The Cerebral Cortex (above) is what distinguishes man from animal, giving us the innate ability to speak and think. It is therefore the most important part of our brain (at least in the field of psychology) because it is what makes us human. Sometimes referred to as "grey matter", the cerebral cortex is actually densely packed neurons. We were born with more neurons than we have now, but they were young and inexperienced. As we grew older, the neurons learn to work together forming what we call neural networks which form our memory. As we develop as humans through study and experience, we go through a slow elongated continuum shift in knowledge development. In many instances this continuum shift is jogged by major inputs, transforming the memory pattern into a swift paradigm change, generally with a totally new direction and new reserve stamina to pursue.
PRELUDE

The historic events and opinions expressed in this overview are the writer’s personal experiences gleaned over five decades of service within the South African lift industry and may therefore differ from the empirical factual data of peer colleagues and the individual multi-national lift companies. It is however borne out by protracted overseas studies in the UK, Europe, Scandinavia and even as far afield as Moskow. The main focus is to demonstrate the slow continuum development in lift engineering technology over approximately eight decades, compared to the expeditious paradigm shift in this technology in less than two decades since the millennium.

Late René Hassler

The iconic René Hassler served the South African Lift Industry for just on half a century. He is certainly credited as the longest serving CEO of any engineering company registered under the Metal Industries in South Africa. Building Schindler Lifts up as the second largest Sub-Saharan Multi-National lift company, René’s tenure of stewardship lasted from 1954 to 1993 when he finally retired. The number of managers and engineers that he mentored over this period is legion. It is therefore our privilege to dedicate this special release of the Educom to his memory.

Dr Theo Kleinhans

INTRODUCTION TO LIFTS & ESCALATORS IN SOUTH AFRICA

Lifts and escalators were installed in South Africa pre-1942, with the only standard available for design, manufacture and installation, being that of the original multi-national manufacturing company overseas. Manually-operated lifts (Waygood-Otis) were recently discovered by Peter Murray in the old Escom plant in President street when this was opened in 2015 for re-development, of which he became part of the resurrection team. The building’s doors and windows had been closed and welded up against any unauthorised entry for several decades. The installation date appears to be in 1908 when this building was erected. (See article featured in a previous Educom.)

We had recently visited a 1927 Express Lift installation in a PE hotel, now a heritage site. The late Graham Mould, ILIASA Chairman for the Eastern Cape, had taken photos of and was busy writing an article for the Educom before his untimely departure.

We also remember visiting Waygood-Otis escalators in the Elloff street ‘OK Bazaars’ in 1964 as part of our lift introduction training. Of note was the fact that they were still running with timber steps. We requested Otis for data on this installation, but regrettably their old cardex system was no longer available. Fortunately Peter Murray forwarded us photos of identical Otis escalators, taken in the USA recently, still running with timber steps almost a century later.

A special word of thanks to our ILIASA colleagues who regularly forward photos and articles for the monthly Educom journal editorials, and who contributed to this special issue.
The ancient Greeks are accredited for designing and building the first ‘elevators’, by using pulleys and winches, which led to the development of elevator technology.

The first written report of an elevator came in the 1st century BC when Roman architect Vitruvius recorded that Greek mathematician and inventor Archimedes, had built the first elevator as early as 235BC.

The Romans following in the Grecian footsteps, soon developed a parallel achievement in lifting loads mechanically. This architectural drawing extracted from Google, refers to development in Rome circa 95BC.

The most complex elevator system of the ancient times was made by Romans at the Colosseum Arena in 1st century BC, which hosted 24 elevator cages. They were operated by a ‘human’ force of 192 slaves. Teams of 8 slaves worked on a single winch driving an elevator cage. This then gave life to the complicated system of pulleys, levers and ropes which finally delivered their deadly cargo to the arena floor. In peak usage moments, all 24 cages could be brought up and down from the floor to the basements in a matter of seconds, raising gladiators and/or carnivorous animals.

Google in fact lists a picture of one of these lifts, with external counterweight so that the gladiators or animals such as lions, could not open the car gate from the inside. The cars themselves were counterweighted, requiring less force to move them up or down.

During the middle ages in Europe, elevators with designs similar to ancient Greeks and Romans were in use at several locations. For example, walled castles and secluded mountain monasteries used the ‘winch system’ to elevate people and goods to their inaccessible entrances. The age of ‘ancient elevators’ could therefore be said to have ended by the 18th century with the Industrial Revolution allowing the discovery of iron-screw mechanisms and safety devices which prevented fall. Even the first vestiges of ‘hydraulics’ and ‘electricity’ technologies came to the fore.

In 1793 Russian mechanic and inventor Vladimere created what is considered the first true elevator that lifted its cabin using iron-screw mechanisms. His elevators were installed in the two Russian royal palaces at Saint Petersburg and Moscow.

Wikipedia states that the Revolution in elevator technology began in earnest with the invention of hydraulics and electricity. Hydraulic elevators were initially used to transport freight goods over short vertical distances of two or three floors. They operated on the principle that a water pump increased the pressure of the main drive plunger or piston which pushed freight car upwards. This solution was not practical for the tall buildings of four to six floors which now arose and was soon replaced with hemp and then steel rope geared elevators with multiple pulleys. Henry Waterman of New York is recorded as inventing and commissioning such an hydraulic elevator in 1850 (Wikipedia).

Elisha Graves Otis designed the first elevator as we know it today. In 1852 he presented his patented discovery of the ‘safety device’. This device prevented the cabin or ‘car’ from falling if the main cable broke. Mr Otis demonstrated his in-
vention in New York’s Crystal Palace at the 1854 exhibition of technical achievements. A few years later his elevator was installed in the first building in New York City. Elisha Otis became the formally acknowledged discoverer of the modern lift or elevator, with all its modern safety features.

