The Australian Mail Handling Scene

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Abstract: Two historic papers from 1966 detailing the mail handling scene in Australia and the development of the state-of-the-art Sydney Mail Exchange.

Keywords: Telecommunications, History, Australia Post, Mail Handling.

Introduction

The two historic papers were published in the *Telecommunication Journal of Australia* in October 1966. Mail handling and telecommunications were the primary focus of the Postmaster General's Department (PMG) from Federation in 1901 until Australia Post and Telecom Australia were separately established in 1975.

The first paper (Page, 1966) details the mail handling scene in Australia in 1966 and highlights the challenges of delivering an increasing volume of mail to a geographically dispersed customer base. At the time, 2.5 billion articles were handled per annum and this increased continuously until 2008 when they peaked at 5.6 billion (Australia Post, 2008).

In 1966, the PMG was well aware of the growing volumes and the implications for standardisation, automation, staffing levels and delivery times. The construction of the state-of-the-art Sydney Mail Exchange in 1966 and the introduction of the current four-digit post code system in 1967 were no coincidence. This was a deliberate strategy by the PMG to cost-effectively manage the increasing postal volumes.

The second paper (Magnusson, 1966) summarises the development of mechanised mail handling around the world and details how the PMG used the new four-digit post code system to significantly simplify the design of the Sydney Mail Exchange. Any reader familiar with the British six-digit, alphanumeric post code system would appreciate the simplicity of the Australian four-digit numeric system, at a time where machine learning was very crude.

Both papers make fascinating reading, given Australia Post still delivers over three billion articles a year but the mix is shifting dramatically to parcels as the community embraces eCommerce and new forms of digital communication (Australia Post, 2018).

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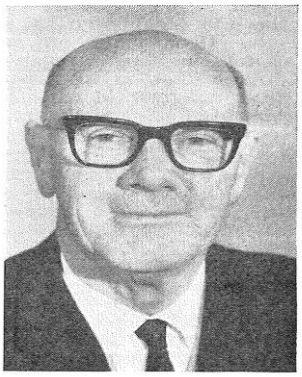
The Historic Papers

R. J. PAGE

R. J. PAGE, author of the article "The Australian Mail Handling Scene", joined the Postmaster-General's Department in 1937 as a Telegraph Messenger. After completing the Cadet Engineers' Course in 1941, he worked as an Engineer and Divisional Engineer in the Telephone Equipment and Lines Sections, Victoria, before being seconded on special duty to Central Office in 1951. After completing a Post Graduate Scholarship awarded by the Public Service Board in 1952, during which time he attended the Administrative Staff College, Henley, United Kingdom, he returned to the Engineering Division, Central Office. In 1955, he was promoted to the Postal Services Division as Controller, Transport Branch, and later Controller, Mail Exchange Branch. He was appointed Assistant Director-General, Postal Services Division in 1961, and is now First Assistant Director-General.

Mr. Page graduated Bachelor of Science in 1945, completed the Diploma of Public Administration in 1948, and graduated Bachelor of Commerce in 1950. He is an Associate Member of the Institution of Engineers, Australia.



V. ST. G. MAGNUSSON

V. ST. G. MAGNUSSON, author of the article, "The Development of the A.P.O. Mechanised Mail Handling Concept and Overseas Trends", commenced service in the Sydney Office of the Department where he qualified in 1929 for appointment as engineer. He was transferred to the Central Staff in 1935 where he took up duty in the Telegraphs and General Works Section. During the war years he was seconded to the Department of Munitions to initiate and oversight the production in Australia of communication equipment for the armed services in the Pacific Area.

Soon after his return to the Department he was appointed to the Central Office position of Supervising Engineer, Buildings Branch. It was in this position that he developed the present philosophy of mail flow and the modern concept of the machine systems for the handling of large volumes of mail. Later he took control of the Planning and Development Branch on its establishment in the Postal Services Division where he now holds the position of Deputy Assistant Director-General.

He has taken a leading part in the initiation and launching of the Sydney Mail Exchange Project, which ranks as one of the largest of its kind in the world. Mr. Magnusson has represented the Department on several overseas missions and is regarded as one of the leaders in his particular field. He is a Senior Member of the Institution of Radio and Electronic Engineers (Australia).

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THE AUSTRALIAN MAIL HANDLING SCENE

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INTRODUCTION

Australia presents a number of unique problems in mail handling. With a total area of just under three million square miles, 60% of the population live in the six State capital cities, with over 40% in the metropolitan areas of Sydney and Melbourne. The capital cities are separated by distances ranging from 400 miles to almost 3,000 miles. Outside these capital cities, the population is scattered widely; many of the communities being very small and very remote.

The Australian postal service has been linked with the development of each country centre. The existence of a Post Office in each town, catering for a wide range of community needs and acting as a focal point for Government contact on a widely decentralised basis, is characteristic of our development.

The distribution of mail along the established transport routes, combined with the uneven concentration of population, leads to unusually heavy volumes of mail circulating through the capital cities and to equipment and cost problems in its handling. The need for delivery of letters, packets and parcels to outback areas has produced rural road mail services, using every known means of land transport and covering all types of country over distances up to 1,200 miles.

In addition to the capital city G.P.O.'s, there are approximately 8,500 Post Offices scattered throughout Australia, from the smallest non-official Post Office operated in conjunction with a store in the outback, to a Post Office of the size of Newcastle, having a staff complement of 67.

Mail (and there were over 2,500 million articles processed in the year ended 30th June, 1966, equivalent to 79 articles per second) must be distributed to all these offices and, in most cases, delivered by postman or mail contractor, to over three million delivery points.

Although departmental transport and the railways are used widely, it is not surprising that the aeroplane is used extensively. Since 1959, the normal means of conveyance for the ordinary letter is by air, where it is quicker to do so. Since that date, the amount of domestic mail conveyed by air has quadrupled, and today one in every five articles handled is conveyed by air during some part of its journey.

The normal pattern of mail flow is illustrated in Fig. 1. Mail flows

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MAIL CIRCULATION PATTERN IN AUSTRALIA

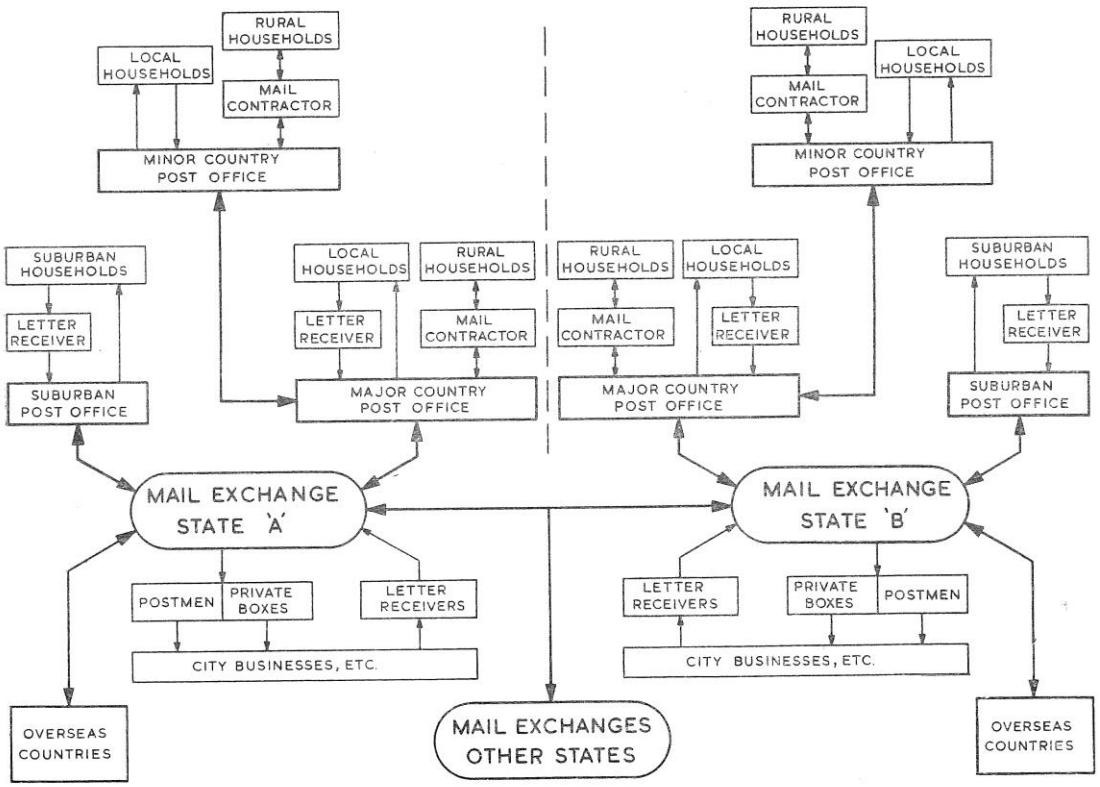

Fig. 1.

