email from Val Burr on 31/10/2012. She was investigating the history of a building that housed the Feilding Julius tote, for the Manawatu District Council. This tote was installed in 1920. Val came across a company name Totalling Mechanisms Ltd, in relation to this tote, in the Feilding Jockey Club (1913-1922) minute book. As this reference in 1914 pre-dates the founding of Automatic Totalisators in 1917 it seemed that Totalling Mechanisms Ltd became Automatic Totalisators Limited. I queried this with the ex-staff who had the earliest memories of Automatic Totalisators and no one had heard of Totalling Mechanisms Ltd. Val's research revealed that Totalling Mechanisms Ltd was formed in 1911. I have now just come across a reference to Totalling Mechanisms Ltd in an Automatic Totalisators Ltd document. This document is Tote Topics magazine Number 4 Dated April 1967. Following is an extract from the magazine. The whole article is 5 pages long and *signed D.C.H. Peter Collier, the ex Chief Engineer of Automatic Totalisators in Victoria, informed me that D.C.H. is Don Hardy.*

In April of this year we are celebrating the 50th anniversary of Automatic Totlaistors Limited and 20 years of operation from our present premises in Meadowbank, and we will attempt to give a brief outline of events and highlights of the 50 years of our existence.

Prior to the formation of Automatic Totalisators Limited, Mr., later Sir George Julius, for Totalling Mechanisms, had installed mechanical totalisator equipment on two racetracks, the first on the Ellerslie Racetrack in New Zealand, and the second at Gloucester Park in Western Australia. This equipment was completely mechanical, and consisted of Ticket Issuing Machines and Drum Indicator Units all in the one building, for one Pool only. Miles of flexible wire cables connected the Ticket Issuing Machines to the Indicator Units. A considerable length of bicycle chain ran over chain sprockets, and heavy cast iron weights were used for drive power. These installations were the first Mechanised Totalisators in the world, and operated until early in the 1920s.

Mr. Julius conceived the idea of making a Totalisator after having carried out research into the possibility of making a Vote Counting Machine for the Government of Western Australia where he was in residence prior to the formation of Totalling Mechanisms.

Immediately after the formation of the Company *(Automatic Totalisators)* in 1917, the miles of flexible wire cable were replaced by simple electrical conductors which operated solenoids both in the Ticket Issuing Machine and in the Indicators. This meant that the Ticket Issuing Machines no longer had to have a close physical relationship to the indicators.

ATL Around The World 1974

Branch	**Location**
Head Office and Factory	Nancarrow Ave Meadowbank NSW
Automatic Totalisators (USA) Limited, Automatic Totalisators Inc, Premier Equipment Pty Ltd	100 Bellevue Rd Newark Delaware USA
Automatic Totalisators Limited Newcastle	69 Hunter St Newcastle</FONT< TD>
Automatic Totalisators Limited Victoria	412 Collins St Melbourne
Automatic Totalisators Limited Queensland	Winchcombe Carson Building 85 Eagle St Brisbane
Automatic Totalisators Limited South Australia	12 Currie St Adelaide
Automatic Totalisators Limited Western Australia	Capitol House 10 William St Perth
Automatic Totalisators Limited South Tasmania	T&G Building 113 Collins St Hobart
Automatic Totalisators Limited North Tasmania	93 Cameron St Launceston
Automatic Totalisators Limited New Zealand North Island	139 Albert St Auckland
Automatic Totalisators Limited New Zealand South Island	180 Manchester St Christchurch
Associated with Totalisators Limited	Prudential House, Croydon, Surrey England
Subsidiary - Page Manufacturing Co Pty Ltd	
Subsidiary Premier Equipment Pty Limited	
Subsidiary New Zealand Totalisators Limited	
Subsidiary Gladstone Electric Co Pty Limited	
Automatic Totalisators Hong Kong (1976 - this was added to the above document)	