Elisha Otis gained his notorious publicity during 1854 New York World’s Fair where he presented his automatic break elevator with a demonstration in which a man with an axe cut the rope that held the elevator with Otis inside it. As the elevator started to fall its safety-gear energized and brought the elevator to an immediate standstill. After this demonstration of his ‘Otis Elevator’, orders started rolling in.

Three years after his first public demonstration, a 5-story department store in New York City installed his first steam driven public elevator. It proved to be such a success that many other stores followed them. In 1870, a 9-story building was built with an architecturally designed internal core structure, designed for the installation of the first truly commercial elevators. This moment marked the starting point of mass elevator usage in USA and the world. Toward the end of 19th century several key discoveries regarding the use of electricity with elevators were made.

While their initial commercial lifts manufactured by Schindler & Villiger in 1883 were water driven, the first hydraulic models for lifting heavy freight were shipped from their factory in 1890. With the invention of commercially supplied electric power in Europe, these hydraulic lifts were in turn followed two years later in 1892 by the first belt-driven electric lifts.

In 1899 Schindler electric lifts were designed to be equipped with iron worm gears and controlled by a pull rope operating an UP & DOWN contactor in the shaft head. In 1901 Alfred F Schindler took over the company from his brother Robert, deciding to make ‘Schindler’ a world renown product.

Thus the first modern electric passenger lift with automatic push-button control left the Schindler factory in 1902. In 1915 Schindler began manufacturing lift motors on a full production scale in Lucerne, that would supply the whole of Europe.

OTHER NOTED ELEVATOR INVENTIONS in the 19th CENTURY

Whereas this historic overview on lifts and escalators focuses more on the Lift Industry in modern South Africa, it is however requisite to research the origins and development of vertical and inclined travel in Europe, the hub of the Industrial Revolution. Although not finite, the following inventions impacted on the modern product ...

- In 1823, two architects working in London, Burton and Horner, built and operated a novel tourist attraction, which they called the ‘Ascending Room’. It was a giant lift cabin, designed to elevate paying customers a considerable height of approximately three floors in the center of London, allowing them a magnificent panoramic view of downtown.

- In 1835 an innovative elevator called the ‘Teagle’ was developed by the company Frost and Stutt in England. This elevator was steam and belt-driven and used a counter-weight to increase the available power, alternately requiring far less power to move the same heavy loads.

- In 1846 Sir William Armstrong invented and patented his hydraulic crane, primarily for use at the Tyneside docks for loading very heavy cargo. This quickly supplanted the earlier steam driven elevators. Exploiting Pascal’s law, he could provide a much greater lifting force to raise over a tonne at a time. A water pump supplied a variable level of water pressure to a plunger encased inside a vertical cylinder, allowing the level of the platform (carrying the heavy load) to be raised and lowered for as much as three floors. Counterweights and balances were then designed into the system to increase its lifting power.

- In 1845, the Neapolitan architect Gaetano Genovese installed in the Royal Palace of Caserta the ‘Flying Chair’, an elevator ahead of its time, covered with chestnut -wood outside and with maple-wood inside.

SCHINDLER LIFTS (1874) ACKNOWLEDGED as World No.2

The ‘Schindler Lifts’ company was founded in Switzerland in 1874, by Robert Schindler and Eduard Villiger who established the collective joint partnership Schindler & Villiger. Shortly thereafter, a mechanical engineering workshop was built on an island in the River Reuss in Lucerne, Switzerland, for the production of lifting equipment and electrical motors and machines of all types.
It included a light, two benches and a hand operated signal, and could be activated from the outside, without any effort on the part of the occupants. Traction was controlled by a motor-driven machine utilizing a system of iron toothed gears. He designed a safety system to take effect if the suspension rope broke - it consisted of a wedge pushing outwards onto the guides by a steel spring. This fact was not demonstrated and communicated to the world as in fact his invention preceded that of Elisha Otis by 7 years.

- In 1850 Henry Waterman of New York is credited with inventing the ‘standing rope control’ for an elevator.
- In 1877, J.W. Meaker of London patented a method for safe opening and closing of automatic elevator doors.
- In 1880 German inventor Werner von Siemens built his first electric elevator. This invention would apparently be taken over and developed further by Thyssen to the development of the ThyssenKruppe lift that we know today.

The escalator that we know today, was created in 1859 by the Jesse Reno from Massachusetts, USA. His invention used steam to power his stairway conveyor belt that moved at a 25° angle. His first industrial working model was built in 1895. The first commercial ‘moving staircase’ escalator is recorded as being built by Charles Seeberger in 1897 in cooperation with the Otis Elevator Company. Both Jesse Reno and Charles Seeberger then sold their manufacturing offices and patents to Otis Elevator Company in 1911. By the 1920’s Otis engineers created the first basic metal model of escalators, which design is still in use today, albeit with a far higher technology application.

Since ancient times, humans always searched for a way to transport goods and people easily from one place to the other. Carriages, ships, and other means of transport at that time did not help when smaller amounts of goods needed to be transported to a lower or higher elevation of approximately one-floor height within a building. Stairs were the only medium, although leading to many accidents with people tripping whilst commuting the stairways with these heavy hand-loads.

‘Elevators’ discovered in the 3rd century BC by Greek inventor Archimedes was ideal for larger heavier goods of a ton or more, but not for boxes of vegetables or even people. In other words a means of transport was required to move lots of goods up or downward over shorter distances and shorter periods of time. This resulted during the Industrial Revolution of the first escalator being designed fit for use!

One of the earliest uses of escalators is recorded as being used in the building of the Egyptian Great Pyramid at Giza. In its construction over 2 million stone cubes were laid on the tree trunks (steps?) and slowly rolled upwards at 15° on the artificial earth bridges that surrounded the building site. That continuous use of rolling wheels beneath the transported weight, according to engineering historians, became one of the first basic principles behind today’s escalators.

