大槻文庫洋學關係書零葉 七種

合綴

因是先生文

語不同所以其各國書話俱異也

西國米里堅國波耳都其國等皆用的音母切字都同但連字成英吉利國所用之音母切字乃羅馬國於古時所用之字且法蘭及紙口卽能流然說出其字句之音而後學其字義不難也

四個音母至或十個音母或二十母音母切字悉然甚熟致目一要習連音母之法者必先學連兩個音母次連三個音母又次連語方可得其眞音也

此漢文字音不過畧似英文音母切字音故學者務聽人口傳言

音母碎字音 亞 彼 西 地 衣 冨 治 喜 唉 這 其 拉 米 尼 阿 被 舊 耳 士 豐 友 非 武 𠃓(雙合) 外 洗

音母小字樣 a b c d e f g h i j k l m n o p q r s t u v w x y z

音母大字樣 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

音母碎字第 丨 刂 川 乂 ろ ㄴ ㄷ ㄹ 攵 卄 ㅏ ㅑ ㅕ 以 ㄴ ㅗ ㅛ ㄹ 攵 卄 ㅏ ㅑ ㅕ 以 ㅏ

以碎字表之致後可以是切字變易連合成無數之字之音矣

其音母字叫做切字因制字者將萬音分開切碎取各音之端倪所用叶其音之漢字要南京字音讀纔畧似英國切字音可成字義也玆將其二十六音母切字照印板字樣次序列於右

駝鳥圖

BRIEF EXPLANATION OF AN ALPHABETIC LANGUAGR.

AS EXSMTLIPIEO BY THE ENGLISH.

為示語音不為形字義而制的但相連音母切字後方其數也其音母切字畧仿佛康熙字典切音之法原係英文有二十六音母切字可以變化相連生字句不盡頭起而往下讀英文係從左手起而往橫讀英國書係在左手而起讀似清文一般惟清文係在上其字樣也以此觀之形字義之法有甚得矣即是字樣可恒存而不以各地語音不同則輒要更改形出其義斷然形不出來惟形字義之文有一件長處又論及形字義之法於凡屬心念無物可見之字雖要不能自達己音乃要學者音義俱心記固然係一短處將此制字法兩端比較有些難定其長短形義之文字形義之字乃[宜至比多]國古字中國古今之字是也或之字即如清文梵字英字及西域友羅巴之列國皆然所言之音兼義一則形所言之義而不達語音達音義多相異惟大概論其制字之理止有兩端而已一則達天下萬國人等言語不下二百樣說法不同且其字樣

英吉利國字語小引

噎滅鳥。一名蛤昨亞里斯。產于亞細亞洲馬路古斯島中。安具那番達又出于則意蘭蕪門荅剌太剌撥捘涅。及其近傍諸地。亞墨利加洲諸國亦產之。頭頸甚長大。自頭前至嘴下端四寸餘。以我邦曲尺約之。以下倣之。項部如兀。其際色赤。至下邊漸淡赤微帶黑。自頭至足約高五六尺。其體自胷至尾骶約三尺許。頭比他部小而兀。白黑而多青彩。頭上邊生微毛。其色黑。眼竅太。悍目火光周匝生睫甚細小。眼傍有耳竅。小而兀。觜前鉤曲。自上邊至尖。約五六寸許。纔去尖。上有二孔。是為鼻孔。頭上戴如冠者。高三四寸許。其質宛如

蘭畹摘芳序

藥物之產乎西洋諸蕃者。農経桐録暨輓近本草之書。唯論其功用。而枝葉花實真偽之辨。鹵莽含糊。鮮得其詳覈。蓋邈乎八紘之外。不身到目擊。其所耳聞。

重譯傳訛。是猶酈氏注水經。至于塞外衆流。江南諸派。要非無乖錯。而況於八紘之外乎。仙臺醫員大槻子煥。夙耽西洋學。側行之文。摟羅之言。莫不精諳。從境所產之藥物。若枝莖花實。功

用真假之辨。讀其書。而得其詳。驗之病者。而核其真。更纂華產諸家之說。甄綜以作一編。名曰蘭畹摘芳。其爲書。遐搜博攷。非騁胸懷者也。近時託學西洋。以衒鬻其名者。欲呈奇詭新漫原

無稽異種。以充未審物品。強爲著說。公然付梓。以聳動俗耳。施之外傅。則可也。用之内服。則其能毒未必可知焉。蓋識者自有取舍之明也。若夫粗工。則取舍不明。其流弊恐至害生靈也。允

生之道。豈可忽諸。予每爲之長吁。既閲子煥此編。駭然因是猶無重譯傳訛之弊。又不出異奇詭新之意。而西洋之諸藥物。從來所不得其詳核者。不啻一目瞭然如示諸掌也。乃至農皇未

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嘗之品。桐君勿采之種。逐件辨晰。殆無餘蘊。可謂備矣。予風受箕業。研究本草之書。畧有心得。而常病西洋所產者。不免舍耜。今也展觀此編。髮竇氷津。始知西學之有裨補于此道爲。子煥

之功。豈爲詹詹乎。後之觀者。幸勿爲世間新奇聳俗之比爲。頂初編三卷。校讐纂寫。乃高上木需序於余。以赭鞭之業。相識子煥於亡兄西湖阪氏之門。殆三十餘年。當其態清。不敢固辭。

嘗之品。相君句乗之種。逐件辨晰。殆無餘蘊。可謂備矣。予夙受箕業。研究本草之書。略有心得。而常病西洋所産者。不免含糊。今也展観此編。疑竇氷泮。始知[illegible]術之有裨補于此道。爲予煥

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II. HOOFDSTUK.

DE TEGENWOORDIGE STAAT VAN JAPAN; enz.

Japan, een groot Ryk, ligt rondom in den *Oostelyken Oceaan*, ten Ooften van *Corea*, tuſſchen de 30 en 42 Gr. Noorder breedte, en tuſſchen de 147 en 161 lengte; ſtrekkende zich N. O. en O. N. O. uit. Het beſtaat uit drie groote Eilanden, als *Nipon*, of 't eigenlyke *Japan*, *Kiuspi* en *Sikokf*, welke allen door eene groote meenigte van aan hun onderhoorige Eilanden omringd zyn. 't Land is zeer wel bewoond en bebouwd, ſchoon het veel al een rotzigen grond heeft; en is dies vol Dorpen, Vlekken en Steden; die 'er op een ongelooflyk getal begroot worden; 't is ook zeer bergagtig, doch de vlyt der Inwooneren, die ook alle of de meeſte veld den tot ſpyzen weten te bereiden, maakt het zeer vruchtbaar. 'Er zyn verſcheiden brandende Bergen, voor al op 't rotzig Eiland *Firando*, die eeuwen agter een gebrand en gebeefd heeft. 't Ontbreekt 'er niet aan veele koude en warme altyd vlietende Bronnen, Beeken en Rivieren, waar door het Land doorſneden is.— De lugtſtreek is 'er zoo gezond, dat men 'er nooit van Peſt of Steen hoort. Echter zyn 'er de Buikloopen, Kolyken, Kinderpokjes, Oogziekten, en Blinde Luiden zeer gemeen. Veelen bereiken 'er hooge Jaren. Des Zomers is het 'er ondraaglyk heet. Veel regen valt 'er gemeenlyk, doch voor al

延綴數言以贈焉于皆文化十二年歲次乙亥花朝

法眼侍醫兼醫學教諭管鑒定

藥品栗本瑞見源昌澹撰

gr. Octavo, van 375 *bladz. te* Amſterdam *by* F. de Kruyff, A. van der Kroe, Yntema *en* Tieboel, 1771. *De Prys is* 16 *ſt.*

Daar we in ons voorig Uittrekzel over 't eerſte Deel, onzen Leezer eene proeve gegeeven hebben van de wyze, hoe de geleerde Mosheim, in deeze uitmuntende Kerkelyke Geſchiedenis, de gevoelens der Ketters ontwikkeld en opgegeeven hebbe; zullen we uit dit Deel, 't welk de lotgevallen der IV. V. en VI. Eeuwen beſchryft, eene andere ſtof kiezen, en wel byzonder het 3 Hoofdſt. handelende *over de Leer der Kerke* in de VI. Eeuw, waar uit men aangaande de voortreffelyke uitvoering op nieuws zal kunnen oordeelen.

I. Wanneer de Dienaars der Kerke, (dus begint Mosheim) eens waren afgewecken van de oude eenvoudigheid in den Godsdienſt, en de oorſpronglyke zuiverheid der Godlyke Waarheid bezoedeld hadden door 't jammerlyk inmengzel van menſchelyke vindingen, viel het zeer bezwaarlyk, aan dit ſteeds toeneemend verderf paal en perk te zetten. De misbruiken vermenigvuldigden van dag tot dag, en 't vrugtbaar bygeloof teelde ontelbaare ongerymdheden, die men by de leer van Chriſtus en de Apoſtelen voegde. De Geſchilſchryvers in *'t Oosten* voeren voort met eenige van de voornaamſte Leerſtukken der Chriſtenheid te verwarren en te verduiſteren, door ziftende onderſcheidingen, welke zy van eene niets beduidende, en harſſenſchimmige Wysbegeerte ontleenden. De Leeraars en Onderwyzers weeken wel verre af van het voetſpoor der Apoſtelen Zy ſcheenen niets anders te bedoelen dan de meenigte in de ſchandelykſte onkunde en byge-

zetels der Navolgeren van Origenes waren, verdedigden de Monniken, onderſchraagd door de Biſſchoppen, en boven al door Theodorus van *Ceſarea*, in *Cappadocie*, de waarheid en agtbaarheid der Leerſtellingen van *Origenes* tegen alle zyne vyanden met ongelooflyke vuurigheid en yver. De zaak werdt in 't einde voor Justinianus gebragt, die in een lang en breedvoerig bevelſchrift, gezonden aan Mennas, Patriarch van *Conſtantinopole*, een ſtreng vonnis over Origenes en zyne leere ſtreek, en beval, dat dezelve geheel niet zou gepredikt worden. De uitwerkzels van dit bevelſchrift waren eer heevig dan langduurig: want, na dat het geſchil over de *drie Hoofdſtukken* was uitgeborſten, herleefden in *Paleſtina* niet alleen de gevoelens van Origenes, maar zy kreegen als nieuwe kragten, en ſpreidden zich wyd en zyd uit. Dit veroorzaakte veele onluſten in de Kerk, die egter geſtild werden door middel van de vyfde algemeene Kerkvergadering, in den Jaare 563. door Justinianus, te *Conſtantinopole* by een geroepen, waar op Origenes en zyne Navolgers wederom werden veroordeeld. — Nog twiſtte men in deeze Eeuw over de *drie Hoofdſtukken*, en of men eigenlyk kon zeggen: dat een der Drieëenheid aan het kruis geleden hadt? waar over men den Schryver kan raadpleegen.

II. HOOFD-

MAANDELYKSCHE

UITTREKSELS

OF

BOEKZAAL

DER GELEERDE

WAERELD.

I. HOOFDSTUK.

OUDE EN HEDENDAAGSCHE KERKELYKE GESCHIEDENISSEN, van de geboorte van Chriſtus tot den aanvang der tegenwoordige Eeuwe, door J. L. MOSHEIM, *Kanſelier der Hooge Schoole te* Gottingen, *uit het Latyn vertaald, en vermeerdert met de Byvoegzels enz. van* A. MACLAINE, *Doct. in de H Godgel. en Leeraar in de Engelſche Kerk in* 's Hage, *tweede Deel in*

given, the work of electro-lithography, printed by the printing-press, which, though not very fine in appearance, shew that this new form of the art may yet become of great importance to publishers.

Rollers for printing are from 6 to 24 inches long, and from 3 to 5 inches in diameter. The wooden roller, with handles projecting to hold by, is covered with several folds of flannel, and then with calf-skin. Differently prepared skins are required for printing line, chalk, tint, and colour drawings. Instead of the wood inside, hollow metal may be covered with flannel and calf-skin.

The *printing-ink* is made of varnish, boiled from old linseed-oil, and of different degrees of strength—thin, middle, strong, and very strong. For the printing of writings, music, maps, and line-drawings, common calcined lampblack is ground with the varnish, and some *hard* blue is added to improve the colour, and to make the ink dry in a short time; for chalk-ink, Paris black is added instead of the common lampblack; for printings where gold-leaf, bronze, or dusting-colour is required, very strong varnish is in use; for tinting and colour-printing, colourless or bleached varnish must be employed, as otherwise the purity of the colours will suffer.

Printing.—The stone is first properly fixed into the press, and to prevent it from breaking, it should be backed to another stone, best to a slab of Aberdeen granite, with a mixture of plaster of Paris and water; after the printing has been done, the slab can easily be separated from its backing. The gum is now entirely washed away with a Turkey sponge and water; the writing or drawing is then removed with oil of turpentine, after which the stone is cleaned with water. The stone is now wetted with another sponge, or, for writings, with a piece of soft printing-cloth; the printing-roller charged with ink, is passed repeatedly over the stone, and the writing or drawing will reappear. A sheet of paper is put on the stone, the tympan is let down, the scraper brought to its proper place, the pressure effected, and by means of the handle, cross, or wheel, according to the style of press, the table with the stone is equally drawn through to nearly the end of the stone. The printer now relaxes the pressure, the table with the stone runs to its original place, the tympan is put back, and the impression is removed. The wetting of the stone and the rolling it with ink, &c., as already described, are repeated for every impression.