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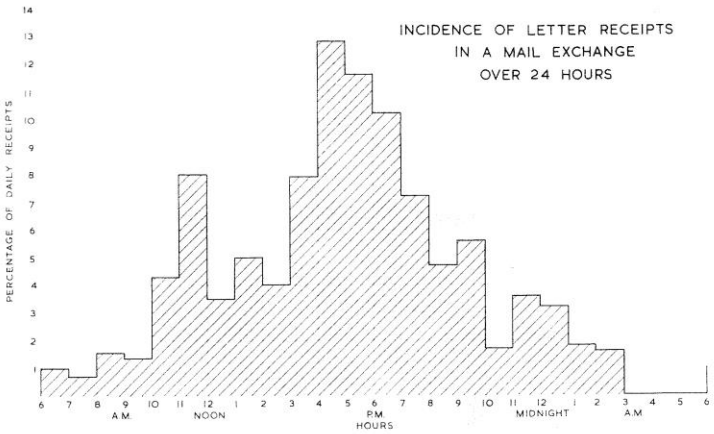

Fig. 2.

from Post Offices to the central mail handling centre, is processed and then despatched according to its particular destination. It is of interest to note that of mail processed —

35% is for suburban destinations
25% is for city destinations
22% for country destinations
14% is for interstate destinations
4% is for overseas destinations

The interstate component, generally speaking, is conveyed to the mail exchange in the State of destination where arrangements are made for it to be included in the despatch to the particular suburb, town or city concerned.

STANDARDS OF SERVICE

To maintain an efficient postal service, standards of service must be determined. This operates from the time the letter is cleared from the letter receiver, conveyed to the Post Office or Mail Exchange, processed through the various operations at that centre, transported to the Post Office of destination and finally delivered by the postman.

Speaking generally, within the whole capital city area, which in the cases of Sydney and Melbourne each cover about 650 square miles, same day delivery is provided for letters posted in the morning, and next morning delivery for letters posted in the afternoon and evening. Three deliveries a day are provided in the inner city area and two deliveries in most suburbs. Next morning delivery of letters to interstate destinations is provided in most instances. Similarly, standards have been determined for other categories of mail such as newspapers, packets and parcels.

Scientific sampling techniques are used to check the grade of service actually given and information obtained from such checks is used to highlight and remedy weaknesses.

The postal service must meet our customers' demand but, in so doing, we must provide a service which is reasonable, from both the cost and service standard points of view, and reliable. In some cases in the past, we have provided a service of a standard which is higher than the customer really wants. To enable us to know what the customer does want, and is prepared to pay for, surveys are now undertaken.

Standards of service must be reviewed from time to time. Requirements and habits of the public change and it is essential that the Post Office be aware of the current needs of the customers.

SOME PROBLEMS IN MAIL HANDLING

Inherent in mail handling are the problems of peak traffic so well known to communication engineers. These seasonal, monthly and daily peaks cause many difficulties, which increase rapidly with increase in volume. Fig. 2 gives a general indication of the spread of traffic through the hours of a day in a typical mail exchange.

The "cut off" time in a mail exchange for afternoon suburban delivery is approximately 11.30 a.m. Despatch time for this delivery is approximately 12.45 p.m. This means that there is $1\frac{1}{4}$ hours for the processing of this mail. If the volume of mail for this suburban delivery doubles and if the "cut off" and despatch times remain constant (and any variation in these times has a marked effect on the standard of service), twice the volume of mail must be handled within the same given time. Bearing in mind the peak nature of the traffic input, if the staff is increased to handle this increase in mail receipts, the amount of ineffective time over the stretch of the shift can be increased substantially.

In addition, the spread of the metropolitan areas means that the mail "pick up" runs are attenuated and transit times between the mail exchange and the suburban post offices are becoming greater.

Management has, of course, over the years, introduced innovations, modified procedures, and resorted to a number of expedients to retain the

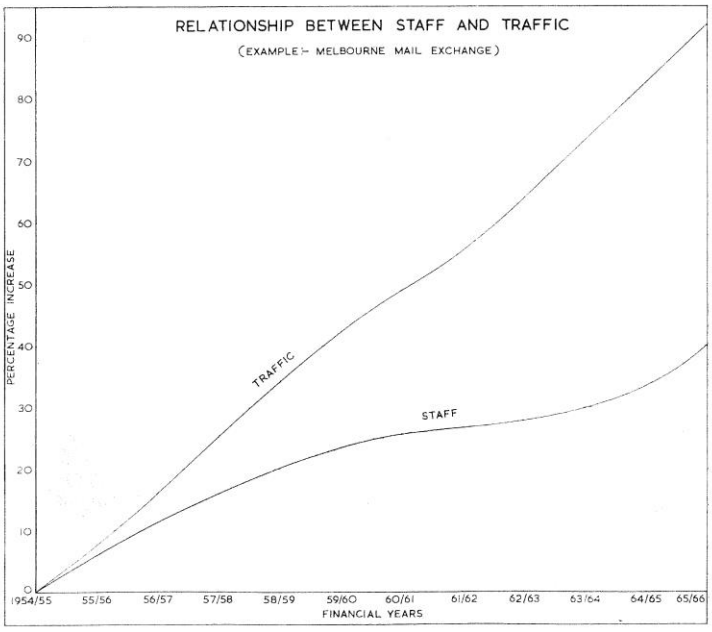

Fig. 3.

desired standard of service, having in mind at the same time the economy of operation. Such efforts have been aided by a continuous programme of mechanisation designed to speed the processing of mail. Our efforts have been fruitful and the reward has been the handling of greater volumes of mail without commensurate increase in staff. The graph illustrated in Fig. 3 indicates the relationship of growth in volume of mail handled as against increase in staff numbers, both expressed in percentage. It also indicates that, regardless of the degree of efficiency exercised by management, a point could be reached where staff increases would tend to follow more directly that of volume. Indeed, if volumes continue to increase, a convergence of the two growth curves could eventually be expected. The postal service has always been a big user of labour. At the present time, about 70% of postal costs are labour costs.

It has become obvious that there could be a limit to the improvements that can be brought about with the use of existing handling facilities. Every consideration must therefore be given to the exploitation of major break-through areas or finally face the dilemma of service standards versus operating costs.

There is, too, an overriding motivating force which bears considerable influence on our problem. That is the need in our rapidly developing country to conserve labour to the utmost, so that it may be utilised on various essential capital works of a national character or to strengthen the industrial capacity of the country. It is important then that the Department plays its part in all phases of its activity and utilises modern techniques to best advantage. Conversely, the demand for labour in other directions makes it difficult to obtain operatives for repetitive tasks such as mail sorting.

INTRODUCTION OF AUTOMATIC MAIL HANDLING EQUIPMENT

At this juncture, it would be as well to observe that the Department has not, over the years, been idle in its efforts to apply the principles of mechanisation and automatisation to the handling of mails. There is every reason to believe that we are as advanced as any overseas country in the effective introduction of machinery in mail handling centres. It is most likely the Australian Post Office was as early in the field of mechanical handling as any other country. The first machinery for the handling of "other articles" (packets and newspapers) was installed in the Sydney G.P.O. prior to 1930. The design was superseded some years ago by a later design which is now in general use.

In all mail exchanges, we have had in operation for many years machine systems for the sorting of other articles, machines for the sorting of parcels, bag handling systems, and other machine aids, such as large letter handling machines. In addition, upwards of 60 letter handling machines have been installed singly as as part of a system, as an aid to the sorting and distribution processes. It is the processing of letter-form articles where the need for advanced machine development is urgent. The number of letter-form articles processed daily exceeds by far that for all other articles, as may be seen by reference to Fig. 5.

During the financial year ending June, 1966, the total number of letters posted annually in the Commonwealth and including those received from overseas was about 2,100 million, whilst the corresponding number of "other articles" was 400 million. It is

Fig. 4.—Developmental Stages in Letter Processing. Top: Until the year 1960, all letters were primarily sorted on upright presses in all mail exchanges. Middle: Machines designed to aid the sorting and distribution processes and installed to replace upright primaries. Bottom: One of the five suites of coding positions installed in the Sydney Mail Exchange. Letters, when coded, can be processed automatically.

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estimated that these figures will double over the next 20 year period.

