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U. S. ARMY NATICK LABORATORIES

TECHNICAL REPORT

MILITARY TYPESETTING EQUIPMENT AND SYSTEMS
FOR
INDO-ARYAN AND DRAVIDIAN LANGUAGES

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MECHANICAL ENGINEERING DIVISION

FEBRUARY 1964   NATICK, MASSACHUSETTS

U. S. ARMY NATICK LABORATORIES
Natick, Massachusetts

MECHANICAL ENGINEERING DIVISION

Technical Report

MILITARY TYPESETTING EQUIPMENT AND SYSTEMS

FOR

INDO-ARYAN AND DRAVIDIAN LANGUAGES

(Hindi, Marathi, Bengali, Punjabi, Gujarati,
Malayalam, Tamil, and Telugu)

(1961-1963)

Edward Nitenson

Field Service Equipment Branch

February 1964

The Department of Army is responsible for carrying out an effective indoctrination program in all major languages of the world which have an alphabet or written form. To carry out this mission, the Army must provide the equipment needed to prepare news sheets, broadsides, posters, training publications, orientation literature, and information leaflets. Necessary, of course, to the effec. e dissemination of this information is field equipment capable of type-setting, printing, and reproducing material in any one of some forty-odd languages. The responsibility for this development is delegated to the U. S. Army Materiel Command's Natick Laboratories.

This report presents significant findings made through an extensive research study on aspects essential to the development of field equipment for typesetting five major Indo-Aryan languages: Hindi, Marathi, Bengali, Punjabi, and Gujarati, and three Dravidian languages: Malayalam, Tamil, and Telugu.

It is believed that the reliable technical, language, and engineering data obtained through this study will make it possible to develop efficient and economical field typesetting equipment for these Indian languages. This will provide a military capability for disseminating timely indoctrination material that can be understood by more than 93% of the literate populace of India.

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Brigadier General, USA
Commanding

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ABSTRACT

This is the first known attempt to assemble technical, engineering, and Indian language data needed to develop military field typesetting equipment that will provide the United States Army an effective capability for preparing indoctrination material in the native language of India.

Prior to this study, sufficient information was not available at these Laboratories regarding adequate technical and mechanical requirements for military typesetting equipment that could accommodate the unique alphabet characters, ligatures (ranging from 200 to 1200), punctuation marks, etc., of the Indian languages.

During the initial phase of this study it was determined that eight Indo-Aryan and Dravidian languages are understood by the largest proportion of the literate population of India. Therefore, efforts have been directed toward obtaining data applicable to field equipment for typesetting these languages.

As a result, sufficient reliable information has been compiled from knowledgeable national and international sources for conducting exploratory development and engineering programs for (a) improving and adapting commercially available Indian typewriter keyboards to military equipment and (b) developing new-concept typesetting equipment and systems that will fulfill immediate, future, and long-range Indoctrination Program requirements.

S. S. R.

FGHANISTAN

CHINA

SHINA

KASHMIRI

WEST
PAKISTAN

E.
PANJABI

W.
PAHARI

NEPAL

ASSAMESE

RAJASTHANI

W.
HINDI

E.
PAHARI

GARO KHASI

E.
PAKISTAN

MEITHEI

GUJARATI

E.
HINDI

BIHARI

BENGALI

BURMA

ORIYA

MARATHI

Bay

Arabian

Sea

TELUGU

of

Bengal

KANNADA

TELU

LACCADIVE
IS

TAMIL

ANDAMAN
IS.

MALAYALAM

CEYLON

Indian Ocean

vi
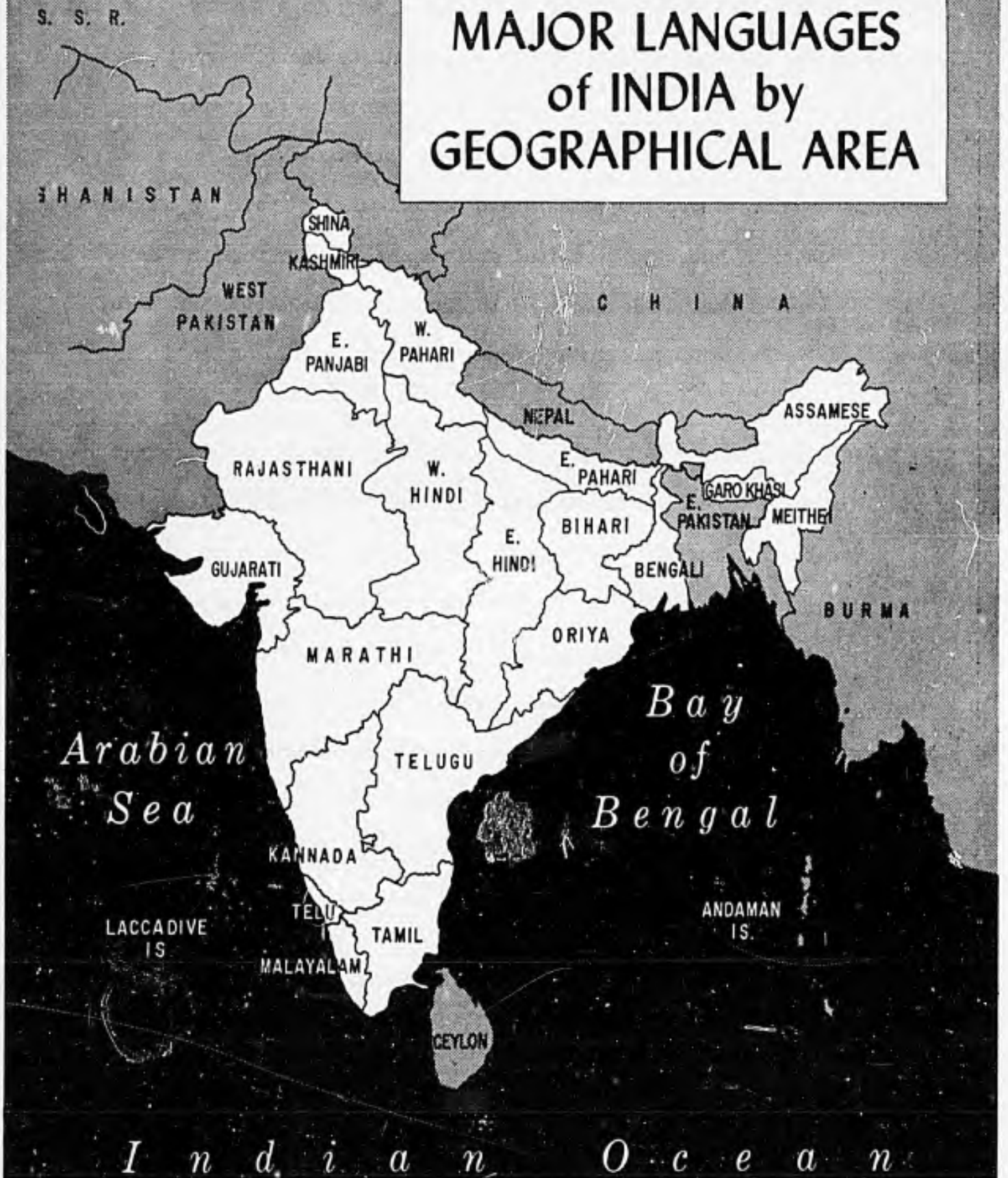
CHAPTER I

INTRODUCTION

As United States assistance and cooperative endeavors among the Allied Free Nations of the world become broader and broader, the U. S. Army is faced with the problem of providing a capability for communicating -- in written or printed forms --- in more and more languages.

For languages having alphabets using less than 200 characters, development of typesetting equipment for foreign language copy has posed no unsolvable problems. Special type fonts and typemasters have been developed by the VariTyper Corporation, Newark, New Jersey -- under contract to the U. S. Army Natick (Mass.) Laboratories. Used with the VariTyper Model 610 Composing Machines and Model 1800 Headlining Machines, they provide U. S. Army field indoctrination units a capability for reproducing more than 30 languages.

The problem of communicating with the populace of India, however, has been more difficult because different regional languages are used within different geographical areas. A recent linguistic survey of India lists 179 languages,[1] of which 8 will fulfill military indoctrination requirements.

Because of the large number of characters required for these Indian languages; the unique methods of character formation; and the anticipated difficulties in obtaining qualified Indian language consultants and technical data, type fonts and typemasters for these languages have not been developed.

Under these conditions it became necessary for the U. S. Army Natick Laboratories to determine the technical mechanics and engineering aspects involved in designing and developing suitable typesetting equipment for these Indian languages.

Accordingly, the author conducted an extensive research study during the period January 1961 through December 1963.
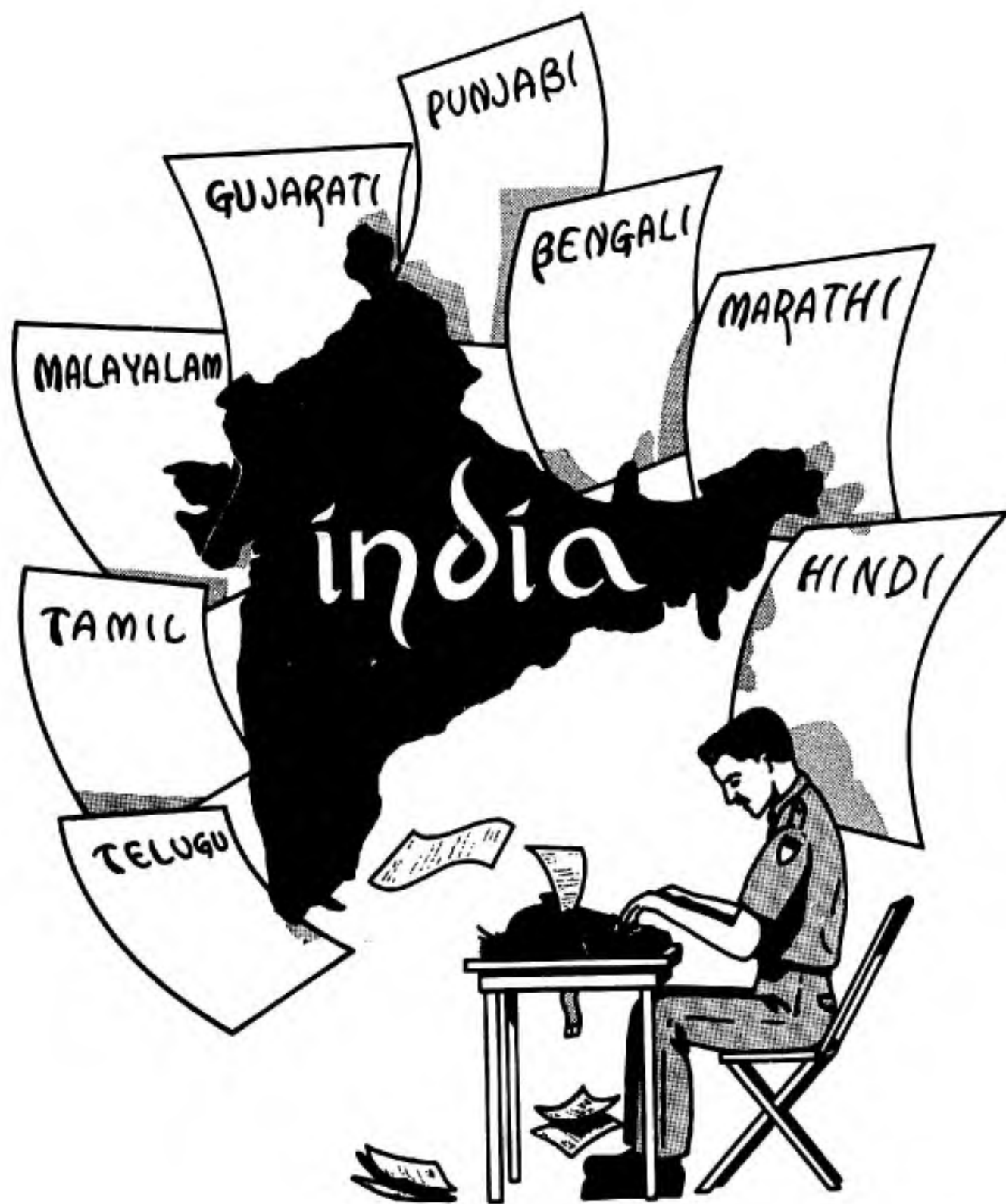
CHAPTER II

RESEARCH AND DEVELOPMENT OBJECTIVES

The immediate objective of this investigative research has been to collect data upon which to formulate methods, techniques, or new-concept engineering principles that will solve the mechanical problems associated with developing typesetting equipment for Indian languages under study, such as:

1. Selecting essential keyboard characters.

2. Adapting acceptable typographical type font designs to U. S. Army military equipment and systems.

3. Evaluating design and engineering principles in currently used items.

4. Evaluating communications systems and processes used in India.

5. Determining items of equipment which are suitable for adoption by the U. S. Army.

The ultimate objective is the standardization of typesetting equipment for International adoption to provide the Military Forces a capability for communicating in the indigenous languages of India.

CHAPTER III

BACKGROUND

For many years there has been a growing concern about the requirement for suitable typesetting equipment that will provide a capability for subsequent printing of indoctrination information for India, which according to population is the second largest nation of the world.

Results of a census taken in 1961 showed a total population of approximately 440 million,[2] an increase of 21.3% over 1951, and the 1962 estimate was approximately 449 million.[*] Significant also, is the fact that the literate population has increased to more than 103 million. (See Appendix A.) Information indicates that even though the remaining persons do not read and write sufficiently well to be listed as literate, most of them understand spoken Indian languages so that printed information relayed through verbal media could be understood by practically the entire populace of India.

Since the findings of this Research Study will be applied to typesetting equipment for eight of the major Indian languages, it appeared logical to contact private, public, and commercial sources (domestic and foreign) which deal directly or indirectly with Indo-Aryan and Dravidian languages. Therefore, this study was conducted largely by correspondence and personal consultation with knowledgeable individuals including linguists, translators, scholars, writers, and publishers, as well as type founders, manufacturers of typewriters, typewriter type, type-setting and printing equipment; also mission societies and schools teaching printing in India.

Detailed questionnaires were designed to obtain all available information considered applicable to the objectives of this study. Approximately

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[*] Britannica Book of the Year, 1963.

200 questionnaires were distributed, and, to date, 160 replies have been received from both national and international sources.[3] Reliable data have been compiled from the respondees.

To reduce the lead time for the development of this equipment, a contract was awarded through competitive bids to Southern Illinois University, Carbondale, Illinois, to conduct a comprehensive study of the major Indo-Aryan, and Dravidian languages and provide essential information, including:

a. A compilation of all possible forms and variations of all characters, accent and diacritical marks, punctuation marks, etc.

b. Data concerning the "frequency-of-use" of each of the characters, etc.

c. Recommendations concerning the minimum number of characters, punctuation marks, etc.,deemed essential for the preparation of military indoctrination information.

The contractor's report is scheduled for completion during April, 1964, and findings will be coordinated with the information obtained through this research study.

CHAPTER IV

SIGNIFICANT FINDINGS

During the course of this study it was found that India is making rapid progress in solving many communications problems resulting from the large number of different regional languages used within its growing cosmopolitan, industrial, and political areas. During an "All-India Linguistic States Conference" the possibility of redistribution of the country on linguistic considerations was indicated as a possible solution.[1]

It was apparent that there was difficulty in adapting Indian scripts in their traditional forms to modern mechanized equipment such as typewriters, typesetting machines (linotype, intertype, monotype) and teleprinters.

It was also found that Committees had been appointed in India to consider script reforms and it will be advisable, therefore, that the Natick Laboratories maintain close liaison with these Committees in order to become cognizant of any reforms which might affect keyboarding design layouts and other mechanical engineering aspects of equipment proposed for development. Information pertaining to "Script Reform in Modern India" was published in an article by Prof. W. Norman Brown, University of Pennsylvania. (See Appendix B.)

Additional significant findings are presented in three major categories: (1) Indo-Aryan and Dravidian Language Data; (2) Typesetting Equipment and Techniques for these Languages; and (3) Major Typesetting Processes and Systems Currently Used or Available for Use in India.

1. Indo-Aryan and Dravidian Language Data

After gaining her independence in 1947 there was some feeling that India whose official business which had for many years been transacted in English, should retain that language in governing herself.[1,2] All of the official records of the country were already English, which has fewer characters than any of the Indian languages. However, there was a stronger feeling that India should adopt as its official means of communication a language current in the country. Consequently, the Constitution of India proclaimed that effective in 1965, Hindi, in Devanagari script, would become the Federal language for the purpose of building a strong common bond of language and literature for the whole of India.[2] In the meantime, English would continue to be recognized as the official alternate language and 13 regional languages of India would continue to be recognized and used for other purposes. Alphabets for these languages are presented as follows:

Table 1. Alphabets for 14 Major Indian Languages[1]

Language	THE ALPHABET
@ Sanskrit	
* Hindi	
** Urdu	
† Bengali	
† Marathi	
† Punjabi	
† Oriya	
† Gujarati	
† Assamese	
† Kashmiri	
‡ Telugu	
‡ Tamil	
‡ Kannada	
‡ Malayalam	

@ Sanskrit is the most ancient language of India and perhaps of mankind. It has a great religious and philosophical literature. To this day it is the language of pandits and savants.
* Hindi is the language of common intercourse throughout the country, especially in the north. It has been recognised by the Constitution of India as the Official language of the Union.
** Urdu is a mixture of Hindi and Persian, and was evolved during Moghul Rule.
† These regional languages are akin to Hindi, being derived principally from Sanskrit.
‡ These belong to the Dravidian group of languages and are spoken in the South.

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Significant findings related to the design and engineering aspects of typesetting equipment show that:

a. In addition to basic alphabet characters, Indian languages use many combinations of characters (conjuncts), half characters, vowel signs, numerals, and punctuation marks. Also, to indicate on paper almost imperceptible variations of sound, a highly intricate system of accent marks and characters is integrated into the languages. For example, Devanagari script is considered one of the most exacting methods devised for transcribing sounds.[4] Whereas in English it is possible for three different words to have the same sound, e.g. "to," "two," and "too," this is not possible with Indian languages. There is only one written form for each sound, and each sound variation must be written in a different way. The unique process of mechanically forming or "building" characters presents difficult engineering problems.