The *printing of tint and colour stones* is treated in the same way; only the rollers, varnishes, and colours are different from those used for ordinary black and chalk-printing.

An *engraved stone* is printed with a small flat wooden tapper or tampon, either round or square at the sides, with handle at top, and covered several times with a piece of a very coarse blanket, fastened at the sides. The tampon, charged with ink, is tapped over the wet stone, the whole is cleaned with printer's canvas, and, finally, a printing-roller is passed over it, to remove all impurities; the paper is then placed on the stone, and the impression made as above explained. A shoe-brush, with long stiff bristles, and charged with ink, may be brushed over the stone, and very good impressions obtained.

Photo-lithography.—From the specimens which we have seen by lithographers of Munich, Paris, and Rome, and from the very slow improvements which have been made since their first impressions were exhibited some years ago, few practitioners can hope, considering the difficulties of printing photo-lithographs from stone, to see them approach the perfection of those examples of photography exhibited occasionally by different photographic societies. Glass and metal for printing purposes seem to be preferable to the stone, so far as the invention has gone. We have heard that a French photographer has made the discovery of a method for fixing drawings directly to the stone.

By many other processes, lithographic drawings may be done, but they are not in general use, or not yet of practical advantage, and therefore not of much interest to the public.

The facility now acquired of multiplying by *transfer* any line-drawing, map, or writing, either done on stone, copper, steel, wood, pewter, or set up in type, enables the lithographic printer to furnish any number of impressions without in the least damaging the originals. A variety of the above-mentioned styles of execution may be transferred to one stone, and printed from it on the same sheet, which, for publishers and manufacturers, is of great advantage.

Britain being a commercial and manufacturing country, lithography has not here attained the same perfection, though some of its establishments may rival any in the world. Great progress, however, is visible; and if the lithographic artists and printers of Great Britain would take especial care to do everything well, their proper position would soon be established. But it is often painful to see badly executed lithographic work printed in a yet worse manner, the production being altogether a disgrace to the art. Any inferior letter-press printing is greatly superior to such work. It is better, where cheapness is essential, to do things very plainly, but always well and tastefully.

The haste with which orders from the public are required to be executed, is often injurious to good workmanship; a little consideration on their part, in allowing sufficient time, would render it the fault of the lithographer if the work were not done to their satisfaction. The difference of price charged for good or bad execution is very trifling; often, indeed, a higher price is charged for bad work than what the competent workman charges for good. Lithography has operated most favourably on the great advances which have been made in type-printing and wood-engraving. By clearing the field of inferior engravers—which it has done most effectually on the continent—it has rendered great service to art and the public, and good engravings have never been more prized than at present.

Much harm, however, has been done by bad lithographs being imported in large quantities into this country. These are the productions of foreign manufactories, not art-establishments, and are the works of tradesmen, not artists, and though the execution appears fine enough, they have in reality little artistic merit. They are often piracies of the publications of eminent living artists, and being executed by mere mechanics, the merit of the originals is destroyed. A parallel case will elucidate this: in order to translate the works of a Schiller or a Homer *well*, it must be done by one who is not only conversant with the language of his author, but who is himself a man of genius commensurate with his undertaking—and so it is with art. It is to be regretted that so many are allured to purchase these inferior prints from their low price and apparent fineness.

MAANDELYKSCHE

UITTREKSELS

OF

BOEKZAAL

DER GELEERDE

WAERELD.

I. HOOFDSTUK.

OUDE EN HEDENDAAGSCHE KERKELYKE GESCHIEDENISSEN, van de geboorte van Christus tot den aanvang der tegenwoordige Eeuwe, door J. L. MOSHEIM, *Kanselier der Hooge Schoole te* Gottingen, *uit het Latyn vertaald, en vermeerdert met de Byvoegzels enz. van* A. MACLAINE, *Doct. in de H. Godgel. en Leeraar in de Engelsche Kerk in* 's Hage, *tweede Deel in*

and water, face to face, and when level, are first polished with pumice-stone, and lastly, with water-of-Ayr stone. The polished stones are for line-work, writing, engraving, and transfer; those for chalking, tinting, litho-tinting, and photo-lithographing, after having been ground, as already described, are *grained* with finely sifted silicious sand, or finely ground glass, either fine, sharp, or rough, according as it is intended for a sketch, a finished drawing, or a tint.

The *writing* and *drawing inks*, and *crayons* (chalks), are composed of old lard, white hard soap, white wax, shell-lac, Venetian turpentine, carbonate of soda, and powdered Paris black. The proportions used, and the methods of making ink and chalk, vary considerably; white-wax, however, together with soap and Paris black, will enable any practical lithographer to make good ink and good chalk, a difference being made in the proportion of the ingredients for softer and harder chalks.

The writing or drawing to be done is either traced or sketched on the stone with a pencil, the artist working it in with a lithographic steel-pen or a very fine camel-hair brush. When an alteration is required, a portion of the writing or drawing may be taken out, either by means of the scraper, the penknife, or by oil of turpentine: a *tooth-brush* is sometimes used advantageously to give the appearance of a chalk-drawing. This is done by warming the stone, and then moving the tooth-brush, slightly saturated with ink, over the back of the blade of a knife, so as to spread a fine spray of oval dots, varying in size according to the strength used in pressing the brush against the knife. These imitations of chalk-drawing have some advantages: they admit of being printed by an ordinary workman; they yield more copies per day than the chalk-drawings; they can be printed on any paper; and are easily transferred to another stone.

A *chalk-drawing*, after having been traced, is drawn on the stone with the lithographic crayon, pointed with a penknife. Great practice is needed to produce a finished chalk-drawing, but great improvements have resulted from the practice of treating these drawings like paintings, with the systematic design of bringing first out the chief effect, and the finish of detail afterwards, instead of copying detail after detail, as was formerly done, which prevents giving the breadth of effect, so desirable in a good copy. This has been much facilitated on the continent by the use of paper, leather, and cork stumps, and the use of the scraper; finishing, of course, with the pointed chalk. The artist must try previously the various effects of texture which the stumps give when worked gently, and with varying degrees of firmness, on the cold, as well as on slightly and well-heated stones, finishing with the crayon, pen, or brush, and scraper. The drawings of Calame, Sabatier, Mouilleron, and others, are done with the stump, recognisable by their finish and richness of appearance, and freedom of manipulation. These drawings will yield a larger number of impressions than ordinary chalk-drawings, but require great judgment when being etched.

When the drawing is finished, it is laid in the etching-trough. One part of nitric acid is mixed with about sixty parts of thinly dissolved gum-Arabic, which is several times poured over the stone. A precise rule for the proportion of the acid can scarcely be established, as it must vary in strength and frequency of application according to the style of drawing, hardness and temperature of the stone, and quality of the chalk.

Engraving is done on a hard stone, which is etched first, and gummed—some do not etch, but merely gum the stone—the gum is afterwards washed off, and a mixture of powdered Paris black, with water and a very little gum, is spread over the stone, and smoothed down with a large flat camel-hair brush, or with the palm of the hand. A red ground is by some substituted for a black one. The red ground is put on the stone by washing off nearly the whole of the gum, and the very small quantity remaining is allowed to dry, after which powdered reddle, or red chalk, is rubbed on the stone with the palm of the hand. The instruments for engraving are fine and broad pointed steel gravers and needles, fixed in holders of wood, and small points of diamonds properly fixed by the jeweller. The lithographer does not require to cut very deeply. When any great mistake occurs, it may either be polished out with pumice-stone, or taken out with the broad scraper; the spot is then prepared again, rubbed over with reddle, and the mistake rectified. Smaller errors are covered with a mixture of weak phosphoric acid, gum and Paris black, and thus do not take the printing-ink. Linseed-oil is put over the finished engraving, and then the whole cleaned away with a bit of coarse flannel and some water; a linen rag, containing some printing-ink, is rubbed over the whole drawing until every line appears distinctly in black, and then the stone is gummed again.

Drawings of the human figure, of objects in natural history, and architecture—for example, the painted windows of the Maria Hilf Kirche at Munich—have been engraved on stone, as also many of the maps of the surveys of continental states, and of the Austrian staff, as exhibited at the Great Exhibition of 1851.

Machines for ruling, with the diamond, grounds, skies, ornamental bass-reliefs for bank-notes, &c., are also used on stone.

Etching on stone is done in a similar way as etching on copper, on a ground of Brunswick black, without cutting into the stone. The biting with acid, and stopping out, are the same as on copper. The whole requires to be washed with acetic acid, and cleaned with pure water; the stone is then dried, and rolled over with printing-ink, the whole removed with turpentine, and the printing effected with the roller.

Autography.—With very little lithographic ink to the pen, write only on one side of any ordinary good writing-paper. A stone is slightly warmed, the written paper is sponged on the back with diluted nitric acid, laid for a moment between blotting-paper, then placed with the written side upon the stone, and passed *once* through the press. The paper now adhering to the stone is washed with water on the back, and, when quite soft, is removed by rubbing repeatedly with the fingers until the paper comes off, after which the stone is gummed. After a while, the printer puts some drops of water on the stone, and with a linen or flannel rag containing some printing-ink, goes rapidly in all directions over the writing, which then assumes a darker colour. The stone is gummed again, and put aside until quite cooled. Remove now the gum, and pass a roller, containing what is called preserving-ink, several times over the writing, after which the stone is *slightly* etched; this, however, is scarcely needed when only a small number of impressions is to be taken. This process is of importance to government offices, bankers, merchants, architects, civil engineers, surveyors, and builders, for circulars and specifications.

Writings, plans, and sketches on coated lithographic paper, are chiefly produced in Great Britain, and especially in Scotland, and have never been equalled in other countries. A thin, smooth, and well-sized paper should be used for this purpose, the size to be prepared in the following way—namely, 1 part gelatine or isinglass, 1 part best flake-white, and as much gamboge as required to give colour, are dissolved over a slow fire, then sifted through double muslin, and spread *once, in a very warm state*, with a large flat camel-hair brush, on one side of the paper. When dry, it should be thoroughly smoothed down, by being passed several times over a warmed stone. Transparent quills, lithographic steel-pens, and small camel-hair brushes, are in use for the writings and drawings. Any mistake is

erased with a penknife, and the place covered again with the coating, to be kept in a small corked bottle.

The drawing or writing, when finished, is put between damped blotting-paper; after a few minutes, the sheet is placed upon the warmed stone, previously adjusted in the press, and passed through five or six times; the back of the paper is sponged with water, the stone turned, and, to compensate for inequalities of pressure, it is passed again five or six times through the press. Water is then put on the back of the paper, and it is rubbed with the fingers until it comes off gradually. The stone is hereafter subjected to the process given under Autography.

Mr Paul Dupont of Paris, and others, have made numerous attempts to transfer ancient copper and wood impressions to the stone, but without producing quite satisfactory results. Some prefer for these transfers zinc-plates.

The invention of *Zincography* is due to the late Mr Eberhard of Bavaria. It is much in use at the Government Survey Offices at Southampton; it is, however, a mere application of lithography to zinc-plates, with some modifications of the etching and printing, but is not so certain as the printing from stone.

Fresh impressions of lithographs, of steel, copper, and wood engravings, and of common letter-press, with the exception of aquatint impressions, may be *transferred* to stone. The ink for transferring lithographic impressions is made of a stick of lithographic writing-ink, thinned, when used, with some oil of turpentine, and mixed with printing-ink. The impressions are taken on slightly damped transfer-paper, which is made as follows: mix three parts of the best wheaten-flour, of the consistency of shoemaker's paste, with one part of the best ground plaster of Paris, and a little dissolved patent glue with some tepid water; then strain the mixture in spoonfuls into a common jar through a double fold of fine muslin, pressing it gently through with the back of the spoon; and when cooled, spread it with a flat camel-hair brush over half-sized thickish paper. The already described yellow-coated transfer-paper is also very serviceable. This last-mentioned paper should be used for transfers from wood-cuts and type with best quality of type-printer's ink.

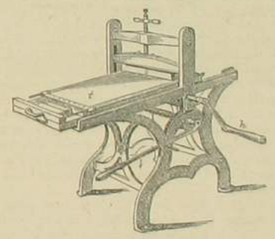
The ink for transfers from copper, steel, or pewter plates is composed of two table-spoonfuls of varnish, 1½ parts tallow, 3 parts brown soap, 5 parts shell-lac, 4 parts brown wax, 5 parts black pitch, and 2½ parts powdered lampblack; the whole is melted, and properly burnt for fifteen minutes, being kept altogether for forty minutes on the fire, and should become, when cold, as hard as pitch. If not so hard, more wax and pitch should be added; some Venetian turpentine may be added when the wax is cooling. To effect the transfer, the plate is warmed on the printer's gas-stove, and inked up in the usual way; the coated paper is slightly sponged on the back, and the impression made on the coated side. A moderately warmed stone is placed in the press, the impression is put between damped blotting-paper, is, after a while, placed on the stone, and the transferring proceeded with as previously described.