It is the rapid advance in the field of electronics that has provided the tools for a major break-through in our processing concept, particularly for the treatment of letters. The installation of the letter coding system is the culmination of the first stage of plans to mechanise to the maximum extent possible the processing of letter-form articles. Details of this system have been dealt with in subsequent pages of this Journal. It is, however, relevant to note by reference to Fig. 4, the progress since 1950 when upright sorting presses were still in use throughout the Commonwealth. Their use for primary and secondary sorting was replaced by letter handling machines which are now in turn gradually being replaced by coding and decoding machine systems.

Our problems do not end with the placing of a highly modernised letter handling system into service. Management must develop new skills and recognise too that operations now require changed disciplines. It must foster a closer relationship with the postal user, particularly large business concerns, to ensure that, wherever possible, postal articles passing through the post are suitable for machine or automatic processing. Already new sections of customer education and correction are operating in an endeavour to achieve these ends.

We will be obliged to develop user specifications and modify our rules and regulations as may be necessary to obtain maximum operating efficiency from our equipment. A committee has already been convened by the Standards Association of Australia to prepare an Australian standard for envelopes. When issued this will be an extension of the requirements now being expressed by the Universal Postal Union. The issue of further Australian Standard Specifications will be necessary to eliminate the use of coloured invoices and other envelope insertions on which the address must be read through a panel. We must also endeavour to bring some influence to bear on the size of cheques and documents, etc., designed for transmission through the post.

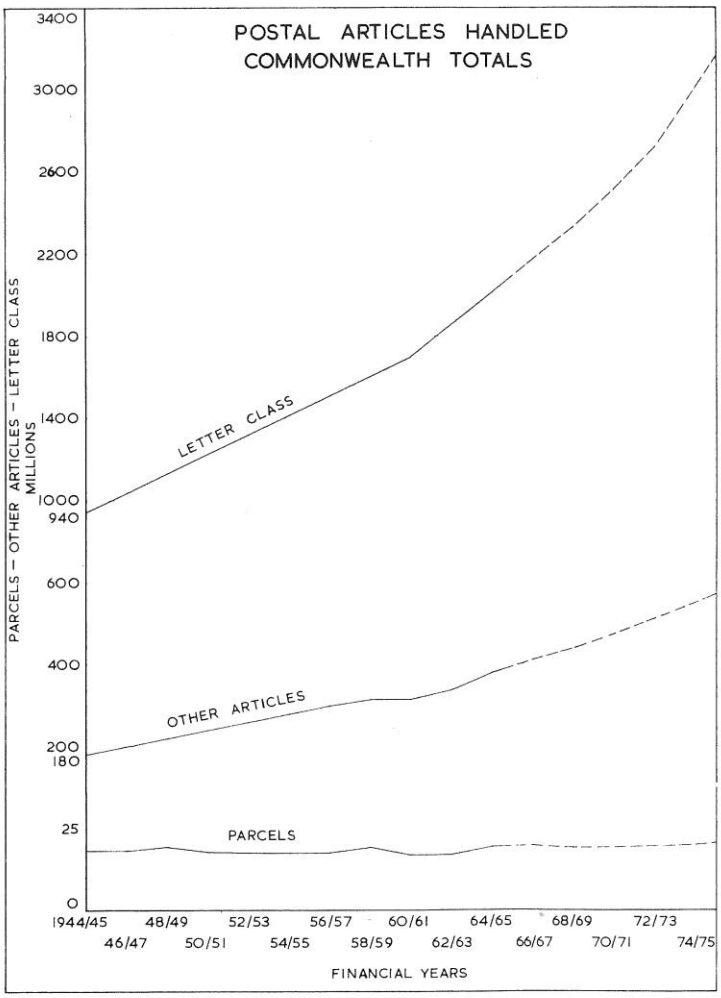

Fig. 5.

NEED FOR A MEASURE OF STANDARDISATION.

The necessity for the introduction of a measure of standardisation of mails, particularly letter mail, can be illustrated by reference to the process of "facing up" of letters. Letters from letter receivers arrive at the mail exchange for processing. In the past, before this mail could be sorted, staff had to arrange the letters so that all the stamps were in the top right hand corner. The letters were then fed through a stamp cancelling machine.

This "facing up" process was very costly, and is one of the processes which have been mechanised. Letters, as you can well imagine, are of various types, sizes and shapes. To "face-up" a square envelope automatically is very much more costly than to "face-up" a rectangular envelope because, on a square envelope to be "faced up", a stamp can be in any one of eight positions, whilst on a rectangular envelope, it can only be in one of four positions. (See Fig. 6.)

In addition, if the length of an envelope is considerably greater than its width, the problems of conveying that letter automatically through the various channels are reduced. It is for these reasons that the Universal Postal Union has standardised certain basic requirements for envelopes; one of which is that the ratio of length to breadth should be at least $\sqrt{2}:1$. In any high speed automatic system, some measure of standardisation is inevitable.

DEVELOPMENT OF THE AUSTRALIAN SYSTEM

Although the system used for the coding of letters is explained in detail in later articles, I would like to briefly indicate the type of problems that were encountered in its development. The manual system consists of a series of operations where a Mail Officer reads the address and sorts the letter into a particular slot or pigeonhole, depending on its destination. The letter, generally, is conveyed by belt to the next sorting stage where a similar manual operation takes place. After a letter is sorted on the final divisions, it is despatched to its destination. Most of the letters are handled two or three times.

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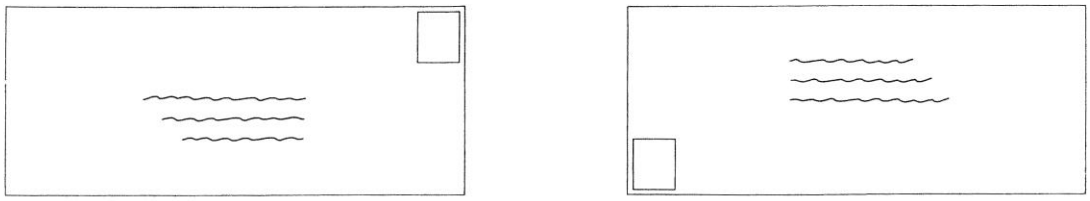
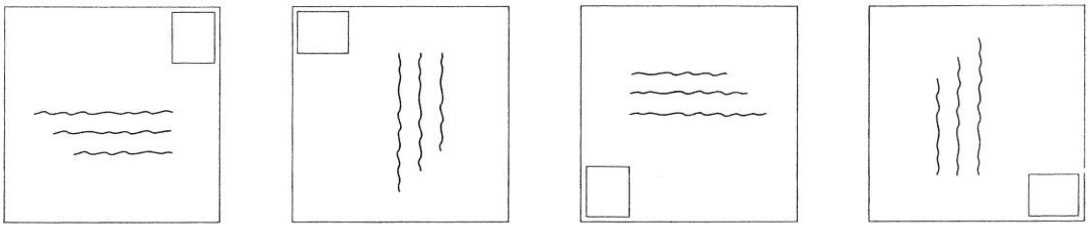


OR REVERSED (4 POSITIONS)

RECTANGULAR LETTERS



OR REVERSED (8 POSITIONS)

SQUARE LETTERS

Fig. 6.

In developing a system of electronic coding of letters, the problem of the place name is, of course, fundamentally important. Some overseas countries are using a system of numeric coding — where the public simplifies the problem by including in the address the four or five digit numeric code appropriate for the particular place of destination. This is a very good scheme and a numeric code of four digits has been developed for all Australian place names and a national publicity campaign has been planned to sell this to the Australian public and business community.

It was felt, however, that this would take an appreciable time to be included in the majority of addresses. So, in addition, a system of alpha extraction was developed. Under this plan, a number of the letters of the place name is extracted by the operator and coded on the keyboard. The problem here was how many elements should there be in the code; how many letters should be extracted from the place name. The number of letters extracted should be as low as possible consistent with an acceptable level of ambiguity. After an analysis of the names of all Post Offices in Australia, it was decided that a five element code consisting of the first, second, fourth and last two letters of the name gave an acceptable low level of ambiguity.

The memory used in the Australian system will therefore recognise either the appropriate numeric code of a place name or the alpha extraction of the place name. For example, if Tamworth in N.S.W. has the numeric code 2340, the code marks for 2340 and TAWTH are the same and therefore the letter will be directed to the same final despatch stacker.

CONCLUSION

There is no doubt that the system of mail handling installed in the Sydney Mail Exchange is one of the largest and most modern in the world. It provides management with a facility having considerable flexibility in the handling of traffic in that there are a number of differing or additional demands that can be readily satisfied to meet changes in traffic requirement. Naturally, it is only the first stage in the coding of mail and from its design and development, experience has been gained which will enable us to further advance towards our goal of providing the Australian public with a postal service of which all can be proud.