There are vertical as well as lateral typographical alignment complexities. Characters require placing diacritical marks beside, below, as well as above the basic character, and space equivalent to 3 lines of copy must be provided.[4] In some instances, diacritical marks must extend beyond and slightly over the basic character.

The following configurations are examples which express some of the sound variations based on the vowel "a":

"a" is expressed as अ which requires only one stroke on a typewriter keyboard.

"ā" is expressed by forming a ligature character, consisting of the basic "a" अ and the diacritical mark ा which completed is आ and requires two strokes on a typewriter keyboard.

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"au" is expressed by forming a ligature character consisting
of the basic "a" अ to which are added T and ꞈ the
diacritical mark, to form the completed character औ.
This requires three strokes on a typewriter keyboard.

    b. The 15 major or literary languages in India are classified under
four categories, in which there are large basic differences in structure and
vocabulary:

    (1) The Indo-Aryan Speech Family, which includes Hindi, Marathi,
Bengali, Punjabi, and Gujarati, is the most important, both numerically and
culturally. These are current languages among more than 73% of the population of
India.

    (2) The Dravidian Speech Family, which includes Malayalam,
Tamil, and Telugu, is spoken by approximately 20% of the population of India.

    (3) The Austeric Speech Family, for which speakers form
approximately 1.3% of the total population, and

    (4) The Sino-Tibetan Speech Family, which is spoken in the
hills and mountains of Assam and Nepal, by less than 1% of the total
population.

    c. The Devanagari script, which derives from ancient Sanskrit, is
to Hindi, the official language of India, what the Roman alphabet is to English.

    d. All of the Indian languages investigated can be transliterated into
English as shown on a Table of Transliteration obtained through this Study.[5]
Information prepared in transliterated forms, however, would probably be rejected
because of nationalistic loyalties which the Indian people feel toward their own
regional languages.

    e. All languages under study have been adapted to typewriter
machines.

f. Devanagari script has been composed on phototypesetting machines.

g. Typecasters are used for all the languages and mostly for the casting of type for the case. Type specimen sheets have been compiled for all languages studied and they are readily available for use in the design and development of military typesetting equipment. Appendix C presents typical type specimens for the various languages.

h. Only the most effective principles should be adapted to U. S. Army field equipment. For example, scientific principles for placing characters on keyboards to attain the most efficient work dispersion on hands and fingers based on relative frequencies of letter sequences, should be considered and evaluated.[6]

2. Typesetting Equipment And Techniques For Hindi And Marathi

Hindi and Marathi have been reproduced by typewriting, typecasting, linecasting, phototypesetting, foundry type, and teletyping systems.

Because of the wide variations in the initial typewriter keyboards by both domestic and European typewriter manufacturers,[7] the Central Indian Government, in 1953, appointed a "Hindi Typewriter and Teleprinter Committee" to design a standard keyboard layout for the Hindi language. This came about as a result of the Lucknow Conference at Uttar Pradesh, in November 1953, to devise reforms in the Devanagari script which would make it possible to satisfactorily type the characters and symbols considered necessary for communicating with the Hindi- and Marathi-speaking communities.[8]

In December 1962, the problem of standardization was solved when the Central Indian Government accepted the "Final standard keyboard for the 46-key Hindi Typewriter" as recommended by the Typewriter Committee.

In addition to the characters required for Hindi, this typewriter keyboard carries two additional characters which are used for Marathi, namely, ॲ and ऴ , thereby making it possible to type both languages on one typewriter. All other Devanagari characters used in both Hindi and Marathi are the same.

Godrej & Boyce, and Remington Rand, manufacturers of typewriters in India, have accepted the standard 46-key Hindi typewriter. The Shinko Teleprinter, manufactured by the Shinko Factory, Japan, has been using a similar general layout design since 1957, when Hindi was first mechanized successfully to a teleprinter keyboard.

FINAL KEY BOARD FOR THE STANDARD (46 KEYS)

HINDI TYPEWRITER

Figure 1. This keyboard for the Hindi typewriter, adopted as Standard by the Central Government of India, uses Devanagari characters which make it possible to type two languages ---
Hindi and Marathi.

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The standard Hindi-Marathi typewriter makes it possible to form complete units with a minimum number of keys by using an over-strike principle. For example, a group of characters, and/or half characters may be joined through the use of proportional spacing, or back spacing. Some keys bearing accent marks are "dead" keys and do not move the carriage when depressed. Other keys have a half movement in upper shift, a half movement in lower shift, a half movement in both shifts, or a full space movement.

To achieve this characteristic, it was necessary to place some of the Devanagari characters out of the so-called "frequency-of-use" sequence. However, the Report of the Hindi Typewriter and Teleprinter Committee[9] was found to contain a detailed analysis of the character usage and keyboard placement which indicated that the final keyboard used in the standard Hindi typewriter is the best possible solution to the problems of minimizing character usage from all avenues of approach at the present time.

It was found that the character keyboard layout of the Standard Hindi Typewriter, shown in Figure 1 was adequate and would provide an immediate capability for communicating with the Hindi- and Marathi-speaking populace of India.

3. Typesetting Equipment And Techniques For Bengali

Bengali script has been reproduced by foundry type, typewriter, linecaster, and typecaster systems.

An interesting situation relative to this language, and the means for its dissemination to the reading public, occurred in 1950 when the West Bengal Government appointed a Committee to reform the language characters. Prior to that time it was quite difficult to mechanize orthodox Bengali script for typesetting because it made extensive use of conjunct (Sanyukt) characters, which can only be formed through half-back-spacing techniques. In addition to requiring skilled typists, this also retarded the speed of operation.

It was learned that the Committee, under the chairmanship of the late Mr. Suresh C. Majumder, Editor of the Bengali Newspaper "Yugantar," recommended that conjunct characters be dropped, in order to make it possible to mechanically typeset the language.[4]

In consultation with Prof. W. Norman Brown, who at that time was representing Linotype Corporation for the purpose of preparing a Bengali keyboard, Mr. Majumder developed what was considered a major breakthrough for linecasting machine typesetting.[10] According to information obtained during this study, it was his ingenuity which made it possible to reduce the number of Bengali letters to accommodate the Linotype keyboard. As a result, it is now possible to set from Linotype with side magazines.

There was considerable objection to the so-called "radical reforms" in the script from the purist element. However, the reforms recommended by Mr. Majumder

made the language ideally suited for linotype and monotype machines, as well as typewriters, and was approved by the West Bengal Government.

Prior to 1950, Remington Rand had developed typewriters which reproduced Bengali, including conjunct characters. As this retarded the speed of operation they have redesigned the keyboards to conform with the reformed Bengali alphabet.

Since that time the business community and reading public have been exposed to and largely accepted the reformed method of the printed and typewritten characters.

A September 1962 meeting between the author and Mr. Jackson Burke, Director of Type Design, Merganthaler Linotype Company, Brooklyn, New York, revealed that as far as machine typesetting was concerned no further time or study was considered necessary. Prof. W. Norman Brown, Chairman, South Asia Regional Studies, University of Pennsylvania, reiterated and supported Mr. Burke's opinions. Since then correspondence with Mr. K. D. Manaktala, Director of Remington International of India,advises that the West Bengal Government has again appointed a committee to evaluate complaints that the reforms are not satisfactory. Information indicated that because of the National Emergency of October 1962, it is possible that resolving the situation may not come for some time.[4]

Reports indicate that use of the reformed language characters for 13 years has had considerable impact on the reading public. Since it has been adopted by the West Bengal Government, it would appear reasonable to assume that until the Language Reform Committee authorizes further changes, the presently accepted language will continue to be used.

Bengal is one of the most economically advanced business communities in India and more text books, religious books, magazines, newspapers, etc., are mechanically typeset in West Bengal than in any other State of India.

The character keyboard layout of the Remington Rand typewriter shown in Figure 2 is considered adequate for providing an immediate military capability for communicating with the Bengali-speaking populace of India.

With minor keyboard modifications, this typewriter can be manufactured as a bilingual machine. According to information recently obtained from L. W. Fleming, Manager, Typographic Department of Remington Rand of New York, N. Y.,[11] the Bengali keyboard can be adapted to Assamese (another Indo-Aryan language) by merely adding two additional characters ৰ and ৱ to the Bengali keyboard layout shown in Figure 2. With the exception of these two Assamese characters, all others are the same for the two languages.

A bilingual typewriter --- Bengali and Assamese --- would provide a capability for communicating with nine of the major Indo-Aryan and Dravidian languages.

Prof. Edward C. Dimock, Jr., Director of Linguistics, University of Chicago, who is presently conducting research in India, has consented to review and evaluate the Bengali keyboard. His comments and suggestions will be considered in the design of new and/or improved typesetting equipment.

Figure 2. Character keyboard layout for Bengali[*]

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[*] Reproduced with permission of Remington Rand International, Division of Sperry Rand Corporation, New York, N. Y.

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Figure 3. Character keyboard layout for Punjabi Typewriter*

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* Reproduced with permission of Remington Rand International, Division of
Sperry Rand Corporation, New York, N. Y.

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4. Typesetting Equipment and Techniques for Punjabi

Punjabi (also called Gurmukhi) is a comparatively simple script since it makes minimum use of conjunct (Sanyukt) characters, or half characters.

This language has been successfully reproduced on the typewriter by Remington Rand and, in fact, would not require the complete keyboard to reproduce the characters essential for U. S. Army use, according to K. D. Manaktala, noted Indian typewriter technologist, and Professor H. A. Gleason, noted American linguist. It was noted that the Punjabi #3488 keyboard layout did not include the subjoined (w), however, Prof. Gleason indicated this is a rarely used character except in technical, religious, or philosophical material, and its omission did not appear to be a critical factor.[10]

Recently, the Punjab Government recommended updating the machine. Correspondence with Remington Rand International of India indicates that Roman numerals will replace Punjabi numerals, and additional punctuation marks will be added to the keyboard.

The character keyboard layout for the Punjabi typewriter shown in Figure 3 is considered adequate to provide an immediate military capability for communicating with the Punjabi-speaking populace of India.

Figure 4. Character Keyboard Layout of Gujarati*

CHAPTER IV

SIGNIFICANT FINDINGS

5.   Typesetting Equipment And Techniques For Gujarati

Gujarati is regarded as one of the less difficult scripts.

To date, it has been reproduced successfully by typewriting and foundry type, as well as Monotype and Linotype mechanized typesetting systems.

An evaluation of information obtained from several sources indicates that the keyboards of the Remington Rand machines carry all the characters considered necessary for inclusion in the proposed military typesetting equipment.

This language is spoken in Gujarat and Bombay and extensive use of the typewritten material by the business community reaffirms the adequacy of the available typewriters.

The character keyboard layout for the Gujarati typewriter shown in Figure 4 is considered adequate to provide an immediate military capability for communicating with the Gujarati-speaking populace of India.

Comments concerning (a) reducing the number of keys and (b) clarifying certain character configurations on several keys, have been submitted by Prof. George Cardona, University of Pennsylvania. His comments and recommendations will be considered in the design of new and/or improved items of military typesetting equipment.[12]

Figure 5. Character keyboard layout for Malayalam[*]

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[*] Reproduced with permission of Remington Rand International, Division of
Sperry Rand Corporation, New York, N. Y.

SIGNIFICANT FINDINGS

6. Typesetting Equipment And Techniques For Malayalam

Malayalam has been reproduced by foundry type, monocasters, and typewriters. The Remington Rand machine was acceptable to the Kerala State business community when it was introduced in 1936 and has been used extensively since by the business community as well as governmental offices.

The character keyboard layout for the Malayalam typewriter shown in Figure 5 is considered adequate to provide an immediate military capability for communicating with the Malayalam-speaking populace of India.

Prof. Leigh Lisker, University of Pennsylvania, has consented to review and evaluate the Malayalam keyboard. His comments and suggestions will be considered in the design of new and/or improved typesetting equipment.

Figure 6. Character keyboard layout for Tamil*

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* Reproduced with permission of Remington Rand International, Division of
   Sperry Rand Corporation, New York, N. Y.

CHAPTER IV

SIGNIFICANT FINDINGS

7. Typesetting Equipment And Techniques For Tamil

Tamil is spoken in the State of Madras and has been successfully typeset by all processing methods. Linotype composition is used extensively for newspaper work and acknowledged by Indian printers and publishers as typographically acceptable according to Prof. W. Norman Brown, University of Pennsylvania, who was commissioned by Linotype Company in 1935 to design a Tamil keyboard.

The State of Madras is highly nationalistic and observes tribal traditions concerning language in its written or printed forms. According to a custom dating back to the use of stylus and palm leaves upon which the characters were scribed, it was necessary to write across the fibers so that the characters would be scribed in an unbroken line. From that time, the custom continues, and even with the use of paper and mechanical typesetting, the characters must be kerned and cursive in nature. The curves should be a full body line, thinning toward the end. It has been indicated that the reading public would object to a bold face sans serif Roman vertical style, compared with the kerned Italic full body, line design.

Tamil has also been designed for typewriter keyboards according to character frequency. The Madras Government has accepted the Remington Rand Model 3608 Tamil Machine as conforming with the "Madras Government Standard." (See Figure 6.) It is considered that the typographical configuration of the characters could be improved. However, the character keyboard layout and design can be used as a basis for developing the proposed field typesetting equipment since it incorporates all characters and symbols considered essential to provide an immediate military capability for communicating with the Tamil-speaking populace of India.

Accent Location.

Accent Location.

Figure 7.   Character strike-up specimen for Telugu Typewriter keyboard
adopted in 1936.[*]   This strike-up shows keyboard arrangement,
alignment, and use of accents.   It was made on one of the first
lot of 100 Model H Machines produced.[13]

[*]   Reproduced with permission of Royal Typewriting Co., Hartford, Connecticut

SIGNIFICANT FINDINGS

8. Typesetting Equipment And Techniques For Telugu

Telugu is one of the most important of the Dravidian languages and one which presents greater mechanical typesetting problems than any of the eight languages studied.

Telugu has been reproduced from foundry type and from monocasters. Currently, Monotype equipment appears to be too bulky and heavy for field use under modern mobile concepts. Telugu has not been mechanically typeset by any other typesetting systems, due primarily to the physical configurations of the characters and symbols which must be set up in tiers ranging from 1 to 3. Also, the characters of this alphabet present proportional problems, as can be seen from the typewriter keyboard strike-up specimen shown in Figure 7.

It was learned that in 1936, Royal Typewriter Company manufactured 100 machines based upon a "Telugu Typewriter Scheme" of Raja P. Parthasarathy Rayanigar, B.C., Raja of Panagal.[13] The keyboard layout design was accepted by the University of Madras and considered a contribution to Telugu Orthography.

Information received from Mr. M. Durochin, Chief Type Engineer of the Royal Typewriter Company, Hartford, Conn., indicates that no additional machines have been made. Information received from the Andhra Pradesh State Government, through the Military Attache, indicates that although the Royal Typewriters have not been widely used, the Government is using several of the machines and considers them adequate.

It was also found that several Indian patents have been issued for improved keyboard designs.[14] Copies of these patents have been obtained and a noted Telugu linguist, Prof. Gerald Kelley of Cornell University, has consented to review and evaluate the improvements.

The character keyboard layout for the Telugu typewriter shown in Figure 8 is considered adequate to provide an immediate military capability for communicating with the Telugu-speaking populace of India. Modifications considered essential will be incorporated in new and improved models of Telugu typesetting equipment.

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Figure 8. Character keyboard layout for Telugu*

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* Reproduced with permission of Royal Typewriting Co., Hartford, Connecticut

SIGNIFICANT FINDINGS

9. Major Typesetting Processes And Systems Currently Used Or Available For Use In India

According to information obtained through this research study, there are

six major mechanical and other typesetting systems currently used, or ready for

use, in India. Presented in the order of predominance they include:

        A.   Foundry Type System (Hand-Setting)

        B.   Typecasting System

        C.   Linecasting System

        D.   Teleprinting System

        E.   Typewriting System

        F.   Phototypesetting System

             (1) Display Composition

             (2) Display and Text Composition

Typical items of equipment used in these systems, together with significant

findings, and evaluations of the effectiveness of these systems, are presented on

the following pages.

A.   Foundry Type System (Hand-Setting) - Even though this system is the primary typesetting method used in India, it is not considered applicable to the typesetting equipment proposed for U. S. military indoctrination purposes because of its obsolescence.

