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

Doron 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.

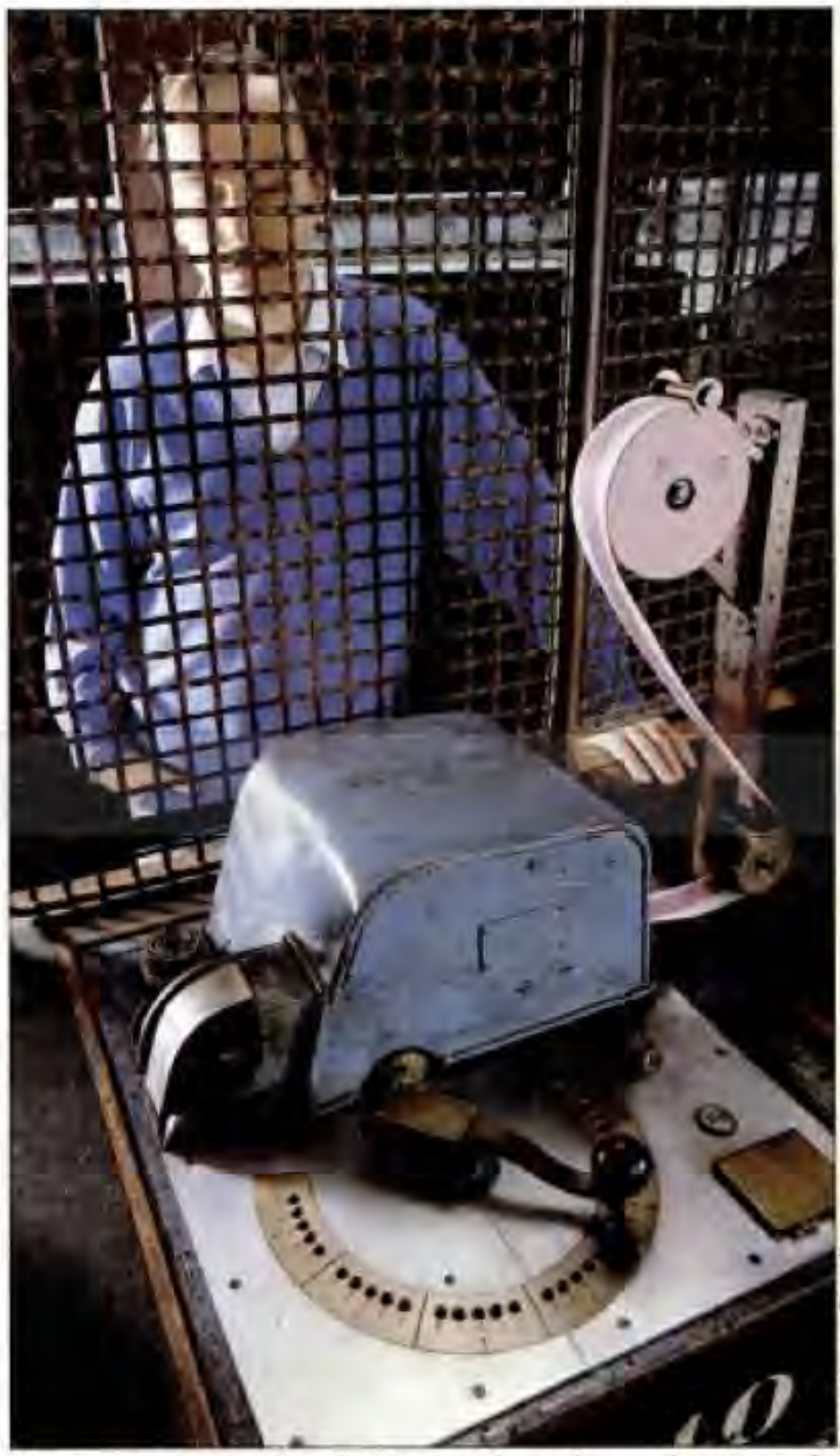
In the *pari mutuel* system of wagering, colloquially known in Britain as the "tote", bets on runners in a race accumulate to form a pool in which people backing the winners share in proportion to the size of their bet. A feature of the system is that the distribution of bets placed on the runners determines 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.)