The first engineer’s drawing that we could find, illustrating the basic design parameters of an inclined escalator at that time.

Editors Note: A question that gets asked regularly is the connotational application of ‘lift’ versus ‘elevator’. Research of dictionaric definitions as well as Google and Wikipedia articles indicate the word ‘elevator’ to have been used almost exclusively in the USA and UK whilst ‘lift’ in turn is used mostly in Europe. It therefore appears to be a preference of use rather than indicating a technical difference.

THE FIRST ESCALATORS & MOVING WALKS

This Photo by Peter Murray, was taken a year or two ago in Macy’s Department Store in New York. Installed in the 1920’s, the photo depicts an Otis escalator with oak and ash timber steps … still running today.
Little more than two thousand years ago, the age of elevators begun with the first experimentations of Greek and Roman engineers and mathematicians who first tackled the problem of transporting people and goods over vertical distances. After centuries of experimentation in medieval Europe with various systems of hoists, winders, screws and gears, elevators finally started taking their familiar shape in the mid to late 19th century. With the advent of the Industrial Revolution, steam elevators powered by coal fire were designed for use in the factories and coal mines. Soon more streamlined and user-friendly elevators started appearing in public places, especially after Elisha Otis created his famous ‘safety elevator’ design in 1852.

The period between 1850 and the early 1900’s historically became one of the most innovative times in the history of elevators. One of the more intriguing designs during that time was the invention of the **Paternoster**, an ever-revolving passenger elevator that consisted of a chain of open compartments which usually carried only one persons per compartment and moved slowly at 0.3 to 0.4m/s in a loop inside a building.

The first Paternoster was built in 1884 by the engineering firm of **J & E Hall** in Dartford, England. Initially this kind of elevator was named **Cyclic Elevator**, but the name soon changed in England and Europe to a more speech-friendly **paternoster** ... (named after the first two words of the Lord's Prayer in Latin ‘Our Father’ because the entire unit’s design resembled religious rosary beads).

During the first half of 20th century, paternosters became very popular across continental Europe, especially inside factories and power stations, because they could achieve a much higher flow of passengers than ordinary elevators. They were most commonly found in public or government buildings, traveling with the average speed of just 0.3m/s, which allowed for safe entry and exit.
In the second half of 20th century (and especially after early 1970’s) paternosters became less and less used because of the rising risk of injury as factories became more safety conscious. The last time that the writer remembers using a paternoster was in factory buildings in the old Salisbury and Gwelo Steel factories in Rhodesia in the late 60’s.

Many countries today forbid their use because of these safety concerns. Regrettably, between 1970 and 1993 five people were killed by paternosters in the UK. The widely publicized 1989 paternoster accident at Newcastle University's Claremont Tower caused an 18-month close-down of all paternosters in the UK, prompting a detailed safety review of all working models, installing additional safety devices and even in some buildings, installing traditional elevators in their place.

Today, modern Paternosters are fitted with absolutely the latest state-of-the-art safety devices, operated completely automatically by computers (Hitachi models - Japan). The ‘paternoster’ unit installed in the Reserve Bank in the 1980’s in Pretoria has been mothballed and partially stripped for many years now.

Willem du Toit's photo above illustrates the bottom landing where a passenger would step off the Paternoster, failing which it stops immediately. Below is the top-floor drive, showing the ‘belt’ as it is driven by the sheave through a high-friction surface.

The oldest existing lift drive that we could establish in South Africa is this approximately 1908 ‘Otis’ lift installed in the old ‘1 President Street’ premises in downtown Johannesburg, now acclaimed as a national heritage site - shown right.

Note the name and load-plate below, specifically a maximum load of 1500 lbs or 700kg.

Bottom is the ‘driving gears’
A post-war tram in Rissik street - the H2 to Turfontein with its 420-volt overhead DC lines, also feeding the odd ‘Directronic’ lift in Johannesburg’s CBD. (Old family photo from 1946)

1920 < 1930 Schindler ‘Directronic’ Drives: In 1964 as part of our Field Engineering training, the late Bill Clifton had us adjust a ‘Directronic’, the oldest Schindler lift technology still in use at that time in the RSA. It was a 420 volt 2-phase DC, with power supplied from the Council’s DC power supplies operating Trams and Trolley busses since the late 1920’s to early 1930’s. A similar installation was also seen in Salisbury in Jameson Avenue next to the Jameson Hotel in the late 1960’s. Regrettably we could not locate any photos of these installations in our archives.

The oldest Schindler installations in South Africa were originally mostly installed under the Schindler-Hubert Davies Agency, with only the odd major installation handled directly by Schindler CH (Ebikon). Only in 1958 when Schindler bought out Len Chappell and Alf Elisio of Alpha Elevators in Booyens, did Schindler take over their factory premises with the full management of Schindler Lifts (SA) Pty Ltd, under the iconic management of the late René Hassler.

We recently inspected an old Telkom installation in Vermeulen street, Pretoria. Dating back to the early 1930’s. This Waygood-Otis installation was likewise covered in a previous issue of Educom. It is an early UMV Ward Leonard DC drive, and like most of the lifts installed up to 1942, was a geared drive. Whereas the majority of lifts installed pre-1960 were AC technology, with their controls mostly being simple relay logic, modern technology for that period was DC Ward Leonard drives, such as the Otis UMV seen below left.

Above right is the world-renown Otis position indicator ‘dial’, whilst left is its drive, all worthy museum-pieces.

Otis’ UMV (above) in Somerset House (Pretoria)

Above right is the world-renown Otis position indicator ‘dial’, whilst left is its drive, all worthy museum-pieces.