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THE DEVELOPMENT OF THE A.P.O. MECHANISED MAIL HANDLING CONCEPT AND OVERSEAS TRENDS

*V. St.G. MAGNUSSON, S.M.I.R.E.E.(Aust.)**

The Australian Post Office concept for the design and application of machines for the processing of mail has been based on observations made over many years on methods of handling mail, the physical and other characteristics of articles and the labour components required in the various work areas. The most important factor influencing present day thinking is the rapidity with which mail processing costs are increasing.

Basically, the conditions under which mechanisation in the postal service becomes most efficient are when the desired standard of service to the community is provided with the greatest economy of operation. This broad statement assumes that full consideration has been given to such factors as staff comfort and the desire to eliminate burdensome tasks.

Insofar as the standard of service to the community is concerned, there could be two conditions under which an Administration accepts the principles of mechanisation. It could be that the present standard of service is satisfactory and that the reason for mechanisation is to reduce the costs of providing service; or it may be that mechanisation is necessary to upgrade the standards of service. There could conceivably be a further condition where it becomes necesary to readjust service in a downward direction. This would apply only in various parts of the total area over which the service is given and would only mean a reduction in service standards for certain groups which at present enjoy a higher standard than others.

This would suggest that service standards should be assessed and determined as an independent factor regardless of the method of handling mail. This in itself is a complex problem, having many facets, some of which are the determination of boundaries for country and metropolitan delivery; the form of inter-office transport employed; and the time of the day when the first letter delivery is to be effected. Once the standard of service to be provided is determined as a fundamental fixed condition to be met for a period of time, then all other calculations or comparative economic studies should be developed to meet this condition, whether the methods of handling remain manual or are mechanised. It is, of course, realised that variations to any so-called fixed service standard will occur from time to time, but that the major variations which are within the control of Administrations should, if possible, be planned to provide for a definite period of time.

The processing of mail in itself could be regarded as a relatively simple problem, but the operation tends to become complex when large volumes of mail are to be treated. For convenience of handling, articles of mail must be divided into several characteristic groups each requiring its own unique machine system. Processing must also be governed by the time elements which must be observed to provide service. There is also the problem of documentation and secondary activities associated with the handling of large volumes of mail.

It becomes obvious in any analysis of the ratio of staff to traffic load that a proportion of the operatives must be occupied on activities other than the prime process of sorting. It seems essential, therefore, in the attempt to reduce the cost of the sorting process, that we should also consider the labour expended in other areas. This then highlights the fundamental need for the co-ordination of the output of operatives engaged on the same sorting process and the automatic transfer of articles from process to process, particularly in large mail exchanges. It also points to the basic need to think in terms of machine systems rather than of machines. It is most unlikely that machines designed to process low volume flow can be adapted for use where peak hour volumes are considerable. However, the converse, that design should be based on the evolution of machine systems the elements of which could be utilised at centres of low volume peaks, could be true.

The second important conclusion is that design efforts should not contemplate the use of machines or systems which in themselves separate articles into many directions. If the natural evolution is through mechanisation towards automation, some balance should be made between the number of primary separations as against those required subsequently.

With few exceptions, the trend until recently has been to develop letter processing machines with a single, or at most, a limited number of associated operating positions. These may enable letters to be divided into a considerable number of directions but where two or more machines would be required to meet peak load conditions, there is no ready means for automatic co-ordination of outputs. (See Figs. 1, 2 and 3.)

It seems evident that the solution is to develop systems in which the coding desks are self-contained and detached from the sorting or decoding operation. This is the basis for development in West Germany where there is a system utilising 14 coding desks which feed to several decoders.

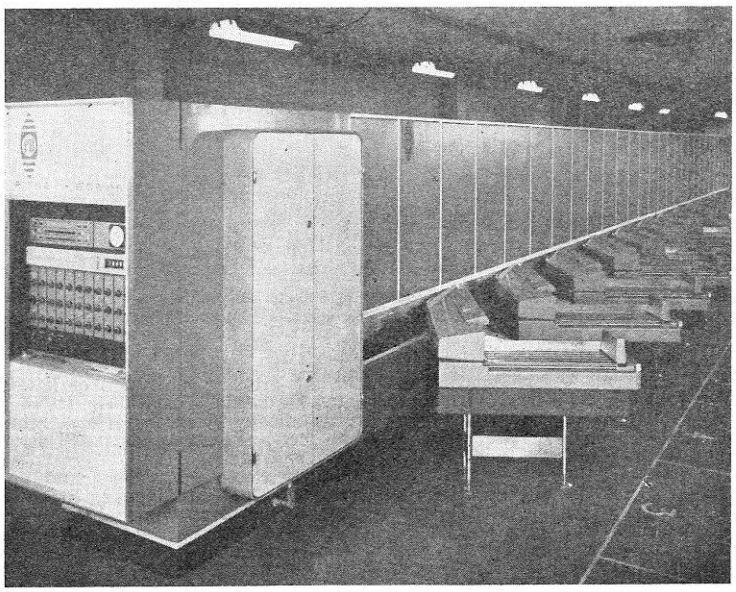

Fig. 1 — Sorting Machine of a Type Used by the U.S. Post Office. 12 positions — 300 separations. Manual feed to operators — manual clearing.

* Mr. Magnusson is Deputy Assistant Director-General, Postal Services Division.

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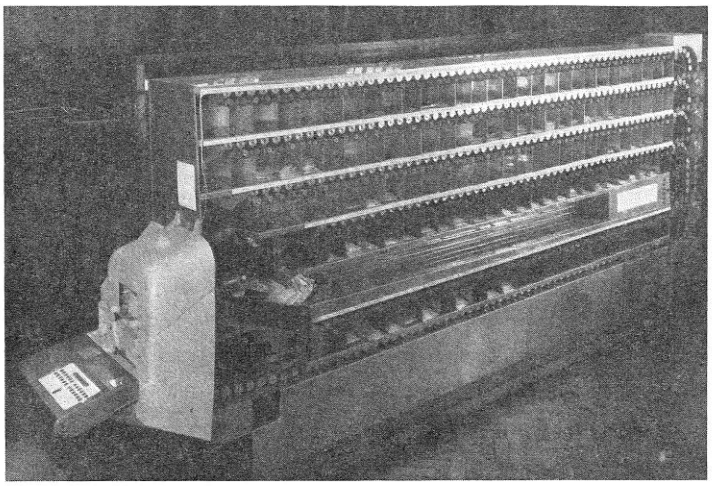

Fig. 2 — Sorting Machine of a Type Used by the B.P.O. Single position — 144 separations. Manual feed to operator — manual clearing.

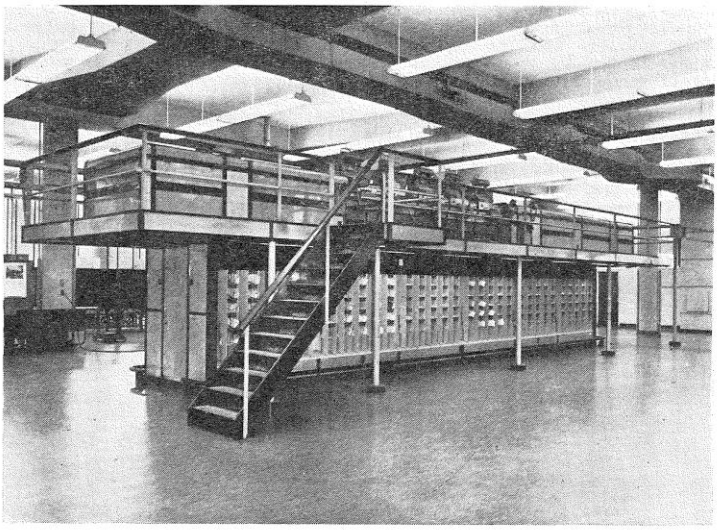

Fig. 3 — Transorma Machine Manufactured in Holland. 5 positions — 300 or more separations. Manual feed to operators — manual clearing.

(See Figs. 4 and 5.) The British Post Office proposes to isolate the coding desks but has interposed an intermediate electronic separator between the desk suite and the decoders.

The A.P.O. letter sorting system is designed to accommodate 150 keyboard operators for the processing of peak traffic volumes in the vicinity of 300,000 letters per hour. The installation is capable of extension or modification to handle loads of greater magnitude. As a by-product of the coding operation, the system provides for the primary separation of letters into 30 channels and their transfer automatically by means of a distribution network to decoders. Without further handling the letters pass through electronic readers and are sorted to final destinations. Refer to Fig. 6 which shows the primary separations effected at the primary coding positions.