In explaining drawings with *two tints*, the mode of doing a drawing with one tint will be easily understood. The principal drawing is done upon a grained stone, and should be very bold, more like a sketch on tinted paper, the middle and finer tints being left out. The drawing is then etched, and two impressions are taken, so that, when each of these is put upon a roughly grained stone, and passed through the press, counter-impressions will be found upon the stones, shewing the drawing quite distinctly. The outlines are then cut in the stones with a sharp-pointed graver, after which the artist covers those parts which are neither to appear in the one nor in the other colour, as well as the margins, with a brush containing acid and gum. The stones are then slightly warmed, and a greasy composition is rubbed over them, and smoothed down with a bit of coarse cloth, until it is of an even dark-grayish colour. The outlines come out very distinctly, having been previously cut in. The grayish coloured portions form the middle tint; the scraper is used to reduce it, where gradation of colour is desired, and the darkest tints are laid in with lithographic ink; the blending together is done on the two stones with chalk, the brush, pen, and scraper, so as to produce, when printed, the effect of shadings with two tints, and so on. The Architecture of the Middle Ages in Germany and the Netherlands by Louis Haghe, Roberts's Holy Land, Egypt, and Syria, Simpson's Crimean War, the British Fleet, &c., are done in this style. The stones, when ready, are very strongly etched.

The tints of the studies of heads and figures by Jullien and Emile de Lasalle are done on a ground of asphaltum, the lights being taken out with the broad scraper, so as to give them the appearance of crayon-drawings on tinted paper, touched with white chalk. Maps are now coloured by printing to a considerable extent—as, for example, the New People's Atlas of Messrs Chambers, Messrs Black's American Atlas and new edition of General Atlas, Messrs Johnston's Atlases, &c.

Chromo-lithography is executed in a similar manner to those drawings with rubbed-in tints—with this difference, that the first drawing is generally only in outline, and is used merely to take as many impressions on stones as are required for the several colours of the painting to be copied, so as to bring out on each stone precisely the same outline, to enable the artist to fill in the proper shades of colour, and the printer to have proper register.

Lithographic presses vary in construction, but the chief points in their mechanism are these: The scraper (*s*) is a wedge-formed plate of brass or boxwood, fixed



to the bottom of the scraper-holder, with its edge downwards. The table on which the stone is placed, and on which the tympan (*t*) is brought down, is, by means of a handle (*h*) or wheel, brought upon the metallic moving roller, and under the scraper. The handle of the lever-power (*l*) is put down, the handle (*h*) is turned round, and the stone is gradually moved through its whole length; the handle of the lever-power (*l*) is raised again, and the table upon which the stone rests is returned to its former place.

The *lithographic steam-press* of Sichel, of Berlin and Vienna, patented in Britain, is a triumph of ingenuity, but it has not benefited lithography in the same proportion as the steam printing-machine has letter-press printing.

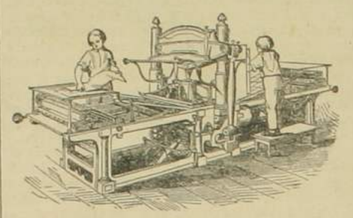
The application of *electrotyping to lithography*, and thus the production of plates, which can be printed by the common printing-press, is likely to supplant the lithographic steam-press. Several publications have been issued in Germany; and occasionally in *L'Illustration, Journal Universel de Paris*, drawings have been

made with a wedge-like section—that is, thicker towards the outer surface of the type—they keep it in its place, like the keystone of an arch, or the stone ribs of a rubble vault.'

The most recent improvement is the Rotary Printing Machine, patented by Messrs Hoe & Co. of New York. These machines are made with 2, 4, 6, 8, or 10 cylinders. The frontispiece of this number represents one with six cylinders, made by Messrs J. Whitworth & Co., Manchester, for the *Manchester Examiner and Times*, at a cost of nearly £4000. It is thus described: 'The most conspicuous part of the machine is the large *horizontal* cylinder, which revolves on its axis. On one portion of the cylinder the types are imbedded, having been previously made up into pages, and thoroughly secured. The other portion of the large cylinder forms a table for receiving the ink, and distributing it over the type as it revolves. The ink is contained in a fountain, placed beneath the large cylinder, from which it is taken up by a "ductor"-roller, and transferred, by a series of vibrating and distributing rollers, to the cylindrical distributing-table. The large cylinder being put in motion, the type imbedded in it is carried, successively, to the six impression-cylinders, which are placed horizontally to the large one, and arranged at proper distances around it. These subsidiary cylinders give the impression to six sheets of paper introduced, one at each cylinder. For each impression-cylinder there are two inking-rollers, which revolve on the distributing surface and take up a supply of ink, and, at the proper moment, pass over the type, giving it the requisite amount of ink, after which they again fall to the distributing surface. Six persons are required to feed in the sheets, which, after receiving the impression, are carried out, by means of tapes, to the end of the machine, and laid regularly in heaps by self-acting flyers. In order to produce 12,240 impressions in one hour, each feeder must lay in sheets at the rate of 34 per minute, or 2040 per hour. In each revolution of the large cylinder, therefore, six sheets receive, each its impression, and as it moves, say at the rate of 34 revolutions in a minute, 204 impressions are necessarily produced, giving in 60 minutes, or one hour, 12,240 impressions. It is, however, quite possible to produce a still greater number of impressions in an hour, by causing the cylinder to revolve more rapidly; for the productive power of the machine is only limited by the skill and dexterity of the feeders, or layers-on. In the *New York Herald* printing-office, the manipulative power of the feeders has been so much increased by practice, that 2500 is by no means an unusual number of sheets to be laid on by each workman in an hour. Applying this to the machine in question, and supposing the cylinder to revolve at the rate of 42 revolutions per minute, with six skilful feeders, each capable of laying on 42 sheets in a minute, it follows that 252 impressions would be produced, and as the number of revolutions performed in one hour would be 2520, the aggregate number of impressions produced within the hour would amount to 15,120.' Messrs Whitworth & Co. have also constructed a similar machine for the *Morning Star*, a London daily penny newspaper. They have also just finished two machines of the same kind, but with ten instead of six cylinders, for the *Times*, and which are each capable of throwing off 20,000 impressions per hour.

Flat-pressure Machines.

The best kind of flat-surface machine was the contrivance of a gentleman in London, and is now in general use in this country. It consists of an upright frame and printing-platten, resembling the common hand-press, with a type-carriage at each side. The type-carriages go below the platten alternately; so that, in point of fact, the apparatus is two presses with one printing-surface to serve both. The movements to and fro of the type-carriages, and the pull downwards of the platten, are effected by machinery beneath. The forms are also inked by an apparatus for the purpose. This machine requires a layer-on and taker-off of sheets at each end, besides a superintendent, and works about 700 sides per hour, or 350 complete sheets. Since the



expiry of the patent, machines of this kind have been made by J. Brown & Co., engineers, Kirkcaldy. The mechanism is very beautiful and effective, answering every purpose of book-work in ordinary demand. Two machines of the Messrs Brown's construction are employed in the establishment from whence this sheet proceeds: the preceding illustration represents the latest and most approved form of arrangement—the type-tables travelling horizontally, as in the cylinder-machines, and the platten rising and falling with undeviating accuracy at the return of each table.

By the introduction of the steam-presses which we have now described, the profession of the printer has within these few years undergone a most extraordinary revolution; and although perhaps fewer hand-pressmen are now employed than formerly, the increase of employment to compositors, engineers, bookbinders, booksellers, &c., must be very great. The principal advance in the profession has been since the year 1832, when the printing of cheap literary sheets rose into importance; and, by a fortunate coincidence, the patents of various machines having about the same time expired, a new impulse was given to the trade. Hardly a newspaper is now anywhere printed with a hand-press, and few or no periodical publications. The making of printing-machines has in itself become a great business.

It will readily be supposed that the introduction of steam-presses such as we have described, has caused a very extensive alteration both in the dimensions of many printing-offices and in their organisation. Printing is now a manufacture. The printing-office is a factory; and the interior of one of these concerns usually presents a remarkable spectacle of industry, animate and inanimate, which to a stranger leaves a lasting impression on the memory.

LITHOGRAPHY.

Lithography was invented by Aloys Senefelder, who was born at Prague on the 6th of November 1771. He received a tolerable education, his father having meanwhile removed to Munich, being employed at the theatre there. He lost his father before he had reached manhood, and was thus reduced to great hardships. Being undecided what profession to choose, he endeavoured to support himself as a composer of music, and not being able to pay for the engraving of his compositions, he resolved to engrave them himself. Finding this, however, rather expensive and difficult, he tried to work with a greasy ink on copper, to etch this afterwards in relief, and to print the plate with the ordinary type printing-press. One day, being asked by his mother to note down some account, and having no

paper on hand, he wrote it with his composition-ink on a polished Kelheim or Solenhofen stone. It occurred to him afterwards to raise this writing with acid, and to print with a press of his own invention, a rude enough implement, on the principle of a common press. From this beginning, Senefelder gradually discovered the whole process of chemical printing from stone, called lithography, derived from the Greek lithos (λίθος), a stone, and graphein (γραφειν), to *write*.

Lithography is founded on the following principles: 1st, on the adhesion of an unctuous composition to a sort of limestone; 2d, the power acquired by those parts covered with the greasy mixture, of receiving printing-ink; 3d, the power of preventing the adhesion of the ink to the other parts of the stone by the interposition of water; and 4th, the power of removing the ink from the greased parts by pressing an absorbent paper into close contact. In 1796, a piece of music, Senefelder's first work, was printed from the stone, and in 1800 he patented his invention in Bavaria and most of the German states. He obtained afterwards a patent in Austria, and commenced business at Vienna, chiefly with the view of printing on cotton, but without much success. Mr André of Offenbach, the well-known music-publisher, became then his partner; they opened establishments at Offenbach, London, and Paris, but did not succeed very well. Its further progress was long prevented through the great secrecy and jealousy with which the working of lithography was guarded, and it was not until many years afterwards that the very complicated manipulations of this invention became more simplified by the assistance afforded by artists and scientific men, and since then, rapid progress has been made.

Senefelder was appointed director of the government lithographic establishment at Munich; and, in later years, the king of Bavaria settled on him a handsome pension for life. He saw his invention brought to comparative perfection, and died at Munich, we believe, in 1834. His work on lithography, published about thirty-eight years ago, although containing antiquated and too complicated notions, comprises a pretty correct skeleton of nearly the entire system of the present day.

In a work like the present, only a general outline of this invention can be given. Before proceeding, however, it is advisable to direct attention to a few of the benefits of which it has been productive. By its means the fine arts have become better understood, and art-education and taste advanced, particularly in France and Germany, where the new invention was practised by artists and professors of art-academies, some of whom drew on stone—for example, Professor Mitterer of Munich—without attempting to finish, often in mere outline, correct elementary models for their pupils, and for the use of schools of design. Thus art began to be aroused from the dormant state into which it had sunk, so that, without much expense, drawings of great merit were provided. Schadow, the great sculptor of Berlin, lithographed his famous academical and anatomical studies; elementary drawings were issued at Stuttgart, Munich, Berlin, Brussels, and Paris; and by the assistance of the different governments, the art of drawing was made one of the branches of general education, and thus the way prepared for the creation of that taste for the fine arts which is so generally to be found among all classes on the continent.

The famous collection of paintings of the Nether Rhenish School, formed by the Brothers Boisseré of Cologne, was purchased by Bavaria. Its choicest examples were, about forty years ago, lithographed on a large scale, and published in numbers by Strixner. This work, having been executed under the superintendence of the best painters of Munich, and even now remarkable, though somewhat heavy and mechanical in treatment, made at the time a great impression, and enabled young lithographic artists to improve their abilities. From that time, lithography may be considered to have taken its place among the fine arts.

Other works of importance were undertaken; the choicest specimens of the old and modern masters were brought under the notice of the public; they were executed very frequently in a masterly style, and rendered with scrupulous fidelity the characteristics of the paintings of the different masters and schools. Piloty, Hohe, Hanfstaengl, and others, formed numerous artists. Hanfstaengl commenced the publication of that celebrated work, *The Choice Paintings of the Dresden Gallery*, a triumph of lithography and art. The entire work was executed by young men of talent, and who had received an art-education—who made it a point to study and understand thoroughly their originals before copying them on the stone. This work, rendered with careful adherence to whatever gives merit to the paintings, could not fail to facilitate the progress of art in every direction, and exercise a beneficial influence on education in general. The best works of this kind ought to be in all public libraries, not merely for the advantage of professed art-students, but as a means of refining the general taste. Every town may not have funds at its disposal to purchase a good collection of paintings; but every town might possess *first-rate* copies of the best masters, engraved or lithographed, some of which, if framed and hung in accessible places, would be a source of public enjoyment and culture.

Many other important lithographic works connected with the arts and sciences, &c., may be mentioned. Excellent copies after paintings in the galleries of Berlin, Brussels, Munich, Paris, and Vienna, and many remarkable lithographs for the different art associations on the continent. The Flora of the Brazils, by Professor von Martius at Munich; Jacob's Anatomy; Herculaneum and Pompeii, by Zahn of Berlin; the Flora Germanica, by Nees von Esenbeck; Natural History and Petrifactions, by Goldfuss; Ornaments, by Weitbrecht; Gothic Architecture and Ornaments, by Pugin; Calame and Sabatier's charming views; Count de Bastard's history of art of the early Christian era in France; King Ludwig of Bavaria's splendid Album; Louis Haghe's Architecture of Germany and the Netherlands in the Middle Ages; Roberts's Holy Land, Egypt, Syria, &c.