B.   Typecasting System - This equipment is currently available and is the most extensive mechanical method used for typesetting each of the Indo-Aryan and Dravidian languages under study. In its present form, this equipment is not considered acceptable for U. S. Army field use because it is too bulky and too heavy to be transported under modern mobile Army concepts. If the weight and bulk problems could be solved through a research, engineering, and development program, the typecasting system would be an efficient and effective system for fulfilling U. S. Army requirements. This conclusion is based upon findings that typecasting equipment has the capability for setting all the characters and ligatures in the several languages considered essential for general use.
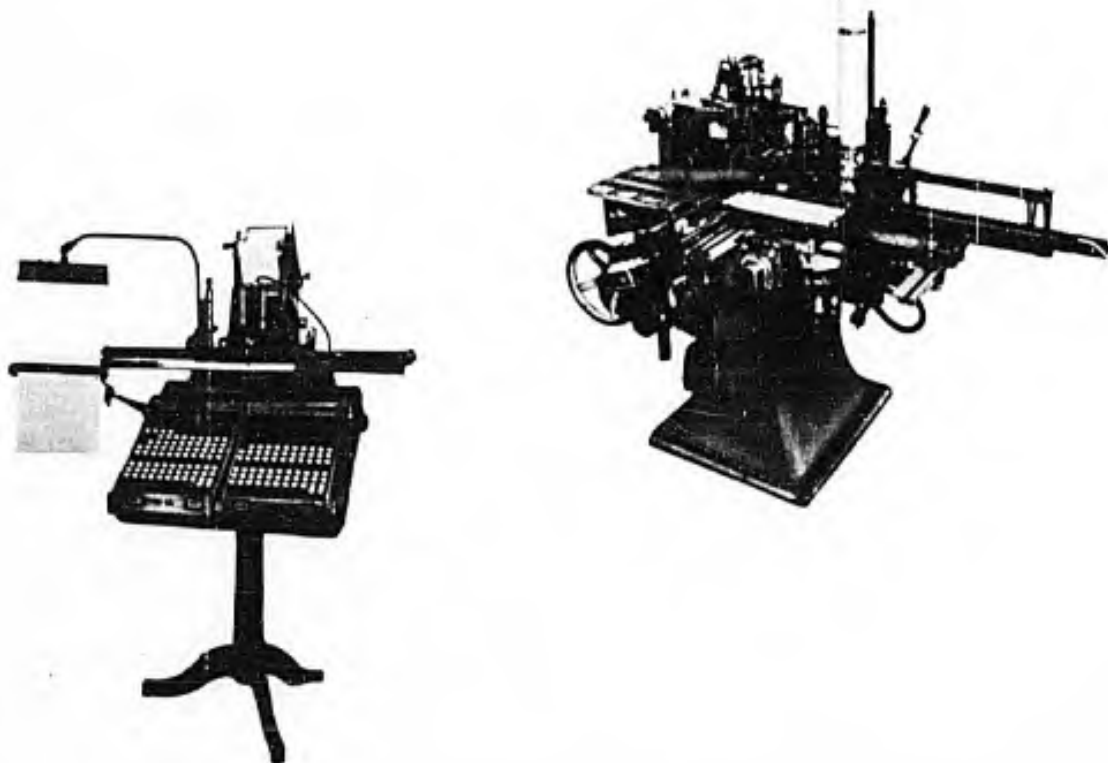
Figure 9.   Typical Typecasting System consisting of 2 machines, the keyboard and the casting machine.

C. Linecasting System

Linecasting equipment is currently being used for Hindi, Marathi, Bengali, Gujarati, and Tamil newspaper composition. Because of mechanical limitations, primarily in Hindi and Marathi, this system is less applicable to U. S. military typesetting equipment than other systems. The matrices, which must be made up into a line, the complexities of which are explained on Page 8 do not permit the character latitude that is possible with typecasting or other systems which permit vertical as well as horizontal character construction.
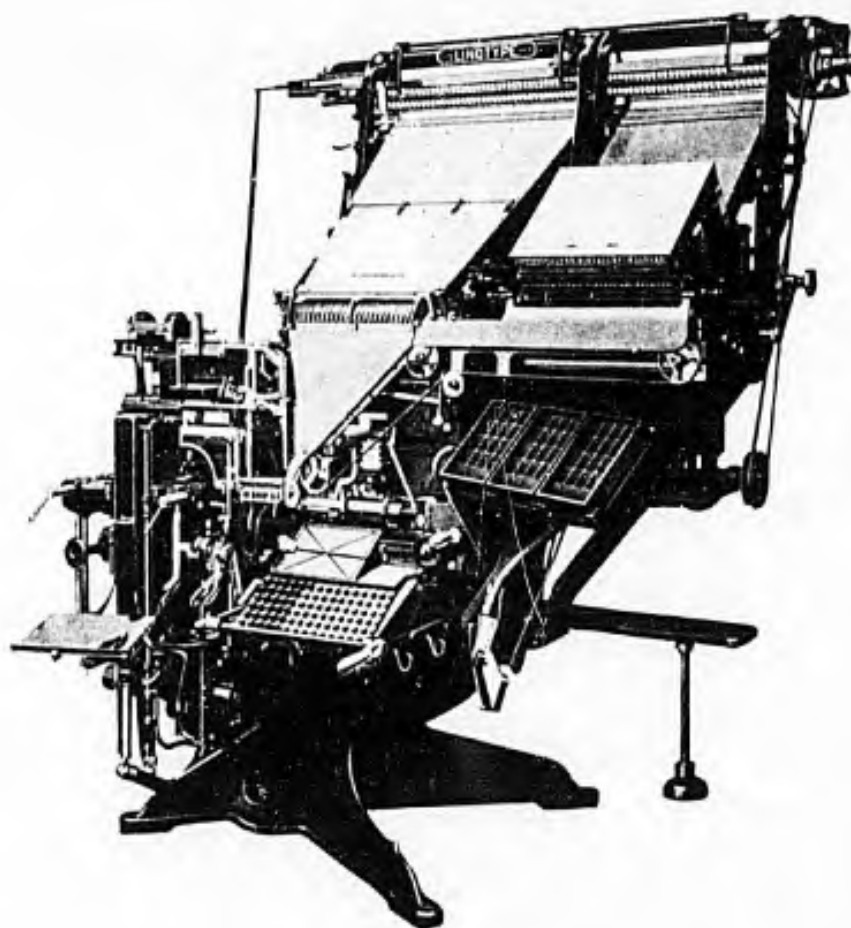
Figure 10. Typical Devanagari Linotype[*] which may also be used for the composition of any modern language in Roman and other scripts, including Arabic.

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[*] Reproduced with permission of Mergenthaler Linotype Co., Brooklyn, N. Y.

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D. Teleprinting System

In 1956, the Shinko Factory of Japan initiated development of a
teletype unit for reproducing Hindi, using Devanagari script. This teleprinter
was fashioned after the Western Electric, (Model 15) counterpart, for which a
manufacturing license was obtained. Although it was basically designed for the
English language, K. B. Lal Seth, Chief Engineer, United Press of India, Ltd.,
New Delhi, adapted the machine to Hindi, thereby making the unit bilingual --
English and Hindi. This Shinko teleprinter, which uses a 6-bit tape, was
successfully completed and distributed in 1957. To the best of the author's
knowledge it is currently being used in India for teletype communications.
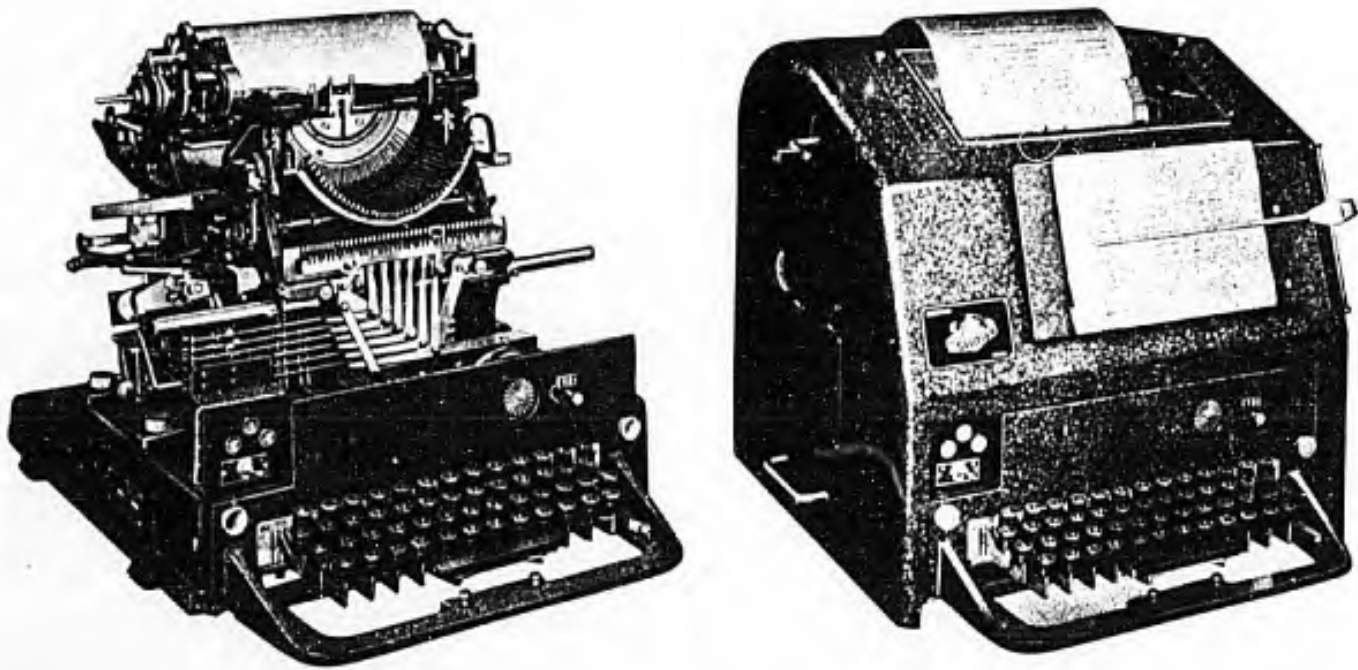
Figure 11. Teleprinter Communications System[*]

_____

[*] Reproduced by courtesy of Shinko Factory, Tokyo, Japan.

Olivetti Corporation, Ivrea, Italy, also designed a machine for setting Hindi and furnished the author a copy of the keyboard layout,[15] which they advise has been adopted as standard for Ceylon.

Teleprinters have also been developed for South Asian and near Eastern languages, other than those included in this study.

Telegrams can be sent in any Indian language provided they are written in Devanagari script.[2] Telegraph traffic in Hindi is progressively increasing as indicated in the following table:

Table 2. Telegraph Traffic in Hindi*

Year	Number of Telegrams (Lakhs)
1950-51 - - - - - - - - - - - - -	5,784
1955-56 - - - - - - - - - - - -	58,522
1956-57 - - - - - - - - - - - -	66,927
1957-58 - - - - - - - - - - - -	89,202
1958-59 - - - - - - - - - - - -	106,445
1959-60 - - - - - - - - - - - -	122,747

*India - A Reference Annual - 1961, compiled by the Research and Reference Division, Ministry of Information and Broadcasting, Government of India, page 372.

E. <u>Typewriter System</u> - Typewriters are used extensively throughout India for business, industrial, and governmental communications. There is a typewriter keyboard and machine for each of the eight Indo-Aryan and Dravidian Languages included in this study. One typewriter keyboard has been modified to include all the characters needed for two languages -- Hindi and Marathi. The characters carried on the keyboards appear adequate to provide an immediate capability for preparing indoctrinational information.

Of all the systems investigated, the typewriter is the most versatile because a minimum number of basic character symbols is required for the construction of full characters.

This System, although capable of fulfilling immediate U. S. Army requirements, is not considered the most practical for future and long-range requirements because of the bulk factor. Seven different typewriters are required to provide a capability for communicating in the eight languages under study. In addition, the characters are not considered as typographically desirable as printed type. Character keyboard layouts for the Indian languages under study have been obtained through the courtesy of various typewriter manufacturers in India, England, Germany, Italy, and the United States[16] for evaluation to determine adequacy and/or adaptability to fulfill military indoctrination requirements.

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F. Phototypesetting System

(1) Display Composition - Through considerable research it was determined that a phototypesetting machine for display composition has been developed for some years. This machine is currently being used for setting Hindi, with Devanagari characters. A type specimen sample is presented in Appendix C.

Figure 12. Phototypesetter developed by Morisawa Phototypesetting Machine Mfg. Co., Osaka, Japan, a Division of Minolta Camera Corp., Osaka, Japan.

F. Phototypesetting System

(2) <u>Display and text composition</u> - In 1955, Hari Govil, an Indian electrical engineer, designed and developed a Hindi bilingual phototypesetting system adopted by the Intertype Corporation for its Fotosetter machine.
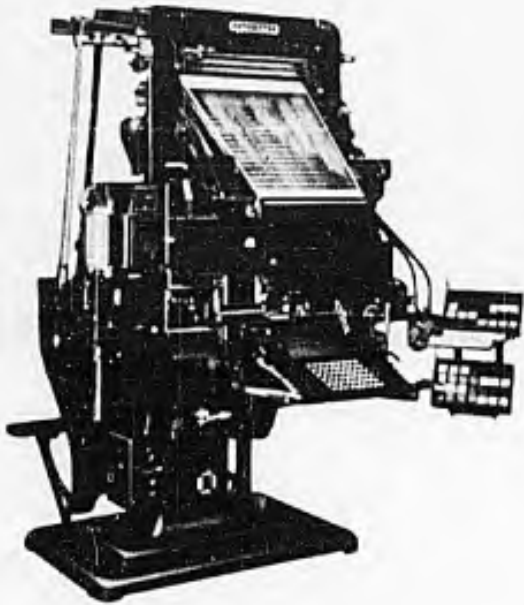
इण्टरटाइप फोटोसेटर मशीन

देवनागरी ''फोटोमैट'' मैट्रिक्स

भारतीय तथा अन्य एशियाई भाषाओं के प्रसार के लिए मुद्रणकला में एक नया युग, तथा मुद्रित शब्द द्वारा भारतीय जनता की साक्षरता, प्रगतिशील शिक्षा, सांस्कृतिक विकास, तथा ...जिक उत्थान और आर्थिक सुधार में उन्नति ।।
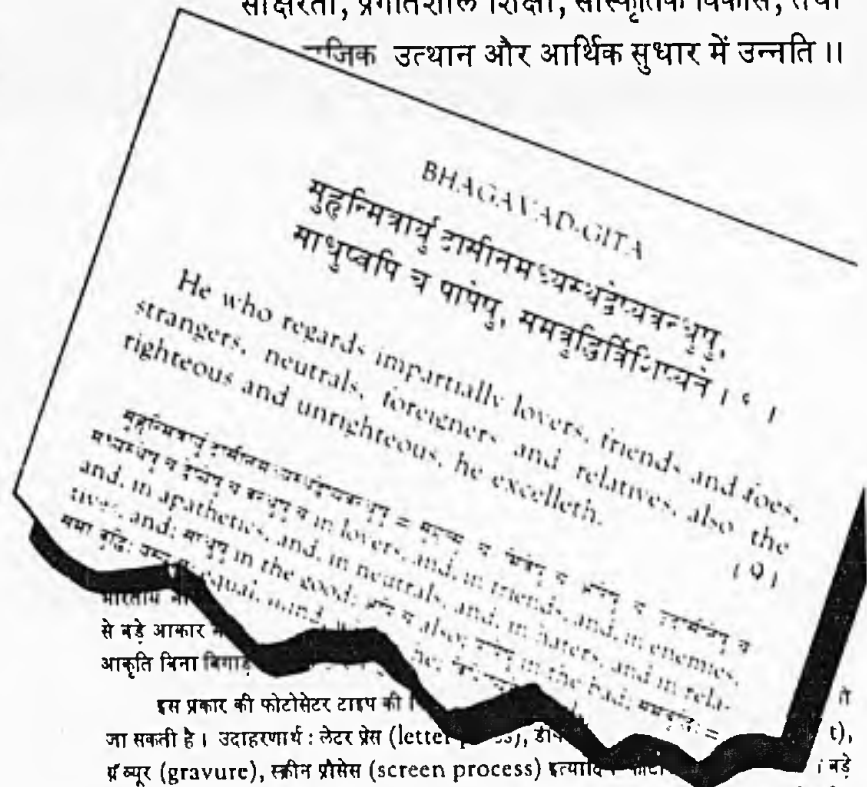
इस प्रकार की फोटोसेटर टाइप की ... जा सकती है । उदाहरणार्थ : लेटर प्रेस (letter ...), डी... ... ग्र॑व्यूर (gravure), स्क्रीन प्रोसेस (screen process) इत्यादि ... नड़े आकार (sizes) में नड़े विज्ञापन पत्रों (posters) के लिए या प्रदर्शन (display) और विज्ञप्ति (advertising) के लिए भी इच्छानुसार बड़ा बनाया जा सकता है ।

फोटोसेटर यन्त्र में सब से मुख्य वस्तु ''फोटोमैट'' (Fotomat) अर्थात् फोटोग्राफिक मैट्रिक्स है जिसमें अक्षरों के फोटोग्राफिक निगेटिव (photographic negative) की प्रतिमूर्ति (image) रहती है । इस प्रतिच्छाया (negative) से फोटोसेटर शब्दरचना (composition) चाहे फिर फिल्मपर या फोटो छापने के कागज़ पर की जाती है । किसी भी अक्षर का चाहे वह कैसी भी कठिन

Figure 13.   Intertype Fotosetter using Devanagari script[*]

The best information available indicates that none of these machines has been used in India with the system developed by Govil. Shortly after it was introduced, both Mr. Govil and Mr. Freund, former President of Intertype, died and the project failed to receive the personal attention needed to overcome trade restrictions and engineering modifications, which included those needed to reduce the excessive number of characters carried in the pi box. The system was designed for bilingual use on a mixer machine. This meant that it was not possible to carry a sufficient number of matrices in the magazines because it was necessary to carry English or other base-language matrices.

During a meeting in September 1962, arranged by the author with Mr. E. Schaar, Director of Type Design and Development, and Mr. E. Buckelew, Assistant to the Vice President, Intertype Corporation, Mr. Schaar indicated that redesign pertaining to the characters being carried in the mixer machine magazine would increase the accessibility of the characters, thereby increasing the speed of operation and enhancing the acceptability of the machine. After redesign it would be necessary to carry only a limited number of ligature-type characters which are too bulky to carry in a magazine using standard channels.

An important factor affecting the nonavailability of this machine, as well as all other American-manufactured machines, for use in India is that in 1957 the Central Indian Government placed trade restrictions on importing printing and typewriting equipment. To the best knowledge of the author, these restrictions are still enforced. (See Appendix D.)

CHAPTER V

CONCLUSIONS

Based upon information obtained through this research study, the following conclusions have been reached:

1. <u>Immediate Military Requirements</u> - These can best be fulfilled by an exploratory development and engineering program directed toward:

   a. Adapting presently available monotype typesetting equipment, which carries all of the Indo-Aryan and Dravidian languages included in this study, to mobile field equipment.

   b. Adopting the several commercially available typewriters having acceptable Indian language keyboards, or

   c. Adapting the several keyboards to commercially available electric typewriters which provide proportional spacing features.[17]

2. <u>Intermediate Solutions</u> - Until these capabilities are provided, two alternative methods may be used:

   a. Transliteration of indoctrination material - This involves the use of English for pronouncing the several Indian languages. While not considered effective, this method could be used under emergency conditions.

   b. Preparation of material in English language - Of the estimated 23% literate populace of India, approximately 90% can read and understand English. This method is not considered the best solution because the Indian populace is highly nationalistic and tends to disregard, or completely reject, printed material unless it is prepared in the native language of the land.