Access to a central translator with capacity for the storage of over 12,000 place names is possible from any coding position when a code combination for a particular address is set up at the operator's keyboard. The translator transmits back to a printer the equivalent in machine language of the code which has been keyed. The printer impresses in bar form with phosphorescent ink the translated code on the back of the letter. The letter then passes through the appropriate primary channel to the decoder.

The Australian design for electronic reading and sorting machines (referred to as decoders) does not follow those of overseas countries, due to a distinctive approach to the overall problem. Whereas the tendency in other administrations is to develop machines which will divide letters into 100 or more directions in one pass, the A.P.O. only provides for 30, but, two or more subsequent runs may be made if required. Fig. 7 shows a decoder designed for the B.P.O. to give 144 separations.

The need for a relatively large number of separations at the decoding units becomes unnecessary when an automatic primary is associated with the coding operation. If the number is limited to 30, then designs can be simplified and high speed operation—a feature of most machines — can be avoided. Additional passes may be run through the machines installed in the Sydney Mail Exchange. However, 95% of letters can be separated into final despatches during the first pass, one further pass only being required on each decoder.

The A.P.O. concept has influenced the keying arrangement and code information printed on each letter. These tend primarily to specify the route a coded letter is to follow to reach its final destination point. Once a letter has been coded, further reference to a central memory is unnecessary even where the final electronic sorting operation takes place in any other State.

This, together with the specialised keyboard, gives a high degree of flexibility to management in that routing arrangements may be altered at will. Other groupings, although not at present envisaged, will surely be brought into being after traffic experience has been gained with the system. It is probable that within the near future, numeric codes will be developed for sorting to delivery rounds in capital city areas.

The design of machine systems for the sorting of non letter-form articles which consist mainly of rolled newspapers and packets referred to generally as other articles (O/A.) is also based on the use of a distribution network. The first O/A. machines were placed in service in the Sydney Mail Exchange prior to the year 1930. These have since been replaced by machines to the present design. The system installed in the Redfern building consists of a primary made up of three machines, the outputs of which are co-ordinated and automatically conveyed to four secondary machines

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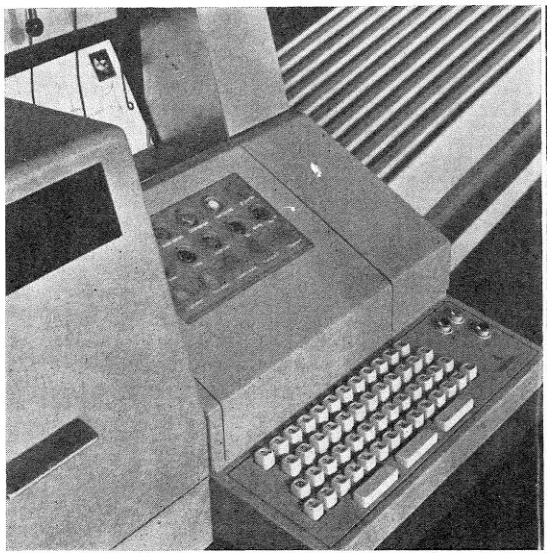

Fig 4 — Coding Desk. One of 14 used in conjunction with Decoders shown in Fig. 5. Automatic infeed and clearance.

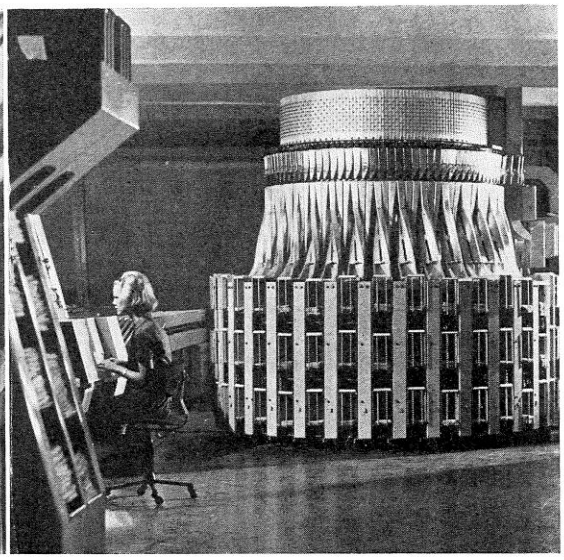

Fig. 5 — Decoder Used in Conjunction with Coding Units shown in Fig. 4. Automatic infeed — manual clearance.

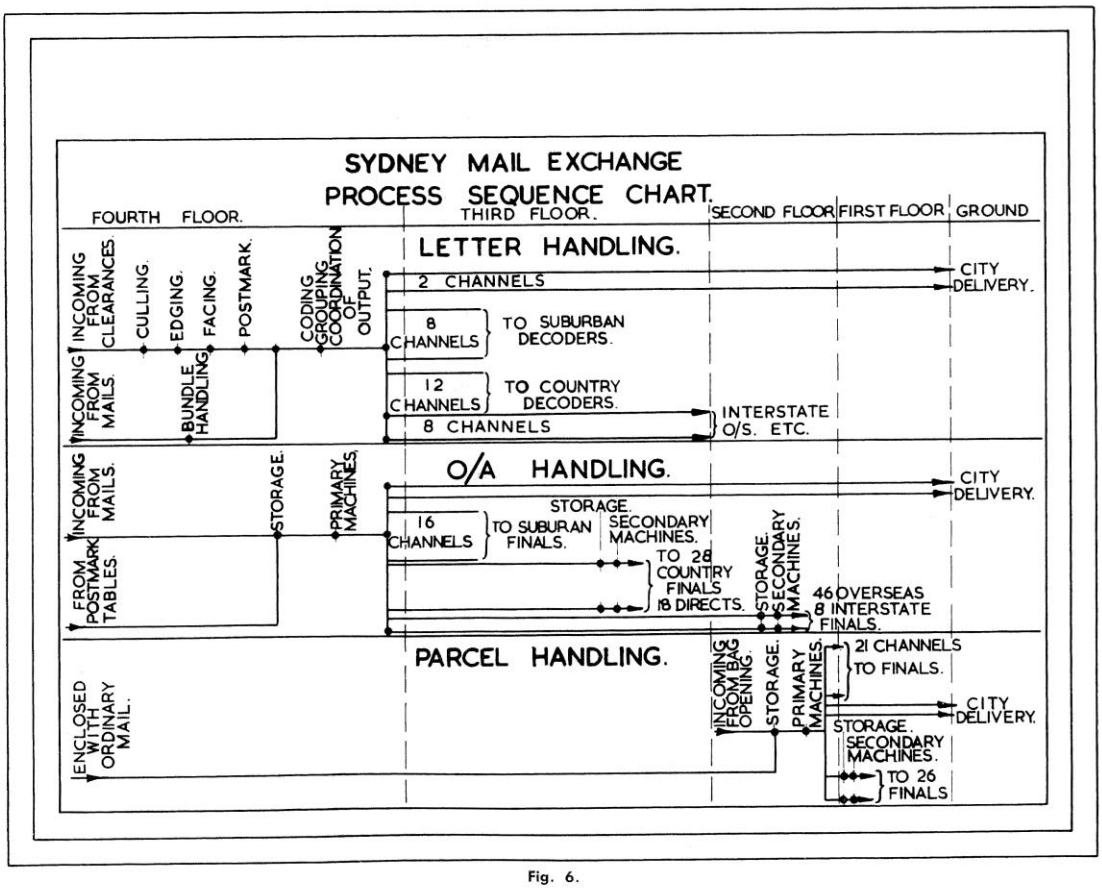

Fig. 6.

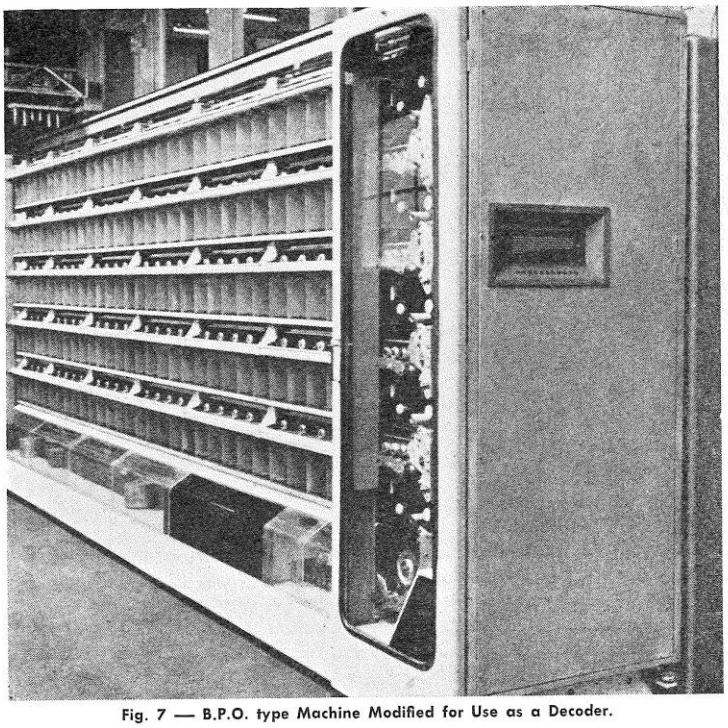

Fig. 7 — B.P.O. type Machine Modified for Use as a Decoder.