The following lithographic establishments, besides Senefelder's, have principally contributed to the proper development of this art—namely, those of Strixner, Hanfstaengl, Ebner, Piloty and Loehle, Dondorf, De la Motte, Graf and Engelmann, Lemercier, Hullmandel, Day and Son, Hanhart Brothers, Vincent Brooks, the Imperial Establishment at Vienna, the Royal Establishment at Berlin, &c.

The Stones.—The immense quarries of Solenhofen, near Pappenheim on the Danube, in Bavaria, furnish the best stones; they are from a pale yellowish-white, to a light buff, reddish, grayish, bluish, and greenish colour. The beds commence with layers as thin as paper, but the strata become thicker, until they form slabs of considerable size. The thickness required for printing purposes varies from one to four and five inches. The stones are, while in the quarries, tolerably soft, and can easily be cut and squared by the workmen. Very beautiful petrifactions are found between these layers, of which there are very complete and interesting collections at the museums in Munich and Eichstädt. These stones were formerly, and are yet, used in Bavaria and elsewhere for the floors of houses, churches, and mosques, arranged in geometric patterns, like inlaid tiles, also for window-sills, tops of tables, &c. Useful lithographic stones have been found in England, France, Canada, the West Indies, and Silesia. This calcareo-argillaceous stone, of a conchoidal fracture, resembles the lias limestone, but does not belong to the same geological period, being of a more recent formation. The stones require to be *ground* with sand

Common Prayer, there is no preventive to the freest and fullest application of the printing-press, unless perhaps the duty on paper, which acts in a certain degree as a check and obstruction.

PRINTING BY MACHINES.

After all the ingenuity of Lord Stanhope and that of his successors had been lavished on the press, the process of printing could not be executed without considerable fatigue, and at a rate of speed seldom greater than that of throwing off 250 impressions, or 125 complete sheets, in an hour. As the taste for reading increased, the necessity of more rapid production, especially in the case of newspapers, stimulated invention, and led to an entire revolution in the structure of the press.

In 1790, Mr Nicholson, the editor of the *Philosophical Journal*, procured a patent for certain improvements in printing, which patent embodies almost every principle since so successfully applied to printing machines; and although he did not carry his views into practical effect, little has been left for subsequent engineers to do, but to apply, in the most judicious manner, the principles he laid down in his patent.

Whether Mr Nicholson's ideas were known to Mr König, a German, is now uncertain; but to him is due the distinguished merit of carrying steam-printing first into effect. Arriving in London about 1804, he first projected improvements on the common press; but after a while, he turned his attention to CYLINDER PRINTING.

The first result of his experiments was a small machine, in which the two leading features of Nicholson's invention were embraced (the cylinders and the inking-rollers), which he exhibited to Mr Walter, proprietor of the *Times* newspaper; and on shewing what further improvements were contemplated, an agreement was entered into for the erection of two machines for printing that journal. Accordingly, on the 28th of November 1814, the public were apprised that the number of the *Times* of that date was the first ever printed by machinery, steam-propelled. At this period but few persons knew of any attempts going on for the attainment of this object; whilst among those connected with printing, it had often been talked of, but treated as chimerical.

After the utility of cylindrical printing had been thus proved, it was thought highly desirable that the principle should be applied to printing fine book-work, where accurate register is indispensable. This was, to a certain extent, attained by using two large cylinders, the sheet of paper being conveyed from the bottom of the first cylinder (where it had received the first impression) by means of tapes, leading in a diagonal direction to the top of the second cylinder, round which the sheet was carried till the second side was printed. The first machine of this description was erected at Mr Bensley's office, where it continued at work for some years, till more modern machines superseded it.

So sanguine were the patentees (Mr König, Mr Bensley, and Mr R. Taylor) that no further improvement could be effected, that in March 1817 they issued a prospectus, offering three kinds of machines at high prices, and requiring a considerable annual premium; but we believe these offers were not embraced.

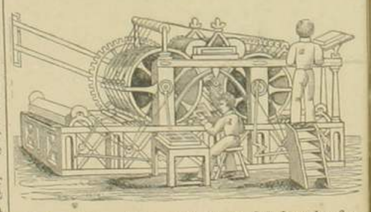
In the course of 1818, Messrs Applegath and Cowper took out a patent for improvements in cylindrical printing machinery. The chief improvements were, the application of two drums placed betwixt the cylinders to insure accuracy in the register, over and under which the sheet was conveyed in its progress from one cylinder to the other, instead of being carried, as in König's machine, in a straight line from the one cylinder to the other; and the mode of distributing the ink upon tables instead of rollers—two principles which have secured to machines of this construction a decided preference for fine work. Machines of this construction were made by Applegath and Cowper for the principal printing establishments in London, Paris, Edinburgh, and many other cities; and it is nearly upon the model of their machines that other manufacturers now construct their steam-presses for the execution of ordinary book-work.

We now pass on to a notice of three different machines, calculated to produce register and non-register sheets, under various modifications and rates of speed:

1. A machine with one cylinder, called a single machine, generally used for printing newspapers, throws off from 900 to 1200 an hour on one side, and requires two boys—one to lay on the paper, and another to receive it when printed.

2. A machine with two cylinders, called a double machine, but only printing from one form of types, at the rate of from 1600 to 2200 an hour, requiring two boys to lay on the sheets, and two to take them off, exclusively used for newspapers. It consists of two small cylinders, about ten inches in diameter, placed about five inches apart, and suspended from a beam at each end. A camb, or eccentric, causes the beams to vibrate, and with them the cylinders to rise and fall about one-half of an inch. The cylinders turn in opposite directions, and as the machine only prints one form at a time, that cylinder only which is turning in the same direction as the types is permitted to rest upon the form, and take the impression, so that a sheet is printed by each cylinder alternately every time the type-carriage goes backwards or forwards. Two boys feed the paper into the machine, at two drums placed about three feet above the carriage, and the sheet is led down to the cylinders by tapes, which also convey it, after being printed, to the end of the machine, where two boys receive the sheets, and lay them straight in a heap, ready to be again put through the machine when the second form is placed on the type-carriage to print the other side. There is a distinct and complete apparatus for inking the types at each end, similar in principle to that which is mentioned in the account of the book-machine.

3. The third kind of machine is called a book or perfecting machine, printing both sides of the sheet in register before it leaves the machine. The machine from which the annexed engraving is taken is one of



this description. It is about fifteen feet long by five broad, and consists of a very strong cast-iron framework, secured together by two ends and several cross bars. To this frame all parts of the machine are fixed. In external figure, as seen in the cut, it is a large apparatus, of imposing appearance. On approaching it when at work, we perceive two cylinders, as large as hogsheads, revolving on upright supports; two smaller cylinders or drums revolving above them; and beneath, within the framework, a table on which lie the types at both ends, going constantly backward and forward. A belt from a steam-engine, acting upon a shaft in the frame, gives motion to the whole apparatus. It will

further be observed that a boy, marked *a* in the cut, is standing on the top of some steps feeding in sheets of paper, each of which, on being delivered, is swept round the first cylinder *b* (being held on by tapes), gets its impression below from the types, is carried over and betwixt the drums above, and then brought round on the second cylinder *c*; now it gets its second side printed, and issuing into the space between the cylinders, is seized by the boy *d*, who lays it on a table completely printed. The whole operation is accompanied with a loud noise, from the revolving of the cylinders, the working of the notched wheels, and the driving of the table to and fro by a rack beneath, but without any strain on the mechanism, or risk of injury to the attendants. On minutely examining the parts, we observe that at each end there is an apparatus of rollers taking ink from a ductor or reservoir of that material, and placing it upon a portion of the moving table beneath; here other rollers distribute it, while others take it off and roll it upon the pages of types, ready for each impression.

The two printing cylinders are nearly nine feet in circumference each, and are placed about two feet apart. They are accurately turned, so that the surfaces of the type-carriages and the cylinders may be perfectly parallel. The axis of each cylinder works in brass bearings in the upright framework, where, by means of screws, the degree of pressure with which the cylinders are allowed to rest upon the types may be regulated to any degree of nicety. Over about two feet of the circumference of each cylinder which forms the printing surface, two folds of cloth, called blankets, are stretched by means of rollers placed inside the cylinder. The lower blanket is seldom changed, but the upper one, on the second cylinder (which stands in the stead of what are called slip-sheets in hand-press printing), must be shifted as soon as the ink which it has absorbed from the printing on the first side of the sheet begins to set off, or soil the paper when receiving the second impression. This shifting is speedily effected, by unrolling a sufficient quantity of the cloth off one roller, and winding it up on the other, to present a clean portion to the printing surface.

The cylinders have a continuous rotatory motion towards each other, given by two large toothed wheels, whilst the type-carriages move backwards and forwards under them. The movements are so contrived that the type-carriages shall have gone and returned to the same point during the period that the cylinders have made one entire revolution; consequently, each successive impression is taken from the types by the same part of each cylinder. The two drums placed between the cylinders are for the purpose of causing the sheet of paper to pass smoothly and accurately from one printing cylinder to the other.

To preserve the sheet in its proper place on the cylinders, and carry it forward through the different parts of its journey from the hand of the one boy to that of the other, there is an extensive apparatus of tapes, some of which are observable in the cut. These tapes are half an inch broad, and are formed into series of endless bands, arranged at certain distances apart, so as to fall into the interstices and margins of the forms, and therefore escape being crushed between the types and cylinders. The machine may be stopped at any instant by turning the handle of a lever, which shifts the belt from the fast to a loose pulley, without stopping the engine.

To produce an impression with a flat surface from a large form, requires a force of about from forty to fifty tons; and even with a cylinder, where a line only is impressed at a time, the pressure is little short of a ton. But, in the machine, to prevent any undue pressure of the cylinders upon the forms, there are wooden bearers, of the same height as the types, screwed upon the sides of the carriages under the ends of the cylinders; thus effectually shielding the types from the enormous and injurious pressure which a cylinder might, through accident or otherwise, be caused to exert.

Eleven machines such as has been described are almost constantly employed in printing the publications of Messrs Chambers at Edinburgh, the whole, together with two flat-pressure machines, and two self-inkers, being moved by a steam-engine of twelve-horse power. At the large printing establishment of Messrs Clowes and Son in London, we believe at least twenty machines of this kind are to be seen daily at work.

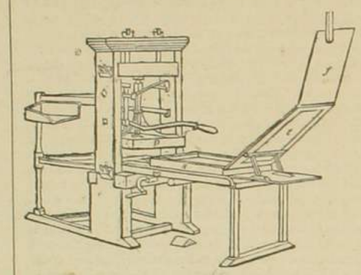
Besides those various descriptions of machines above alluded to as being principally in use, there are others calculated to execute work of a more peculiar nature. Perhaps the most wonderful of those ingenious pieces of mechanism is a machine which has been made to print two colours by only one impression—a lower form charged with one colour being caused to rise through and come upon a level with another form, so that both may be printed at once. Hitherto the work which has been executed by this machine has consisted chiefly of the stamp-duty marks for the Excise, and for bank-notes, fancy labels for druggists, and other similar jobs.

Extra-fast Machines.

Astonishing as the powers of any of the above machines may appear, they are infantile in comparison with what has been exhibited by more recent inventions. Among these inventions—successful and partially successful—we may point to those of Mr Little, Mr Applegath, and Messrs Hoe & Co. The advantages of Mr Little's *Double-action Machine* are thus stated: 'It works with *eight cylinders*, six of which have a reversing motion, and it produces *seven* printed sheets with every transverse motion of the type. Thus, in the "Fast Machine" (such as is used for printing the daily newspapers), only half the cylinders actually print alternately, whilst in the latter, *seven* out of *eight* of the cylinders are constantly at work; so that, supposing both machines to have the same number of cylinders, the Double-action Machine would, from this circumstance alone, produce nearly twice the quantity of printed sheets; but on comparison it will be seen that considerably more than twice the number can be produced.'

The machine constructed by Mr Augustus Applegath, in 1848, for printing the *Times*, was thus described in that paper: 'The great improvement which has now been effected by Mr Applegath, is the substitution of a uniform rotary motion for the horizontal reciprocating motion of the old machines. It is the change from a plane to a circular "table." Instead of being laid on a table traversing a railroad, the types are now built up, as it were, on the face of a cylinder revolving on a perpendicular axis. This cylinder is a drum of cast-iron, about 5 feet 6 inches in diameter. The "forms," or pages of type, are made segments of its surface, just as a tower of brick might be faced with stone. Eight printing-cylinders, forty inches in circumference, are arranged round the drum. Instead of the four impressions taken by the old machine in its double journey, eight sheets are now printed in every revolution. Any one who knows the immense weight of metal type, and the impossibility of giving it any hold upon the "form" besides weight and pressure, will at once perceive the extent of the obstacle overcome by giving the central drum a vertical position. In the vertical disposition there is the same centrifugal impulse as in the horizontal, but it does not operate in the direction of gravity, and therefore is more easily neutralised. This is done chiefly by means of the "column-rules," which make the upright lines dividing the columns of the page. These "column-rules" are usually long strips of brass, and in this instance they are so screwed to the sides of the iron frame, or "chase," as to become powerful tension ties; and being

them, and not from plates, they are carried into the press-room, where they come under the charge of the press-men. The earliest printing-presses were exceedingly rude, and seem to have resembled the common screw-press, with a contrivance for running the form under the point of pressure. This must have been not only a laborious and slow operation, but one exceedingly defective, from the difficulty of regulating the impression, and the risk of injuring the faces of the types. The defects in these original presses were at length remedied by an ingenious Dutch mechanic, Willem Jansen Blaew, who carried on the business of a mathematical instrument-maker at Amsterdam. He contrived a press, in which the carriage holding the form was wound below the point of pressure, which was given by moving a handle attached to a screw hanging in a beam having



a spring, which spring caused the screw to fly back as soon as the impression was given. This species of press, which was almost entirely formed of wood, continued in general use in every country in Europe till the beginning of the present century. With certain lever-powers attached to the screw and handle, it is represented above.