3. <u>Long-Range Military Requirements</u> for typesetting equipment can best be satisfied by a research, engineering, and development program directed toward:

a. Adapting the monotype typesetting equipment to lighter and more compact design characteristics.

b. Adapting compact, electro-mechanical, phototypesetting systems to Indian typewriter keyboard layouts presented in this report. (See Figures 1 through 8.) This will provide a bilingual machine (Hindi, the accepted National language, plus any one of the other major Indian languages) and/or a multilingual machine, with a capacity for typesetting two or more of the Indian languages. Essentially, this would solve the major typesetting problems and provide the U. S. Army a capability for preparing indoctrinational material which could be read by at least 103 million and be verbally understood by approximately 449 million Indian Nationals.

c. Designing new-concept equipment which incorporates the principles used in several currently available systems into a composite unit.

CHAPTER VI

RECOMMENDATIONS

Based upon the significant findings and conclusions reached through this Study, the following recommendations are made:

1. The seven character keyboard layouts for Hindi-Marathi, Bengali, Punjabi, Gujarati, Malayalam, Tamil, and Telugu presented in this report be accepted to provide an immediate military capability for preparing indoctrination information in the eight Indian languages under study.

2. Typographical design for Hindi and Marathi (Devanagari script) should be similar to that used by the Nirnaya Sagar Press; Punjabi should be similar to that used in the Punjabi Bible; and Tamil should be similar to that used by Linotype, in 12-point sizes. Knowledgeable Indian printers and publishers should be consulted for recommendations relative to typographical selection and type sizes for Bengali, Gujarati, Malayalam, and Telugu.

3. The U. S. Army Natick Laboratories establish and maintain close liaison with the Central Indian Government, including Research and Development authorities, in order to keep currently cognizant of National policies, language reforms, etc.,which have a direct bearing on development of the proposed typesetting equipment.

4. Exploratory development and engineering efforts be directed toward (a) improving and/or modifying currently available equipment, and (b) developing new-concept typesetting equipment to fulfill future and long-range field indoctrination program requirements.

A typical example of an area in which redesign and minimum modifications of currently available equipment can provide an efficient and effective capability is that of the Electro-Mechanical, Phototypesetting System.

CHAPTER VII

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Technical Printing Schools in India and England

Universities teaching the subject languages throughout India, United
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Manufacturers of typewriter type and typewriters in India, Germany,
    Japan and the United States

Type Foundries in Great Britain and India

Manufacturers of Linecasting, Typecasting, and Phototypesetting
    equipment in India, Great Britain, Japan, and the United States

Governmental Agencies in India and the United States

Church Mission Societies throughout India, Great Britain, Scotland,
    Denmark, and the United States

Technical Libraries throughout India

U. S. Library of Congress

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The author is also grateful for the kind cooperation of others, too
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Study, and who have assisted in various ways.

CHAPTER VIII

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11. Letter dated 2 January 1964 from L. W. Fleming, Manager, Typographical Department, Remington Rand, Division of Sperry Rand Corporation, New York, N. Y., to U. S. Army Natick (Mass.) Laboratories.

12. Letter dated 10 February 1964 from Professor George Cardona, University of Pennsylvania, to Edward Nitenson, U. S. Army Natick (Mass.) Laboratories.

13. Instruction Manual obtained through the courtesy of Royal Typewriter Company, New York.

14. Letter dated 8 November 1963, from the U. S. Military Attache, Embassy of India, Washington, D. C., to Commanding General, U. S. Army Natick (Mass.) Laboratories.

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16. Compilation of Character Keyboard layouts for the Indian Languages under study.

17. International Business Machines <u>Instructions for Operating the</u>
<u>Devanagari Keyboard</u>.

18. Compilation of technical recommendations submitted to U. S. Army
Natick (Mass.) Laboratories by specialists in the subject languages for considera-
tion in designing new or improved military typesetting equipment and systems.

Literacy in India[*]
(1961 Census)

LITERACY IN INDIA[*]
(1961 CENSUS)

State/Union Territory	LITERATES			PERCENTAGE OF LITERACY		
	Persons	Males	Females	Persons	Males	Females
INDIA	10,32,15,780	7,62,50,052	2,69,65,728	23·7	33·9	12·8
States						
Andhra Pradesh	74,88,618	53,93,357	20,95,261	20·8	29·7	11·8
Assam	30,54,576	22,43,938	8,10,638	25·8	35·5	14·6
Bihar	84,70,426	69,05,649	15,64,777	18·2	29·6	6·8
Gujarat	62,46,778	43,41,949	19,04,829	30·3	40·8	19·1
Jammu & Kashmir	3,81,753	3,11,009	70,744	10·7	16·3	4·2
Kerala	78,00,284	45,21,648	32,78,636	46·2	54·2	38·4
Madhya Pradesh	54,72,286	44,24,881	10,47,405	16·9	26·7	6·6
Madras	1,01,68,095	72,69,803	28,98,292	30·2	43·0	17·3
Maharashtra	1,17,31,272	85,44,228	31,87,044	29·7	41·8	16·7
Mysore	59,55,995	43,24,043	16,31,952	25·3	36·0	14·2
Orissa	37,79,565	30,21,196	7,58,369	21·5	34·4	8·6
Punjab	48,14,911	35,24,241	12,90,670	23·7	32·4	13·7
Rajasthan	29,52,533	24,08,821	5,43,712	14·7	22·8	5·7
Uttar Pradesh	1,28,91,099	1,03,38,655	25,52,444	17·5	26·7	7·3
West Bengal	1,01,80,682	74,35,309	27,45,373	29·1	40·0	16·8
Union Territories						
Andaman and Nicobar Islands	21,314	16,631	4,683	33·6	42·4	19·4
Delhi	13,49,414	8,71,813	4,77,601	51·0	58·9	41·1
Himachal Pradesh..	1,97,533	1,58,480	39,053	14·6	22·6	6·0
Laccadive, Minicoy and Amindivi Islands	5,613	4,283	1,330	23·3	35·9	10·9
Tripura	2,53,033	1,90,118	62,915	22·2	32·2	11·4

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* Appendix to Chapter VIII. "India - A Reference Manual," published by Research and Reference Divn., Ministry of Information and Broadcasting, Government of India. Figures are provisional and relate to the territory and population covered by the Census on March 1, 1961.

APPENDIX B

SCRIPT REFORM IN MODERN INDIA, PAKISTAN, AND CEYLON

BY

W. NORMAN BROWN

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SCRIPT REFORM IN MODERN INDIA, PAKISTAN, AND CEYLON

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IN INDIA, Pakistan and Ceylon today it is possible to see script reform in progress. We can identify forces leading toward change and factors that retard or shape it. Though the principal scripts of those countries have in the past usually been successful means of writing the languages that use them, they now need to be adapted to new conditions. All the scripts of the area used in printing are so affected, but the pressure is greatest upon those used where modernization of the national life is proceeding most rapidly.

The scripts involved belong to two different families. One is the Indic script family, the modern members of which are all descended from the Brāhmī script known first in inscriptions of the 3rd century B. C.[1] They employ certain common principles, though in their more than two millennia of development the separate scripts have often acquired widely differing shapes of corresponding characters. Prominent contemporary members of this family now subject to reform are Devanagari or Nagari (used for Hindi, Marathi, Bihari, Rajasthani, and more frequently than any other script for Sanskrit), Bengali (also used for Assamese), Gujarati, Tamil, Telugu, Kanara, Malayalam, Sinhalese. Other members of the family likely at any time to become subject to reform are Oriya and Gurmukhi (used by Sikhs for Punjabi). These all read from left to right.

Features which suggest a need for reform are the following. First, these scripts consider that the basic form of each consonant has the vowel short *a* as an inherent element which does not need to be otherwise indicated when it occurs after the consonant in pronunciation. All other vowels have special forms when following a consonant in pronunciation. When a consonant is not followed by any vowel sound, whether because it is the final sound in a word or is one of the prior members in a consonant cluster, these scripts use a positive indicatory sign. Secondly, the various scripts have a greater or less number of special ligatures for consonant plus following vowel, consonant and minus vowel, and consonant plus consonant. Hence, though a script may have only from thirty to fifty basic forms, its total number of forms may be increased by these various ligatures to a startling number. In Devanagari manuscripts of Sanskrit the number runs to many hundreds, possibly a thousand or more — I have never tried to count them. Often enough the ligatures bear so little resemblance to their component elements that they become entirely new characters.[2]

The other script family now being subjected to reform in South Asia is the Arabic-Persian, reading from right to left, used for Urdu, Sindhi, Balochi, Pashtu, frequently for Punjabi and Kashmiri, and sometimes for other languages. In South Asia, as in Western Asia, it employs several forms of the same consonant, depending upon position in a word as initial, medial, final, or independent. It indicates vowels only under duress. It varies the level of writing a character in relation to the horizontal axis of a word according to the character's junction point with a preceding or following character and employs a number of ligatures. In the Indian subcontinent the most widely used script belonging to this family has been that called Nastaliq, that is *nasta'līq* (for *naskh-ta'līq*) or *ta'līq*, which means the "hanging writing." In it the line of writing slopes downward from right to left, falling away from the horizontal axis of the page. In this respect it differs from the Naskh (*naskh*) form, common in the Western Islamic world, which does not so fall away. Nastaliq and

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[1] For the theory that Brāhmī is ultimately of Near Eastern origin see Georg Bühler, *On the Origin of the Indian Brāhma Alphabet* (Strassburg, 1898), pp. 53 ff. S. Langdon in the chapter on script, Sir John Marshall, *Mohenjo-daro and the Indus Civilization* (London, 1931), suggested that Brāhmī is derived from the unread Harappa script, but this view seems to have convinced very few scholars. A recent discussion of the origin of Brāhmī appears in David Diringer, *The Alphabet* (New York, 1948), pp. 328-337.

[2] The method of writing Devanagari is conveniently described in the first chapter of W. D. Whitney, *A Sanskrit Grammar*.

Naskh each contain many more symbols than the phonemes of any language using them.

The various scripts mentioned are increasingly coming to be recognized in South Asia as having disadvantages for use in the modern world. First, the large number of symbols imposes a serious difficulty in the process of learning to read and write and is a handicap to achieving general literacy. Secondly, the scripts in their traditional forms are difficult or impossible to adapt to such modern writing and printing instruments as the typewriter, type-setting machines (linotype, intertype, monotype), and the teleprinter. The difficulty is especially marked for printing. A reasonably complete font of Devanagari type for Hindi requires four cases to accommodate it (against the two used for the Roman script for English); including the symbols for the numerals, punctuation, and commercial signs and a few others, it has about 500 different symbols (against the roughly 230 in an English font, which latter includes such modifications of the basic lower case symbols as large and small Roman capitals and italics, all of which have no corresponding modifications in the Devanagari). Such a Devanagari font, however, is still incomplete; a complete one may require twice as many symbols.[3] Other scripts in the native Indic family also require many separate characters for printing; for example, Sinhalese may run to more than 450. In the case of Nastaliq the complications are so many that no successful method has been devised for printing it with movable types, though the Nizam of Hyderabad sponsored long and expensive efforts to develop one. Instead, Urdu matter is usually printed by a lithographic process which reproduces unevenly, often illegibly, is difficult or impossible to correct in proof, and is unsatisfactory generally, though it may be cheap. The various South Asian scripts, both those of the native Indic family and the Nastaliq, if used in their traditional forms, would require greater accomodation than is available on the present number of keys, channels, or other devices of the existing typewriting and type-composing machines. Machines with sufficient such parts would be too clumsy for efficient operation.

Yet in the countries of South Asia political, educational, and publishing leaders consider the typewriter a necessity for transacting business and mechanical type composition inevitable to produce reading matter, especially newspapers, in the large editions and with the speed now required. The point of view is illustrated in an editorial published by a leading Tamil newspaper (*Swadesamitran*, Madras, November 11, 1948), when promoting some script reform:[4]

Times are changing. It is necessary to adapt certain things to the changed conditions, and it is precisely for that reason that we have to change the mode of Tamil writing to some extent.

Have not the Tamilians themselves changed? How many changes there are in our customs, manners, and dress! It is quite natural to have the customs, dress, and language suited to a civilization. The Tamilian who used to tuck up a colored cloth in folds at his waist wants now to go about in a suit and shirt. He who used to travel in a bullock cart has now to rush about in a motor car. He who considered village life heavenly now desires to know world affairs. In order to cope with this situation it is necessary for the Tamil language to bend a little. The appearance of the Tamil characters has to be changed to some extent and their number has to be reduced.

In order to meet the Tamilian's eagerness to know world news it is necessary to employ a machine which sets type with great speed. There are two advantages . . . (1) the extremely quick casting of types in lead . . . (2) the neat appearance of printed matter because each letter is newly made. We can use the machine with this double advantage only if we reduce the number of Tamil characters. A large number of characters is a handicap for quick printing.

The machines now being used for writing and printing are simplifying the scripts of South Asia as in the past the different kinds of implements used for writing produced varying kinds of script: in north India, for example, pen and ink produced the thick-line rectangular Devanagari script; in southern India the stylus, which cuts a line in the surface of the palm-leaf, produced thin-lined curvilinear scripts.

A simple and obvious answer to the general problem of script reform might seem to be use of the Roman script. It has only a few symbols, is relatively easy to learn, operates with a minimum of complications, and can be adapted to the languages of South Asia by the use of a few diacritical devices such as are already successfully employed by scholars. If adopted it would give the whole

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[3] These points are developed in the Report of the Uttar Pradesh Government's Committee on Devanagari Script Reform, cited below in footnote 9.

[4] The translation was kindly provided me by Dr. A. C. Sekhar, formerly of the South Asia Regional Studies department of the University of Pennsylvania.

BROWN: *Script Reform in Modern India, Pakistan, and Ceylon*

area a single basic script, which is also that of the greater part of the modern industrialized world and has an international value. In the 1920's and 1930's some of India's leading linguistic scholars advocated the substitution of Roman for Indic scripts, and at one time Jawaharlal Nehru seemed to entertain the idea.[5] In some other Asian areas a change to Roman has been successfully effected, notably in Turkey and Indonesia. In Indo-China, too, the change has been accepted, though the number of diacritics needed to write Annamese is so great as to produce a complicated and unwieldy form of Roman.

In India, Pakistan, and Ceylon cultural nationalism has been opposed to a change to Roman. The local scripts were a symbol of nationalism; the Roman script was a symbol of British imperialism. The use of Roman would have had a connotation of cultural imperialism, and a legislator or administrative officer promoting it would have imperilled his political future. Politicians, who in all three areas now need the votes of a democratically created constituency, tend to advocate the use of indigenous languages for national purposes written in their own scripts. Hence the Constitution of India 1950 formally provides in Clause 343 (1) "The official language of the Union shall be Hindi in Devanagari script."[6] It also permits by Clause 345 use of regional languages in the various States and implies that they are to be written in their own scripts.

The situation in Pakistan is somewhat similar to that in India. Late in 1947, less than four months after the nation of Pakistan had been created, the Ministry of Education convened a conference which in the course of its deliberations on many subjects recommended to the Pakistan Constituent Assembly "that Urdu should be recognized as the lingua franca of Pakistan." This meant also that Urdu should be written in its present Arabic-Persian script. In Ceylon three

languages — English, Sinhalese, and Tamil — are recognized as official, each written in its own script. In all three countries the attitude is that script reform is to be accomplished not by substitution of Roman for oriental scripts but by modification of the latter.

The agencies through which changes have been proposed and tried were at first non-governmental. For example, before the South Asian countries achieved self-government Gandhi, anxious to promote Hindustani as India's national language, sought to simplify the Devanagari script. He proposed that the initial forms of all vowels should have the initial form of short *a* as their base and this should be modified for all other vowels by adding elements based upon the short forms that are used when the vowels appear in post-consonantal position.[7] This scheme does not now seem to have much support. Again, printers using Devanagari and Bengali scripts reduced the number of ligatures representing consonant clusters by increasing the use of the minus-vowel sign called *virāma* or *hal*. India's largest vernacular newspaper, the Bengali *Ānanda Bāzār Patrikā* (Calcutta), began to experiment with script reform in 1936 so that it could reduce the number of characters and set its matter mechanically. Though the experiment was criticized by part of the Bengali public, it was generally accepted, and the newspaper has found its circulation and general effectiveness increased. It has since extended the process of simplification. Other newspapers and the Bengal Government Press have accepted a greater or less number of the changes. In Ceylon a tentative effort at simplification by orthographic reform was made by the leading Sinhalese newspaper *Dinamina* (Colombo) in the year 1950, but readers would not accept it.

Besides efforts by persons or newspapers of wide influence, there has been a flood of direct script reform schemes offered by individuals or literary or cultural organizations.[8] These have often been ingenious, providing a small number of symbols for writing the language involved. They have,

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[5] See, for example, Suniti K. Chatterji, *Language and the Linguistic Problem*, Oxford Pamphlets on Indian Affairs No. 11, 3rd. ed. (1945), p. 27. Jawaharlal Nehru's remark was made in February, 1949; as reported in the press he said, " . . . it would be desirable to explore the possibilities of the roman script."

[6] By Clause 343(2) the use of English is permitted for fifteen years for all purposes for which it was used when the Constitution came into effect. The situation is later to be subjected to review.

[7] This scheme is illustrated in the Appendix to the Uttar Pradesh Government's Devanagari Script Reform Committee's Report (see footnote 9), p. 25.

[8] Some of the less drastic are shown in the Appendix to the Uttar Pradesh Government's Devanagari Script Reform Committee's Report (see footnote 9).

however, invariably been considered impracticable by publishing or printing concerns. The schemes have introduced changes in the shape of characters or manner of writing which were so radical that no newspaper or government press would risk the danger of reader resistance and rejection.

