

Discussion.

Mr. E. Woods, President, congratulated the Author upon having given the Institution the benefit of a most instructive Paper. The prefatory remarks were well deserving of the attention of the members as supplying a most interesting account of the earliest inventions for the improvement of the printing-press. The latter part of the Paper chiefly referred to the most recent improvements, describing the degree of perfection to which successive designers and mechanics had brought the printing-machine, and by means of which periodicals could now be obtained in quantities sufficient to satisfy the requirements of the public at an extremely moderate cost.

Mr. JULIAN HILL said that reference had been made in the Paper to a machine designed by his uncle, Sir Rowland Hill, whose idea certainly was that, if there was to be quick printing, the rotary form was necessary, and he also advocated printing from a roll or web. In those days, however, there was a curious difficulty in the way; the Excise would not allow printing on rolls of paper, the duty being collected on each sheet, so that the experiments in that direction had to be carried on by sheets of paper pasted together in order to make a continuous roll. In designing his roller which was to carry the type, Sir Rowland's great difficulty was to prevent the type from being separated and getting astray by centrifugal force. That difficulty he endeavoured to overcome by means of a chase cast in the type. Into the chase was inserted a plate, and the whole was put into a kind of trough, which Sir Rowland called a galley. The ends of the plate fitted into the metal sides of the trough, and the whole was held fast. He had the circular compositor's stick to which reference had been made, but instead of the type being put round the cylinder, the galleys were put across the cylinder. Sir Rowland Hill was helped very much in carrying out his invention by Messrs. Clowes; indeed, no inventor could have possibly received more help or encouragement than he did from those gentlemen. But the defect of the whole thing was the time that it occupied to put together. The type had to be set in a cylindrical stick, and it took a long time to put together, and also to distribute. For that reason he did not think it could ever have been adopted for newspapers; but probably if, in the year 1835, other publications, like *The Family Herald*, had been printed in the numbers now issued, the invention might have been applied to that purpose. Sir Rowland

Mr. Hill. Hill's brothers joined him in the adventure; but the invention ended in the loss of about £4,000.

Mr. Napier. Mr. J. MURDOCH NAPIER observed that he had long been connected with printing-machinery, and his father, Mr. David Napier, was well known in the printing-machine trade as an inventor and constructor. He would refer to two of his inventions as of primary importance; namely, the rising and falling cylinder, and the employment of grippers to take the sheet and carry it through the machine. The action of the rising and falling cylinder enabled him to construct light and compact machines with small cylinders. About the year 1823, the machine then in use had large, heavy and cumbrous cylinders, and he desired to make a quick-acting machine of less dimensions and easily transported. He therefore reduced the size of the cylinder so that it made two revolutions for each printing, one revolution when raised while not doing any work, and the other when down while printing, the return of the forme being permitted by the rise of the cylinder. The second improvement was the use of grippers for taking the sheet and releasing it for delivery. This was first applied to single-cylinder machines, and double-cylinder newspaper machines printing on one side of the sheet only; but in 1824 it was applied to perfecting-machines, two small cylinders placed close together being arranged so that the set of grippers on the first cylinder, after the first side of the sheet was printed, gave the sheet to the grippers of the second cylinder direct, without the intervention of tapes, to be printed on the other side, or perfected. The first type-revolving printing-machine of Hoe had, in his opinion, been already invented and patented by his father, although it had not been carried out, as orders could not be obtained in this country at that time.

Mr. Dow. Mr. W. S. Dow thought that Colonel Hoe was really the inventor of the machine which bore his name, and it was patented by him in 1847. The old Hoe machine had a great many good points. If one cylinder was broken, the others would continue in operation, so that the time of the men was not wasted. With regard to the question of damping the paper before using it in the machine, some difference of opinion existed. In nearly all machines the paper was damped the day before the printing, in order to allow the moisture to soak into it. In his opinion, nothing had so greatly advanced the process of printing as the art of stereotyping. At present, in twenty-five minutes after news had been received, twelve machines could be at work with the type in stereo. Formerly, such a result could only be obtained by setting

up the type twelve times. There was no difficulty about speed in printing, the great thing being to have the type ready, and also to deliver the sheets as quickly as they were printed. There was now a machine in Glasgow that could deliver single sheets as rapidly as they could be printed, coming out in one continuous stream; and in New York there was a machine which did the same thing, and folded the papers ready for posting, besides printing a supplementary sheet with the addresses upon it. Mr. Dow.