Acknowledgements

- Thanks to Max Anderson, Frank Matthews and Max Sherrard, for allowing me to quote from the book *From Tote to Cad* published by Julius Poole & Gibson.
- Thanks to Peter Collier for providing the Tote Topics magazine numbers 4, 18 and 27.
- Thanks to Neville Mitchell for providing an audio tape relating his working life at ATL which I have transcribed and included under the heading *Neville Mitchell's career with Automatic Totalisators.*
- Thanks to Phil White for providing the letter confirming the Australian Design Award for the J33 Wagering Terminal and the J40 Mark Sense Reader.
- The photographs titled *Part of the ATL Toolroom* and *Part of the Assembly Section* were taken by Milton Kent and Son in Sydney, commissioned by Automatic Totalisators.
- The photograph titled *A Projector Indicator in the Lady Members Randwick* was taken by Photographers Hall And Co Sydney.
- Thanks to Frank Matthews, last senior partner of Julius Poole and Gibson, for donating the photographs titled *An example of a barometer style indicator* and *A Projector Indicator in the Lady Members Randwick* and *One of the Melbourne mini adder systems inside the pantechnicon truck* from his company photo album.
- Thanks to The Powerhouse Museum for the image titled *The world's first automatic totalisator*.
- Thanks to A+B+C Graphics for the background.
- Information has been extracted from Automatic Totalisators company magazines and documents.
- Thanks to Ian my 11 year old son (1997) who was a great help with the typing, the html and the images.

Comments and suggestions welcome to totehis@hotmail.com eMail

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Appendix VI - *"A sure bet for understanding computers" by Doran Swade – New Science 29th October, 1987*

A sure bet for understanding computers

The end of an era of dog racing in North London gives the Science Museum a prize that is certain to be odds-on favourite in helping to explain modern computing

Doran Swade

THE CLOSURE of the dog-racing track at London's Harringay Stadium on Friday 25 September marked the end of an era in the social history of the area. The site had hosted greyhound racing since 1927 and now Sainsbury's, the supermarket chain, has purchased it, at £12·5 million, for redevelopment.

The fate of Harringay Stadium might be less remarkable were it not for one fact: to the last, the track operated what is probably the only surviving example of the earliest automatic totalisator in Britain. Curators at London's Science Museum believe that the installation at Harringay is one of the earliest examples of an on-line, real-time data processing and computing system.

A "totalisator" is not, as might well seem, an Americanism for a worthy English word for an adding machine. It is an apparatus for managing a system of betting that the French devised around 1869, called the *pari mutuel*, which is still widely used on racetracks.

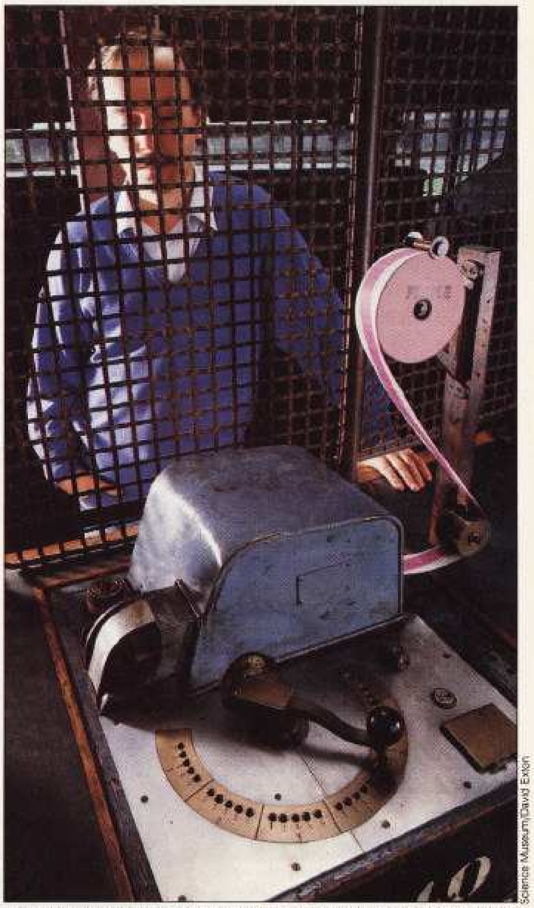
In the *pari mutuel* system of wagering, colloquially known in Britain as the "tote", bets on runners in a race accumulate to form a pool in which people backing the winners share in proportion to the size of their bet. A feature of the system is that the distribution of bets placed on the runners determines the odds against a runner winning. The odds, therefore, change continuously as betting progresses. The odds on which the stakeholder pays winning dividends are those that apply when betting stops at the start of the race. A person who bets with this system does so "blind" because neither he nor the stakeholder knows the final odds against the winners until the race begins.