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ILLASA Chairman Ronnie Branders sent us these photos taken in Cape Town last week of the 1936 ‘Exchange House’ lift installation by Way-Good Otis, still running in original condition without the benefit of an upgrade … after 70 Years!
The drives encountered in South Africa from pre-war dynasty to the millennium included …

- AC (geared) Single speed < 0,5 m/s
- AC (geared) Two-Speed Cascade (dual motors) with AW-type resistance starter < 1,0 m/s
- AC (geared) Three-Speed motor with take-off speed, switching to high-speed and again to levelling-in-speed, but with additional final micro-levelling-in-speed, especially for hospitals (beds & trolleys lifts) and post-office trolley lifts that all required very accurate floor-stopping levels < 1,2 m/s
- AC (geared) 3-Speed Dynamics (mono-bloc start and high-speed windings + level-motor for accuracy < 1,0 m/s
- DC (geared) Directronic 420 volt Council Tramway supply < 1,2 m/s
- DC geared Ward Leonard drive with own generator set < 2,5 m/s and gearless < 6,0 m/s
- AC geared Thyristor Drives < 1,75 m/s

### 1941 FACTORIES, MACHINERY and BUILDING WORKS ACT
(Introduced 1942)

Major Multi-National Lift and Escalator Suppliers

With the DoM (Department of Manpower) now formalising their occupational safety requirements in the engineering manufacturing industry in the Union of South Africa, the 1941 Act was introduced, becoming effective in 1942. This Act for the first time included the ‘C’ Lift and Escalator regulations. The Only multi-nationals active at the time were Otis, Schindler and an Express agency, with the latter withdrawing soon afterwards.

At this stage DC ‘gearless’ drive lifts were introduced from the USA (Otis) and Switzerland (Schindler), each powered by its own DC exciter set. These were originally running from 2,5m/s but soon rose towards the 5,0m/s level. They were installed in such ‘A’ grade commercial buildings as Sanlam, Mutual, Volks-kas and Barclays, etc.

Schindler DC MG-set.

Groups or ‘banks’ of 3 to 5 identical lifts began to materialize in these corporate buildings. Their technological handicap appeared to be the multiplexing of the control parameters, requiring multi-banks of row-upon-row of relays, hence the very large original motor rooms, and in many cases dual-floored motor rooms.

Our introduction to lifts and mammoth-size mine-winders started in 1958 when we joined Stilfontein Gold Mine as trainee electrical engineer. The new Margaret Shaft ‘Cope Winder’ had just been commissioned, the first automatic mine winder (apparently) in the world. Granted bursaries, six of us joined an illustrious ‘miners’ electrical engineering class at Wits University where we studied light-current electrical engineering under Prof. Aspinall. He had just completed his ‘Aspinall-device’ - a ‘Lilly-type’ over-speed governor for mine winders, two of which were installed in Stilfontein’s Margarette Shaft mine winders. They operated between 1400 ft/min (7,0 m/s) for passengers and 2400 (12,0 m/s) for goods and rock. The winder was driven by an equally massive Ward Leonard generator set, with a liquid starter (acid-mix) mechanically operated to keep the current manageable on both acceleration and deceleration under full load hoisting conditions.

Schindler DC MG-set.

Seen above, are the selector and control panels for one Schindler lift, requiring five-times duplication for a bank of say 5 similar lifts. Such a group would then have a central call-selection and despatch panel as well. With up and down call-buttons on every landing in the building, this equated to 75 call relays for a 25-floor building.
Recognised Voluntary Association in terms of Section 36(1) of the Engineering Professions Act.

Educom fulfills a requirement for Continued Professional Development as specified in the Act No.46 of 2000.

Below is the approximate 5m rope drum which houses several thousand feet of 38mm steel wired rope which the riggers had to inspect weekly since the cages hang on only one main rope for their ± 1150m travel (almost 3500 ft in those days).

A condition of our mine study bursary was that all six of us had to work a minimum of 2 weekends every month, cleaning and polishing Winder control contactor points. Weekdays were spent at Wits with classes during the day and lab-work in the evenings between 6 and 9 p.m.

With the assistance of Wits lab-guru Mr Doman, we spent odd Saturdays in the ESKOM House lecture theatre, with practical tests on their ‘emergency’ generators and the Way-good Otis lifts that were commissioned for them to run on the emergency generated power; for when the Eskom supply power was tripped. Eskom House in 1958 was the tallest building in South Africa at 21 floors, serviced by a group of triplex passenger lifts and a goods lift, running at 3.0 m/s.

These mine winders together with Otis, was the world’s bench-marking gearless Westinghouse-technology, copied by the rest of the world at that time. Was it perhaps poetic justice that Schindler in later years bought out ‘Westinghouse’?

Our ‘electronics’ of the day at Wits revolved around ‘valves’, where in fact the writer’s practical graduation task was the building of a ‘Superhetrodyne’ valve-driven short-wave radio receiver. Circa 1959, Prof Aspinall told us of the new breakthrough in Germany of a ‘transistor’. It was proposed to revolutionise multi-circuit controls.

When one thinks back to the ‘Directronic’, it used massive mercury-arc rectifiers as well as power-drive valves. If you misjudged a start setting, you easily blew two valves. At some R225 each in those days, two valves equated to more than a month’s salary, but all considered part of our learning curve.

This pre-war-type emergency MG set in Eskom House in 1958 that we carried out practical tests on, could drive one of the Otis Elevators at a time. Note the water-cooling on the diesel engine which ran on ‘Voco’ (power paraffin).