In connection with this representation of the old common press, the process of printing may be described. The form, being laid on the sole of the press (*s*), is fixed at the sides, so as to render it immovable from its position. There are two men employed: one puts ink on the form either by means of stuffed balls or by a composition roller, and the other works the press. The latter lifts a blank sheet from a table at his side, and places it on what is called the *tympan* (*t*), which is composed of parchment and blanket stuff, fitted in a frame, and tightened like the top of a drum—and hence its name—and which, by means of hinges connecting it with the sole, folds down like a lid over the form. As the sheet, however, would fall off in the act of being brought down, a skeleton-like slender frame, called a *frisket* (*f*), is hinged to the upper extremity of the tympan, over which it is brought to hold on the paper. Thus, the frisket being first folded down over the tympan, and the tympan next folded down over the form, the impression is ready to be taken. This is done by the left hand of the pressman winding the carriage below the *platten* (*p*) or pressing surface, and the impression is performed by the right hand pulling the handle attached to the screw mechanism. The carriage is then wound back, the printed sheet lifted off, and another put on the tympan, the form again inked, and so on successively. In the above engraving, the press appears with the frisket and tympan sloping upwards, ready to receive the sheet, the frisket being sustained from falling backwards by a slip of wood depending from the ceiling. One of the greatest niceties connected with this art is the printing of the sheet on the second side in such a manner that each page, nay, each line, shall fall exactly on the corresponding page and line on the side first printed. To produce this desirable effect, two iron points are fixed in the middle of the sides of the frame of the tympan, which make two small holes in the sheet during the first pressure. When the sheet is laid on to receive an impression from the second form, these holes are placed on the same points, so as to cause the two impressions to correspond. This is termed producing *register*; and unless good register is effected, the printing has a very indifferent appearance. Expert workmen perform these operations with surprising rapidity, though with considerable labour. Two men employed at a press take the process of pulling and inking for alternate quantities. After the forms are wrought off, they are washed in a solution of potash to remove the remains of the ink, which is of a thick oleaginous character, and then carried back to the composing-room to be distributed. This last operation is very speedily performed by the compositors.

To suit paper for printing, it is necessary to wet it some hours previous to its being used. This is done by dipping alternate quires in water, and afterwards pressing the mass with a heavy weight, or by the screw or the hydraulic press, till the whole is in an equally damp state.

After the sheets are printed, they are hung upon poles in the *drying-room* to be dried—a process which is effected slowly or speedily according to the degree of heat applied. On being dried, they are individually placed between fine glazed boards, and in this condition subjected in a mass to the pressure of a powerful press. On removal, the indentations of the types are found to be levelled, and the whole sheet to be smooth and ready for the operations of the bookbinder. A great improvement has been effected in the smoothing process, by employing the hydraulic or water press. (See HYDRAULICS, Vol. I.)

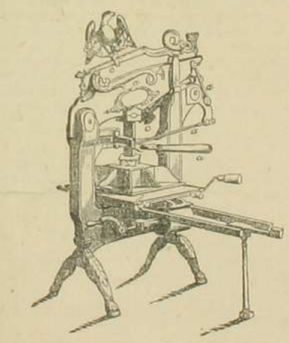
INK AND INKING-ROLLERS.

Much of the beauty of good printing depends on the quality of the ink, which it requires considerable skill to manufacture. The ink used by the earliest printers was of such excellent quality, that, in many instances, it remains intensely black to this day; but a long period afterwards elapsed during which very inferior ink was employed. Within the present century, great improvements have taken place in the composition of printing-ink, which is now produced of a good quality in London by several manufacturers; it is, however, still inferior to the finer kinds of ink used in Paris, the French having evidently surpassed the English in producing a pure and intensely black ink which will preserve its colour. Printing-ink is composed of genuine linseed-oil, boiled to the consistency of a sirup, and then well mixed and ground with lampblack. The qualities desired in the composition are depth and durability of colour, and that it should be stiff without strong adhesion, and keep soft and mellow, but dry quickly after being put upon paper. It is made of different qualities, from 1*s.* to 5*s.* and upwards per pound-weight, the cheaper sorts being of an indifferent black, but working easily and setting rapidly, while the higher priced require both care and time in the working and drying. The colour of the work can be increased only by the quality of the ink, and the better the quality of the ink, the more time it will take the pressman to work it, and the better should be the quality of the paper; for it is impossible to work good ink upon inferior paper.

One of the greatest of recent improvements in the art of printing is in the mode of inking the forms. From the days of Gutenburg, this had been done by stuffed cushions, or balls covered with skins, by which no regularity could be preserved, and no speed acquired. It is now done with rollers made of a composition of treacle and glue, which, being heated and melted together, are poured into long iron moulds, in which the central rod has previously been inserted. When taken out of the mould, the roller is a cylinder of soft and elastic matter, resembling India-rubber. If required for the hand-press, it is connected with a handle after the manner of a garden-roller. The ink being placed, in moderate quantity, at the back of a smooth metal table, the workman, grasping the handle, draws the roller backwards and forwards along the table, distributing a little ink equally all over its surface; and having thus diffused some ink all over the roller, he applies the same to the types, drawing it backwards and forwards over them, to make sure that all have been inked. By this plan the types are inked more equably than by the balls, and in less than half the time. Now, however, the forms are inked by an apparatus attached to the press. Self-inking presses are in pretty general use; the peculiar advantages of the invention being a more regular and uniform distribution of the ink, and the saving of manual labour.

IMPROVED PRINTING-PRESSES.

The first improvement upon the printing-press was made by the celebrated Earl of Stanhope, near the close of the eighteenth century. The press of Blaew was made of wood, and the platten was generally only the size of half a sheet. Earl Stanhope constructed the press of iron, and that of a size sufficient to print the whole surface of a sheet, and he applied such a combined action of levers to the screw as to make the pull a great deal less laborious to the pressman; the mechanism altogether being such as to permit much more rapid and efficient working. A multitude of improvements speedily succeeded that of Earl Stanhope, in most of which the screw was dismissed, the pressure being generally effected by levers, or by the simple and efficient principle of straightening a joint. Among those which have gained a large share of approbation may be mentioned the *Columbian press*, which is of American invention. This press, a representation of which is annexed, was brought to this country in 1818



by Mr George Clymer of Philadelphia, and patented. The pressing power in this instance is procured by a long bar or handle acting upon a combination of exceedingly powerful levers (*a*, *a*, *a*, *a*) above the platten; the return of the handle or levers being effected by means of counterpoises or weights (*c*, *c*). For ease and facility of *pull*, this press is preferred by most workmen, and certainly the powerful command which the leverage enables the workman to exercise, is favourable to delicacy and exactness of printing—his arm feeling, as it were, through the series of levers to the very face of the types.

In the present day, the old wooden press of Blaew is entirely discarded from use in printing, and it is only to be seen occasionally in an obscure corner of the printing-office, reduced to the humble character of a proof-press.

THE CHAPEL.

It is worth while to remark, that up to the present day the phraseology used in relation to the mechanical details of the printer possesses certain traces of the early connection of the art with men of learning. A number of the technical terms, as may be seen from the descriptions we have given, are a corruption of Latin words. We may instance *tympan*, from tympanum, a drum, and *stet* (let it stand), which is used as a mark in correcting proof-sheets. The name *brevier*, applied to a certain size of type, originated, as has been already mentioned, in that letter being first used in printing the Breviaries of the Romish Church. An exceedingly old practice prevails among printers of calling their office a *Chapel*, and under this title the compositors, pressmen, and all others engaged in the office, have been in the habit of meeting together, and forming a species of lodge, in order to settle affairs connected with the internal arrangements of the office, or any disputes which may occur among members. The general improvement in everything connected with printing establishments, and the advance of manners, have greatly modified the spirit which used to prevail in these confederacies: nevertheless, the appellation of *the chapel* remains, and is of traditionary interest. It has been supposed by many writers that the title of Chapel originated in Caxton's exercising the profession of a printer in one of the chapels in Westminster Abbey; and it is exceedingly probable that it has an origin of this nature, for printing was at first carried on in many places in England in connection with religious houses. Hence in M'Creery's poem, entitled *The Press*, the author has the following lines:

> O Albion! still thy gratitude confess
> To Caxton, founder of the British Press:
> Since first thy mountains rose, and rivers flowed,
> Who on thine isles so rich a boon bestowed?
> Yet stands the chapel in yon Gothic shrine
> Where wrought the father of our English line.
> Our art was hailed from kingdoms far abroad,
> And cherished in the hallowed house of God;
> From which we learn the homage it received,
> And how our sires its heavenly birth believed.
> Each printer hence, howe'er unblest his walls,
> E'en to this day his house a CHAPEL calls.

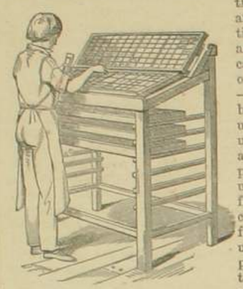
LAWS AFFECTING PRINTERS.

Printers of books, or any common species of work, are practically left at liberty to carry on their business in any manner or way that seems suitable to themselves. Each printer, however, by the act 2 V., c. 12, is required to print upon the front of any sheet, if printed on one side only, or upon the first or last leaf of every book consisting of more than one leaf, his name, place of abode, and business; penalty for omission £5, and the like penalty for dispersing any such publication without the imprint. But no actions for penalties can be instituted except in the name of the Attorney or Solicitor General for England, or the Queen's Advocate in Scotland. On the whole, the allied businesses of printing, publishing, and bookselling in Great Britain may be regarded as altogether free—that is, as subject to no restriction that might impede the circulation of whatever a man chooses to write, provided it be not libellous, treasonable, or of a grossly immoral tendency, and even then such offences can only become subjects of after prosecution. Copyright, as a matter of property, is very justly protected for a term of years; but otherwise, since the abolition of the royal prerogative to print the authorised versions of the Bible and Book of

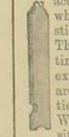
principally at New York; and the style of both typography and press-work in that country is rapidly improving.

COMPOSING.

All the types used in p...ing-offices are sorted in cases, or shallow boxes, with divisions. There are two kinds of cases—the *upper* and *lower case;* the latter lying nearest the compositor upon the frame for their support. The annexed illustration exhibits the arrangement of the cases and position of the compositor—the lower case being immediately under his hand, the upper case directly above in a slanting position, and the under part of the frame stocked with cases of different founts. In the upper case are placed all the capitals, small capitals, accented letters, a few of the points, and characters used as references to notes. In the lower case lie all the small letters, figures, the remainder of the points, and spaces to place betwixt the words. In the lower, no alphabetical arrangement is preserved; each letter has a larger or smaller box allotted to it, according as it is more or less frequently required; and all those letters most in request are placed at the nearest convenient distance to the compositor. By this ingenious and irregular division of the lower case, much time is saved to the compositor, who requires no label to direct him to the spot where lies the particular letter he wants. To a stranger, nothing appears so remarkable as the rapidity with which a compositor does his work; but habit very soon leads the hand rapidly and mechanically to the letter required. When *Italic* letters have to be introduced, they are taken from a separate pair of cases of the same fount.



The process of composing and forming types into pages may now be adverted to. Placing the copy or manuscript before him on the upper case, and standing in front of the lower case, the compositor holds in his left hand what is termed a composing-stick. Sometimes this instrument is of wood, with a certain space cut in it of a particular width; but more commonly it is made of iron or brass, with a movable slide, which, by means of a screw, may be regulated to any width of line. In either case, the composing-stick is made perfectly true and square. One by one the compositor lifts and puts the letters of each word and sentence, and the appropriate points, into his stick, securing each with the thumb of his left hand, and placing them side by side from left to right along the line. When he places a letter in the stick, he does not require to look whether he is placing it with the face in its proper position; his object is accomplished by looking at what is called the *nick*, which must be placed outward in his composing-stick. (See adjoining representation of a type.) This is one of those beautiful, and at the same time simple, contrivances for saving labour which experience has introduced into every art, and which are as valuable for diminishing the cost of production as the more elaborate inventions of machinery. When he arrives at the end of his line, the compositor has a task to perform in which the carefulness of the workman is greatly exhibited. The first letter and the last must be at the extremities of the line:



there must be no large spaces left in some instances, and crowding in others, as we see in the best manuscript. Each metal type is of a constant thickness, as far as regards that particular size of letter; though all the letters are not of the same thickness. The adjustments, therefore, to complete the line with a word, or at any rate with a syllable, must be made by varying the thickness of the spaces between each word. A good compositor's work is distinguished by uniformity of spacing: he will not allow the words to be very close together in some instances, and with a large gap between them in others, as is evident, for instance, in this sentence. In composing poetry, or similar matter, where there is always a blank space at one of the ends of the line, spacing is very easily accomplished by filling up the blank with larger spaces, or *quadrats*. But whether prose or poetry, the matter of each line must be equally adjusted and *justified*, so as to correspond in point of compactness with the previously set lines. The process of composing is greatly facilitated by the compositor using a thin slip of brass, called a *setting-rule*, which he places in the composing-stick when he begins, and which, on a line being completed, he pulls out and places upon the front of the line so completed, in order that the types he sets may not come in contact with the types behind them, but glide smoothly into their places to the bottom of the composing-stick.