Since independence various central and state governments have appointed committees to consider script reform. Several newspapers have also tried some modest reforms. These committees and newspapers have proceeded with caution, feeling that changes should be introduced few at a time, should depart only slightly from traditional practice, and should be intelligible, as far as possible, at sight without an elaborate explanation. The most important reports on script reform are those of the Uttar Pradesh (formerly United Provinces) Government Committee on Devanagari[9] and the Madras Government Committee on Tamil.[10] Less impressive is the Bombay Government Committee's report on Devanagari and Gujarati.[11] The Central Government Committee on Devanagari has seemed to hold back for the Uttar Pradesh Committee. In Pakistan the Government's Advisory Board of Education has made a few general proposals.[12] In Ceylon the Government's language Committee is presumably considering script reform.

The Uttar Pradesh Government Devanagari Script Reform Committee's report included the following important recommendations.[13] In print-

ing and typewriting no element representing one of the sounds in a consonant cluster should be placed below another; instead elements should follow one another horizontally from left to right in the order of pronunciation. In consonant clusters so-called "half-consonants" (*ādhā akṣar*) should be used for consonants in the prior position in the case of those consonants which in their basic forms have a vertical stroke (*kharī pāī*) at the right hand side (such as *c, j, b, m, s,* and others) and for *k* and *ph*; for all others the minus-vowel sign (*virāma, hal*) should be employed. For short *i* in the medial position, which is now written by a hook preceding the consonant which it follows in pronunciation, the Committee proposes a new symbol which is to follow the consonant. For the semivowel *r*, which in clusters is now written as a hook above a consonant which it precedes in pronunciation and as a diagonal stroke below one which it follows in pronunciation, the Committee proposes simplification, namely a new modified form when it occurs independently or as the final element in a cluster and a half-form of that when it is prior member in a cluster. The nasalization called *anusvāra*, now written as a dot above the consonant or vowel which it follows in pronunciation, is to be indicated by a small circle at the right. The nasalization called *anunāsika* is to be shown by a dot which is also to be set at the right. A nasal consonant, when it is a prior element in a consonant cluster before a consonant of its own phonetic series (guttural, palatal, domal, dental, labial), is to be written with the *anusvāra* sign. In printing the Committee recommends that the signs for medial vowels, which are now shown in whole or in part above or below the consonants which they follow in pronunciation, should be moved slightly to the right so as to stand at the side without any overlapping. This would make composition easier and eliminate thin projecting overhanging or underhanging elements that tend to break in newspaper printing when the type is subjected to pressure in the mangle used for making stereotype plates. The Committee proposes that the consonants *bha* and *dha*, which are both liable to confusion with other consonants of similar appearance, should be given a slightly altered form. With these various changes the Committee lists the number of characters needed for ordinary printing work as 110:

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[9] *Devanāgarī Lipi Sudhār Samiti-kā Vistṛt Vivaran,* Śikṣā Sacivālay (Lucknow, Saṃvat 2006 [A. D. 1949/50]). This work has an Appendix, *Devanāgarī Lipi Sudhār Samiti-ke Mūl Vivaraṇ-kā Pariśiṣṭ* (Lucknow, 1949).

[10] Preliminary Report in February, 1948; second Report, by an enlarged Committee, in August, 1950. Neither Report was publicly circulated, though both were printed, and I have a copy of each. A summary of the second report was published in *The Hindu* (Madras) July 13, 1951.

[11] Published in Marathi and Gujarati. The Marathi publication is entitled *Lipi-Sudhāraṇā-Samiti Ahavāla 1949* (Bombay, Government Central Press, 1950). The Gujarati publication appears as *Lipisudhāraṇā Samitino Gūjarātī Ahevāla 1949* (Bombay, Government Central Press, 1950).

[12] *Proceedings of the Second Meeting of the Advisory Board of Education for Pakistan* [held at Peshawar, February, 1949] (Karachi, Government of Pakistan, Education Division), pp. 20, 37, 38. See also *Proceedings of the Third Meeting of the Advisory Board of Education for Pakistan* [held at Dacca, December, 1949], p. 29.

[13] See the work cited in footnote 9.

Brown: *Script Reform in Modern India, Pakistan, and Ceylon*

Full consonants and initial forms of vowels	42
Half-consonants	26
Conjunct consonant (*śr*)	1
Medial vowel signs	14
Punctuation signs (` , ! · _ : ; ?)	5
Numerals	10
Other signs (... / % " " ( ) = °)	9
	—
	110

This notable simplification seems to violate the principle that changes should depart only slightly from traditional usage, for it gives strange looking forms; for example, ब्राह्मण *brāhmaṇa* would appear as ब्राह्मण. It would, however, simplify the learn· ing process and facilitate printing. Three Hindi newspapers (*Hindustan* of Delhi, *Viśvamitra* of Calcutta, and *Swatantra Bhārat* of Lucknow) are experimenting with various of the Committee's recommendations. None has adopted the new sign for medial short *i* nor the new forms for *tha* and *bha*, but at least one is trying the new forms of *ra*. All three newspapers are retaining a number of the traditional ligatures for common consonant clusters, which in their new forms might be offensive to the public. Further, there are ways of designing type so that the signs for medial vowels can still partly overhang or underhang the preceding consonant signs and yet not overburden the facilities of type-composing machines. By utilizing such designs printers can avoid the wide, wasteful, and displeasing open spaces between parts of consonant clusters and combinations with medial vowel forms which would result if the Committee's recommendations were followed completely.

The Madras Government's Committee for the Reform of Tamil Script has been more cautious in its recommendations than the Uttar Pradesh Committee on Devanagari. The Committee was appointed in 1947 and was then enlarged in 1950.[14] Though the Madras Government accepted the Committee's recommendations in 1951, it did not enact any implementing measures, and the new Government which was formed after the 1952 elections has been hostile to the recommendations. But it is not certain that the reforms are permanently blocked. One difficulty has lain in the fact that publishers of schoolbooks who have large stocks on hand printed in the traditional script object to any action that would make their stocks obsolete.

[14] See footnote 10.

The Committee in its second report (August 16, 1950) advised that "the total number of characters necessary for printing in the Tamil language should be reduced from the present unwieldy figure and also that there should be greater uniformity in the use of symbols or signs for vowel-consonants (*uyir-mey*)." It added, "It is thus necessary to reform the Tamil script, both in the interests of mechanical efficiency and in the light of educational psychology." Its recommendations all concerned the vowels. They included two changes in the form of initial vowels: first, the use of an already existing alternative but seldom employed form for long *i*, which is close in appearance to that for short *i*; and, secondly, a small alteration in the form of the diphthong *au*, which is now the same as the sign for *l*. In writing medial vowels the Committee recommends that in the case of long *ā*, short *i*, long *ī*, short *e*, long *ē*, short *ai*, long *āi*, and *au*, these be written uniformly in all combinations with consonants instead of varyingly as is now the case. In this way it would be possible to dispense with a good many special ligatures now in use. Slight though these various proposed changes are, they would reduce the number of Tamil characters materially. The largest Tamil newspaper, *Swadesamitran* (Madras), has been printing a small amount of matter with application of some of the recommendations. The same newspaper, striking out on its own, had previously been experimenting with the use of certain existing but seldom used symbols for medial *u* and *ū*, thus eliminating a large number of ligatures for consonants plus those vowels, but the Committee did not endorse this innovation and the newspaper too has discontinued it. If the Committee had been willing to favor a very slight shift to the right of the dot above a consonant which indicates no-vowel, a large number of present ligatures could have been eliminated. The *Swadesamitran* had also tried this change but met strong reader resistance.

In the case of Sinhalese the largest newspaper, the *Dinamina* (Colombo), has made experiments in changing the relative position of medial vowel signs and the no-vowel sign, moving them slightly to the right of the consonant which precedes them in pronunciation, and seems to have met no serious opposition. A few Sinhalese consonants have an irregular way of combining with the no-vowel sign. These the newspaper endeavored to alter so as to correspond with the forms used with the majority

of consonants, but the change was unpopular and the newspaper reverted to the traditional practice. This newspaper's unsuccessful effort to reduce the number of Sinhalese characters by eliminating the aspirated consonants in Pali and Sanskrit loan words and substituting the corresponding unaspirated consonants was mentioned above.

The Pakistan Government has been interested in Urdu script reform.[18] At the first meeting of the Advisory Board of Education for Pakistan (June, 1948) a committee was appointed to deal with many questions including script and it reported back at the second meeting of the Advisory Board (February, 1949) favoring the Naskh form of the Arabic-Persian script over the Nastaliq. It had considered the use of Roman but rejected it, saying "it would be impossible to transcribe the immense literature in Urdu and Bengali in the Roman script." Naskh, it said, "would serve as a unifying force within Pakistan and also bring Pakistan nearer to other Muslim countries. It would also make the printing of literature easy and cheap." At the Advisory Board's third meeting (December, 1949) it was reported that the recommendation concerning the adaptation of Arabic (Naskh) script for the regional languages of Pakistan was "under the consideration of a Committee appointed by the Central Government." One newspaper, the Urdu version of *Dawn* (Karachi), which afterwards ceased publication, and the Pakistan Central Government's Press (Karachi) and the Punjab Provincial Government Press (Lahore) undertook to adapt Naskh to the print-

ing of Urdu. Officers of the two presses have worked out a system to reduce the total number of characters including punctuation signs and numerals to about a hundred. Consonants are restricted to two forms, with the exception of *'ain* and *ghain*, which still retain four. All juncture points are on the same level in the line. In one respect the problem of initiating reform is simplified by the two facts that, first, the readers of Urdu are not accustomed to the use of printing, and, second, they are not accustomed to the use of Naskh. The forms of characters being introduced to supplant lithography do not have to compete with previously established type forms, while the use of Naskh derives a certain amount of sanction from the fact that it is the script in which the holy Koran is regularly written, even in Pakistan.

In time other scripts of South Asia seem due for reform. The Mysore State Government has a committee considering reform of Kanara. The government of Travancore-Cochin will some day have to face the problem in respect to Malayalam; the government of Madras will have to deal with Telugu; the government of Orissa will presumably want to consider Oriya. The Bombay Government's Committee on Gujarati has suggested some reforms, but nothing final has been done.

It appears that reform of separate scripts within each nation—India, Pakistan, Ceylon—is a necessary precursor to effective adoption of any single script for the nation as a whole. The rate at which reform can take place is slow at present, but as accelerating economic and social development increases the pressure it too may be accelerated.

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[18] See footnote 12.

TYPICAL TYPE SPECIMENS FOR.......

Foundry Type

Typecasting System

Linecasting System

Typewriting System

Phototypesetting System

BLANK PAGE

TYPICAL TYPE SPECIMENS FOR FOUNDRY TYPE[*]

FOR

HINDI, BENGALI AND MALAYALAM

HINDI

16-pt.

स्टिफन आसटिन एन्ड सनस कम्पनी लिमिटेड़ पूर्वंदेशीं
और बाकी मुलखों के भाषा छपाने में मशहूर हैं । वह

12-pt.

स्टिफन आसटिन एम्ड सनस कम्पनी लिमिटेड़ पूर्वंदेशों चीर बाकी
मुलखों के भाषा छपाने में मशहूर हैं । वह वाननीय और व्यापारी

12-pt. (MONOTYPE)

स्टिफन ब्रासाटिन एन्ड सनस कम्पनी लिमिटेड़ पूर्वंदेशों मौर बाकी मुलखों के भाषा
छपाने में मशहूर हैं । वह वाचनीय ब्रौर व्यापारी

BENGALI

16-pt.

ররিণ ঈশ্বর জগৎকে এমন প্রেম করিলেন যে, আপনার
একজাত পুত্রকে দান করিলেন, যেন, যে কেহ অহাতে

12-pt. (MONOTYPE)

ররিণ ঈশ্বর জগৎকে এমন প্রেম করিলেন যে, আপনার একজাত পুত্রকে
দান করিলেন, যেন, যে কেহ অহাতে বিশ্বাস করে, সে বিনষ্ট হয় না কিন্ত

MALAYALAM

14-pt.

നിലയിൽ പിരിഞ്ഞതിരിക്കന്നവല്ലോ. വൻപിച്ച നഗര
പരിഷ്കരണതീതികാ നടപ്പിൽ വന്നാലും കൈക്കാടും,

* Reproduced from Oriental Typefaces Catalogue, furnished through the
courtesy of Stephen Austin & Sons, Limited, United Kingdom

APPENDIX C

TYPICAL TYPE SPECIMENS FOR TYPECASTING SYSTEM

MONOTYPE FOR DEVANAGARI SCRIPT[*]

अ 1	इ 2	उ 3	ऊ 4	ऋ 5	ए 6	क 7	ख 8	ग 9	घ 10	च 11	छ 12	ज 13	झ 14	ट 15	ठ 16
ड 17	ढ 18	ण 19	त 20	थ 21	द 22	ध 23	न 24	प 25	फ 26	ब 27	भ 28	म 29	य 30	र 31	ल 32
व 33	श 34	ष 35	स 36	ह 37	ळ 38	क्ष 39	श्र 40	ध 41	क 42	प्र 43	द्र 44	दु 45	न 46	द्र 47	प्र 48
ब 49	ब 50	श्र 51	स 52	ॐ 53	त्त 54	द् 55	म्र 56	द्व 57	द्र 58	च 59	द्र 60	क 61	रु 62	र 63	६ 64
क्र 65	ड 66	ड 67	ह 68	ड 69	ए 70	ट 71	ट 72	ड 73	ट 74	ट 75	ट 76	ट 77	प 78	ड 79	४ 80
ड 81	ट 82	≈ 83	ट 84	ट 85	ड 86	ट 87	ट 88	ड 89	४ 90	कृ 91	य 92	हु 93	कु 94	तु 95	तृ 96
दु 97	दृ 98	पु 99	पृ 100	फु 101	रु 102	रू 103	सु 104	सू 105	हु 106	हू 107	१ 108	२ 109	३ 110	४ 111	५ 112
६ 113	७ 114	८ 115	९ 116	० 117	♂ 118	, 119	; 120	. 121	? 122	! 123		124	: 125	— 126	- 127	' 128
' 129	(130	) 131	Γ 132	ि 133	ि 134	ि 135	ि 136	ि 137	ि 138	ि 139	ि 140	ि 141	ि 142	ि 143	ि 144
ी 145	ी 146	ी 147	ी 148	ी 149	ी 150	. 151	ॖ 152	ॖ 153	ॖ 154	ॖ 155	ॖ 156	ॖ 157	ॖ 158	ॖ 159	ॖ 160
ॖ 161	ॖ 162	ॖ 163	ॖ 164	ॖ 165	ॖ 166	ॖ 167	ॖ 168	ॖ 169	ॖ 170	ॖ 171	ॖ 172	ॖ 173	ॖ 174	ॖ 175	क 176
ग 177	च 178	ज 179	ट 180	ड 181	त 182	द 183	न 184	प 185	ब 186	म 187	य 188	र 189	ल 190	व 191	श 192
स 193	ह 194	अ 195	ई 196	उ 197	के 198	कें 199	चे 200	चें 201	णें 202	ते 203	तें 204	दे 205	ने 206	पे 207	मे 208
रे 209	रें 210	ले 211	लें 212	वे 213	वें 214	से 215	सें 216	हे 217	हें 218	ऽ 219	ा 220	ु 221	ु 222	ण 223	Γ 224
ं 225		226	म्र 227	छ 228	ड 229	ए 230	भ 231	ल 232	४ 233	ह्य 234	५ 235	ट 236	६ 237	॰ 238		239	क 240
ख 241	ग्र 242	ज 243	फ 244	फ 245	फ 246	कृ 247	क 248	ह 249	र 250	व 251	प 252	ड 253	४० 254	ऋ 255	ड 256
ड 257	ं 258	॰ 259	॰ 260	॰ 261	॰ 262	ड 263	) 264	) 265	— 266	= 267	≡ 268	. 270	ल 271	ल 272	ल 273
द 274	ड 275	श्र 276	कु 277	ब 278	म 279	ह 280	क्र 281	ध 282	ष 283	घ 284	ध 285	म्र 286	भ 287	३ 288	२ 289
। 290	॰ 291	५ 292	६ 293	॰ 294	८ 295	९ 296	॰ 297	१ 298	२ 299	३ 300	४ 301	५ 302	६ 303	॰ 304	८ 305
॰ 306	॰ 307	ड़ 308	अ 309	ओ 310	औ 311	म्र 312	ल 313	॰ 314	ग 315	॰ 316	॰ 317	॰ 318	॰ 319	॰ 320	॰ 321
॰ 322	॰ 323	क 269	ले 324	है 325	लें 326	४ 327	४ 328	३ 329	४ 330	४ 331	४ 332	४ 333	४ 334	४ 335	४ 336
४ 337	४ 338	४ 339	४ 340	॰ 341	॰ 342	॰ 343	४ 344	॰ 345	४ 346	— 347	... 348	[349	] 350	/ 351	व 410

60

TYPICAL TYPE SPECIMEN FOR LINECASTING SYSTEMS

FOR

BENGALI, GUJARATI, TAMIL, AND DEVANAGARI[*]

Bengali

10 Point Light and Bold (10△420) Code word, ZEMIK

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যে, সম্পূর্ণরূপে মানুষ হইতে হইলে অপরাপর ভাষার ১২৩৪৫

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যে, সম্পূর্ণরূপে মানুষ হইতে হইলে অপরাপর ভাষার ১২৩৪৫

12 Point Light and Bold (12△432) Code word, ZIRDU

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যে, সম্পূর্ণরূপে মানুষ হইতে হইলে ১২৩৪৫

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যে, সম্পূর্ণরূপে মানুষ হইতে হইলে ১২৩৪৫

10 Point No. 2 with Bold Face No. 2 (10△464) Code word, ZIPMI

11 Point No. 2 with Bold Face No. 2 (11△136) Code word, ZIPNO

12 Point No. 2 with Bold Face No. 2 (12△472) Code word, ZIMFO

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যি, সম্পূর্ণরূপে মানুষ হইতে হইলে ১২৩৪৫

যদি এমন ভাবে বঙ্গভাষার সম্পদ্ বৃদ্ধি করা যায় যি, সম্পূর্ণরূপে মানুষ হইতে হইলে ১২৩৪৫

Gujarati

12 Point (12△169) Code word, ZEKTA

છાપખાનાના મંડળમાં ખડ, પ્રસિધિમાં આ વેળા મી. જવળ ગુજરાતી સંસ્કૃત ૧૨૩૪૫

Tamil

10 Point Light and Bold (10△480) Code word, ZILIH

நளவெண்தமிழ் உசெ சோமவாரம்கைதபூசத்தன்றுநெல்சன் கம்பெனியைந் தொடங்க எ 12345

நளவெண்தமிழ் உசெ சோமவாரம்கைதபூசத்தன்றுநெல்சன் கம்பெனியைந் தொடங்க எ 12345

12 Point Light and Bold (12△446) Code word, ZIRCO

நளவெண்தமிழ் உசெ சோமவாரம்கைதபூசத்தன்றுநெல்சன் கம்பெனியைந் 12345

நளவெண்தமிழ் உசெ சோமவாரம்கைதபூசத்தன்றுநெல்சன் கம்பெனியைந் 12345

Devanagari

14 Point Light and Bold (14△224) Code word, ZENIS

भाषाविज्ञान आदिविद्याओं से इस बात का निर्णय हो चुका है किइस पृथ्वी पर जितनी सभ्य जातियां १२३४५

भाषाविज्ञान आदिविद्याओं से इस बात का निर्णय हो चुका है किइस पृथ्वी पर जितनी सभ्य जातियां १२३४५

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TYPICAL TYPE SPECIMENS FOR TYPEWRITING SYSTEMS

RARO-TYPE FOR HINDI AND GUJARATI*

Schrift-Nr. No.	Schriftprobe type-styles	Modell model	Umschalthub motion	Wagenschrift spacing	Schriftart type
Ro 453	દ્વે જગન યર અટલી યી નિ	Standard	6,6 mm	1/8" 3,2 mm	Gujarati
Ro 358	उनालफेड रानसमयर उनौर उन	Standard	6,6 mm	2,54 mm 1/10" 2,6 mm	-Hindi Devanagari

* Reproduced with permission of Alfred Ransmayer & Albert Rodrian,
  Berlin, Germany

INTERNATIONAL BUSINESS MACHINES (EXECUTIVE MODEL) FOR DEVANAGARI SCRIPT*

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* Reproduced with permission of International Business Machines, New York, N. Y.