Mr. W. BLADES said it was the general belief in Germany that König was the sole inventor of the printing-machine, but history did not confirm that belief. In 1790, as mentioned in the Paper, William Nicholson took out a patent which contained many important suggestions, but for some reason he never succeeded. He was always inventing, always poor, always borrowing from his friends, and he at last found himself in Fleet Prison. König tried in Germany to improve the simple wooden press, and he began by using a little machinery for pulling down the platen instead of a bar. He found no one to support him, and then he came to London, where he made the acquaintance of Bensley, the printer, who maintained him during four years of experimental work. He found that he could get his machinery made better in London than elsewhere, and he effected some clever improvements, but still retained the old screw and platen. It need hardly be said that if he had gone on for ever in that direction he would never have succeeded in making a fast machine. The principle of printing-machines was in the cylinder, which König never discovered. He made, however, a working platen machine, from which he printed two or three thousand copies of *The Annual Register*. Mr. John Walter of *The Times* looked at it, but he would have nothing to do with it. While going on with his work, König heard of Nicholson, who was in prison. Bensley visited him there and learned from him that he had taken out a patent in 1790. He and König then went to the nearest library and examined the patent. König thoroughly mastered it, and in a few months adopted the very plans that Nicholson had patented. His new cylinder-machine was again shown to Mr. Walter, who ordered a couple of them on the spot. That was the origin of all the machinery used in the present day. Englishmen ought to be proud of Nicholson's genius, though not, perhaps, of his character; and no history of printing ought to be written without giving him the credit of his invention. Mr. Blades.

Mr. J. PARDOE considered that the greatest improvement in printing-machines had been made during the last thirty or thirty-

- Mr. Pardoe. five years. He had prophesied, when Applegath brought out his vertical machine, that the time would come when rotary-printing would be adopted, and his prophecy had been amply fulfilled. That kind of printing was used for illustrations of all kinds, and he should not be surprised in a few years to see a morning paper like *The Times* illustrated. His firm was now printing a number of illustrated works on a rotary machine, giving about 5,000 copies an hour, and he should be happy to show the machine to the members of the Institution.
- Mr. Harrild. Mr. HORTON HARRILD, Jun., said that the Author had given 1859 as the date of the Belle Sauvage machine, but it ought to be 1856. He was in a position to produce the man who had copied the Wharfedale machine in a great measure from the Belle Sauvage. There was, therefore, evidently an error in the date assigned by the Author.
- Mr. Cowper. Mr. E. A. COWPER said that he was nearly of the same age as the printing-machine, and had taken great interest in it all his life. The earlier appliances had been well described by the Author, but he had not referred to some of the articles which were exhibited on the table. Among these were the inking-balls, between which a small quantity of ink was worked by the printer with great labour, and by means of which the ink was more or less distributed and then applied to the type. Although that method had been practised for three hundred years, no one saw that the work could be done by rollers till the time of Nicholson in the year 1790. Donkin in 1813 conceived the idea of glue-and-treacle rollers—a clever method derived from the potteries, where impressions were taken on a slab of glue and treacle, and transferred to pottery. Mr. Cowper's father adopted those rollers, and also invented an inking-table, which was the first table for the purpose. By running the roller, first in one direction and then in another, the ink was equally distributed. There could be no proper distribution without some side-motion. His father's plan was to move the rollers endways, and Applegath improved upon it, by arranging the rollers diagonally; then, when the ink was well distributed on the table, or on a part of the cylinder in a circular machine, it was taken by the inking-rollers and applied to the forme. That method of distribution was the essence of good work. König had no distributing-table, but attempted to distribute with one of the rollers. After 1818 schemes were brought out for distributing ink on the same principle as his father had adopted. Sir William Congreve had an ingenious circular table, and every time the rollers went over it the table

moved round a little, and that, of course, distributed the ink in all directions. Others moved the table a little at each turn as the roller went over it, and that distributed the ink crossways. Since that date every machine had embodied that principle. Mr. Oldham, of the Bank of England, had a long roller across the machine, and a little roller, called the "Jim Crow," running backwards and forwards the whole length of the long roller across the machine, and that also distributed the ink. The "ductor" used in his father's machine consisted of a trough and an iron roller. A knife approached the roller by screws, so that only a thin film of ink was on the surface of the roller; instead of being always in contact with the inking-table, it was only occasionally that the vibrating-roller came and just touched it, thus taking a very narrow film of ink. There was no difficulty in getting any degree of blackness required. Reference has been made to the rise and fall of the cylinders. In the machine made by his father for *The Times*, there were four cylinders which rose and fell; numbers 1 and 3 printed as the forme went forwards, and then numbers 2 and 4 as the forme returned, thus printing 5,000 large sheets per hour, or about two hundred times as much printed matter as could be done at a hand-press. That was soon after the patent of 1818. With regard to the curved stereotyped plates, there were in the library many impressions of banknotes entirely printed from curved stereotyped plates by his father's machines in one, two, three and five colours. Four million £1 notes were printed for the Bank of England by his father and Mr. Applegath. In order to prevent the numerous forgeries of those days the notes were printed in two colours to his father's design. The Bank of England had one of those notes forged by its own engraver, and some of the forged and some of the real notes were mixed together in a book and shown to his father, who picked out the forged notes directly. It was suggested, however, that a £1 note might be given at night to a hackney coachman, who would not be able to tell whether it was forged or not. The four million notes were afterwards burned, the Bank of England determining not to issue £1 notes any longer, but to issue gold. There were no long rolls of paper at the time to which he referred; all the paper had to be cut up in sheets and stamped by the Excise. With regard to stereotyped plates, his father did not cast them to a curve, like the plates exhibited, but cast them thin, and then curved them and put them on the cylinder. In connection with rotary machines, Dellagana's name ought always to be mentioned, for without his castings the present degree of perfection would never have been