<table>
<thead>
<tr>
<th>THE GOLDEN LIFT SALES’ YEARS between 1960 and 1975</th>
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<tbody>
<tr>
<td>Lift Geared &amp; Gearless Traction Drives</td>
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<td>- General Development</td>
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<tr>
<td>Having joined Schindler in April 1964, every new installation (as far as I knew) was either Schindler or Otis, with 15 to 25 floor buildings being the norm - especially tenement buildings in the Hillbrow/Berea belt in Johannesburg;</td>
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The Eskom House lecture room used by the Wits students on the occasions that we had lectures given there.

The architect’s official sketch of the 61m tall Eskom House built in 1955 on the corner of Main & Rissik streets. (Regrettably demolished some 15 years later)
Moore Road and Berea in Durban was no exception. Schindler had at this stage released their new ‘Dynator’ Ward Leonard DC geared drives to operate up to 2.5 m/s, seen below on previous page. This was developed in line with earlier gearless models at the same speed. At the same time new DC gearless drives were developed to achieve 5.0m/s.

Seen below is an Otis UMV DC Geared machine from the same vintage. Note the selector tape driving a quasi lift car selector seen right in the photo, which regulates the calls, the speed and the final slow-down and stop - Still in service today.

Regrettably the hydraulic’s maximum contract speed was a slow 0.6m/s compared to the AC Two-Speed traction machines at 1.0m/s. It however gave low-rise building owners a more affordable lift installation option, especially since it did not require a standard roof-top motor room, where the hydraulic drive now be housed next to or even a reasonable distance away from the lift shaft, mostly at its lower level.

Jack brought in traction drives as well, in AC and DC configuration, but never reaching the heights of the Otis and Schindler sales. The Sabiem product however formed an important inset into the South African lift market, especially since the Sabiem controls were simple, robust and easy to maintain for both hydraulic and traction drives.

To illustrate Express Lifts’ presence in the RSA, is this identical vintage DC Ward Leonard geared drive below, photographed in PE on a very recent inspection - Still in immaculate condition today.

Noticeable on all three above makes of Otis, Schindler and Express, is their daily use, with yeoman service after more than half a century. Most surely an indicator of the multinational’s lift design and manufacturing quality of yester-year.

Hydraulic Drives

Jack Ligeti had during this bonus period for Otis and Schindler, started up the ‘Sabiem’ Italian lift agency in South Africa, focussing on low pressure GMV hydraulic drives, operating at under 5 kpa pressure, for buildings up to six floors. These hydraulic lifts steam-rollered low-rise lift sales in RSA.
Schindler countered the Sabiem GMV hydraulic drive with their higher pressure Beringer hydraulic drives at around 40 kpa pressure, but the rides were in general not as smooth as the lower pressure GMV drives. A further downside of the Beringer was the heat generated by the higher pressure pumps and pressure-orifices, requiring oil-coolers to be installed at additional cost to the Client.

At this stage circa 1980, the Otis and Schindler gearless drives of up to 6.0 m/s were considered the ‘Rolls Royce’ of lift drives world wide. The limitation in contract speed seemed to lie in the lagging ‘control technology’. Schindler’s controls at the time were called ‘Supermatic’ requiring extensive relay banks for effective control.

With the slow continuum shift in lift control technology development in the 1950’s and 1960’s therefore, it was only a matter of time for ‘Solid State Electronics’ to see the light in the USA and Europe. Only in the late 60’s and early 70’s were they released in South Africa. Schindler called these solid state controls ‘Aconic’ and Otis ‘MS 300 and Gamma-D’. But these controls became problematic in multi-lift banks with their extensive lift operational requirements such as floor-zoning, Up and Down peak periods, etc.

Another technological handicap in our opinion was that only ‘mechanical’ selectors were available for use by the market leaders. Otis utilized steel selector tapes (seen on Page 11) whilst Schindler utilized steel selector ropes to drive their selectors (seen below). In both cases a ‘mechanical selector’ was driven, representing the lift car’s position in the shaft. With this configuration, banks of lifts could individually be selected for an ‘up’ lift to an ‘up’ call; conversely down to a down, or down to up, etc. Floor ‘zones’ were also introduced to foresee lift demand during peak periods, spaced in up to three zones, spread approximately 6 to 8 floors apart.

At this early stage many Otis’ position indicators were the rotating dial-type positioned on every floor and driven mechanically by an extensive rope operating multi-floor CPI’s. With the development in ‘solid stated electronics’ came the introduction of bi-stable switches and photo-electric cells. These were fitted on the lift cars and switched by cams fixed at predetermined positions in the shaft. This gave an immediate cost-saving on the now obsolete mechanical selectors (seen above).

The same (parallel) switching was used for the car position indicator, justly relegating the Otis mechanical dial to the museums as they had been the technological bench-setters for many decades.

Importantly, this new electronic technology allowed for closer and faster selection of lift speeds, especially on high-speed drives. A 5.0 m/s gearless-drive lift would only select this speed for calls of more than 4-floor distances. For closer calls it would select 2.5 m/s for 3 floor-calls; approximately 1.2 m/s for 2-floors and 0.75 m/s for one-floor calls. Acceleration and deceleration could now be optimally set for faster turn-around trip times, yet keeping lift-user comfort in perspective.
Recognised Voluntary Association in terms of Section 36(1) of the Engineering Professions Act.
Educom fulfills a requirement for Continued Professional Development as specified in the Act No.46 of 2000

1984 MACHINERY & OCCUPATIONAL SAFETY ACT

1984 Saw the introduction of the MOSAct, the first such Act since 1941.

Still a slow Continuum Shift in Lift Drive & Control Technology Development

The slow continuum shift in lift technology can be likened to the slow appreciation of safety standards from the 1941 Act to the 1984 Act ... Four Decades! The electronic research pace however picked up and soon saw the appearance of PLC controls (Programmable logic controls) where E-proms and E-roms could be engineered for multi-function requirements. This surpassed the ‘Aconic’ with its banks of series/parallel transistors. PLC were still however limited in their range and required 2 or 3 PLC memory units to be paralleled in order to have sufficient memory for multi-functioning. As a result, their time-span was doomed for lift-controls. A serious handicap was their limitation to duplex banks only, with 3 and 4-car groups beyond the PLC’s achievable scope.