The tote system differs from that of the bookmakers, who give fixed odds at the time that the punter places a bet, and these odds provide the basis of the winning payout regardless of subsequent changes. Because the size of the pool in the tote system is a factor in determining the winning dividends, the stakeholder operating the pool cannot lose. Bookmakers, on the other hand, are obliged to make good any shortfall between their total takings and the winning payout in the event that they offer ill-judged odds.

In many countries, among them France, New Zealand, Argentina, Canada and certain states in the US, the tote system has become the only legal form of betting. In other countries, bookmakers are allowed to compete against the tote for the punters' custom, either legally, as in Britain and New South Wales, or illegally, as in France, where the authorities grudgingly tolerate them.

While the customs of betting differ in various countries, it is common, at least in Britain, for the tote to offer three basic types of bet on a greyhound race: win, place and forecast. A win bet backs a single runner to come outright first. A place bet (in races in which there are six dogs) backs a single runner to come first or second. A forecast bet backs a pair of dogs to come first and second in a specified order.

To operate the *mutuel* system, the totalisator has to add up individual bets of different denominations on particular dogs, or combinations of dogs, and produce a grand total, or pool, for each class of bet (win, place, forecast) for each race. In a six-dog race, six dog totals make up the wins pool, six dog totals make up the place pool and 30 combination totals make up the forecast pool. (There are 15 pair combinations in a six-dog race, but because the bet specifies a definite order, that is to say AB or BA, there are two forms of each combination, thus making a total of 30.)

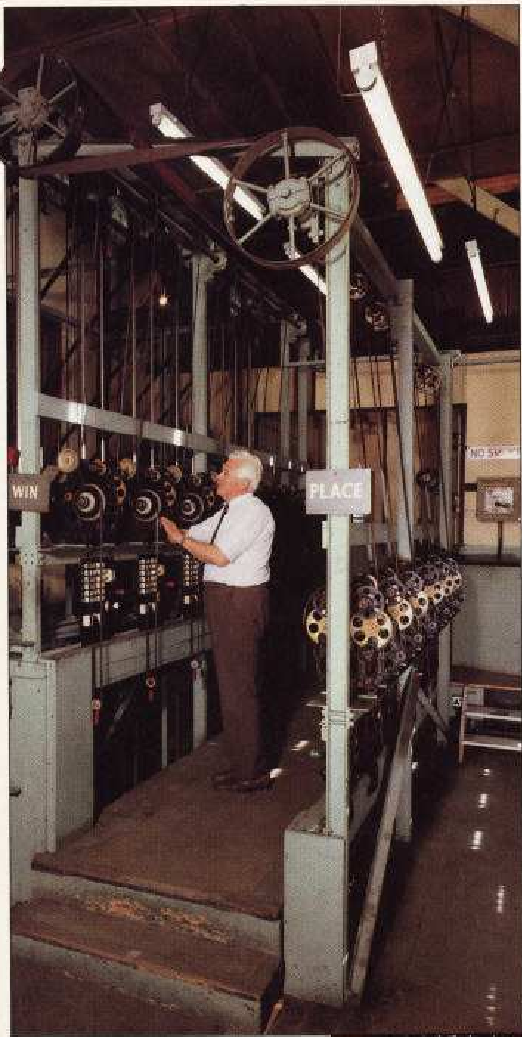


Science Museum/David Exton

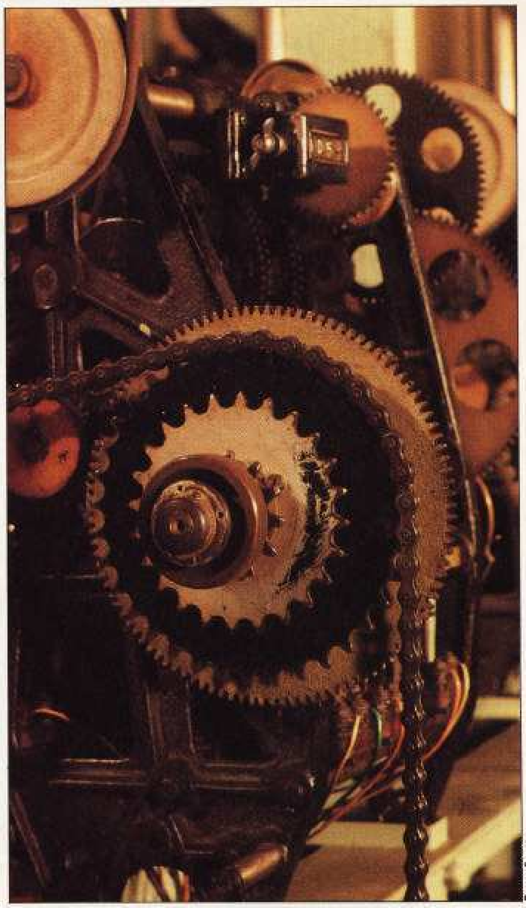
The Julius ticket machine for "forecast" bets relays each wager to the tote room, where it contributes to the pool