APPENDIX C

TYPICAL TYPE SPECIMEN FOR PHOTOTYPESETTING SYSTEM[*]

FOR

DEVANAGARI SCRIPT

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अनुसंधानकों ने अपनी इस सफलता

APPENDIX D

REPORT OF PRINTING FACILITIES AVAILABLE IN INDIA

A Study Undertaken on Behalf of the UNESCO[*]

by

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All-India Printers' Conference, 8th Session, May 1960

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REPORT ON PRINTING FACILITIES
Available in India

A STUDY UNDERTAKEN ON BEHALF OF THE UNESCO BY SHRI S. N. GUHA RAY
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INDIA is the largest and the most populous of the four countries dealt with in this review. It has a population of 356,891,624 persons (1951 Census) while the area of the country is 12,69,460 sq. miles. It is divided into the following States, with their area and population noted against each:

	Area (Sq. miles)	Population
Andhra Pradesh	1,05,963	3,12,60,133
Assam	85,012	90,43,707
Bihar	67,164	3,87,84,172
Bombay	1,90,919	4,82,65,226
Kerala	15,035	1,35,49,118
Madhya Pradesh	1,71,201	2,60,71,637
Madras	50,110	2,99,74,936
Mysore	74,326	1,94,01,193
Orissa	60,136	1,46,45,946
Punjab	47,456	1,61,34,890
Rajasthan	1,32,077	1,59,70,774
Uttar Pradesh	1,13,409	6,32,15,742
West Bengal	33,945	2,63,01,992
Jammu and Kashmir	85,861	44,10,000
Delhi	578	17,44,072
Himachal Pradesh	10,904	11,09,466
Manipur	8,628	5,77,685
Tripura	4,032	6,39,029

According to 1951 Census there is a total of 845 languages or dialects including 720 languages spoken by less than a lakh (100,000) persons each and 63 non-Indian languages. Ninety-one per cent. of the people, however, speak one of the fourteen main languages, which are specified in the country's Constitution. They are Hindi (Hindusthani), Urdu, Punjabi, Telugu, Marathi, Tamil, Bengali, Gujrati, Kannada, Malayalam, Oriya, Assamese, Kashmiri and Sanskrit.

According to 1951 Census 16·61 per cent. of the total population were literate. The following Table gives a State-wise breakdown of the literacy figures per centum of population:

		Percentage of literacy
Andhra Pradesh	..	13·12
Bihar	..	12·15
Kerala	..	40·88
Madras	..	20·81
Orissa	..	15·80
Rajasthan	..	8·95
West Bengal	..	24·02
Manipur	..	11·41
Himachal Pradesh	..	7·71
Assam	..	18·07
Bombay	..	21·64
Madhya Pradesh	..	9·83
Mysore	..	19·29
Punjab	..	15·23
Uttar Pradesh	..	10·80
Delhi	..	38·36
Tripura	..	15·52

Printing was introduced in India by the Portuguese in the 16th century, soon after Gutenberg's invention of movable types had revolutionised the printing industry. The greatest concentration and development of the industry in India have been in Calcutta, Bombay and Madras, the three Presidency towns, as they were known in the pre-Independence days. It was in these three cities of India that the British had concentrated their administrative power. Commerce and industry naturally flourished in these three cities.

Printing industry is somewhat more organised in India than in the other three countries. In almost all the important cities there are master printers' organisations, many of them being affiliated to the All-India Federation of Master Printers, which is again affiliated to the International Bureau of Federations of Master Printers. The Indian Federation is recognised by the Government of India and their opinion is invited on all policy matters affecting the interests of the printers.

ALL-INDIA PRINTERS' CONFERENCE, 8TH SESSION, MAY 1960

So far no statistics has been taken of the number of printing presses in India. The Government of India had, in 1954, taken a statistics of the number of printing presses in five States of India to find out details of printing machines in use. This was a sample survey. The author had, as the Hony. General Secretary of the All-India Federation of Master Printers, collected statistics of printing presses State- and District-wise in 1953-54. According to the Government of India list there are about 12,549 printing presses throughout India on the basis of the sample survey. But according to the statistics collected by the All-India Federation of Master Printers, the number of Printing Presses all over India, excluding Jammu and Kashmir and some of the district towns of Madras and Bombay, was slightly over 23,000. According to both the surveys 70% of the printing presses were located in the five States of Bombay, Delhi, Madras, Uttar Pradesh and West Bengal.

The Printing Industries in these five States are mainly located in the capital cities of the States, viz., Bombay Delhi, Madras, Allahabad and Calcutta. The number of printing presses in Bombay City is less than 800, Madras 350, Allahabad 160 and Calcutta 2,275. The number of printing presses in Delhi is nearly 1,200. As a matter of fact, it is only in Calcutta and Bombay that the printing industry has developed in a scientific way.

WEST BENGAL

There are about 2,700 printing presses in the State of West Bengal of which over 2,275 are in Calcutta alone. Most of the printing presses outside the capital city of Calcutta are very small and do not require any special mention. In speaking of West Bengal, I have, therefore, dealt with the printing industry of Calcutta.

Calcutta.—About 40% of the printing presses in Calcutta are book printers. West Bengal, though one of the smallest States in India, produces probably the largest number of books, which are varied in their contents. The school and college text-books naturally hold the palm in the field, then comes fiction including drama, belles lettres, technical and religious books and books of verses. The number of weekly and monthly magazines is also considerable. One of the Bengali weekly magazines has a circulation of over 60,000 while the most popular Bengali monthly magazine has a circulation of over 70,000.

Printing presses of Calcutta command the custom of not only the publishers of West Bengal, but those of Assam, Bihar and Uttar Pradesh who rely on the printers of Calcutta for their quality jobs. Most of the Government of India publications, meant for public sale, are printed by printers of Calcutta and Bombay.

As Bengali and Assamese alphabets are same (only two extra alphabets are necessary in Assamese) almost all the school text-books of Assam are printed in Calcutta, as there is no book printer worth the name in the Assam State.

Most of the printers in Calcutta have arrangements to print in English, Bengali, Hindi and Urdu, the first three being in very common use. The Baptist Mission Press has arrangements to print in 40 languages, a feat not surpassed by any printing establishment in India as yet.

By far the largest number of printing presses in Calcutta print in letterpress process. Though lithography first came to Calcutta more than eighty years ago, for many years the lithographers confined themselves to stone lithography, producing posters for theatres and cinemas. Calcutta lithographers at one time produced fine chromo-lithographed work It was after the first World War that the interest of some of the letterpress printers of the city was drawn to the photo-offset process and offset printing came to stay as a permanent feature of the printing industry of West Bengal. The stride has been rather rapid after the Second World War towards installation of photo-offset departments. There are nearly 100 photo-offset printers in Calcutta. But for the restriction put in 1957 on the import of printing machines, there is no denying the fact that almost all the leading printing concerns of Calcutta would have installed offset printing machines in their establishments.

There are two Gravure printers in Calcutta, viz., the Indian Press Private Ltd. and the Calcutta Phototype Co. Ltd. Both of these printers, over and above Gravure, print in Letterpress and Photo-offset.

Though the printing industry in Calcutta has earned recognition as the top quality producers in India, it is notorious that only about two dozen or so, are responsible for the reputation. The rest of the printers do not claim any distinction for themselves. But it should be said in their favour that the productions of many of them are fairly competitive in quality when compared to printers of their own class in other States.

Printing equipment available.—Among letterpress printing equipment found in Calcutta printing houses, the most popular in the platen press section is U.S.-built Chandler and Price disc-inking platen press, next comes the Golding Jobber. Makes like Cropper, Harrild, etc., also came to Calcutta many years ago and these sturdy machines are still found running in many printing presses of repute. Among Art platen press group Phoenix and Victoria, with cylindrical inking arrangement are very popular for printing from half-tone cuts. The East German printing industry, which has taken over the factory of Schelter & Giesecke in Leipzig, has discontinued manufacturing Phoenix platens—it is concentrating on the Victoria platens, which also came in a considerable number in the Calcutta market prior to the recent import restriction. There are a few Miehle Verticals in the market but as their price is rather high they are not popular with the printers, though they have good reputation for high speed quality printing. Heidelberg automatic platen presses are also popular with the printers.

Among cylinder presses, British Wharfedale presses are the most popular as elsewhere in India in spite of serious competition from German Stop-cylinder presses. They are liked for their simplicity and sturdiness. Among German Stop-cylinders Bohn & Herber's "Record", Maschinenfabrik Johannesberg's "Vorwaert" and "Diana", Koenig & Bauer's "Rex" were popular after the First World War. This field, it seems, has again been captured by Dawson, Payne and

Elliot's Standard Perfection Delivery Wharfedales. There has recently been a demand for Demy (18" × 22") and Crown size (15" × 20") automatic cylinder presses like Albert-Automat of Albert & Cie., Frankenthal and A.T.F. Little Giants (U.S. and U.K.). Italian "Nebuolo" automatic cylinder machines have also appeared in the Calcutta market.

In the field of Two-Revolution presses, Calcutta printers prefer Linotype & Machinery's "Centurette" and "Centurion" presses; U.S. Challenge Machinery Co.'s "Lee" Two Revolution presses had also a good market.

Heidelberg Cylinder presses were fiñding a good market just before the restriction was clamped upon the import of printing machines. U.S.-built Kelly cylinders as also Miehle Two-Revolution presses are also found in many presses.

Double-crown (20" × 30") size cylinder presses are more popular than other sizes; so is Crown folio size (10" × 15") in the platens.

It might be mentioned that it is only recently, i.e., after the Second World War, the book printers of Calcutta are installing automatic feeders with their cylinder presses. Almost all the Wharfedale presses in use in Calcutta are hand-fed. Before the Second World War, the print order for any book, except a school text-book, did not exceed one thousand copies. The print order for more popular text-books varied between 3,000 to 10,000. Publications of the Calcutta University, excepting some of the text-books, were limited to editions of 500 copies. Naturally the printers did not think it economical to make extra investment for an automatic feeder. But after Independence, things have rapidly changed. Even books of abstruse verse have editions of two or three thousands and call for a reprint within one year. Editions of school text-books have usually a run of ten thousand copies. One has a run of 100,000 copies. All these have prompted the printer to reconsider his views about automatic feeders. Printing is almost everywhere from direct type formes.

In the composing section, hand composing from type cases is still the most prevalent method. The number of individual types used in Bengali, Assamese and Hindi is nearly 480 and so a compositor has to use four type cases. Types are supplied by a large number of type-founders who cast types from pivotal type hand casting machines. Automatic type casting machines of Fouche and Kustermann and Monotype Supercastor are also used by many of the up-to-date type-founders. Some prominent bookprinters have their own type casting departments.

In mechanical composition, the Linotype, Intertype and Monotype machines are all popular. With the demand for printing of books increasing, the printers are now installing mechanical composing machines.

A revolution in the printing industry occurred when the Bengali language was first set from a Linotype Keyboard in the Sri Gouranga Press, Calcutta. The late Mr. S. C. Majumder, Proprietor of the above press and the Managing Director of the Hindusthan Standard—*Ananda Bazar Patrika* newspaper group and a past President of the All-India Federation of Master Printers, was mainly responsible for drawing the Bengali Keyboard of Linotype. It was his ingenuity which made it possible to reduce the number of Bengali letters to suit the Linotype Keyboard. Now Bengali, Assamese and Hindi are all set from Linotype with Side Magazine models. This has, as I have said earlier, revolutionised the Bengali printing industry. Now Linotype is a *must* equipment in every Bengali newspaper and magazine office and the book printer is gradually discarding his type cases for either a Linotype or a Monotype composing machine, which has also now Bengali matrices in its Matrix Library. The rapidity of expansion in the printing industry of Calcutta has been such that it would be no surprise if one finds an Intertype Typesetter in a commercial printing firm in Calcutta soon. In the newspaper offices Linotypes, Intertypes and Monotypes are regular features in the composing section, with a few Supercaster, A.P.L., and Ludlow in many of them.

Photo-offset process of printing is rapidly replacing stone lithography in Calcutta. Many of the letterpress printers are now installing Photo-offset equipment. Like European countries and the U.S.A. there are no separate plate making concerns in Calcutta or as a matter of fact anywhere in India. A combined printing and plate-making section is the common order with printers everywhere in India. The Crabtree, George Mann and Roland offset presses are popular. The usual size is Double-demy. Most of the machines are single colour units, though there are a few two-colour presses. In the plate-making section, so long Hunter-Penrose (U.K.) had held a monopoly in the supply of cameras and plate making equipment. But Klimsch and Co. of Frankfurt are also now in the market. East German Planeta presses and Hoh & Hahne camera and plate making equipment have also come to the market. U.S.-built Harris-Seybold and ATF presses and equipment, though liked, are beyond the purchasing power of many. Kodak (U.S. and U.K.), Agfa, Gaevert and Ilford are the most popular suppliers of films and chemicals. Some of the chemicals used in lithography are now being prepared in India and it is expected that India will be self-sufficient in most of these materials within a few years.

In the case of materials like paper and board, ink, roller composition, etc., India is almost self-sufficient except for good quality coated art paper and coated boards. India makes printing and writing papers, boards as also cover papers of several varieties. A newsprint mill has already started production. The total production of Indian paper mills in paper and board rose from 155,000 tons in 1954 to 200,000 tons in 1956. The target of production in 1960-61 has been fixed in the Second Five-Year Plan at 350,000 tons. During 1955-56 period 4,200 tons of Newsprint were produced in the Nepa Mills. The target for 1960-61 has been fixed at 60,000 tons of Newsprint. Printing inks both for letterpress and offset are being manufactured in sufficient quantity and the country is not only self-sufficient in this respect but it is also being exported outside. Inks for Gravure printing and aniline printing are still being imported but their requirement is small.

Printing premises.—It is unfortunate that except a very few most of the printing presses in Calcutta as

also in the interior of the State are located in rented premises. Very few of them were constructed to suit the requirements of a modern printing press.

Current printing processes.—As mentioned already current processes of printing in Calcutta is first Letter-press; secondly, Lithography (Photo-offset) and thirdly, Gravure. A few printing presses are experimenting in silk screen printing with fluorescent ink and considerable success has already been attained.

Current illustration methods.—The most popular illustration process current in West Bengal is photo-engraving. There are over 300 photo-engraving firms in Calcutta alone, most of whom are equipped to manufacture line, halftone and multicolour blocks. Many of them have arrangements for making blocks from colour transparencies.

Wood engraving was at one time, especially before photo-engraving was introduced, very popular for illustrating books and periodicals. This industry is now in decay.

Hunter-Penrose, Sydney Littlejohn, Pictorial Machinery Co. of the U.K. and Klimsch of West Germany are the principal suppliers of process-equipment in Calcutta For process copper and zinc sheets Calcutta like rest of India depends on supplies from the U.K. and West Germany.

Photo-offset process is the second next popular illustration method. Whenever the run is high there is a demand for photo-offset process. Folders, brochures, show-cards, labels, posters, illustrated one or multicolour booklets are very often produced by photo-offset. As there is a great scarcity of coated papers and boards customers are now switching on to Offset process.

Silk screen process of printing has recently come into prominence with cinema posters and various kinds of window display cards.

Gravure process is in its infancy in Calcutta now and it has influenced the market very little.