In the above illustration, this PLC already consists of a double tandem unit on a duplex drive (two lifts). Note the wiring pulled out in fault-finding as also extra components added to ‘make’ the PLC work for this lift. Actually a hopeless situation because of the poor training of servicemen in this instance ... All to the detriment of the Customer!

Regrettably, the Computronic had its limitations for larger more complex installations, but was possibly the best affordable upgrade option on medium and low-rise installations not exceeding two lifts per group. It certainly surpassed the Thompson Millar and O’Thompson controllers imported from the USA.

AC ‘Thyristor’ drives were introduced in 3-speed configuration, whereby a medium-speed 12 < 16 pole starter winding thyristor-driven started the lift moving; switching over to 4-pole high-speed windings within the same motor casing. On stopping, a ‘brake-motor’ was initiated which electrically absorbed the revolving kinetic energy of the rotor, slowing the motor down almost in linear deceleration to a final stop at accurate floor level.

Note the special cooling duct to the main motor, where excessive heat is generated through the brake-motor in its regenerative slowing-down phase.

Seen below (left) is a very recent photo of a new Alan Bradley PLC in a simplex controlled lift, installed by an independent service provider. This implies that certain lift service providers are still installing PLC controls on low-rise simple-lift drives.

At this stage, Schindler developed their own local ‘Computronic’ control, with Billy Clifton and the late Daniel Fischer the brains behind the development. It was in essence a solid state control utilised almost entirely for lift upgrade projects where the old relay logic had become obsolete or too troublesome, all with locally sourced electronic components.
Unfortunately this regenerative braking was thermal in operation with excessive heat generated in the motor. The motor and motor room had to be forcibly cooled down to an acceptable level. With a ceiling speed of 2,0m/s, this technology could not be applied for higher gearless speeds, which was a technology handicap.

A further down-side was the regular blowing of ‘thyristor’ caused by break-down faults. In each case all three thyristors had to be replaced at several hundred rand cost per set.

The concomitant discovery of the ‘Micro-processor’ with its enormous think-capability compared to the diminutiveness of its size, heralded a revival for lift control engineers. They could now reach new levels of lift selection operations within guaranteed safety stopping parameters. Banks of lifts immediately grew to 6- and even 8-car groups. Heights of travel increased dramatically, where Otis already bench-set RSA with the Carlton Centre at 52 floors and 6,0m/s contract speed the perfect example in South Africa and the first mega-lift sales contract.

Express Lift in the Kodak Building in the USA had launched the first standard passenger lift with dual decks, similar to the gold-mine winders with two and even three decks ... all to boost passenger movement. Kodak claimed a high 7,5 m/s top speed. At the same time the London underground Metro station lifts (especially), now had massive 80-passenger lifts for people movement over 3 to 4 long-travel floors, but still at a lowly 1,5 m/s maximum speed.

Seen right is a late-model micro-processor drive. Note the otherwise almost empty control panel, mostly due to only a few relays and slave contactors required to drive this lift.

These latest drives are almost entirely AC V3F: variable voltage variable frequency technology, utilising less power and therefore smaller contactors, mains switching and power cables.

With the micro-processor came new grey-coded signals, buttons and ancillary equipment such as the below multi-lift indicator.

DC Technology takes a Back Seat

Expensive to manufacture and install, ‘DC Ward Leonard’ technology has now been shelved in favour of a much more cost-effective AC V3F option, of which Kone became the market leaders. Generally running with the same high contract speed as the DC, yet easier to control through micro-processor technology; as well as saving the need for a motor room.

A boon for lift Field Engineers is that they no longer have to replace and seat new carbon brushes to both MG set generator and main drive motor commutators, after which the brushes had to be seated and the compounding reset for more accurate floor levels.

An immediate bonus with AC V3F over DC Ward Leonard drive technology was ...
- that the drive was in geared and gearless configuration
- Allowed an immediate saving on manufacture, installation and maintenance cost
- Perhaps above all, had no brush-gear since the motor utilised permanent magnet technology.

**In retrospect, Micro-Processor and AC V3F technology can now rightly be labelled a paradigm shift in lift engineering development as it has revolutionised lift engineering within little more than the last decade as compared to the whole previous century of continuum lift technological and regulatory safety development.**

Kone’s bench-mark setting ‘MonoSpace’ was soon followed by Schindler’s ‘Smart MRL’ and Otis’ ‘Gen-2’. The speed of these MRL’s (motor room-less) is however limited in general to 1,75 m/s. Kone then took the MonoSpace a step further with tandem motors mounted together on their MX Series for high-speed commercial lifts up to 6,0 m/s in South Africa. Compared to the previous ‘Westinghouse’ technology machines, these latest variants are at least a third smaller, with power consumption almost halved … but with the same power output!

**This Kone MX Series AC V3F gearless machine is running at 5,0m/s with 23 passengers @ 1610kg capacity, and serves the equivalent of 30 floors. The photo right shows two identical stators fitted together in tandem on each side of the drive sheave, effectively reducing the mechanical size by almost half.**

**Hydraulic Drives took a Back-Seat after 1990’s … but are Back In!**

AC V3F technology cost savings appeared to have now pushed hydraulic drives into the back-ground after 1995 as MRL’s took over, allowing for a motor-room less drive at a far superior contract speed of at least 1,0m/s, but generally 1,6 < 1,75m/s … compared to the hydraulics’ maximum speed of 0,63 m/s.