After each race, the stakeholder divides the pool among the winning punters in proportion to the size of their bets. The stakeholder is entitled to deduct up to 17·5 per cent as a commission before distributing the pool in the form of dividends. Until recently, he was also obliged to deduct a government betting tax of 4 per cent—a practice abolished early this year.

The totalisator at Harringay is a completely electromechanical apparatus for managing *mutuel* betting at the track. George Julius, a versatile and distinguished consultant engineer, developed the system in Australia. He is said to have remarked, not without humour, that the constant association of his name with the invention of the totalisator distracted



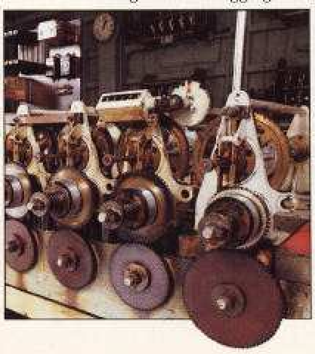
Science Museum/David Exton



Doron Swade

The tote room coordinates the accumulation and display of the pools and contains the machine which calculates the winning odds. The "odds machine", with its array of local aggregators (above), stands in the far distance

Tote engineer resets the odds machine between races. Below: Clutch mechanisms on the forecast grand total aggregator



Science Museum/David Exton

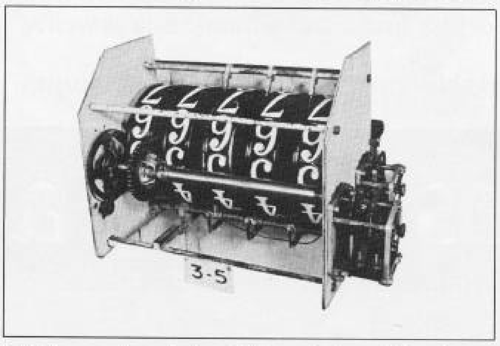
from his other achievements, including his prominence in Commonwealth scientific affairs.

The Ellersie racetrack in Auckland, New Zealand, installed the first "Julius", as it became known, in 1913. Organisers of the course at Longchamps, in France, introduced one in 1928 for horse racing. Britain introduced its first Julius in 1930, at Northolt, and on several greyhound tracks, including Harringay, in the same year.

The Julius totalisator with its automatic odds machine is the earliest on-line, real-time, data processing and computation system that the curators at the Science Museum have identified so far. The system is an extraordinary achievement both in terms of engineering design and information processing.

Julius designed his system at a time when other data processing systems required operators to prepare batches of punched cards which were then processed *en masse*—these systems were thus "off-line". People wishing to "compute" used, in general, mechanical calculators. The Julius features on-line machines which not only act as the source of input into the system but also produce, for the punters, tickets recording details of each bet. The centralised processing apparatus aggregates, in real-time, different sizes and types of bet into subtotals, for each runner, and totals, for each pool, and presents a continuous display of these amounts to the public on digital drum indicators.

Perhaps the most dramatic and ingenious device is the "odds machine". This continuously calculates the odds against winning for each of the six dogs as betting proceeds and displays these directly for the public on large clock-dials. The odds against a particular dog winning are given as the ratio of the total stake on all dogs to the total stake on the given dog. The odds machine both performs the necessary arithmetical division for each of six runners and displays the final dividend, taking account of the fixed proportion of the pool deducted as commission for the operators of the course.



Behind-scenes view of a drum indicator for the pool from forecast bets on trap 3 to come first and trap 5 to come second

The circumstances surrounding the introduction of the tote system into Britain in 1928 provide an insight into social attitudes to machines. Bookmakers were universally hostile to the tote because it represented competition. The two systems are quite different. The bookmakers have autonomy and are free to determine or manipulate the odds as they see fit, independently of each other, and are accountable only to their own need to prosper. The tote offers a system of centralised control, in which the stakeholder cannot lose, which is to say, takes no risk, and in which the odds are determined by collective action and are the same for all. Perversely, as it happened, a boycott by bookies at Windsor in 1926, in protest against the imposition of a betting duty, mobilised the racing authorities against the bookmakers and in favour of the tote, which they saw as a way of depriving bookies of a means of representation.