Mr. Cowper.

Mr. Cowper. attained. He understood that at *The Times* office the plates were cast and six sheets printed in twenty or twenty-two minutes. In his father's machines the "set-off" blanket was wound on two small rollers placed in hollows in the impression cylinder, so that it could easily be moved a little. A modern improvement, which had been introduced of late years, was to have a long paper "set-off" sheet, and run it through behind the paper.

Mr. Southward. Mr. JOHN SOUTHWARD said it was to the history of calico-printing that the origin of machine-printing on paper for literary and graphic purposes must be referred. Nicholson, in his patent, had apparently but carried out that principle. As a matter of fact, a rotary printing-machine of that kind had been suggested many years previously—seventy or eighty years before machines of a similar kind for printing on paper had been proposed. He was sorry as a printer that no radical improvement in printing-machines had ever emanated from the craft to which he belonged, all of them having been suggested by members of the engineering profession. William Clowes, the grandfather of the Author, was the first who printed an illustrated book with a steam-press, thereby contributing in a very important way to the spread of intelligence and education. Future improvements would no doubt have to be made by engineers, and he would suggest whether they could not do something in the way of simplification. At present he thought that the result achieved was somewhat incommensurate with the complicated means adopted. The problem was simply the transference of a film of ink from a raised surface on to a sheet of paper. Possibly there might be some improvement in the surfaces. Within the last few years india-rubber had been brought into use. Of course it was easy to say that this was only for stamps and little things of that kind, and that it would not give the clear impression required for good printing. But still it had peculiar advantages of its own, and it might be possible, by the development of the stereotyping process and in conjunction with inventions in chemistry, to produce in future some printing surface that would not require so much pressure and mechanism. A number of experiments had been made in this direction, and several projects had been patented. They had relation, however, to type and were therefore impracticable. The application of stereotyping had been almost overlooked. There could be little doubt that in the future very much improved methods of printing would be practised, methods, perhaps, of the nature of which there was no conception at the present time.

Mr. Clowes. Mr. E. A. CLOWES, in reply, thanked Mr. Cowper, who, as was

well known, was one of the greatest authorities on the subject, for Mr. Clowes. his explanations of some of the articles exhibited. He agreed with Mr. Napier as to the originator of the machine to which he alluded. Mr. Napier had sent him the patent of his father's invention, which was dated 1837, whereas the Hoe machine was introduced in 1847. As to the machines made by Messrs. Hoe, he had had the advantage of inspecting their workshop in New York, and could confirm what had been said respecting them. He had certainly never been in a more wonderful printing-machine manufactory in his life. With reference to Mr. Harrild's objection as to the date of the Belle Sauvage patent, he was certain that all the dates in his Paper were correct: the Belle Sauvage machine could not have been patented for some years after its invention, if the Wharfedale was copied from it. He should be glad to show the works of his own firm to any members of the Institution who might desire to see them. He would like to add that in preparing his Paper he had been greatly struck by the following facts: the hand-press was still in use in most of the best printing offices, but the platen-machine, which was really an enlarged press, was dying out; the single-cylinder machine at the present time was little better than that which Dutartre brought out in 1830, and Cowper's double-cylinder machine of 1823, combined with Napier's improvements of 1824, was still practically but slightly altered. All this, he thought, showed a want of enterprise and invention on the part of the machine-makers during the last fifty years. He was bound in justice to say though, that rotary machines had undoubtedly caused a great revolution in the printing world, and in this class he could congratulate several gentlemen present; but he must still tell them that if it had not been for the art of stereotyping, and electrotyping, they would not have been able to use these machines, and that notwithstanding this, he must remind them of the fact that a rotary machine capable of doing good cut-work had yet to be invented. In conclusion, he wished to acknowledge the great kindness he had received from all to whom he had applied for information, and to thank his friend Mr. James Thompson for the untiring energy and great practical knowledge which he had brought to bear on the matter during the researches which it had been necessary to make, in order that the Paper should be a true statement of facts.