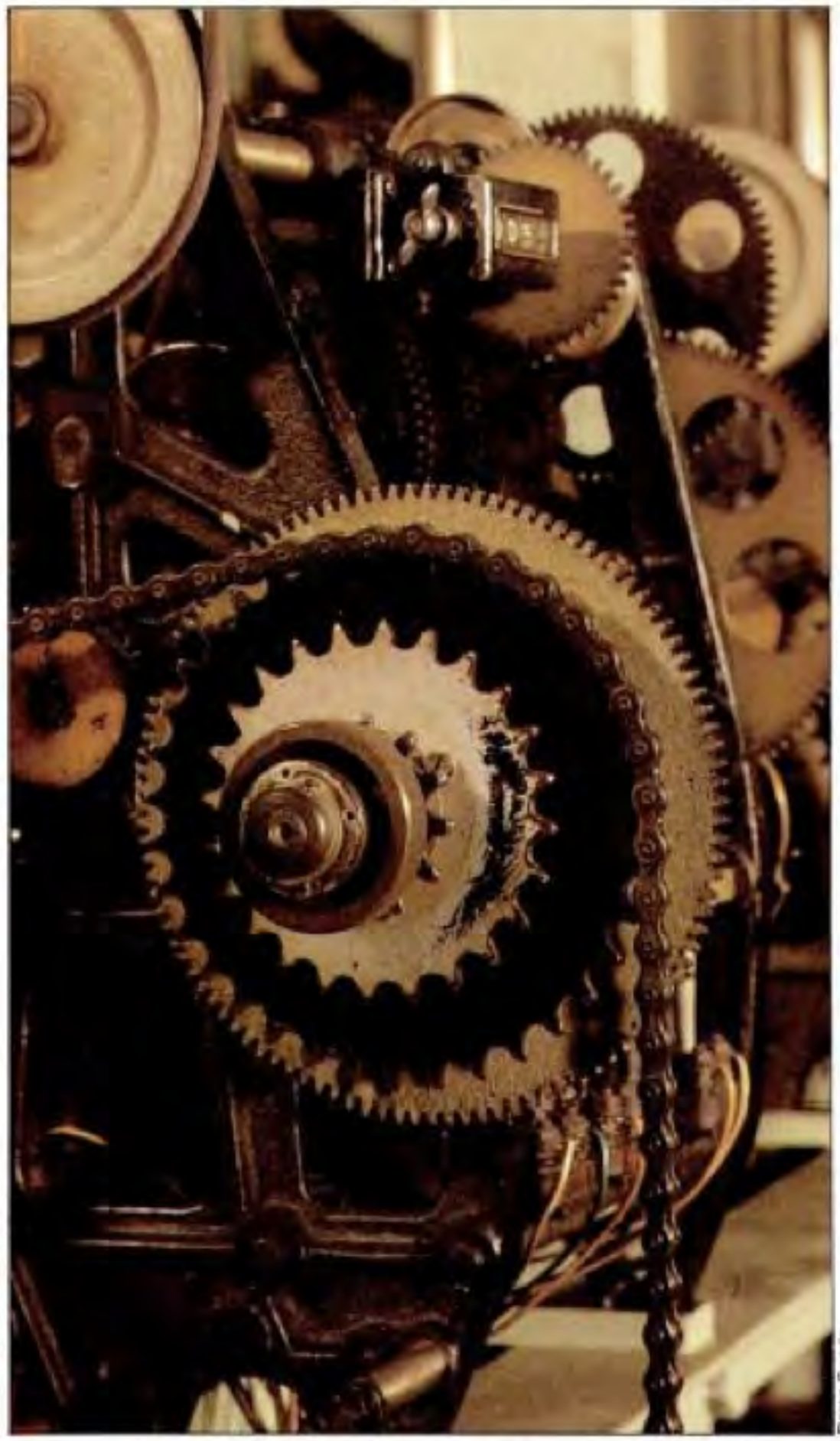
Science Museum/David Eaton

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



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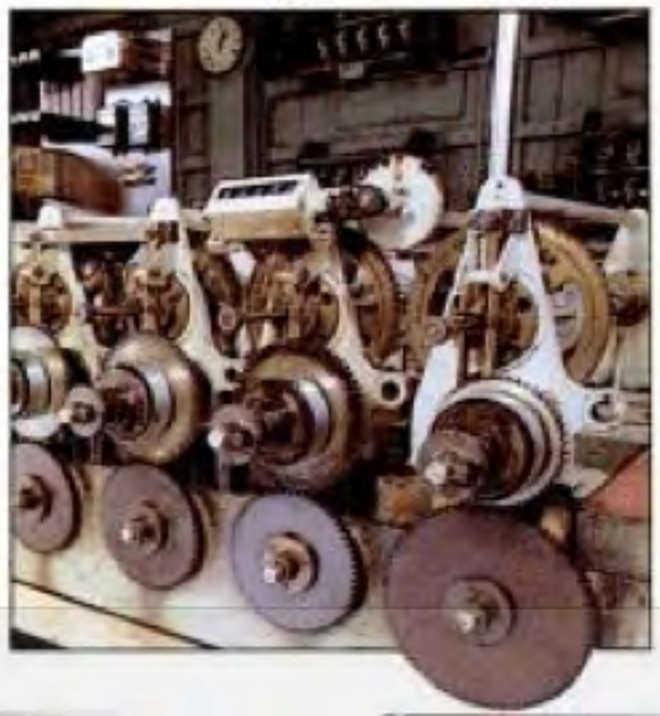
The tote room coordinates the accumulation and display of the pools and contains the machine which calculates the winning odds. The "odds machine", with its array of local aggregators (above), stands in the far distance