Moralists advocated the tote on the grounds that eliminating bookmakers from the track would purge racecourses of their worst elements—"the welcher and the organised gangs of thugs that still infest English race-meetings", as Bampton Hunt claimed in the *National Review* of May 1927. This would at least cleanse the term "racing man" of its pejorative connotations. Punters were divided and in some respects were at the mercy of the publicists. Some held that betting against a machine that could not err removed the essential attraction of pitting your luck or judgment against the bookmaker's. Others welcomed the tote's mechanical impartiality.

Winston Churchill, at the time Chancellor of the Exchequer, and thus responsible for the Treasury, welcomed the opportunity afforded by the tote's centralised control of information to make a tax on betting a workable proposition. It was the prospect of revenue from the Betting Duty and the convenience with which such taxation could be administered that was so attractive. Churchill legalised the totalisator in 1928 by an amendment to the 1853 Act for the Suppression of Betting Houses.

A great merit of the Julius is that it embodies principles fundamental to modern electronic data processing and implements them in a visually immediate way—part of the challenge that faces curators at scientific and technological museums who wish to exhibit technology to a wide range of visitors.

In the operation of the rotary distributors, for example, eight contacts, each connected to a separate ticket machine, are swept by a rotating arm so that each ticket machine is connected in turn to a single aggregator. In so doing, the Julius device provides a visible illustration of the principle of "multiplexing", which is central nowadays to many computer applications, whereby a single device serves several peripheral devices on a time-shared basis. The distributor solves the problem created by several machines competing for the attention of a processor at the same time—in computer jargon this is referred to as a "contention" problem—by consulting each ticket machine in turn—a process known as "polling".

Further visible demonstrations of the principles of data processing are provided by various measures that the totalisator provides to ensure "data security". For example, a mechanism locks the handle of the ticket machine while a bet is being processed and releases the handle only after an automatic hand-shaking exchange with the processing apparatus has been completed successfully. The arrangement prevents the operator from placing new bets until the system has registered and cleared the current one.

The Science Museum has dismantled representative portions of the Harringay tote, including the odds machine, and is taking them to an aircraft hangar at Wroughton, in Wiltshire, as part of the Computer Collection. The staff of the Science Museum also hopes to reassemble a slightly later machine, dating from 1933, which came out of service at Wembley Stadium last year, and to use it as a working demonstration in the Computer Gallery at South Kensington.

Harringay Stadium, with its unmodernised and partially derelict wooden stands, has lived under threat of closure for many years as a "danger to public safety". It is an irony that the long-standing uncertainty surrounding the future of the stadium kept the totalisator working until now. Track operators were not willing to invest in an electronic replacement faced, as they were, with an uncertain future. Although it is a sure bet that the Harringay Stadium will soon be demolished, the odds are that the Julius totalisator will not now be lost. □

Doron Swade is curator of computing and data processing at the Science Museum, London.