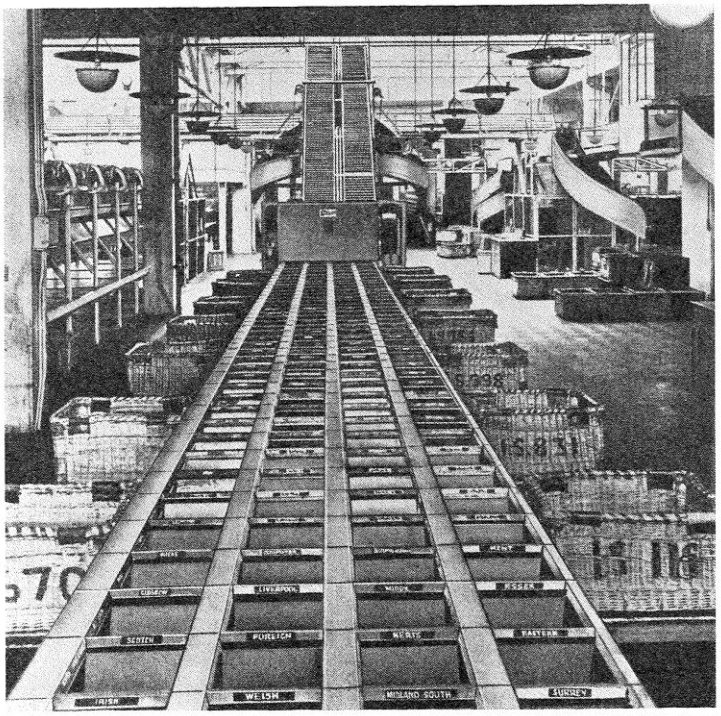

Fig. 8 — Machine Installed at the Mount Pleasant Sorting Office, London, for the Sorting of "Other Articles".

or to storage hoppers. Articles are sorted manually at each stage. The only other machine of this type known to be in operation is that installed in the Mount Pleasant Sorting Office, London. (See Fig. 8.)

There are several types of machines designed for the sorting of parcels in use in other countries. Machines to the A.P.O. design, the basis of which has been adopted by the B.P.O. and the New Zealand Administration, have been in use for some years. The design of most machines developed in recent years is based on keyboard operation. This common approach has been influenced by the size and weight of the articles for which they are designed to sort. The Australian design is based on the sloping belt and drop panel method of diversion. The machine is keyboard operated and an electro-magnetic memory unit is used for the storage of pulses necessary for the sorting of parcels. There are several other methods whereby keyboard selections may be held in store to perform subsequent operations. The Australian designed machine can be manufactured at low cost and is simple to operate with an extremely low fault incidence. For an appreciation of machines in operation overseas, see Figs 9, 10 and 11.

It is thought necessary to refer also to one other machine system, which has been installed for the handling of bagged mail. It is usual for overseas administrations to use chain conveyors for the purpose. Whilst this method may be satisfactory for small or medium size sorting offices, the method is not suitable for a mail handling centre the size of that in Sydney, where considerable distance must be traversed with limited time available. A system utilising twin band conveyors for the elevation of bags and spiral chutes for descending bags has been installed. The outgoing bags are automatically distributed to 64 or more vehicular dock points.

The mail handling machine systems have only been referred to briefly as each has been dealt with in some detail later in this issue. Reference to equipment installed for the pretreatment of letters and other articles will also be included with its appropriate handling system. There are, however, certain basic design aspects which should be discussed in a paper such as this, as they have been observed throughout the development of of the new systems, the outstanding fundamental being the co-ordination of output and the routing of mail.

The layout of the various working areas and of the equipment in each demanded considerable thought. Having regard to the total floor area in the Sydney Mail Exchange, the factors uppermost were:

(i) the transit time for mail passing between the various processes; and

(ii) the need to transfer operatives to other work areas to meet demands.

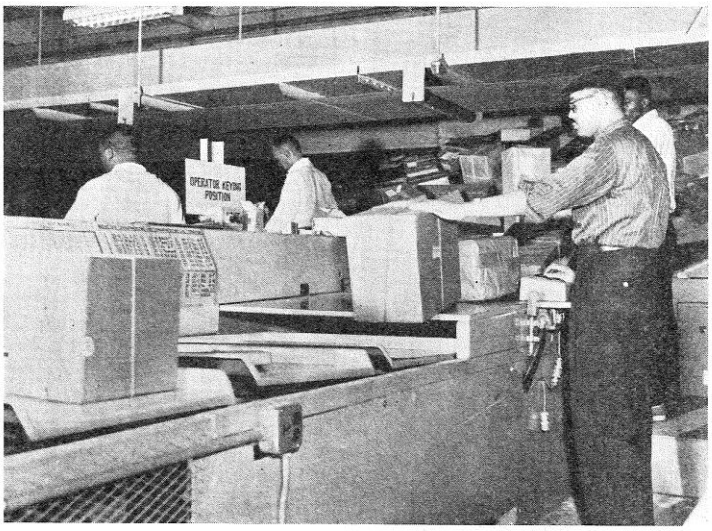

Fig. 9 — Parcel Sorting Machine — Using Tilted Tray Method for Parcel Diversion — U.S. Post Office.

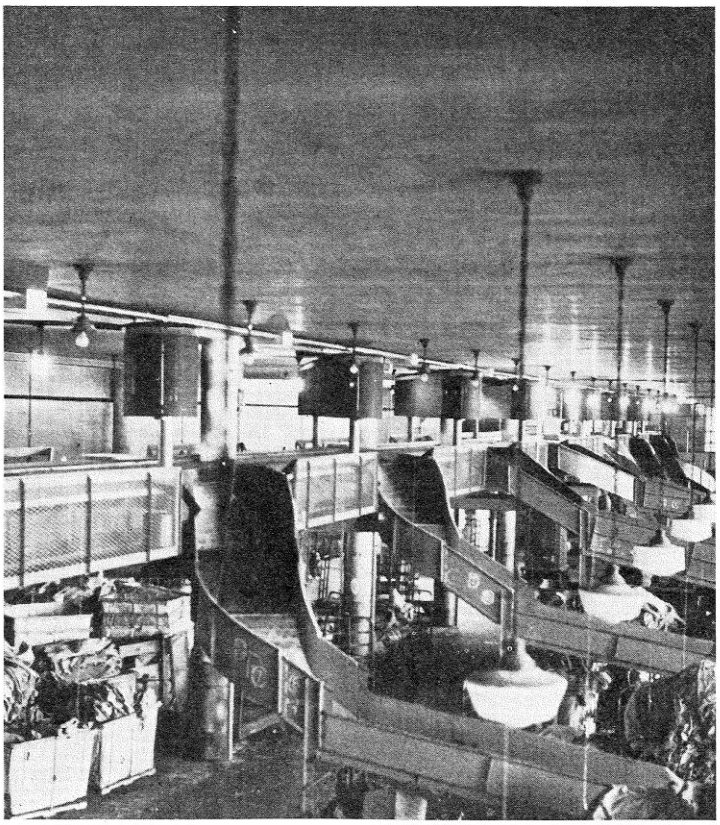

Fig. 10 — Parcel Sorting Machine Using Sweeps for Parcel Diversion — U.S. Post Office.

It is essential that the total transit time for each processing line including the conveyance of bagged mail from and to the dock area be kept at a minimum. It was for this reason that the bagged mail handling system described in this issue was designed, in order that the average transit time for outgoing bags may be kept at an average of 90 seconds. It follows, therefore, that sequential operations should be adjacent or, where possible, in a vertical line between floors. Obviously, the length of time required to convey mail from point to point has a bearing on peak staff requirements. This factor must also be taken into consideration when determining equipment provision and the capital expenditure involved.