When the workman has set up as many lines as his composing-stick will conveniently hold, he lifts them out by grasping them with the fingers of each hand, and thus taking them up as if they were a solid piece of metal. He then places the mass in an elongated board, termed a *galley*, which has a ledge on one or perhaps both sides. The facility with which some compositors can lift what is called a *handful* of movable type without deranging a single letter is very remarkable. This sort of skill can only be attained by practice; and one of the severest mortifications which the printer's apprentice has to endure, is to toil for an hour in picking up about a thousand letters, and then see the fabric destroyed by his own unskilfulness, leaving him to moura over his heap of broken type, technically denominated *pie*.

Letter by letter, and word by word, is the composing-stick filled; and by the same progression the galley is filled by the contents of successive sticks. When the compositor has set up as many lines as fill a page, he binds them tightly round with cord, and removes them from the galley.

Sometimes, as in the case of newspaper and similar work, the *handfuls* of type are accumulated till they fill the galley, and in that form are prepared for press. After the matter is thus far prepared, it is the duty of the pressman to take an impression or *first proof* from the types, in order that the compositor may correct the errors which are sure to have been made. Proofs are usually taken by a press kept for the purpose. After the galley matter is corrected and re-corrected by the compositor, it is divided into pages of the size wanted; and head-lines or figures indicating the number of the page, being added, the pages are arranged upon a large firm table, and there securely fixed up in an iron frame or *chess*, by means of slips of wood and wedges, or *quoins*. The annexed cut is a representation of a small *form*, consisting of four pages of type.

This process, which is called *imposing*, being completed, and the face of the types being levelled by a *plainer* and mallet, the *form*, as it is called, is proved,

and prepared for press. Proof-sheets being taken, they are subjected to the scrutiny of a *reader* employed in this peculiar function in the office, the author himself having previously given effect to his corrections or emendations on the *galley-proofs*. When the *reader* has pointed out words and letters to be altered or corrected, the compositor once more goes over the form, correcting the errors by lifting out the letters with a bodkin, and, when revised, the sheet is pronounced ready for printing. It may be explained that the imposing-table at which all these corrections are made is usually composed of smooth stone or marble, or cast-iron on the top, and requires to be a substantial fabric.

It need scarcely be told that the size of books greatly varies; but the sizes are all reducible to a standard determined by the number of leaves into which a sheet of paper is folded. The largest size is denominated *folio*, being simply a sheet folded into two leaves or folios; and the next *quarto*, or a sheet folded, as the name implies, into *four* leaves. The most common size is *octavo*, each sheet of which contains eight leaves, or sixteen pages; the next is *duodecimo*, containing twelve leaves, or twenty-four pages in the sheet; and the next *octodecimo*, or eighteens, containing thirty-six pages in a sheet. There are many other sizes, such as *twenty-fours*, &c. To know how to place pages of types in a form so as to produce, when printed, a regular series upon paper, is one of the branches of the art to be acquired by the young compositor.

STEREOTYPING.

We may now offer a brief explanation of the process of stereotyping, which has been of immense service to fictitious literature. Stereotyping is the manufacturing of fictitious, or, as the word signifies, *solid* pages of types, and the invention is generally attributed to a Mr William Ged, of Edinburgh, about the year 1725. When the art was properly made known, it was hailed with acclamation by the printing and publishing world; but as experience developed its powers, it was found to be strictly applicable only to a particular kind of work.

When a page is intended to be stereotyped, the same process of putting up the types is gone through that we have already described; instead, however, of being carried to the press, the pages are plastered over with liquid stucco to the thickness of about half an inch, so that a level cake is formed on the surface of the types. As soon as the stucco hardens, which it does almost immediately, the cake is separated from the types, and, on being turned up, shews a complete hollow or mould-like representation of the faces of the types, and everything else in the pages. There being no longer any use for the types, they are carried off and distributed. As for the cake, it is put into an oven, and baked to a certain degree of heat and hardness, like a piece of pottery. It is next laid in a square iron pan, having a lid of the same metal, with holes at the corners. At the bottom of the pan there is a movable plate, called the *floating plate;* and upon this plate, which has a smooth accurate surface, the moulds are placed with their faces downwards. The lid being now placed and held tightly on by a screw, the pan, by the assistance of a crane and other mechanism, is immersed in a pot of molten type-metal, and being allowed to fill by means of the holes, it is at length taken out and put aside to cool. On opening the pan, a curious appearance is presented. The metal has run into the mould-side of the cake, and formed a thin plate all over, exhibiting the perfect appearance of the faces of the types on which the stucco was plastered. Thus is procured a plate, or fictitious page of types, not thicker than the sixth of an inch. When the plate comes out of the pan, it is in a somewhat rude state, and has to be carefully pruned at the edges, its little specks picked clean, and, if necessary, one or more bad letters cut out, and replaced by soldering in the heads of movable types. The plates are also planed upon the back, in order to reduce them to one uniform thickness, by means of an ingenious rotatory cutting-machine upon which each is fixed.

The stereotype plates, so prepared, are next taken to the printing-office, and made ready for press. This is done by placing them upon iron or wooden blocks, so that both plate and block make up the exact height of a page of real types. They are fixed to the blocks, by the aid of small metal-catches at the sides, head, and foot, which catches are held fast by slips of *furniture* properly wedged.

The Papier-mâché Process.—This mode of stereotyping, which is of recent invention, possesses some advantage over the other in respect of economy in time and material. The substance used in making the mould consists of several layers of paper—one of brown paper, another of blotting paper, and two of thin white paper—glued together with a paste made for the purpose. It is kept always in a damp state; and when about to be applied to the types, the surface is lightly and very carefully rubbed with French chalk, to prevent the plate from adhering to the mould. The paper is then laid on the types and beaten into them with a hard brush, a piece of cotton cloth being laid over it to prevent its being destroyed. When it is sufficiently beaten in, an additional layer of paper is applied on the top to strengthen the mould, and the whole is placed for some time under a press, and then on an iron table heated for the purpose of drying it. The mould being dry, is removed from the types, and, the edges being pared, is now ready for casting. The casting-box consists of two pieces joined by a hinge; the mould is placed in the one half, and the other being fastened down, leaves a space equal to the desired thickness of the plate. The metal is then poured in at the open end of the box, and sets almost immediately. Care must be taken that the metal be not too hot, otherwise it adheres to the mould. When French chalk is too freely used, the quality of the plate is injured. If a piece of white paper dipped into the metal is made dark-brown, it is a sign that the metal is too hot.

The utility of stereotyping may be thus stated: In all cases of common book-work, it is best to print from types to the amount of the copies required, and then distribute the types; but in most cases of books published in parts, sheets, or numbers, stereotyping becomes absolutely necessary, and the reason is obvious. When books are published in numbers, it often happens that many more copies are sold of one number than of another; and unless the types be kept up to complete sets in the hands of the publisher, or to print copies according to the increased demand, a serious loss is sustained. The manufacture of stereotype plates is, therefore, simply a means of keeping up fictitious types to answer future demands, at an expense greatly inferior to that of keeping the actual pages standing, or of putting the types up anew.

Another important advantage of stereotyping is, that any number of *sets* of plates can be cast from the same types, and these plates sent to be printed in different parts of the world: Thus, a work set up and stereotyped in Edinburgh (this sheet was printed from plates cast by the papier-mâché process), may be printed without the expense of recomposing, in London, Paris, New York, or any other city to which the stereotype plates may be sent; and this without any risk of error or deviation from the original—a feature scarcely to be obtained by the resetting of movable types. In illustrated works this advantage is especially noticeable—casts of an expensive wood-cut, for instance, being readily obtained for the use of several and simultaneous publications.

PROCESS OF PRINTING.

The duties of the compositor differ from those of the printer. When the forms are duly prepared in the composing-room, and if it is intended to print from

Caxton set his press to work at Westminster, and therefore that that city has the honour of having been the first seat of the art in England; but Caxton was the first who introduced the printing with *moulded metal types*, the works by his predecessor having been executed merely with wooden ones. It is by our early writers not having attended sufficiently to this line of demarcation between the two stages of the art that the misunderstanding has, as far as we can judge, after much careful investigation, solely arisen.

After the art of printing had been thus introduced into Oxford and St Alban's, it spread to Westminster, Cambridge, Tavistock, Worcester, Canterbury, Ipswich, &c., in almost all cases by the encouragement of the churchmen of these places, and generally with the view of printing works of piety. About the year 1500, or probably somewhat earlier, Pynson was, by patent of Henry VII., invested with the office of king's printer, which may be regarded as the first instance of an appointment of this nature. At the close of the fifteenth and the commencement of the sixteenth century, London possessed a number of printers, but none whose name has been so celebrated as that of Wynken de Worde, a foreigner, who had been instructed under Caxton. He improved the art considerably, and was the first printer in England who introduced the Roman letter—all previous printing, and much of a later date, being in the black or German letter.

Although at first countenanced by the clergy, the art of printing was soon looked upon with extreme jealousy by the church, which at length discovered that this invention was but too certainly calculated to revolutionise the whole fabric of society. The earliest efforts of the art, as we have seen, were directed to the multiplication of the Bible; but for a period of sixty or seventy years from the date of the invention, all the copies of the Scriptures which were printed were in the Latin or some other classic language, not understood by the people. But now a new era commenced. Certain printers began to issue the Bible in the English tongue, translated from the original, and this gave mighty offence to the church, or Romish hierarchy.

The progress of the art in England, after its first rush into notoriety, was remarkably slow. In the sixteenth century it was interrupted by the broils consequent on the Reformation, and in the seventeenth century by the still greater harassments of the Civil War, and the gloomy religious spirit which prevailed up till the Restoration. This last event was even unfavourable to it, by introducing a general licentiousness and contempt for any solid and respectable literature. At this period there was an act of parliament still in force, preventing more than twenty printers to practise their art in the kingdom.

The whole number of books printed during the fourteen years from 1666 to 1680, we ascertain, by counting, was 3550, of which 947 were divinity, 420 law, and 153 physic—so that two-fifths of the whole were professional books; 397 were school-books; and 253 on subjects of geography and navigation, including maps. Taking the average of these fourteen years, the total number of works produced yearly was 253; but deducting the reprints, pamphlets, single sermons, and maps, we may fairly assume that the yearly average of new books was much under 100. Of the number of copies constituting an edition, we have no record; we apprehend it must have been small, for the price of a book, as far as we can ascertain it, was considerable.

Roger North, speaking of those booksellers of his day who had the knack of getting up volumes on temporary matters, says: 'They crack their brains to find out selling subjects, and keep hirelings in garrets, on hard meat, to write and correct by the grate; so puff up an *octavo* to a sufficient thickness, and there is *six shillings* current for an hour and a half's reading.' In a catalogue, with prices, printed twenty-two years after the one we have just noticed, we find that the ordinary cost of an octavo was *five shillings*.

After the Revolution of 1688, the business of printing rapidly increased, by the demands for sheets of intelligence or news, as well as for a better class of literary productions. In the reign of Queen Anne, printing was increased still further by the issue of the *Guardian*, *Spectator*, and other literary sheets; and in 1731 it received considerable impetus by the establishment of the *Gentleman's Magazine*, being the first of the class of larger periodicals. Between 1700 and 1756, about 6000 volumes (exclusive of tracts and pamphlets) were published—a number which, since the commencement of the present century, has been increased thirtyfold. According to the last census, upwards of 26,000 persons are employed in printing, and 11,000 in book-binding.

Printing was introduced into Scotland, and begun in Edinburgh, about thirty years after Caxton had brought it into England. Mr Watson, in his *History of Printing*, says that the art was introduced into Scotland from the Low Countries by the priests who fled thither from the persecutions at home. Be this as it may, we find James IV. granting a patent in 1507 to Walter Chapman, a merchant of Edinburgh, and Andrew Mollar, a workman, to establish a press in that city. According to bibliographers, the most ancient specimen of printing in Scotland extant is a collection, entitled the *Porteus of Nobleness*, Edinburgh. In 1509, a *Breviary of the Church of Aberdeen* was printed at Edinburgh; and a second part in the following year. Very few works, however, appear to have issued from the Scottish press for the next thirty years; but from 1541, the date from which we find James V. granting licences to print, the art has been pursued with success in the metropolis. At present, and from the beginning of the present century, it is perhaps the most distinguished craft in the city, being conducted in all its departments of typefounding, printing, publishing, and, we may add, paper-making at the mills in the vicinity.

Printing was not known in Ireland till about the year 1551, when a book in black letter was issued from a press in Dublin; but till the year 1700, very little printing was executed in Ireland, and even since that period, the country has acquired little celebrity in this department of the arts, although possessing some respectable printing establishments.