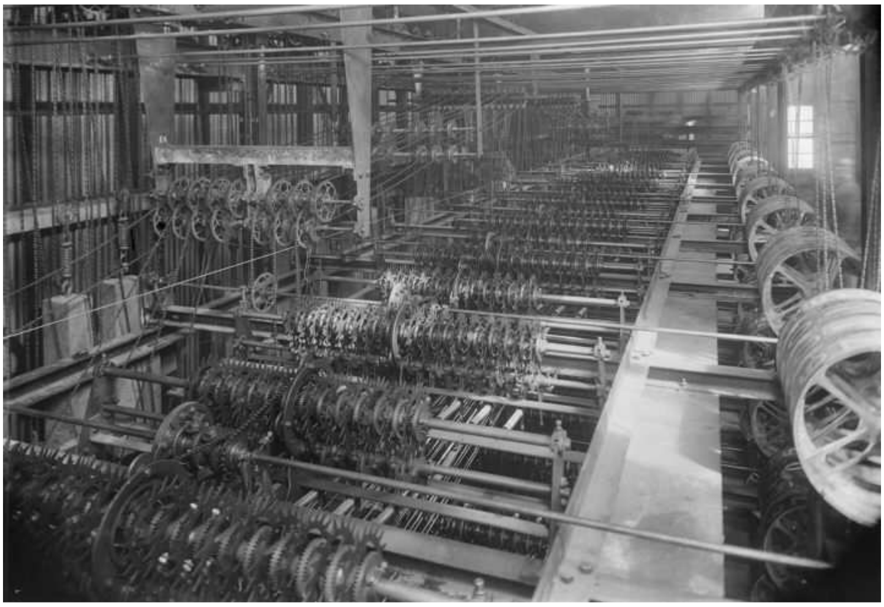
Appendix VII - *"Sir George Julius"*

Sir George Julius

Sir George Julius

George Julius was the founder of Julius Poole & Gibson Pty Ltd and Automatic Totalisators Ltd, and during his life he gained a wide reputation as a Consulting Engineer. He invented the world's first automatic totalisator. He was the first Chairman of Australia's Council for Scientific and Industrial Research, now the world-famous Australian Commonwealth Scientific and Industrial Research Organisation (C.S.I.R.O.). In 1929 he was knighted for his contribution to technology.

The world's first automatic totalisator



The following information on the life of Sir George Julius has been quoted from the book *From Tote to Cad* published by Julius Poole and Gibson.

George Alfred Julius was born in Norwich, England on 29 April 1873. Shortly afterwards his family emigrated to Victoria when his father, the Reverend Churchill Julius clerk in holy orders, was appointed Archdeacon for the diocese of Ballarat.

From an early age, George's mechanical inclination was obvious to his parents. He had an inquiring mind and skillful fingers and loved helping his father fix clocks in the small workshop at the back of the manse.

George Julius attributed his mechanical inclination to two generations of ancestors. As reported in the Melbourne Herald (22 August 1931):

"Any inventive capacity I may have may be attributed to inheritance through two generations. My father, who was one of the Court physicians in London, but had such a mechanical bent that he spent what money he had in backing any invention that had wheels on it."

George Julius entered Melbourne Church of England Grammar School in 1885. After matriculating, he followed his family to New Zealand where his father had been appointed Bishop of Christchurch. Here the Bishop demonstrated his continued interest in mechanisms by going up in a bosun's chair accompanied by the local Rabbi, to lay the finial on the rebuilt cathedral spire which had been shaken down by the earthquake of 1890.

In 1890, George Julius enrolled in a BSc(Mechanical Engineering) degree course at Canterbury College, University of New Zealand. Because of the contemporary boom in railway construction, he specialised in railway engineering and was the first such engineering student to graduate from this university.

Professional Career

George Julius commenced his professional career in 1896. He went to Western Australia to accept the appointment of assistant engineer on the staff of the Locomotive Department, Western Australian Government Railways. At this time the gold boom was at its height and the Department had many railway lines under construction. George Julius worked for the Department for eleven years and was promoted to chief draughtsman and then engineer in charge of tests.

In 1898, he married Eva O'Connor, daughter of C.Y. O'Connor, a celebrated engineer from Western Australia. They had three sons; the eldest Awdry Francis (born 1900) was later to become a partner in his father's firm.

While working for the Government Railways, George Julius conducted a series of tests on timber and wrote a handbook entitled Physical Characteristics of the Hardwoods of Western

Australia published in 1906. He followed this with the publication of Physical Characteristics of the Hardwoods of Australia, published in 1907.