Needs of the area in printing equipment and materials and supply thereof.—As the printing industry in the State of West Bengal is developing at a very rapid pace the needs of the State in printing machines and equipment, paper, ink, etc., are also on the increase. The Government of West Bengal is making an intensive campaign for eradication of illiteracy and there is a great demand for reading materials for the new literate. The State needs more modern printing establishments in place of the existing ones on the marginal line of economy. It is these latter which, as everywhere else in India, stand against the development of the printing industry. The needs of the area are mostly in Letterpress printing machines, both flat-bed cylinders and platen presses. At present there is almost total restriction in the import of these. This policy, unless amended and altered suitably in the near future, will react heavily on the printing industry of the State. Not only will the quality suffer but the economy of the industry will be affected due to uneconomic production.

In printing materials, West Bengal is the major producer of printing paper, board, printing ink, etc. But the increased demand throughout India of these materials is responsible for irregular supply of paper and board. The target of production of paper and board of the Second Five-Year Plan (1960-61) has been fixed at 350,000 tons (excluding Newsprint). In view of the all-round demand on paper and board, it is doubtful whether even this quantity will meet the requirements of India. The quality of the paper and board manufactured in India, though suitable for printing, requires further improvement. The coated paper and board suitable for reproduction of fine screen blocks are not manufactured in the country. The high pressure of demand on the mills does not allow them to improve their quality. Most of the largest printing ink manufacturers of India like the Hooghly Printing Ink Co. Ltd., Ganges Printing Ink Mfg. Co. Ltd., Coates Bros., Bengal Chemical and Ph. Works, Chakravarti Bros., etc., are located in and around Calcutta. They manufacture all kinds of printing ink, Letterpress and Lithographic. Calcutta also gets some of its ink supplies from Bombay and Madras. It is not that the Calcutta ink manufacturers cannot meet the requirements of printers of West Bengal. Most of the printers have some predilection for special brands of inks and they will go to far distant places to get them. In ink too, as in paper, the demand is for a better quality. Indian ink-makers, while competent to manufacture quite good quality inks, suitable for almost all needs, are still unable to match their products with the best of the foreign inks. No aniline or gravure ink is made in the country.

There are a number of firms who make roller compositions, made from gelatine and glycerine. Most of the printers throughout the State use this type of composition. More up-to-date houses use synthetic rubber rollers for their high speed cylinders and platens. German Felix Boettcher's synthetic rubber rollers are popular.

The greatest need of the State is in letterpress and offset printing presses, process copper and zinc-sheets, offset zinc-sheets, process films, plates and equipment.

Besides the foreign manufacturers stated above, several manufacturers in West Bengal, like Dass Bros., Maya Engineering Co. and Harmond Engineering Works manufacture platen presses and paper cutting guillotines.

Process and equipment most suitable for the production of reading materials for the new literates.—Both photo-offset and letterpress are suitable processes for producing literatures for the new literates. If the demand is high photo-offset is economical otherwise one has to fall back upon the letterpress process. Many illustrated children's books are being printed in Calcutta in photo-offset whenever the print order is for 10,000 and over. Printing presses of Calcutta are well equipped to produce this type of literature but most of the better quality print shops are so busy with their existing custom that it is doubtful whether they will be able to accept new orders without expansion of their existing plants.

Availability of trained personnel.—Calcutta is fortunate in having quite a number of persons who received their training in the British and Continental printing institutions. The influx of such personnel every year is also regularly increasing. These are being absorbed in the various Government and semi-Government

institutions as also in commercial printing presses. The Calcutta School of Printing Technology established under the First Five-Year Plan started functioning in 1955. The School is imparting training in craftsmanship in Letterpress and Photo-offset processes of printing as also in Process-engraving and Bookbinding. The course is of three years' duration, of which two years is in the class-room. Successful students will receive the certificate after completion of a satisfactory apprenticeship in a recognised printing press for one year. There are eighty students in each session. Besides the Day Course, there is a part-time Evening Course, where the apprentices and employees of printing presses get a theoretical training in the craft, in which they are employed. At present greater emphasis in the training of Evening Course students is being given for obvious reasons. Not only do they get theoretical training they are also allowed to work in the machines and all unscientific modes of handling are rectified. The School will shortly start a course of training for junior executives. The entire senior teaching staff of the School has been recruited from the diploma-holders of London School of Printing, Manchester College of Printing Technology, and Leeds School of Printing. All of them have a minimum of five years' practical experience in commercial printing presses. It is hoped that the students turned out from the School will be able to influence the quality of production of printing in the country.

Organisation of printing presses.—Most of the larger printing units of Calcutta follow the costing system of the British Federation of Master Printers and have some scientific system of management. The efforts of the Printers Associations in persuading the printers to follow some scientific system of management are bearing fruit. But most of the smaller printers—and their number is quite large—scarcely follow any scientific system.

Financial problems.—Most of the small units suffer from chronic financial crisis due to lack of adequate working capital. The failure of a large number of Banking houses affected almost the entire industry in various ways. Banks were not only good customers but they also gave temporary financial assistance to the printing presses. Then came the partition of the State in two. East Bengal, which was most advanced culturally, went under a separate sovereign State. This was immediately followed by influx of millions of refugees from East Bengal to West Bengal. The refugee problem is still one of the greatest headaches of the country, which has upset the economic, social and cultural balance of West Bengal. The printing industry of the State has been greatly affected by all these upheavals. Fortunately the Central Government and the State Government are alive to the situation. Financial assistance from the State as also from the Government-sponsored financial aid organisations is available to the smallest unit, provided reasonable securities are offered. The smaller units are in a far happier position than the larger ones as the margin of security demanded is very small. The printing industry in the State can receive State financial aid from three sources. For the larger units requiring financial assistance of over Rs. 10,00,000 for expansion

of business including working capital, the Indian Finance Corporation advances loan on a security margin of 50% repayable within 12 years, the interest payable being 7% per annum. For units requiring financial assistance of Rs. 25,000 to Rs. 10,00,000 the West Bengal Financial Corporation advances loan under the above conditions. For the smaller units who require assistance of less than Rs. 25,000 the West Bengal State Directorate of Industries advances loan to purchase new equipment to existing printing units. Many of the printing presses are taking advantage of these benefits to expand their business.

BOMBAY

The number of printing presses in the State of Bombay will be nearly 1,200 of which nearly 800 are in the Bombay City. Ahmedabad and Poona also have quite a large number of printing presses. In Poona the Lokesangraha Press, which is run on co-operative principles, is well known for its activities. Most of the Ahmedabad printers specialise in label and form printing being located in a textile mills area.

The quality of printing of the city of Bombay is well known. Almost all the big pharmaceutical, toiletry and cosmetic firms of Europe and the U.S.A. have started their factories in and around the city, which has naturally benefited the printers of Bombay. As is natural in such cases, most of the printing presses in the city specialise in the printing of labels and cartons of a very high quality. The number of book-printers is also considerable, who depend mostly on the printing of school and college textbooks. Among book-printers the Times of India Press, Vakil & Sons, Commercial Printing Press (Tata) are very well known and their products can be compared favourably with those of their confreres in Europe and America.

In Bombay both the letterpress and photo-offset processes of printing are popular. The Times of India Press runs very successfully Photogravure units. As a matter of fact, it is only this Press in India whose photogravure work is well known everywhere for its quality work. Though the letterpress process predominates, photo-offset process is also making a rapid stride in the city. Lithography is being practised in Bombay from very early days of printing and once its lithographers were well known for chromo-litho work. The famous pictures of the well-known artist brothers Raja Ravi Varma and Ram Varma were produced in Bombay. Now photo-offset has replaced stone lithography. But it is still busy with the printing of posters, labels and show-cards. Letterpress is the principal process for bookprinting.

Printing equipment.—Bombay being the richest commercial and industrial city in India, the printers of the city have fortunately financial ability to select their machines and equipment while everywhere else, the printer, due to financial limitations, has to purchase a machine which is either cheap or which might be available on easy payment system. Most of the printers in Bombay are not limited by these considerations. As a result almost every make and variety of printing machines and equipment might be found in Bombay. In Letterpress, Dawson, Payne & Elliot's

Wharfedales are still most popular. Then comes the various German Stop-cylinder presses. In the Two-Revolution class, L. & M. Miehles and Centurettes are popular. Very recently Heidelberg cylinders have found quite a good response with the printers but they are mostly used for printing illustration works and cardboards. In the platen the palm in numbers is still held by Chandler & Price's disc-inking platens. Golding Jobber, Harrild, Cropper, Phœnix, Victoria, Komet, Kobold, etc., are found scattered everywhere. There are a few Miehle Verticals too in some reputed printing presses Heidelberg platens for their high speed are also preferred by many job-printers.

In the offset section, Geo. Mann, Roland and Crabtree are popular.

In Letterpress and Offset 20" × 30" is the popular size but now book printers are considering 23" × 36" as the more suitable and economical unit.

The Times of India Press is the only Photogravure printer in Bombay. It has installed Albert & Cie's (Frankenthal) unit. It has also a large Letterpress Section.

In the Composing section Linotype, Intertype and Monotype are most popular machines.

Printing premises.—Most of the printing premises are rented. As they were not built for the purpose for which they are being used now, the printers naturally suffer a good deal of inconvenience for obvious reasons.

Current printing processes.—As already stated the main printing processes in use in the State is Letterpress and Photo-offset. Gravure is used in only one printing press for printing magazines, posters and calendars.

Current illustration processes.—Photo-engraving and photo-offset are the two processes which are used in the State for reproduction of illustrations. Bombay has over one hundred photo-engravers, who produce both line and tone work and are well known for their skill in reproduction. The equipment used is mostly British. Hunter-Penrose, Pictorial Machinery, Sydney R. Littlejohn. Klimsch's camera and other equipment are finding greater favour for their latest improvements.

Needs of the area in printing equipment and materials and supply thereof.—The problem under this head is almost the same for all the States in India. Except the small marginal units, almost all the printers have sufficient work. Those who are better equipped for producing books for the new reading public do not usually have the capacity to accept further work, without expansion. The almost total restriction on imports of printing equipment and materials has created a serious situation. It has not only stopped establishment of new firms but arrested expansion of the existing plants. It is hoped that the present situation is temporary and the restrictions on import will be removed shortly. As exact information about the quantity of reading materials which might be necessary in a particular period is not known, it is not possible to give the exact need in the quantity of equipment and their details.

As most of the paper mills in India are located in Northern India, Bombay as also the southern zone of the country have to meet difficulties in the supply of paper. On the other hand, Bombay is better placed than the States of Northern India in respect of the supplies of imported materials. This is true in respect of coated paper and boards, process films and plates, chemicals, process and offset zinc and copper sheets, etc.

Bombay has now quite a number of printing ink factories, who make both letterpress and lithographic inks. Besides its own factories, Bombay also gets its supplies from Madras and Calcutta.

In Roller Composition Bombay printers depend upon indigenous and foreign composition. Of the latter John Kidd's and Imperial Chemical's compositions are most popular. For high speed automatic machines synthetic rubber rollers from U.K. and West Germany are in general use.

Process and equipment most suitable for the production of reading materials for new literates.—As I have mentioned earlier, photo-offset process is most suitable for production of literature for the new reading public as it is economical. But in view of the existence of a large number of letterpress units throughout the State, it would be inadvisable to starve them out of their business. Bombay has enough photo-engravers who can be entrusted with the preparation of blocks suitable for reproduction.

Availability of trained personnel.—The number of technical personnel in the printing industry who have got their training in recognised printing institutions in Europe and the U.S.A. is steadily growing. Most of the printing presses who are bent upon running their business in a modern way are absorbing them. The Regional School of Printing Technology, Bombay, has started functioning though in a small way and it is hoped that within a few years there would not be any dearth of skilled craftsmen.

Organisation of printing presses.—The majority number of the printing presses have but little knowledge about modern business management but the progressive printers like the Times of India Press, Commercial Printing Press of the Tatas, Vakil & Sons, etc., follow the latest management methods.

Financial problems.—As everywhere the smaller units suffer from lack of working capital but the medium size and the larger units have sufficient resources of their own for expansion and reorganisation.

MADRAS

As in the States of West Bengal and Bombay, in the State of Madras, the printing industry is mainly located in the capital of the State, i.e., at Madras. There are about 500 printing presses in the entire State out of which approximately 350 are located in Madras alone. Very small units have not been taken into consideration. The other prominent towns are Madurai, Coimbatore, Trichinopoly and Sivakasi. As English and Tamil are the principal languages of the State, all the printing presses provide for these languages.

As stated above there are about 350 large and medium size printing establishments in the city of Madras. Though letterpress is still the most popular process, offset is gaining in a rapid stride, there being quite a few large offset printing establishments in the city.

Printing equipment.—As in other parts of India the most favourite cylinder machine of the letterpress printers is Dawson, Payne & Elliot's Standard Wharfedale, with or without perfection delivery arrangement. German stop-cylinders like ' Record ', ' Diana ', ' Planeta ' also are in common use. In the platen press section after the popular Chandler & Price presses preference is given to the German art platens like Victoria, Phœnix, etc. Madras is known principally for its book printing. Tamil being available in the keyboard of all the mechanical composing machines many of the book printers have Linotype, Intertype and Monotype composing machines.

In the photo-offset section bèsides Crabtree, George Mann and Roland, Madras has quite a decent number of Japanese Offset presses. Process equipment is, however, mostly British, Hunter Penrose being the most popular.

Double-crown $(20'' \times 30'')$ in the letterpress and Double-demy $(23'' \times 36'')$ in the offset are the most popular sizes for the machines.

Printing premises.—Most of the larger firms are housed in their own premises and have laid out their plant according to plan. But the major portion of the small establishments are housed in rented premises, with almost no provision for expansion.

Current printing processes.—Letterpress process of printing enjoys the greatest popularity. The photo-offset process is also coming up and though there is no possibility of its replacing letterpress from its major role, it is true that all the large printers will shortly, as circumstances permit, instal an offset section to supplement their existing letterpress line. There is no gravure printer in Madras.

Current illustration methods.—Photo-engraving and photo-offset are the only two processes of illustration methods. In both the cases, the British equipment is most popular.

Supplies of printing equipment and materials and their availability.—The situation, recently created by the restriction on the import of printing equipment and materials, has affected the entire Indian printing industry. For the materials produced indigenously, like paper, board, printing ink, etc., the supply position in Madras is not smooth due to transport bottleneck. There is no paper and board mill in the South and so long the new expansion schemes of the North Indian Mills are not put to effect, the printing industry in Madras, as a matter of fact, shall have to suffer time and again. There is a proposal to start a Paper and Board Mill in South India, during the Second Five-Year Plan period. The production of this Mill together with augmented supply from the North Indian mills should improve the present situation. In respect of printing ink, Messrs. Mander Bros. Ltd. of Wolverhampton; England, has started a factory in Madras. Another British ink manufacturer is also going to start its plant in the city. At present the Madras printer has to depend for his supply of printing inks on the local factory as also on the Bombay and Calcutta manufacturers. In respect of roller composition Madras depends mostly on imports of British and German composition. For the present the printing industry in the locality has not work enough to

run even a second shift. There is no possibility of an increase of demand on the local industry early because of the programme of the Government for the production of Social Education Literature. The Government of Madras sanctioned in 1955-56 a scheme for the production of social education literature for adults at a cost of Rs. 75,000. Under this scheme 10,000 copies of each of 30 booklets, 6 books and 5 folders have been produced at two printing presses. If the quantity of reading material is not increased considerably then the printing presses with their existing plant can meet the requirements.

Process and equipment most suitable for the production of reading materials for new literates.—Though photo-offset process is suitable for the production of reading materials for the new literates, the existing plant and equipment is not adequate to take up the extra load for producing the required literature. The letterpress printers have not enough work and so it would be economical to produce them by letterpress for which the existing equipment is sufficient.

Availability of trained personnel.—There is a comparative dearth of skilled technical personnel. The Madras School of Printing Technology, which was so long a part of the Madras Polytechnic, has recently been raised to the status of the Regional School of Printing Technology for South India. At present the teaching and instructor staff consists of some of the experienced printing craftsmen. This, of course, is not satisfactory and better arrangements for qualified teaching staff need be made early so that the students coming out of the School may prove worthy of their job.

Organisation of printing presses.—The larger printing presses are managed quite well and they are always for improving the management techniques of their organisation. But the situation in the smaller and medium size establishments is otherwise. They however appreciate the introduction of better business methods in their organisation, which they cannot do owing to lack of adequate knowledge and qualified personnel.

Financial problems.—Like all other States in India the printing industry in Madras is entitled to financial assistance under the Indian Financial corporation Act and State Financial Corporation Act. The Madras Government is also providing financial assistance under its development programme and the printing industry is entitled to receive such assistance under some special contingencies. Barring some of the large printers most of the printing presses suffer from inadequate finance.

NEW DELHI

New Delhi, the capital of India, like Calcutta, Bombay or Madras, is not an industrial city. It is a trading centre, rather a clearing house of the various trades. It is only recently that some industries are growing in and around the capital. Before Independence, there were but a very few printing presses in the city but things have changed since and in the new and the old city many printing presses of various descriptions have sprung up. In one estimate there are about 1,200 printing presses in both the old and new cities but

according to another there are about 3,000, which figure I am unable to confirm from on-the-spot examination. I have not taken into account the very small units, units with a few cases of types or a ramshackle platen press. If these are taken into consideration then the figure may go beyond 3,000. Most of these units have been started by refugees from West Pakistan, and except a few, they are merely one-man shows, being started by the refugee printing craftsman of the printing presses who left their original homes in the present West Pakistan.

That the number of the printing presses of New Delhi (including Delhi, the old city) is no indication of the strength of the city in printing is evident when we find that not more than thirty-five printing presses are equipped to print books.

As English, Hindi and Urdu are the three main languages used in the area, most of the book printers have arrangement for printing in the aforesaid languages. But some of the Urdu printers have no arrangement for printing English or Hindi books.