A bonus (especially for hospitals and commercial buildings) …

- was doing away with the omnipresent ‘oil-smell’ associated with hydraulics - *Seen below is the oil-tank which regularly leaks oil, which smell in turn permeates the whole building!*

- Hydraulic installations now being modernisation-friendly for AC V3F MRL’s as the existing shaft -head overruns in most cases meet the minimum space for an MRL

- Round-trip times of AC V3F almost halved that of hydraulics due to its linear acceleration and deceleration in both directions.

The upside of all the above possibilities, is the opening up of the lift-sales market for the first time to local independent lift service providers who likewise now import directly from China, where ‘generic’ lift manufacturers are only just too keen to sell to anyone. Apart from Mitsubishi (Japan), the other multi-nationals all utilise China as an import base for their run-of-the-mill lift and escalator installation equipment.
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Shown above is a perfect example of total local manufacture by local independent Nu-Line. This photo taken very recently, illustrates a private home installation in Fresnaye, Cape Town, where the architect has really achieved an eye-catching installation.

Below is an equal eye-catching hydraulic from Nu-Line, where shaft-head space was the major criteria, motivating the architect to opt for hydraulic drive.

Like the rest of the universal lift technology development, especially in Asia-Pacific, ‘Hydraulic Technology’ has gone through a paradigm shift in aesthetic and technological development. The above examples visited recently, are a case in point. Right down to the design in oil seals and the polymers used, could we not even detect the inkling of an oil smell. A concomitant resurgence in service quality will hopefully ensure that these installations remain as bench-mark units.

Schindler, Otis and Mitsubishi replied to the Kone MonoSpace MRL with their own products. Respectively these are ‘Smart MRL’, ‘Gen2’ and ‘Elenessa’. Melco’s latest model is called ‘Nexiez’ MRL. With Kone’s claimed over half million MonoSpace sales internationally, they took the major historic share. Importantly in South Africa, Schindler and Otis now mostly source from Asia Pacific (China), whereas Mitsubishi stays with Japan, where their quality is assured.

Innovatively, Kone originally introduced their MonoSpaces with 10.0mm softer steel ropes, immediately reducing rope-sheave diameters from the standard ± 600mm down to 410mm. Their latest models now even boast 6.0mm steel cables.

Otis and Schindler innovatively introduced their MRL’s with steel and polymer-latex belt drives of between 4.5 and 6mm. With the EN81 international requirement for drive sheaves to be 40 times the rope or belt size, Otis and Schindler have now reduced their sheaves to an all-time small of approximately 160mm.

Seen above are examples of Otis and Schindler’s MRL, with the machines situated in the shaft-heads, along with the controllers and frequency converters in very close proximity to the machines, to reduce unnecessary screened power cables of length and cost, making these ideal for upgrade projects.

LATEST MULTI-NATIONAL DEVELOPMENT of AC V3F DRIVES
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The first moving walkway was presented to the public during the World Columbian Exposition of 1893, in Chicago, Illinois. This debut offered two variations on the theme of horizontal automated transport – one that hosted comfortable seating, and one where passengers could walk or stand. A second public showcase happened in 1900 during the Paris Exposition Universelle, offering a different design, the moving walkway was also known as moving sidewalk, horizontal escalator, movealator, travelator, autowalk and slidewalk.

After this interesting period of development, lift engineers and architects developed plans for building and installing moving walkways in various public spaces over Europe and North America. One of the most famous proposed systems was intended to be implemented in Atlanta’s subway system in 1925, named “Continuous Transit System with Sub-Surface Moving Platforms”, but it was never manufactured because of cost inhibitions and shortage of technology for the rubber matting required for such extensive travel distances.

The first operative public moving walkway in the United States was created in 1954 inside of the Hudson & Manhattan Railroad Erie station in Jersey City, NJ. This walkway named Speedway, was 84.5 meter long and it operated at the speed of 0.66 m/s (2.4 km/h). Four years later in 1958 another moving walkway was created in Love Field Airport in Dallas, but it sadly caused the death of the 3 year old in 1960 and was decommissioned.

These three 35° escalators in Asia Pacific, allow for the two extreme escalators to be consistently designated up and down, whilst the central unit is switched according to peak periods in up or down direction to assist traffic flow over the peak period.

Above is a typical movable scissor lift seen at our airports, where travel-bags and food have to be hoisted up to the airplane where ever it is parked at the airport. Operated hydraulically, these units can reach substantial heights. Inside factory plant and even such places as universities, are scissor lifts installed permanently.
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LATEST DEVELOPMENTS in LIFT COMPONENT MANUFACTURE SEEN in SOUTH AFRICA

Very recent duplex passenger lifts, architecturally designed to mix and match heavy steel and glass inside an Mthatha mall, and that by local Cape Town independent.

This very classic ‘Platform’ lift was recently installed in Driefontein, Vanderbijl Park. With 500 kg load it is designed to take two wheelchairs simultaneously, serving two floors. The Architects required Nu-Line to assist them with this singular aesthetic design.

Nu-Line from the Cape completed this funicular in Windhoek, Namibia. The travel is 34m at 0.3 m/s with 450kg load.

WITTUR ELEVATOR COMPONENTS

Few people appear to be aware that international lift component manufacturer ‘Wittur’ has become a generic lift component supplier, manufacturing in Europe and China. We lately notice the EN81 regulated ‘Wittur’ labels on a multitude of door drives, door locks, safety gears and over-speed governors … and this on installations of Otis, Schindler and Kone. It is this sort of generic manufacture that allows lift sales’ costs to be lower because of the numeric supply and demand factors.