It should be mentioned, however, that peak period volumes are influenced by several other factors, some of which are under the control of management. In comparing peak demand, it must be borne in mind that, unlike automatic telephone exchange traffic, mail can often be readily held in store for varying periods without affecting service standards.

It is, for instance, important that machine designs be such that equipment may be readily installed in most buildings particularly existing sorting offices. This condition requires that equipment must be unit constructed and light in weight. Heavy construction is unnecessary, and costly, having regard to lightness of the loads the equipment is to carry. Furthermore, equipment designs should take into account the need for economy in the use of floor space. Considerable attention has been given to the appearance of machines and generally form has followed function. Surface finish has been given due importance, working surfaces are of plastic materials, and pleasing colour treatments have been used.

It is important, too, that designs take into account future developments not only to meet expanding traffic requirements but changes that may be dictated by progress in technology. Obviously a modern letter handling and distribution system should be designed so that letters, if electronically scanned and coded, may be inducted into the main flow. This is of particular significance with the A.P.O. concept where coding identifies the route as well as the Post Town.

Design characteristics must, of necessity, be such that maximum work outputs are possible. The study of human engineering problems is therefore important. The effort required to complete each unit of work should not contain avoidable expenditure of energy. For example, where the sorting operation is manual such as the sorting of O/A.'s, the optimum number of primary separations is 24. To go beyond this number would reduce the hourly rate of sorting and increase the possibility of mis-sorting.

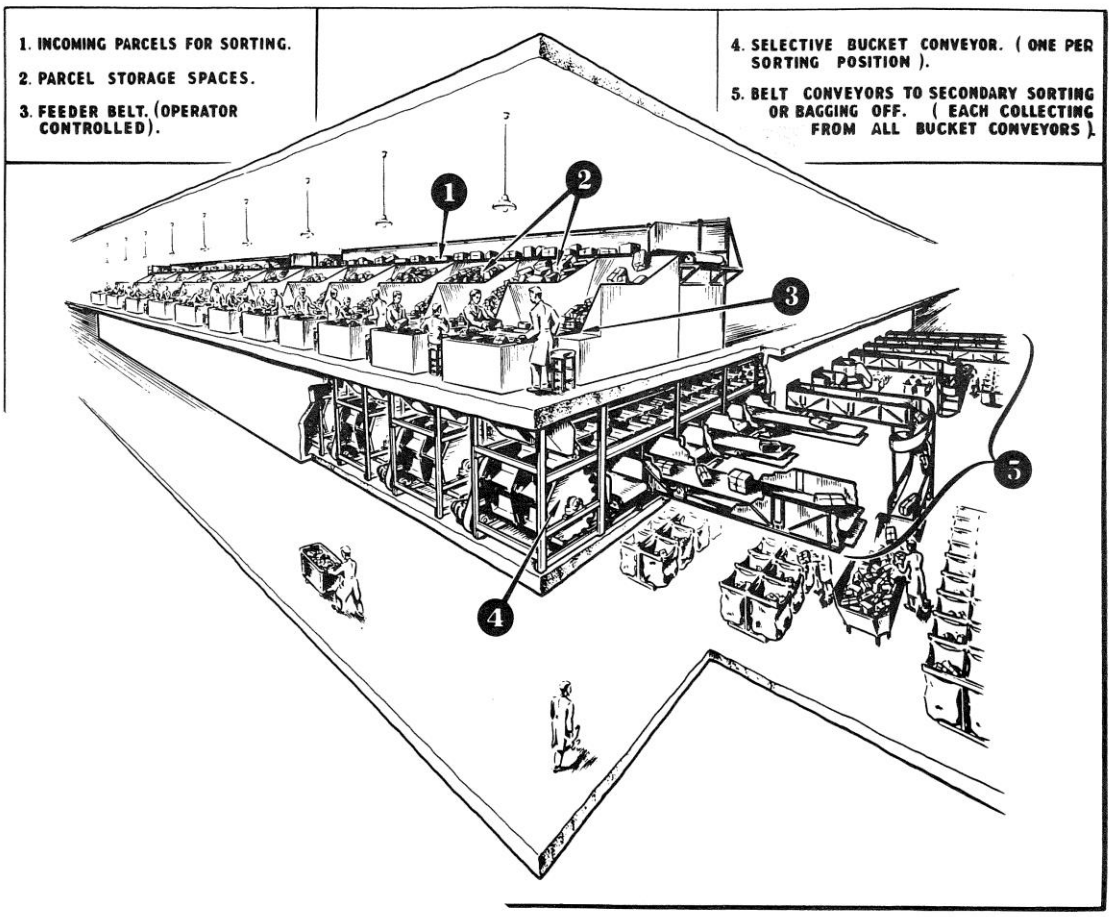

Fig. 11 — Artist's Conception of a Large Machine Installation for the Sorting of Parcels. A number of these Machines single or as a system have been installed by the B.P.O.

To reduce the number could require additional handling at a subsequent process.

Without doubt, the most difficult of design problems arises from the unstandard nature of articles passing through the mail exchange. Even the method of sealing letters or the tying of packets, etc., causes unpredictable vagaries in transit through machine systems. Perhaps the most important Australian development has been the sloping belt. By its use articles may be diverted from conveyors without the possibility of causing interruption to the normal mail flow. The sloping belt feature forms part of every machine system installed in the Mail Exchange. Before this development, sweeps and other methods were used for the diversion of mail flow. In other countries, even jets of compressed air have been used for the purpose.

The manner in which the sloping belt is used in each machine system will be described in the associated articles. The technical aspects of the sloping belt will, however, be given in the one describing the O/A. system, together with a reference to other methods used elsewhere.

An important fundamental feature of design which is of particular significance when entering into a relatively unknown field of development has been the avoidance of over sophistication. Where several techniques or methods have been devised to perform a function, the simple has been preferred, wherever possible, to the complex. This is confirmed by reference, for example to the sloping belt technique or the magnetic memory device used with the parcel machine system.

However, the need for machine systems to perform efficiently and with low fault incidence cannot be denied; circuitry and mechanical components must be designed with this in mind. They must take into consideration, too, the need for adequate control and guard facilities. The provision of these facilities must naturally have high essentiality for a system such as that installed in the Sydney Mail Exchange for the code sorting of letters, where the output capacity is dependent on links which may be common to a particular coding suite.

There are a number of refinements which could have been included with the first stage of the project to assist management. Whilst local supervisory control facilities have been included with each machine system, the ultimate will be the provision of a centralised supervisory control system so that traffic flow and loadings may be oversighted.

Future refinements must also envisage a centralised statistics centre

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where volumes and numbers of articles passing through the Mail Exchange may be automatically recorded for examination or analysis. Access to reliable statistical information is essential to officers concerned with traffic management and staffing arangements.

Provision has been made in the circuitry of each machine system for the tapping of leaks for both supervisory control and the centralised recording of statistics. Electronically actuated units which can be fitted to conveyor runs have already been made for the weighing of mail matter in flow.

As the letter handling system required new methods of work processing, it was necessary to extend study into other technical fields. One interesting example is the application of the science of ergonomics to determine the location of the keyboard at coding positions. The keyboard is located at approximately waist level and is adjustable in both the horizontal and vertical directions. The operator's seat is fitted with a rest for the left arm only.

Many keyboard layout arrangements are possible. Some similar to typewriters fitted with up to 50 keys are in use overseas. A keyboard having only five keys has also been devised and used to provide for coding systems with limited application. A further variation is the use of two sets of five keys, one for each hand. This arrangement required a key in each set to be pressed simultaneously to register a character.

The development of a standard keyboard arrangement for A.P.O. use, was a most difficult problem, involving finally, tests to determine mental reflex actions of keyboard operators. These tests did not favour the use of keyboards where the operation required a finger of each hand to depress keys simultaneously, as even slight variations in timing caused errors. Such errors would increase where the keyboard is to be used for numeric as well as alpha codes.

The keyboard finally adopted as standard is based on one developed for use with tabulators and computers. On this particular keyboard, alpha characters are registered by depressing two keys simultaneously with the thumb and index fingure of the one hand, i.e., a one-handed keyboard. To ensure efficient keying operation, the circuitry is not operative until the pressure is removed from the keys. By this means, tension on the operator has been removed. To ensure that touch coding commences early in the training period, the keys have not been individually designated. However, certain key groupings have been given a distinctive colouring for ready identification and as an aid to quick memorising of key locations. Fig. 12 shows the keyboard adopted by the A.P.O. Fig. 1 on Page 216 gives details of layout and usage.