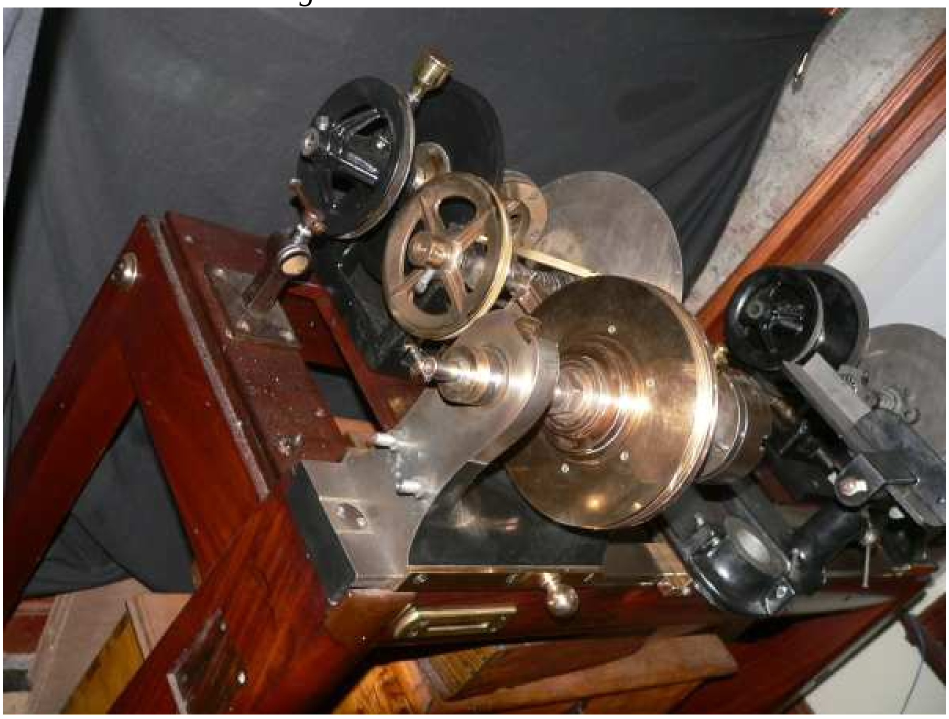
His research on hardwoods attracted a good deal of attention and led to a job offer from Allen Taylor & Co Ltd, a timber company in Sydney, as part-time engineer at an annual salary of 550 with the right to private practice. Accepting this offer in 1907 George Julius moved to Sydney, settling his family into a new home in Ocean Street Woollahra.

The following year he set up a consulting office in the Equitable Building in George Street. His practice, the first of its type in the country was immediately successful.

Automatic Totalisators

In whatever spare time he had, George Julius continued to work on the design for his automatic totalisator. Helped by two of his sons, he built a prototype in the workshop attached to his house.

George Julius' Evans and Sons Lathe



I have added the above image which is not part of the original document. The above lathe belonged to George Julius. He used it to produce much of his early tote work including the prototype mentioned above. It now belongs to George's great grandson Tony Shellshear. Tony is engaged in a rigorous project to return this lathe to its original condition. It has already undergone a major transformation to be in the condition shown in this photograph. The lathe was manufactured by Evans and Sons of London in 1830.

However, the automatic totalisator was not originally conceived as a betting machine, but as a mechanical vote-counting machine. Julius reported:

"A friend in the west conceived the idea of getting me to make a machine to register votes, and so to expedite elections by giving the result without any human intervention. I invented one that aroused some interest, and it was submitted to the Commonwealth Government."

When the Government rejected the voting machine George Julius adapted it as a racecourse totalisator.

"Up to that time I had never seen a racecourse. A friend who knew of a "jam tin tote" - a machine which kept a sort of record of tickets sold at each window - explained to me what was required in an efficient totalisator. I found the problem of great interest as the perfect tote must have a mechanism capable of adding the records from a number of operators all of whom might issue a ticket on the same horse at the same instant."

"I set to work on a machine that would permit the simultaneous addition, give instantaneous records, and would satisfy the requirements of any racecourse."

"The model was built in my spare time, and when perfected a company was formed and secured its first order for a machine at the Auckland(Ellerslie) Racecourse in 1913."

For more information on Automatic Totalisators go to <u>Automatic Totalisators Limited - later ATL</u>

During the Great Depression continuing design work on the tote kept Julius Pool & Gibson in the black when many professional firms were going under. Awdry Julius has commented:

"In 1929-33 I spent a lot of time doing design work and drawings on totes for Ascot, Canada, Chicago, Moonee Valley, Williamstown and Doomben, as well as alterations to the Randwick Tote, and additions to the Flemington and Caulfield Totes."

"I was also kept busy working on modifications to a new ticket issuer and the design of a portable machine for the United States."

The original mechanical totes were large, each one filling a machine room 10 X 10 metres. Awdry gradually took over all design work from his father and was responsible for research and development. He was elected chairman of the Automatic Totalisators Board in 1950 and was a member of the board until 1975 when the company was taken over by Smorgons Consolidated Industries, a Melbourne company.

I have added the following images here as Awdry Julius is mentioned above. These images are provided courtesy of Tony Shellshear Awdry's grandson. Awdry was presented with this medal from The Consulting Engineers Advancement Society for an outstanding contribution to Australian Engineering in 1980.