Printing equipment.—Letterpress is the principal process of printing used in both the cities. As Urdu was very prominent before the partition of the country, there are many stone lithographers in the city. Photo-offset process is slowly making its way and there are now over six photo-offset printers in New Delhi and this number is daily on the increase due to the heavy demand of Government of India for posters, folders and brochures, etc., for its internal and external publicity work. Most of the letterpress machines are from Germany, U.S.A. and Britain. Double-crown $(20'' \times 30'')$ is the most popular size. In the platen press section Chandler and Price, Harrild, Victoria, Phoenix are very popular, though the printers are gradually being attracted to high speed small size automatic cylinder machines.

In Offset, Double-demy $(23'' \times 36'')$ is the favourite size. Most of the offset machines are of German make.

In the mechanical composing section Linotype and Monotype are in use and it seems that the latter is favoured more.

Printing premises.—Most of the printing presses are located in rented premises and there is almost no scope for any expansion. In New Delhi, the Municipal Corporation is trying to force out printers to the outskirts of the city from Connaught Circus, the fashionable shopping centre, where they are at present located.

Current printing processes.—As already mentioned, the letterpress process is the most popular, next to it is stone lithography. Photo-offset is a new venture.

Current illustration methods.—Photo-engraving is by far the most popular illustration method. There are about thirty photo-engraving firms in the city, but except for two or at the most three, the quality of work of most of the firms are not satisfactory.

Needs of the area in printing equipment and printing materials.—It is very difficult to assess the needs of the Delhi area in printing equipment and materials. The Central Government with the various autonomous commercial and cultural organisations is the biggest consumer of printing goods in the country and its headquarters is located in the city. Of course

it has huge printing organisations with both letterpress and offset equipment but they are fully busy with the printing of usual Government reports and forms. For better type of work both in letterpress and photo-offset processes, the Government places its custom with the various commercial printing presses throughout India. It is really ironical that the printers in Delhi get the least portion of it. If, however, the industry could have produced a better quality job than what it is producing at present, there would have been an exacting demand on the printing industry of Delhi. The very few printing presses that are producing quality jobs are overworked. Many of the publishers of Delhi, therefore, go to Lucknow and Allahabad in the Uttar Pradesh with their orders.

In printing materials the printing industry of Delhi depends for indigenous paper on the mills in West Bengal and for coated paper on imports from Bombay and Calcutta. There is no printing ink manufacturer in Delhi. Supply is from Calcutta, Bombay and Madras. The supply is sufficient and except for irregularity there is not much to complain of.

Process and equipment most suitable for the production of literature for new literates.—The Delhi publishers depend on photo-engraving as the most suitable for book illustration. The Sasta Sahitya Mandal and the Jamia Millia, both being non-profit-making institutions of the city, publish literature for the new reading public in Hindi and Urdu respectively. Sasta Sahitya Mandal depends mainly on process-engraving for illustration of its publications, while the other has only one-colour line-drawings in its books. As Hindi literature is making up its lost time in great strides and as there is a great demand for Hindi books for the new literates, the publishers are already considering the advantage of the photo-offset over the letterpress process.

Availability of trained personnel.—Though there are a number of foreign-trained personnel almost all of them are employed in the Government of India printing presses. There are only two foreign experts, employed in a commercial printing press. Delhi is shortly going to have a School of Printing Technology which may ultimately meet the need of trained personnel of the zone.

Organisation of printing presses.—Some of the newspaper organisations who are also publishers of books have a system of production management; but in most of the printing presses there is absolutely no organisation.

Financial problems.—Most of the printers in Delhi suffer from acute financial scarcity. As most of them are heavily encumbered they are unable to get any assistance from the State Financial Corporation.

UTTAR PRADESH

Uttar Pradesh (U.P.) with its population of 6,32,15,742 is the largest State in India. But its literacy figure is much low being only 10·80%. The U.P. Government has undertaken an intensive campaign to reduce illiteracy.

The printing industry of the Uttar Pradesh is mainly centred in Allahabad, Lucknow and Varanasi

(Banaras). U.P. is the centre of the Hindi-speaking people with Urdu prevailing in Lucknow area. Almost all the publishers of U.P. are printers and they mainly depend on school textbooks.

Printing equipment.—The letterpress process of printing is the only process which is in use in Uttar Pradesh. Except a very few in Lucknow all the printers in the State print only in two languages—Hindi and English. Among the printing machines the British Wharfedales are the predominant, closely followed by the German Stop-cylinders. There are a few U.S.-built cylinder machines like the Two-revolution Lee. But in the platen press section U.S.-built Chandler & Price platens form the largest number. The Indian Press (Private) Ltd. is the largest printing unit in the U.P. and is very well organised. It is well known for the huge quantity of text-books printed and published by it.

As Hindi (Hindusthani) is available both in Linotype and Monotype, both these mechanical composing machines are in use throughout the State. The Indian Press has a very well-equipped binding department.

Printing premises.—Except a very few most of the printing presses of the State are located in rented premises. They offer but very little space for expansion but it is not difficult to have larger premises.

Current printing processes.—As stated above letterpress process is the only one which is prevalent in the State, with the Indian Press having a unit of offset printing machine.

The current illustration process is also photo-engraving and there are nearly seventy photo-engraving studios in the State.

The needs of the area in printing equipment and printing material are quite considerable. Being the most populous State in India and having rather a low literacy figure it needs a much larger number of printing presses to cope with the growing demand for production of reading materials for the new literates. The printing presses of the State who are equipped for book printing are already too busy with their existing work. Most of the printing machines, however, require replacement. Regarding the printing materials, mainly paper and ink, the State being centrally situated, no transport bottleneck happens here. There is a regular supply of necessary materials.

Process and equipment most suitable for the production of reading materials for new literates.—Hindi, the principal State language in India, is spoken mainly in two States, of which Uttar Pradesh is the larger and more populous. In all other States, except Bihar, the dominant language is the mother-tongue of the State like Bengali, Assamese, Gujerathi, Marathi, etc. But in all the States of India Hindi is being taught in the lower-grade schools. Naturally there is a demand for Hindi books for new literates in all the States of India. It is for this reason that photo-offset is the most economical process for production of reading material for the new literates. But as the letterpress is the predominant process of printing in U.P. there is little chance of photo-offset machines to be installed here to supplant letterpress.

Availability of trained personnel.—The very few who received training in printing in Europe have been absorbed in the U.P. Government presses. A regional School of Printing has been started in Allahabad under the First Five-Year Plan to meet the growing demand for the skilled craftsmen.

Except the Indian Press and the Law Journal Press of Allahabad none of the establishments follow any scientific system of management.

Most of the printing presses suffer from acute financial scarcity and find it difficult to expand their business, though none of them has yet taken advantage of the financial assistance programme of the State Financial Corporation.

Orissa

The problems of Orissa in respect of printing are peculiar to itself. This sea-coast State in the eastern region of India has a population of 1,46,45,946 speaking the Oriya language. Oriya language though derived from Sanskrit has quite a different script from other North Indian languages and is not similar to any of its neighbours, West Bengal, Bihar and Andhra. As a result Oriya literature though ancient and prolific is confined within its own boundaries. Any reading material produced in Oriya will naturally be limited to within its boundaries as it has no field like that of Hindi or Bengali.

The printing industry of the State is confined to Cuttack, the Capital city. There are a few printing presses in Puri and Ganjam. In Puri there is only one Press, the Bijoya Press, which produces books. In Cuttack there are about 30 printing presses, of which not more than seven are equipped to print books. They depend mostly on Government jobs. Most of the presses have arrangements to print in Oriya, Bengali and English. Letterpress is the only process of printing in use in the State. Most of the printing presses are equipped with obsolete hand presses flyer delivery British-make Wharfedales and U.S.-built Chandler & Price platen presses. Printing materials like paper and ink are obtained from West Bengal dealers. The need of the area in both equipment and materials is great provided of course there is an increasing demand for reading materials. At present most of the presses are starving for work. There is no photo-engraving firm in Orissa; so the very rare demand is met from Calcutta.

As is usual there is a great dearth of skilled personnel. The Government of Orissa has started a Printing School in Cuttack, in 1957 with the Superintendent of the Government Press as Principal. The School aims to train craftsmen for the different crafts of printing. Almost all the printing presses are in financial difficulty.

Andhra

The reconstituted Andhra State is contiguous to Orissa and is larger in area and population than the State of Madras of which it was formerly a part. It now includes the old princely State of Hyderabad.

In the nineteen districts of Andhra there are about 500 printing presses. The following list shows the

approximate number of printing presses in some of the prominent cities of the State:

Secunderabad	..	66
Hyderabad ..	..	120
Warangal ..	..	28
Khammameth	..	6
Bezwada	..	25
Guntur	..	24
Tenali	..	20
Nellore	..	14
Eluru	..	12
Rajahmundri	..	18
Kakinada ..	..	16
Vizianagaram	..	10
Nizamabad ..	..	8
Nalgonda ..	..	3

Most of the five hundred presses of the State are job printers and according to one prominent printer of Secunderabad ' they live from hand to mouth '.

Most of the printing presses are letterpress units, there being only about 15 lithographic printers in the State, which are located in Bezwada and Hyderabad.

Of the 500 printing presses of the State about 180 have Wharfedale (Stop-cylinder) presses. The most popular sheet size of these machines is Double-crown (20" × 30"). About 135 printing presses of the State have cylinder machines of over Demy sheet size (18" × 22"). As in Letterpress, in Lithographic process, too, the most popular sheet size is Double-crown.

As the principal language of the State is Telugu, Photo-offset process is suitable for producing reading materials for the new literates. But it is doubtful what will be the choice of publishers between Letterpress and Lithographic processes of printing. All the fifteen Offset presses are too busy to accept any extra work, while about 20 printing presses (i.e., about 4% of the total presses) have the necessary capacity to accept extra work.

The current process of book illustration is photo-engraving. The Offset printers have their own plate-making arrangements. There are eight photo-engraving firms in the State. Their city-wise location is given below:

Bezwada	..	2
Eluru	..	1
Secunderabad	..	2
Hyderabad ..	..	3

They make monochrome line and halftone blocks; multi-colour halftones are usually supplied by Bombay and Madras.

The reorganised State of Andhra is expected to offer a very large scope to the local printing industry. There are only 135 printing houses who have larger size presses than Demy sheet size. The printers will require a large number of machines of Double-crown and Double-demy sheet sizes. For paper the State has to depend on the Mills in Northern India. It is necessary that at least two paper mills should be started in South India to meet the local demand of paper and board.

There is a great dearth of trained personnel in the State but it is expected that the Regional School of Printing Technology at Madras will be able to supply a sufficient number of craftsmen in the near future.

Most of the printing presses are too small and they do not follow any scientific system of management.

The financial condition of most of the printing presses in the State, excepting 3-4%, is almost precarious and in the language of a prominent printer of Secunderabad, the question of meeting the cost of expanding their presses from their own resources is simply impossible.

MYSORE

The reconstituted State of Mysore is situated to the west of Andhra with Bombay to the north and Madras and Kerala to the south. The reconstitution has brought in the Kannada-speaking population under one State. The area of the State is 74,326 sq. miles and the population is 1,94,01,193. The percentage of literacy of the State is 19·25%. The State Government follows an enlightened programme for adult literacy.

As the State has been recently reconstituted under the State Reorganisation Scheme by the integration of the Karnataka areas of the former Bombay, Hyderabad and Madras States, no figures of printing presses of the Karnataka areas are available. There are nearly 500 printing presses in the reconstituted State, most of them are small ones having one or two platens and are capable of taking up job works only. There are about 11 presses with more than two cylinder presses and more than 20 workmen in each. There are 14 presses in the former Mysore State each with two cylinder presses and about 20 men working. Figures for integrated areas in this category are not yet available. There were 79 presses each with one cylinder press and less than 20 men in the former State while figures for the integrated areas are not included in it as they are not available. In the area comprising the former State of Mysore there are about 130 presses with only platens.

Printing equipment.—Most of the cylinder printing machines are British-make Wharfedales. Double-crown size prevailing among them. Among the platen presses the disc-inking presses are more popular. Lately the automatic Heidelberg platen presses have been installed in some Bangalore and Mysore printing houses.

Most of the premises of the larger houses are owned by the print shops themselves. But the smaller ones, with one or two platens are in hired premises. The larger units in Bangalore and Mysore have in most cases space for expansion.

Except in one press in Bangalore, which has an Offset unit, all the printers follow the conventional letterpress process.

The current illustration method is naturally photo-engraving. There are three photo-engraving firms in the former Mysore State area. The local printers and publishers generally get their supplies of blocks from Madras and Bombay.

Excepting the very small units almost all the Printing establishments, especially those in Mysore and Bangalore have sufficient commercial works as many

of the Government of India administered industries are located in this State. Very recently some of these industries have started printing presses to cope with their own work. This has naturally given rise to a kind of dismay among the printers. Except in two or three establishments, the printing machines and equipment are rather old and need replacement. There is a growing demand for both platen and cylinder presses, not only for expansion but also for replacing the old ones. But owing to restrictions placed on import of machines and equipment the progressive printers are facing a good deal of difficulty.

The present State of Mysore is a Kannada-speaking area and the process most suitable for producing literature for the new literates is photo-offset. But it is doubtful if this process will be adopted by the publishers as the demand for the reading materials for the new literates has a slow growth. Consequently the ultimate choice of process for producing books is letterpress.

Though in Bangalore printing as a craft is being taught in the local polytechnic, this has not solved the problem of scarcity of skilled personnel. The Regional School of Printing Technology in Madras is supposed to cater to the requirements of this region.

Except one press in Bangalore and another in Mysore no printing press follows any kind of scientific production control.

Almost all the establishments suffer from acute financial scarcity and live a hand-to-mouth existence.

KERALA

The former princely State of Travancore-Cochin, now named Kerala is the most literate State in India. Barring Delhi (578 sq.m.), Himachal Pradesh (10,904 sq.m.), Manipur (8,628 sq.m.) and Tripura (4,032 sq.m.), Kerala is the smallest State in India with an area of 15,055 sq.miles and a population of 1,35,49,118. The percentage of literacy in the State, is 40·88 and highest in India. This prominence in literacy the State had attained during the time it was a Princely State. A major portion of the population is Christian. It is said that St. Thomas, one of the disciples of Jesus Christ came to Kerala and being well received by the Hindu rulers established his Church here. Historically Christianity is much older in India than in Europe. The tolerant conduct of the Hindu ruling class helped the Christian missionaries in their proselytising work; as usual besides conversion, they devoted their time to improvement of sanitation and education. The enlightened policy of the last Rulers helped to make the State the most literate in India.

It is really strange that in spite of such a high percentage of literacy, the number of printing presses is not over one hundred in the whole State of Kerala, most of them being located in Trivandrum. None of the printing establishments is modern in any sense. Letterpress is the only process prevalent in the State. The State being mainly agricultural printing has not developed as an industry; and there is but meagre information available about it.

ASSAM

Assam is the north-eastern frontier State of India. It has a population of 90,43,707 persons while its area is 85,012 sq. miles. The percentage of literacy according to 1951 Census is 18·07%. The printing industry in this State has not shown any progress. There are not more than one hundred printing presses in the entire State. As already stated in the preliminary remarks the Assamese publishers depend on Calcutta in West Bengal for the printing of their school text-books. Tea, timber and oil are the three main products of Assam but as the Head offices of almost all the concerns are located in Calcutta, most of the stationeries required in these businesses are naturally sent from Calcutta to Assam.

The few printing presses of Assam follow the letterpress process of printing and they mostly own their premises. For illustration method, process blocks are the only medium the printers follow and there being no photo-engraving studio in Assam the printers depend for their occasional supply on Calcutta which has regular air, railway and steamer connection with Assam.

The printing industry of Assam has not yet gained any recognition in the society. But it is a hopeful sign that students from Assam form quite a considerable proportion in the Regional School of Printing Technology in Calcutta.

So long as the adult literacy and mass education campaign do not get an appreciable momentum, it is doubtful whether there will be any large demand for expansion of the existing printing plants or establishment of new ones. Calcutta supplies the needs of the Assamese printers both in printing equipment and in materials. Evidently the letterpress process will remain the most economical process for producing reading materials for the new literates.

PUNJAB

The area of present Punjab is 47,456 sq. miles while its population is 1,61,34,890 according to 1951 Census. There are nearly 500 printing presses in the entire State. the district of Amritsar leading with 134 printing presses. But almost all the printing establishments are small ones, who mostly follow the letterpress process of printing. In the cylinder presses, British Whar-fedales are predominant while in the platen presses the U.S.-built disc-inking models are popular. There are about half a dozen Litho printers. Punjab is well known for its enterprising activity in the manufacture of small industrial machines and this is also manifest in its manufacture of small paper cutting guillotines and platen presses. Gurumukhi and Hindi are the two principal languages used in the State. For reproduction of illustrations, the photo-engraving process is the only one followed. Most of the process blocks are supplied from Delhi, though there is a couple of block-makers in Simla.

The area gets its supply of printing machines and materials from Delhi, which, as has been stated earlier, is the trading centre of Upper India. The need of the area in equipment and materials being small, no scarcity

is felt. Same is also true about skilled personnel and scientific organisation. The establishments suffer under chronic financial difficulties.

The following table shows the number of printing presses in Punjab districtwise:

Ambala	.. ..	59
Amritsar	.. ..	134
Bhatinda	.. ..	12
Firozepur	.. ..	17
Gurudaspur	.. ..	12
Gurgaon	.. ..	9
Hissar	.. ..	25
Hoshiarpur	.. ..	11
Jullundur	.. ..	95
Kangra	.. ..	5
Kapurthala	.. ..	5
Karnal	.. ..	12
Ludhiana	.. ..	54

Narnaul	.. ..	3
Patiala	.. ..	4
Rohtak	.. ..	19
Sangrur	.. ..	8
Simla	.. ..	9

RAJASTHAN

Rajasthan has an area of 1,32,077 sq. miles but a population of 1,59,70,774 according to 1951 Census. There are over 300 printing presses in the State. The only process of printing followed is Letterpress. The industry is in a very poor state. It gets its necessary supply of materials and equipment through Delhi. Hindi being the only language in use in the State, it gets its requirements of books from Delhi and other parts of Northern India. The local printing presses have almost no incentive to expand their business.