The art of printing has readily taken root and flourished among the civilised inhabitants of North America. The first printing-press established in the American colonies was one set up at Cambridge, in Massachusetts, in the year 1638, the era of the foundation of Harvard College of that place. It was only established by the exertions and joint contributions of different individuals in Europe and America; and there is no doubt that the mechanism and types were imported from England. The first work which issued from this press was the *Freeman's Call*, and the second the *Almanac for New England*, both in 1639; the first book printed was the New England version of the Psalms, an octavo volume of 300 pages. In 1676, books began to be printed at Boston; in 1686, printing became known in Philadelphia; and in 1693, in New York. In the year 1700 there were only four printing-presses in the colonies. Since that period, and especially since the revolution, which removed everything like a censorship of the press, the practice of the art has undergone enormous expansion. Among the occupations enumerated in the census of 1850 were 14,740 printers, and 3414 bookbinders. In their style of typography and bookmaking, the Americans are still inferior to the English, sacrificing beauty and durability to economy and dispatch.

We shall now proceed to a description of the art in its various branches, though without entering into the more minute, and what would be tiresome, technical details of the profession.

OF THE TYPES.

Printers, in early times, made the letters which they used, but in process of time the necessity for a division of labour created the distinct trade of a manufacturer of types, and it is only in rare instances in the present day that printers supply their own letter. The preparation of types requires much delicacy and skill. The first step in the process is the cutting of a punch or die, resembling the required letter. The punch is of hardened steel, with the figure of the letter cut, the reverse way, upon its point. On this die being finished, it is struck into a piece of copper, about an inch and a quarter long, one-eighth of an inch deep, and of a width proportionate to the size of the type to be cast. This copper, being so impressed with the representation of the letter, is called the matrix. The matrix is now fixed into a small instrument or frame, called the mould, which is composed of two parts. The external surface is of wood, the internal, of steel. At the top is a shelving orifice, into which the metal is poured. The space within is of the size of the required body of the letter, and is made exceedingly true. The melted metal, being poured into this space, sinks down to the bottom into the matrix, and instantly cooling, the mould is opened, and the type is cast out by the workman. This process of casting types is executed with great celerity. Of course, every separate letter in the alphabet, every figure, point, or mark, must have its own punch and matrix. In casting types, the founder stands at a table, and has beside him a small furnace and pot with heated metal, which he lifts with a small ladle. Type-metal is a compound of lead and regulus of antimony, the latter giving hardness and sharpness of edge to the composition. The proper proportions of these metals are regulated by the size of the type, a greater quantity of antimony being employed for small than large letters.

When the type is cast from the mould, it is in a long state, as soon as a heap has accumulated on the caster's table, they are removed by a boy, who breaks off the superfluous tag of metal hanging at the end of each type. From the breaking-off boy the types are removed to another place, where a boy is constantly engaged in rubbing or smoothing their sides upon a stone. Being now tolerably well smoothed, they are next removed to a table, and set up in long lines upon a frame; they are then dressed or finished, and after being examined by a magnifying-glass, are ready for use. Whatever be the size of the types, they are all made of a uniform height, and must be perfectly true in their angles, otherwise it would be quite impossible to lock them together. A single irregular type would derange a whole page. The height of a type is, or ought to be, exactly one inch. All the types of one class of any founder are always uniform in size and height; and to preserve their individuality, all the letters, points, &c., belonging to one class, are distinguished by one or more notches or nicks on the body of the type, which notches range evenly when the types are set. These nicks, as we shall immediately see, are also exceedingly useful in guiding the hand of the compositor. Types are likewise all equally grooved in the bottom, to make them stand steadily.

The varieties of size of types in the present day amount to forty or fifty, enlarging, by a progressive scale, from the minutest used in printing pocket Bibles, to the largest which is seen in posting-bills on the streets. Printers have a distinct name for each size of letter, and use about sixteen sizes in different descriptions of book-work; the smallest is called *Brilliant*, the next *Diamond*, and then follow in gradation upwards, *Pearl*, *Ruby*, *Nonpareil*, *Minion*, *Brevier* (the type with which this sheet is printed), *Bourgeois*, *Long Primer*, *Small Pica*, *Pica*, and *English*. The larger sizes generally take their names thus—*Two-line Pica*, *Two-line English*, *Four*, *Six*, *Eight*, or *Ten line Pica*, &c. Other nations have adopted different designations for their letters, principally from the names of their inventors; for instance, the French entitle Small Pica, *Philosophie*, from the first maker of the letter. Some of these classes of letters have derived their names from having been first employed in the printing of the prayers of the Romish Church; thus, *Pica*, from the service of the mass, termed *Pica* or *Pie*, from the glaring contrast between the black and white on the page; *Primer*, from *Primarius*, the book of Prayers to the Virgin; *Brevier*, from *Breviary*; *Canon*, from the *canons* of the church, &c.

All kinds of types are sold by weight by the founders, the price varying in amount according to the size of the letter. The smallest size, *Brilliant*, costs about 15*s.* per pound; *Diamond*, about 8*s.* per pound; *Brevier*, about 2*s.*; English, 1*s.* 2*d.*; and so on in proportion for all intermediate sizes. Expensive as types thus are, their prices will not appear too high, considering the immense outlay in cutting the punches and the general manufacture. In the *Diamond* size, 2800 go to a single pound-weight of the letter *i*, and of the thinnest *space* about 5000.

A complete assortment of types is called a *Fount*, which may be regulated to any extent. Every type-founder has a scale shewing the proportional quantity of each letter required for a fount; and a peculiar scale is required for every language. For the English language, the following is a typefounder's scale for the small letters of a fount of types of a particular size and weight:

a	8500	h	6400	o	8000	v	1200
b	1600	i	8000	p	1700	w	2000
c	3000	j	400	q	500	x	400
d	4400	k	800	r	6200	y	2000
e	12,000	l	4000	s	8000	z	200
f	2500	m	3000	t	9000		
g	1700	n	8000	u	3400		

It will be seen from this scale that the letter *e* is used much more frequently than any other character.

Types are nowhere, perhaps, manufactured so well as in Great Britain, and for their elegance and regularity of form they have been much indebted to the late William Caslon, letter-founder in London. Mr Caslon was originally an engraver of ornamental devices on the barrels of firearms, and a maker of bookbinders' tools. The neatness with which he executed his work brought him into notice, and he was appointed to cut a fount of Arabic letters for an edition of the New Testament. This occurred about the year 1720, and from this period he entered on a successful career as a letter-founder. Hitherto, the types used in England had been mostly imported from Holland; but Caslon's letters, by their decided superiority over those of all competitors at home and abroad, soon put a stop to the importation of foreign types, and were held in such estimation, as to be frequently sent to continental countries. From 1720 till 1780, few books were printed in England with the types of any other than this foundry, which still continues in existence in London.

The ingenuity and success of Caslon meet with a parallel in the case of Mr Alexander Wilson, type-founder in Glasgow. The types produced by Mr Wilson were exceedingly neat, and even elegant, and became the real foundation of the fame of the Messrs Foulis, printers, whose editions of the Classics were printed from them. In Edinburgh, the principal establishment of the kind is that of Messrs Miller and Richard, the durability, as well as beauty of whose types, for half a century past, have established a well-merited name for that enterprising firm.

The large letters used in posting and hand-bills are manufactured chiefly in London and Sheffield. In this kind of types, very great improvements have also been made in recent times; and the varieties are becoming yearly more numerous and ornamental in character. The letter used in printing in North America is made

prints were at first without any text, or letter-press, as it is termed; but after the groundwork of the art had been completed, its rise towards perfection was almost unparalleled in rapidity. Its professors composed historical subjects with a text or explanation subjoined. The pages were placed in pairs facing each other; and as only one side of the leaf was impressed, the blank pages came also opposite one another; which, being pasted together, gave the whole the appearance of a book printed in the modern fashion. The people not being able to read, were in this manner impressed with glimmering ideas of sacred history. Remarkable incidents mentioned in the books of Moses, in the gospels, and in the Apocalypse of St John, were thus made known to the less-instructed classes, but generally in connection with superstitious legends of the middle ages. Some works of this class were called *Biblia Pauperum*—Poor Men's Books; and copies of them are now extremely rare. To those unacquainted with the estimation such ancient pieces of printing bear among the virtuosi, it may be amusing to learn that fair copies have brought upwards of £250, and the very worst rarely less than £50.

The next step in the science of typography was that of forming every letter or character of the alphabet separately, so as to be capable of rearrangement, and forming in succession the pages of a work, thereby avoiding the interminable labour of cutting new blocks of types for every page. It is exceedingly remarkable that this most important and yet simple idea should not have occurred to the Romans; and what renders it the more surprising is the fact, which we learn from Virgil, that brands, with the letters of the owner's name, were in use in his time for the purpose of marking cattle. The credit of the discovery was reserved for a German, John Gutenberg (or Gutemberg), who accomplished this important improvement about the year 1438. As this man was the first great improver of typography, to the study of which he exclusively devoted his whole time and attention, a short sketch of his life will only be a part of the history of the art. Gutenberg, who is supposed to have been born at Mayence, or Mentz, in the beginning of the fifteenth century, settled at Strasburg about the year 1424. In 1435 he entered into partnership with Andrew Drozhennis (or Dritzehen), John Riff, and Andrew Heelman, citizens of Strasburg, binding himself thereby to disclose certain important secrets connected with the art of printing, by which they would attain opulence. The workshop was in the house of Dritzchen, who, dying shortly after the work was commenced, Gutenberg immediately sent his servant, Lawrence Bieldich, to Nicholas, the brother of the deceased, and requested that no person might be admitted into the workshop, lest the secret should be discovered, and the *forms*—or fastened-together types—stolen. But they had already disappeared; and this fraud, as well as the claims of Nicholas Dritzehen to succeed to his brother's share, produced a lawsuit among the surviving partners. Five witnesses were examined; and from the evidence of Bieldich, Gutenberg's servant, it was incontrovertibly proved that Gutenberg was the first who practised the art of printing with movable types, and that, on the death of Andrew Dritzehen, he had expressly ordered the forms to be broken up, and the characters dispersed, lest any one should discover his secret. The result of this lawsuit, which occurred in 1439, was a dissolution of partnership; and Gutenberg, after having exhausted his means in the effort, proceeded, in 1445–46, to his native city of Mentz, where he resumed his typographic labours. Being ambitious of making his extraordinary invention known, and of value to himself, but being at the same time deficient in the means, he opened his mind to a wealthy goldsmith and worker in precious metals, named John Fust or Faust, and prevailed on him to advance large sums of money in order to make further and more complete trials of the art. Gutenberg being thus associated with Fust, the first regular printing establishment was begun, and the business of printing carried on in a style corresponding to the infancy of the art. After many smaller essays with respect to the capabilities of his press and movable types, Gutenberg had the hardihood to attempt an edition of the Bible, which he succeeded in printing complete, between the years 1450 and 1455. This celebrated Bible, which was the first important specimen of the art of printing, and which, judging from what it has led to, we should certainly esteem as the most extraordinary and praiseworthy of human productions, was executed with cut-metal types on six hundred and thirty-seven leaves; and, from copies still in existence in the Royal Libraries of Berlin and Paris, some of them appear to have been printed on vellum. The work was printed in the Latin language; and besides those on vellum, there are several copies on paper in Germany, France, and England—all of which are justly esteemed as the highest bibliographical treasures.

The execution of this—the first printed Bible—which has justly conferred undying honours on the illustrious Gutenberg, was, most unfortunately, the immediate cause of his ruin. The expenses incident to carrying on a fatiguing and elaborate process of workmanship for a period of five years, being much more considerable than what were originally contemplated by Faust, he instituted a suit against poor Gutenberg, who, in consequence of the decision against him, was obliged to pay interest, and also a part of the capital that had been advanced. This suit was followed by a dissolution of partnership; and the whole of Gutenberg's apparatus fell into the hands of John Faust, who, from being the ostensible agent in the business of printing, and from the wonder expressed by the vulgar in seeing printed sheets, soon acquired the name of a magician, or one in compact with the devil; and under this character, with the appellation of Dr Faustus, he has for ages enjoyed no very enviable notoriety.

Besides the above-mentioned Bible, some other specimens of the work of Gutenberg have been discovered to be in existence. One in particular, which is worthy of notice, was found some years ago among a bundle of old papers in the archives of Mayence. It is an almanac for the year 1457, which served as wrapper for a register of accounts that year. 'This,' says Hansard, 'would most likely be printed towards the close of 1456, and may consequently be deemed the most ancient specimen of typographic printing extant, with a *certain* date. That Gutenberg was a person of refined taste in the execution of his works, is sufficiently obvious. Adopting a very ancient custom, common in the written copies of the Scriptures and the missals of the church, he used a large ornamental letter at the commencement of books and chapters, finely embellished, and surrounded with a variety of figures as in a frame. The initial letter of the first psalm thus forms a beautiful specimen of the art of printing in its early progress. It is richly ornamented with foliage, flowers, a bird, and a greyhound; and is still more beautiful from being printed in a pale-blue colour, while the embellishments are red, and of a transparent appearance. What became of Gutenberg immediately after the unsuccessful termination of his lawsuit with Faust is not well known. Like the illustrious discoverer of the great western continent, he seems to have retired almost broken-hearted from the world, and to have spent most of the remainder of his days in obscurity. It is ascertained, however, that in the year 1465 he received an annual pension from the Elector Adolphus, but that he only enjoyed this small compensation for his extraordinary invention during three years, and died towards the end of the month of February 1468.'