Awdry Julius' Consutling Engineers Advancement Society Medal

"Julius" Automatic Totalisators were operated until recently with the last one going out of service on 25 September 1987, at Harringay Stadium, a dog-racing track in North London.

In 2005, long after the above sentence was written I received an email from an engineer in Caracas. I was informed that the Julius tote there was still in operation. After 48 years of operation I was asked if I have any information on how to make adjustments to the system to bring it up-to-date!

Council for Scientific and Industrial Research

One of the great contributions made by George Julius to the well being of Australia resulted from his appointment in 1926 by Prime Minister S.M.Bruce(later Viscount Bruce) as chairman to the Council for Scientific and Industrial Research (CSIR) - forerunner of the Council for Scientific and Industrial Research Organisation (CSIRO). At the time of his appointment Julius said:

"Time was when commercial men thought of the scientist with the faint contempt natural in the practical man for the impractical visionary - and the scientist worked at his problem, caring nothing for the application of his discoveries to commerce."

"But this has all changed with the enlistment of science as an aid to the proper governance of a country."

In its early years before acquiring its own offices, the CSIR (CSIRO) met in a room at the back of Julius Poole & Gibson's office in Culwulla Chambers. (See image of Culwulla Chambers below)

As chairman of the Council related to primary production, it was therefore decided to concentrate on five main groups of problems. These were:

1. *Animal pests and diseases*
2. *Plant pests and diseases*
3. *Fuel problems (especially liquid fuels)*
4. *Preservation of foodstuffs (especially cold storage)*
5. *Forest products*

In the thirties Sir George Julius realised there was a need for more research work in secondary industry. Despite strong opposition from the Department of Defence to any extension of the activities of the CSIR, he presided over the establishment of a Division of Aeronautics and was appointed chairman of the important Commonwealth Committee on Secondary Industries Testing and Research in 1936. According to CSIR Chief David Rivett:

"The switch of the CSIR to secondary industry and into many aspects of defence planning probably stemmed from a visit by BHP chief Essington Lewis to Japan in 1936. He returned thoroughly alarmed at what he saw and urged the Lyons Ministry to act immediately to produce planes and fliers."

George Julius concurred. By 1938 he had convinced the Government that 143000 pounds would be needed for Aeronautical Research Laboratories to be built at Fishermans Bend near Melbourne. The Daily Telegraph, 7 April, 1945 recorded:

"Generally it is he (Julius) who has to battle for new funds, and getting money in lump sums is no sinecure."

"Sir George's value to the Council was in contact with politicians. He was flexible and extremely shrewd in his handling of the species Homo Politicus."

"Without his experience, ability to manoeuvre and thorough understanding of when to concede in appearance without surrendering the substance, the independent scientists might not have had so smooth a run through CSIR's first twenty years."

9th September, 2014

Mr. Owen Peake
Convenor, Engineering Heritage Recognition Committee
4 Islington Street,
COLLINGWOOD. V. 2066

Dear Owen,

Herewith the submission for the nomination of the Julius Totalisator for an Engineering Heritage Award. A complete appreciation of the ingenuity of this invention can be obtained by reading the appendices, which are part of the submission.

Although the heritage award would be granted for the totalisator, the proposed Interpretation Panel will acknowledge the invention, the inventor and the manufacturing company – all part of Australia's engineering heritage.

Copy of approval of the owners, the Brisbane Race Club is attached.

Yours faithfully,

Andrew Barnes
Chairman
Engineering Heritage Queensland

BRISBANE
RACING CLUB

9 September 2014

Mr Andrew Barnes
Chairman
Engineering Heritage Australia – Queensland
PO Box 864
SPRING HILL QLD 4004

Dear Mr Barnes

This letter is to confirm that as owner of the Julius Totalisator the Brisbane Racing Club grant permission for nomination of the Engineering Heritage Award.

We look forward to working with you in recognising the Julius Totalisator in our 150 year celebrations next year.

Yours faithfully

Neville Bell
Chairman

EAGLE FARM & DOOMBEN

BRISBANE RACING CLUB LIMITED
PO Box 817 Hamilton Central, Queensland 4007. Administration Office: Eagle Farm Racecourse, 230 Lancaster Road, Ascot, Queensland 4007.
P: 61 7 3268 2171 • F: 61 7 3868 2410 • W: www.brc.com.au

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