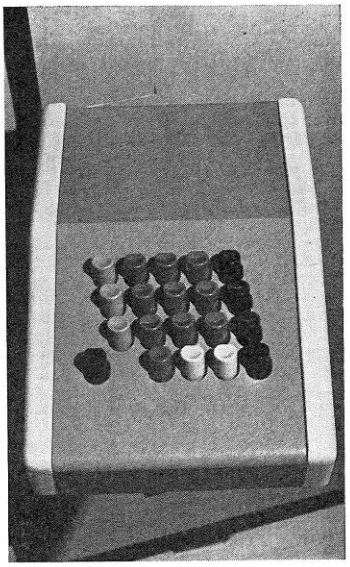

Fig. 12 — Keyboard Adopted by the A.P.O. for the Coding of Letters.

Again to ensure that there is no unnecessary mental strain or undue demand on operators, the development of machines which require the operator to work in rhythm with its movement has been avoided. Whilst earlier machines developed overseas, embodied this method, it has been generally discarded in later machine designs.

It is appropriate to make reference in this article to the code systems devised for use by the A.P.O., as it has had a direct bearing on the type of keyboard design. The development of a code is, of course, essential if electronic equipment is to be employed for automatic sorting. It provides a means whereby the keyboard operator may cause each envelope to be correctly code marked for subsequent sorting by an automatic process.

There are at least three methods of coding which may be devised for the purpose, i.e.:

(i) Extraction coding

(ii) Public Coding

(iii) Keyboard coding.

These methods, each of which is made use of by the A.P.O., are discussed in the following paragraphs.

Extraction coding is based on the selection of alpha characters from the destination name included with the address. The determination of the optimum code pattern is a difficult problem, as one of the disadvantages of extraction coding is the number of characters which must be taken from the place name if the number of ambiguities is to be kept within reasonable limits. Ambiguity is a condition where the extracted characters and their sequence are the same for two or more localities. In Australia, it has been found necessary to extract five characters with the particular order of selection being the first, second, fourth and last two.

Several simple rules are necessary when using the code as some place names may not contain five characters, whilst others may consist of two words. Other rules are also necessary to avoid ambiguity. In total, a keyboard operator is required to memorise eight rules when using the extraction method for coding letters.

Public coding is a system which can be devised for use by the public when addressing mail. The value of public coding depends however on the degree of co-operation obtained from the users of the postal service. The A.P.O. has allotted a unique four-digit combination to each Post Town in the Commonwealth, the first digit representing the State in which the place name is located, i.e., 2 for N.S.W., 3 for Victoria etc. There are sufficient spare number combinations to meet development in New South Wales and Victoria for at least 20 years and for an indefinite period in other States. It is possible to extend the code to 5 digits should future development demand such a course. This could be done with no appreciable inconvenience to the user.

Numbers from the bracket (001-999) have been distributed to localities on a broad geographical basis. In New South Wales, for example, the following areas are observed:

Area	All N.S.W. number Combinations prefixed by "2"
Suburban	001 - 249
Country	
North	250 - 419
East	420 - 559
South	560 - 739
West	740 - 899
Spares	900 - 999

The adoption of the numeric code has provided an additional aid to the sorting process as digits can be keyed with one finger more readily than alpha characters. Futhermore, only the last three digits need be fed into the system when coding for intrastate Post Towns, the first digit only being required when coding for interstate destinations. A numeric code also provides an aid for the manual sorting of non-letter form articles.

Obviously, a public code could be made up of alpha characters or a combination of alpha and numeric digits. Codes of this nature would not meet the requirements of future planning, particularly with respect to the eventual introduction of automatic reading of addresses by scanning.

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Keyboard coding requires the operator to memorise a code for each place name. This method is also used to a limited degree mainly to overcome the problems arising from ambiguities between place names where they occur. It could also be used for the numeric keying of letters to Post Towns receiving considerable volumes of mail. In such cases, the keyboard operator is required to memorise the allotted numeric code for each.

It will be seen that the A.P.O. has made use of the three recognised methods of coding, each for its particular purpose. Having in mind the need to ensure that maximum efficiency is gained from the letter coding and automatic sorting systems, it is essential that the alpha extraction method be used as a base. On this has been superimposed the simpler and more desirable numeric code method which depends for efficient use on the co-operation of the public. In its absence, extraction coding must be resorted to. The keyboard operators could, of course, be given the formidable task of memorising the allotted numeric code for every Post Town in the Commonwealth.

The Post Office recognises in the Commonwealth approximately 9,000 place names which may be included with addresses. All of these must be recorded in the memory system. In addition, all Post Towns of which there are 2,750 receiving direct despatches have been given a numeric code combination. These must also be included in the memory system.

It was the intention, when undertaking this exercise, to give, as far as possible, emphasis to the philosophy of approach to the problems of providing machine aids for the handling of mail. This philosophy cannot be expressed in few words as there are many associated aspects and fundamentals which must be observed. The ultimate in provision arises from efforts to meet the needs woven into the foregoing paragraphs. All these must be weighed and given their proper value in the final summation of effort, so that the result is the moulding of machine systems and traffic flow, capable of best meeting the needs of management. If this is done, the elements must live and extend to other sorting centres in the Commonwealth.

There is, of course, much more to be done and, in this era of technological development, it is obvious that we shall never be able to say "finish". It is essential however, that each step we take is in an orderly progression towards a logical goal. Even during the course of the project, design features have been inbuilt to better meet that which is regarded as the eventual concept. For, in common with other projects of similar nature and magnitude, each step taken crystallises the way to the next.

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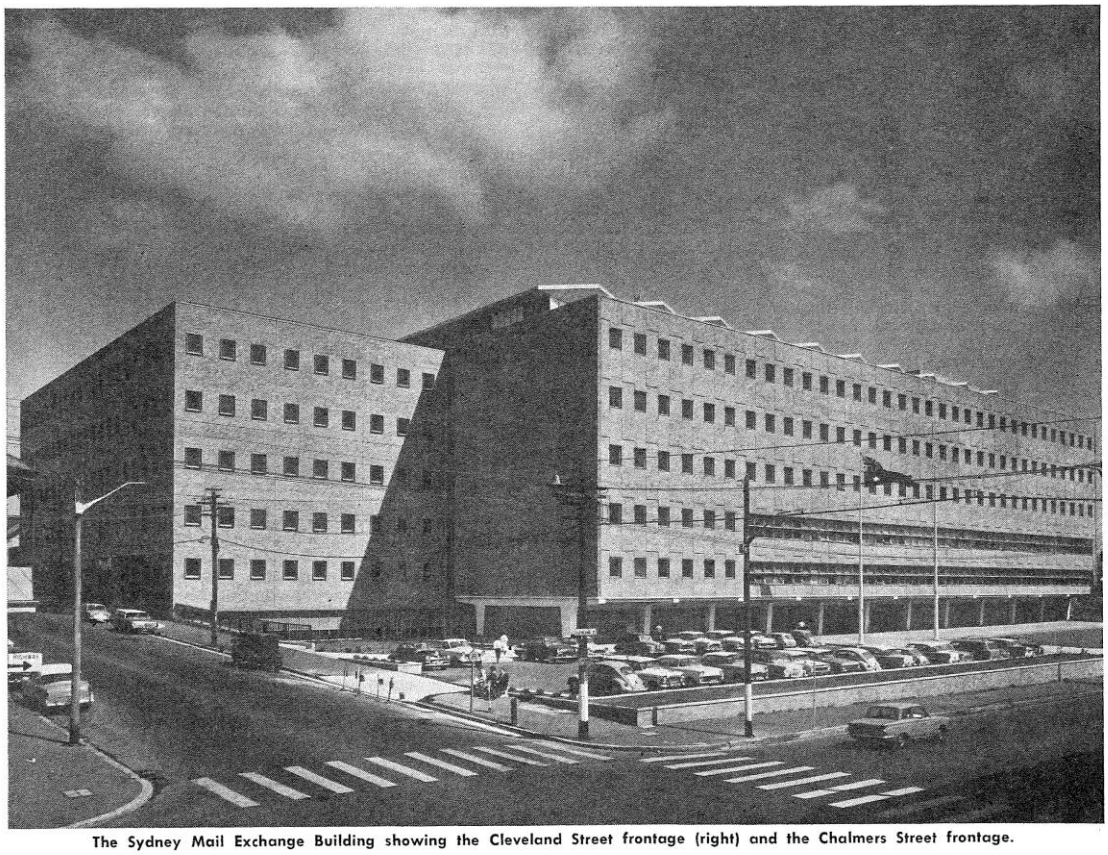

The Sydney Mail Exchange Building showing the Cleveland Street frontage (right) and the Chalmers Street frontage.