It long formed a subject of contention among antiquaries and bibliomaniacs, by what means Gutenberg formed his types; but it is now pretty clearly ascertained that they were at first all individually cut by the hand. The mode of *casting* types in moulds has been very generally, and seemingly correctly, assigned to Gutenberg's successor, Schœffer. This individual was an industrious young man of inventive genius, an apprentice with Faust, who took him into partnership immediately after his rupture with Gutenberg, and who is supposed to have been initiated into the mysteries of the art by the latter. The first joint publication of Faust and Schœffer was a beautiful edition of the Psalms, which came out only about eighteen months after their going into partnership. Along with it appeared a declaration by them, claiming the merit of inventing the cut-metal types with which it was printed; but this pretension was evidently false; and in fact it afterwards appeared that the book had been four years in the press, and must, consequently, have been chiefly executed by Gutenberg. It is worthy of notice that the above publication was the very first to which the date, printer's name, and place of publication were affixed. The most perfect copy known is that in the Imperial Library of Vienna. 'It was discovered,' says the indefatigable Timperley, 'in the year 1665, near Innspruck, in the castle of Ambras, where the Archduke Francis Sigismund had collected a prodigious quantity of manuscripts and printed books; taken for the most part from the famous library of Matthias Corvinus, king of Hungary, from whence it was transported to Vienna. The book is printed in folio, on vellum, and of such extreme variety, that though not more than six or seven copies are known to be in existence, all of them differ from each other in some respect. The psalter occupies one hundred and thirty-five, and the recto the hundred and thirty-sixth, and the remaining forty-one leaves are appropriated to the litany, prayers, responses, vigils, &c. The psalms are executed in larger characters than the hymns; the capital letters are cut in wood, with a degree of delicacy and boldness which are truly surprising: the largest of them—the initial letters of the psalms—which are black, red, and blue, must have passed three times through the press.'

To Schœffer, as said before, must be justly awarded the honour of completing Gutenberg's invention, by discovering the method of casting the characters in a *matrix*. In an account of Schœffer, given by Jo. F. Faustus of Aschaffenburg, from papers preserved in his family, we are informed that the artist privately prepared matrices for the whole alphabet, and shewed the letters cast from them to his master Faust, who was so well pleased, that he gave his daughter, Christina, to him in marriage. Faust and Schœffer concealed the new improvement, by administering an oath of secrecy to all whom they intrusted, till the year 1462, when, by the dispersion of their servants into different countries at the sacking of Mentz, by the Archbishop Adolphus, the invention was publicly divulged, and the art was spread throughout Europe. With Hansard, therefore, we may safely award to Gutenberg the high appellation of the Father of Printing; to Schœffer that of Father of Letter-founding; and to Faust that of the Patron—although, to Gutenberg, a not very generous one—by whose means the wondrous discovery—the nurse and preserver of the arts and sciences—was brought so rapidly to perfection.

Early Progress on the Continent.

Haerlem and Strasburg were the first places to which the art of printing was transplanted from Mentz, and this at so early a date, that each of these places has its respective advocates as being the birthplace of it. From Haerlem, it passed to Rome in 1466, where its first professors were Conrad Sweinheim and Arnold Pannartz, who introduced the present Roman type in the following year, in printing Cicero's *Epistolæ Familiares*. The Gothic character, from which our own *black-letter* was derived, was the next which was employed by the ancient printers; after which, in 1476, the first set of Greek characters was cast by the Italians—whether at Venice, Milan, or Florence, is a disputed point. In 1488, however, all previous attempts at the Greek character were eclipsed by a splendid edition of Homer's works, published at the last-named place, in folio, and printed by Demetrius, a native of Crete. The first book in the Hebrew character was an edition of the Pentateuch, printed in 1482; the whole Bible, including the New Testament, not being executed till 1488. This was done at Soncino, a small town in the duchy of Milan.

In 1467, printing was set up in the city of Tours; at Reuthlingen and Venice, in 1469; and, it is believed, at the same time in Paris. Strasburg was the next town which had the advantage of a press, and soon afterwards Lyon—the one in 1471, the other in 1473. In fact, so rapid at this period was the spread of the new art, that between the years 1469 and 1475, attempts at printing books had been made in most of the principal towns of Germany, Italy, France, and the Netherlands, and often, as in the case of the Spiras of Venice, with eminent success. It was introduced into Russia about the year 1560, or more than a century after its general practice in Southern Europe.

About the year 1406, the letter which we now call *Italic* was invented by Aldus Manutius, a Roman by birth, who set up the business of a printer in Venice.

Printing in Britain.

The early history of printing in England is obscure. The credit of introducing the art into that country was long believed to be due to Mr William Caxton, a mercer and citizen of London, who, during his travels abroad, and his residence for many years in Holland, Flanders, and Germany, had thoroughly informed himself of the process, and upon his return was induced, by the encouragement of many men of wealth and rank, to set up a press in Westminster Abbey about the year 1471. Such was the tradition amongst writers, and it is still generally believed. Its groundlessness was ascertained about the time of the Restoration, when a little book, which previously had been little thought of, fell under the notice of the curious, as bearing date at Oxford in the year 1468, being three years antecedent to the presumed commencement of Caxton's labours. This book, copies of which are yet extant, is a small quarto of forty-one leaves, entitled *Expositio Sancti Jeronimi in Symbolum Apostolorum ad Papum Laurentium*. At the same time (1664) a work was published by a Mr Atkins of London, entitled *Original and Growth of Printing in England*, in which an account is given of an ancient chronicle, said to have been found in the archbishop's palace at Lambeth, containing the particulars attending the first introduction of the art. By the latter, it would appear that it took place during the reign of Henry VI., under the auspices of Thomas Bourchiers, Archbishop of Canterbury, who sent R. Tournour, Master of the Robes, and William Caxton, merchant, to Haerlem, who persuaded an under-workman, named Corsellis, to come to England and set up a press at Oxford. The manuscript mentions that the transaction cost King Henry 1500 merks. But a single press was soon found insufficient for England; upon which the king set up another at St Alban's, and a third at Westminster; the last being placed under the charge of William Caxton, in the year 1471.

It would be useless for us here to enter into the merits of the question concerning the authenticity of the above mentioned chronicle, which at one time divided the literary world to a violent degree. We shall only observe that the result of the disputation appears to be this: The existence of the book before-named establishes beyond a doubt that books were printed at Oxford by Corsellis several years before

No.

大槻磐水　名茂質　字子煥　玄澤　文化十年歿

大槻磐渓　名清崇　字士広　通称平次　磐水の二子　磐里の弟

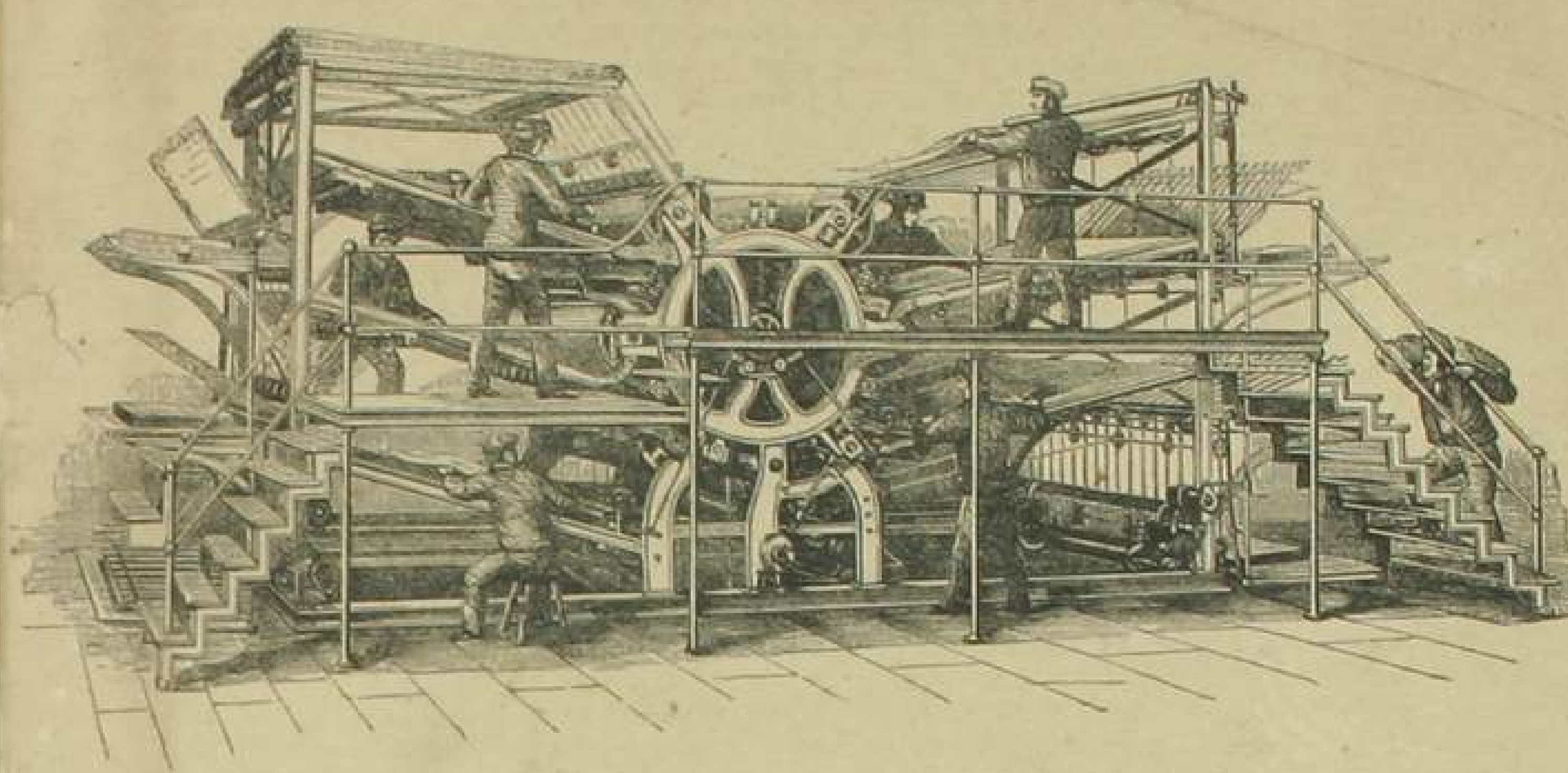
明治十一年歿

大槻平泉　名清準　字名子縄　晩に縄翁　嘉永三年歿

大槻磐里　磐水の子　名茂禎　子節と玄幹　天保八年歿

大槻修二　如電　磐渓の第一子

大槻文彦　復三郎　仝　第二子



Rotary Printing Machine.

PRINTING—LITHOGRAPHY.

PRINTING is the art of producing impressions from characters or figures, movable and immovable, on paper or any other substance. There are several distinct branches of this important art—as the printing of books with movable types, the printing of engraved copper and steel plates, and the taking of impressions from stone, called Lithography. Our object, in the first place, is to describe the art of printing books or sheets with movable types, generally called *letter-press printing*, and which may undoubtedly be esteemed the greatest of all human inventions.

ORIGIN AND HISTORY.

The art of printing is of comparatively modern origin: four hundred years have not yet elapsed since the first book was issued from the press; yet we have proofs that the principles upon which it was ultimately developed existed amongst the ancient Chaldean nations. Entire and undecayed bricks of the famed city and tower of Babylon have been found stamped with various symbolical figures and hieroglyphic characters. In this, however, as in every similar relic of antiquity, the object which stamped the figures was in one block or piece, and therefore could be employed only for one distinct subject. This, though a kind of printing, was totally useless for the propagation of literature, on account both of its expensiveness and tediousness. The Chinese are the only existing people who still pursue this rude mode of printing by stamping paper with blocks of wood. The work which they intend to be printed is, in the first place, carefully written upon sheets of thin transparent paper; each of these sheets is glued, with the face downwards, upon a thin tablet of hard wood; and the engraver then, with proper instruments, cuts away the wood in all those parts on which nothing is traced; thus leaving the transcribed characters in *relief*, and ready for printing. In this way as many tablets are necessary as there are written pages. No press is used; but when the ink is laid on, and the paper carefully placed above it, a brush is passed over with the proper degree of pressure. The Chinese chronicles state that the above mode of printing was discovered in China about fifty years before the Christian era, and the art of paper-making about a century and a half afterwards; previous to which period, all their writings were printed on silk cut into leaves of the required dimensions. Before the discovery of wooden blocks, the Chinese, according to Davis, were in the habit of using stone blocks, on which the writing had been engraved—a process by which the ground of the paper was made black, and the letters left white. This primitive effort led to the improved invention of wooden blocks, on which the characters were cut in relief, and the effect thereby *reversed*—the paper page remaining white, and the letters being impressed in ink.

It is a somewhat curious circumstance, that among the first attempts at printing by means of wood-engraving —see No. 101—which can be traced to have been made in Europe, was the making of playing-cards for the amusement of Charles VI. of France. This was towards the latter end of the fourteenth century. Thereafter came prints from wood-blocks of human figures, single or in groups; one of the earliest existing specimens of which was found in a convent not far from Augsburg, with the date 1423 upon it. It is a representation of St Christopher, by an unknown artist; and is now, or was lately, in the possession of Earl Spencer. These