1000kg Access-Only Goods Lift installed under SANS 1545:5 in McDonald’s by Nu-line. Total local manufacture, especially the car steel picket gate, landing galvanized shutter gates, and the car internal finish with slam-ribs for protection from the heavy trolleys. Note the quality of manufacture and installation. Floor stopping levels were spot-on every time irrespective of load – absolutely a boon for the trolley wheels on the aluminium sills.
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Seapoint MRL by Nu-Line. Absolutely a must-stay in Cape Town with this seavista view of the sea and Mouille Point. Note the glass shaft with rimless glass landing door opening onto the roof view-point.

Schindler’s latest AC V3F gearless MRL in rope drive, with the frequency converter in close proximity.

The lift pit for this chain-driven indirect hydraulic drive. Note the latest technology piston diameter compared to the 300 or even 380mm of yesteryear Beringer and GMV. Possibly the seals will hold longer now and leak less.

Latest rope-brake clamps for older installations ????

Recent-commissioned 5-Ton Access-only Goods Lift in Booyens, Johannesburg, with a local service provider’s hydraulic drive - The latest technology for this large indirect chain drive.

A Schindler International directive in the interest of general safety requires that Qualison Ultrasoundic testing be carried out on the main drive shafts on all existing 3-pedestal-bearinged machines world-wide.
Very recent new Home lift or ‘wheelchair’ lift: Above left is the control panel for the direct-acting hydraulic drive (seen right) in a glass shaft. Whereas mostly imported, the installation was completed by a local Johannesburg independent. Note the small oil reservoir, clean hydraulic piston and safety buffer (arrow) to ensure the human safety-cube in the pit.

Above left is Melco (SA)’s latest high-speed heavy-duty AC V3F gearless machine, a most worthy competitor to Schindler’s similar model. Right is the new AC V3F gearless (slim-line) machine which in our opinion, is an equally worthy competitor to the Kone permanent magnet MX machine. Most people have forgotten that Melco (SA) sold their first Mitsubishi lift installation as far back as 1969, thereby joining Otis, Schindler and Sabiem as one of the Big Four multi-nationals in the RSA. Only in 1999 did Melco (SA) become a wholly owned subsidiary of the Mitsubishi Group of Companies. Thyssen Krupp (SA) joined the group at a later stage, but recently sold out to Otis (SA).
A group of Mitsubishi’s lower speed AC V3F installations at the more general speed of 1.6 < 1.75 m/s and medium-rise travel can equally meet the requirements of a prime office block such as this installation above, which must have one of the lowest break-down figures in the country.

Architecturally where steel and glass are matched for that ‘mechanoset’ feel, Melco (SA) is up there amongst the best of the best.

CCJ Elevators (Martin Jessen) is one of the newer independents on the block, who specializes in Home-lifts, Stair-lifts and Palmform-Lifts. Above is a ‘Wheelchair’ lift installed at Pretoria University - SANS 1545:3

Seen here is a typical example (in final stages of fitment) of a self-supporting glass & steel structure to an existing building, requiring minimal wet trades. This ‘Lifting Platform’ installation was installed at the University of Pretoria by CCJ Elevators in a matter of days as opposed to weeks. It comes as a complete kit from overseas. The installation standard is SANS 1545:4

Intercoms have become a contentious inspection item, mainly because of the interpretation by AIA inspectors of when each developing intercom standard became the enshrined standard. Please see Willem du Toit’s technical bulletin earlier this year, explaining when the various requirements became fact.

The bottom line is that every single lift must be fully standard’s and regulatory compliant by March 2020, as per the March 2015 communication by DoL. Owners will therefore have to pay for this sooner or later, irrespective of whether your lifts were installed under the 1941 Factories & Works Act or not!
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Bonnie quite regularly receives inquiries from Owners or Developers who only require a very low-rise wheelchair platform such as this example (left). The travel in this case is 1220mm, with the mandate to take a standard wheelchair and 120kg total load. This is a no-nonsense unit installed by CCJ Elevators under SANS 1545:4.

Whereas the rationale for this historic overview was more of an informatory than an empirically technically correct nature, readers may request more pertinent information from Ms Bonnie Peden as regards the supplier details (where possible).

Of importance is the absolute necessity for every Owner and Developer to have copies of the latest OHSAct amendments and SANS standards, for you are by Law the responsible judiciary person for that installation. A spin-off of this requirement is the continuous claim by Owners that they are not aware of these requirements ...

**IGNORRANCE OF THE LAW IS NO EXCUSE!**
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Our overview would be incomplete without a mention of ostensibly the world’s most modern building costing some $4.1 billion and serving 155 floors. The high-rise Otis elevators run at a maximum 10,0 m/s. What a far cry from the first commercial elevator installed by Otis in 1853 … the ‘488 Broadway’ in downtown New York.

Shown left for comparison with Kone and Melco’s latest heavy-duty high-speed machines, is the latest Schindler’s AC V3F Gearless, serving upwards of 25 floors at 5,0 m/s speed and 20 persons load. Regrettably, we were unable to source similar photos of the latest Otis machines.

**WORLD’S FASTESTS COMMERCIAL ELEVATOR**

As reported in the October issue if Educom, Mitsubishi now lays claim to the fastest commercial elevator in the world, namely the 632m tall ‘Shanghai Towers’ in China. Manufactured by Mitsubishi Electric in their Inazawa Works in Japan, the lift runs at a contract speed of 20,5 m/s (1230 m/m or a more majestic 73,8 kmph). Travel-time to the 119th floor is 53 seconds.

**WIND-TOWER TURBINE LIFTS**

The most prolific paradigm lift product growth has been that of the wind-towers in South Africa, where in a little over 3 years, well over a thousand towers have been installed and commissioned around the country in what has become known as ‘Wind-Farms’. Yet to be denoted a SANS standard, these 2-person lifts on average serve 80m, with a few reaching the 100m travel mark. Note that they are suspended on rope guides as opposed to rigid steel guides because of the concrete wind-tower sway in strong winds.