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

Science Museum/David Exton



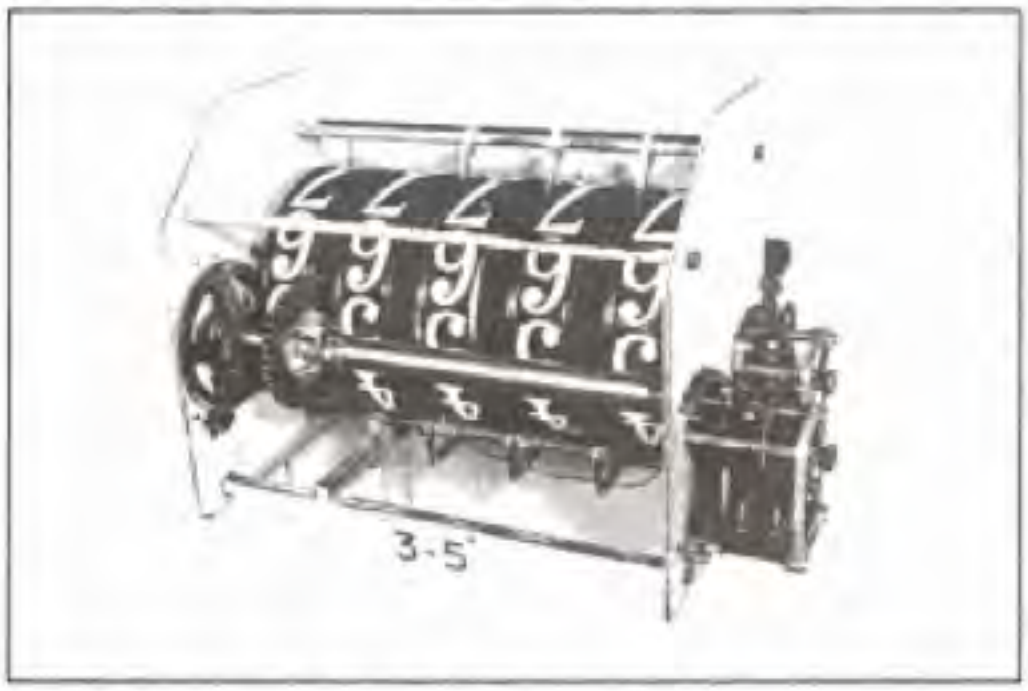
from his other achievements, including his prominence in Commonwealth scientific affairs.

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. □

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