

The Re-Birth of Lithographic Printing

BY OLIN E. HINKLE*

Perfecting of photographic processes and halftone engraving led to the development of the photo-offset method of printing. In this article is an interesting footnote to printing history—the story of the introduction of the three-cylinder offset press at the turn of this century, and of the men who developed it.

BEHIND TODAY'S BOOMING PHOTO-offset printing industry—which may benefit extensively from current developments in photo-composing, faster etching and other improvements—is a story of a process which flowered for a time, was eclipsed by photo-engraving and gravure, then began its steady come-back at a time when many authorities considered it dead.

The same photographic methods which gave the printing industry the line cut and the halftone also give to the lithographic process the photo-transfer with all its fidelity and flexibility. Yet the application of photographic procedures to lithography would have meant relatively little without invention of the "offset" process, in which the printing images are first laid down on a rubber blanket, then deposited on paper, metals, plastics, fabrics and many other materials. And offset printing did not come to mechanical maturity until about 1904, when thin zinc and aluminum plates were wrapped around cylinders and a three-cylinder rotary offset

press was marketed. In other words, the re-birth of lithography came about through introduction of photographic procedures, the rubber-offset principle and the rotary press. The boring required several decades.

This article will trace, with rather meager sources available on some points, the development of the photo-offset lithography which has made possible an industry which today has a large and stable place in the printing trades. For the whole picture, a brief glance may be taken into the history of the original stone printing known as lithography.

The invention of the lithographic printing method about 1798 in Bavaria was fully described by Alois Senefelder who, unlike Johann Gutenberg, documented his experiments and left a book for guidance of the users of his process.¹ Lithography flourished as an art medium, then declined as it was commercialized for mass production of cheap art. As a method of illustrating books, magazines and a few newspapers, it had a period of acceptance which was largely ended with the in-

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¹The *Invention of Lithography* (New York: The Fuchs & Lang Manufacturing Company, 1911).

vention of photo-engraving in the early 1880s. By 1900, it seemed relegated to a minor place in the printing arts.

The apparent re-birth of the lithographic process about 1904 had beginnings several decades earlier. When Niepce etched metal plates and pulled proofs between 1824 and 1829 in France, he not only advanced the photographic art but foreshadowed most of the photo-mechanical processes in use today. Making a permanent image on metal was fundamental. But while etching of line plates may have been done experimentally before the American Civil War, the maps and illustrations of that conflict were wood cuts at a time when photography was well advanced. Frank Luther Mott says that zincographs (line cuts) were in use in Paris about 1859, but that they did not come into use in the larger American newspapers until the early 1870s.²

In making line cuts, American and European engravers used sensitized zinc plates and photographic negatives. Here were materials which are basic in photo-offset lithographic printing today. Their use was extended in the next decade when halftone engraving was perfected by Stephen H. Horgan, Frederic E. Ives, George Meisenbach and others. However, the line cut was not accepted with enthusiasm by many newspapers because of opposition of wood engravers. The London *Daily Graphic* was using wood cuts in 1890, "but soon line blocks were introduced."³ Introduction of Levy halftone screens and fish-glué from the United States helped to establish the engraving industry in England.

In tracing the re-birth of lithography one may begin with the year 1875,

² *American Journalism* (New York: The Macmillan Company, 1930), p. 501.

³ *Printing in the Twentieth Century* (London: The Times Publishing Company, 1930), p. 166.

when a British patent for an offset process was issued to one R. Barclay.⁴ Also patented in the United States, this process included the basic elements of offset lithography. But it is a significant fact that while this and later patents mentioned the applicability of the process to printing on paper, it came into use only for printing on tin, metal foils, celluloid and fabrics. Because these were sheet fed, the rotary principle was not immediately put into use. It is said that the first rotary offset press exhibited in England was a tin-printing machine made by the Messrs. George Mann & Company, Ltd. The year was 1904.⁵

Flatbed offset came first. Presses were like conventional letterpress types, except that there was an extra cylinder covered with a rubber blanket. Such presses could be used for both letterpress and offset work, from both stones and plates. Introduction of rotary perfecting presses in the 1870s, along with the stereotyping process, must have suggested to tin printers that rotary offset would have distinct advantages, including greater speed. In fact, there is evidence, as will be shown, that rotary offset was used by the specialty printers in the United States before Mann exhibited such a machine in London.

One authority has stated that thin sheets of zinc began to replace the larger, heavier press stones some time in 1889. He adds:⁶

We know that in 1889 the first direct rotary litho press had a zinc plate wrapped around the cylinder, which enabled the lithographer to increase production to 1500 per hour.

⁴ William Atkins, ed., *Art and Practice of Printing* (London: Sir Isaac Pitman & Sons, Ltd., 1933), Vol. 3, p. 130.

⁵ *Ibid.*

⁶ Letter to author from Herbert W. Morse, educational director of Lithographers National Association, Inc., dated Feb. 18, 1955.

Still, rotary offset had not been applied to printing on paper. It is at this point that this writer will develop a footnote to printing history on the question of who originated offset printing on paper.

THE FOLLOWING CREDIT IS TYPICAL of articles which have appeared in British books and magazines:⁷

The first person to realize the possibilities of this process in connection with paper and to put his discovery into practice was an American named Rubel, although it seems odd to think that tin-printers used this process for thirty years before its commercial possibilities, when applied to paper, were realized.

This quotation is not given to establish the identity of the inventor of offset printing. As noted above, old patents covered the basic process and metal printers had used the method long before the applicability to paper was discovered. Yet history resists a vacuum. Trade magazines in referring to the new presses were hazy, calling the new process by many names and referring to it as an invention rather than a discovery. Contributors to encyclopedias took their cues from published articles. A few trade paper columnists settled largely upon one man as the originator of offset printing. But while he undoubtedly had a notable part in introducing the offset method in this country and especially in England, the allocation of credit for the "discovery" is easily shown to be a multiple proposition, and even a controversial one. Yet to see the whole picture it is necessary to show how that original credit for the new printing method developed in the period 1904-06.

The man widely acclaimed for two decades as the "inventor of offset print-

ing" and so credited in histories of printing and in encyclopedias is less mentioned today, and his name has been removed from some new references. Controversy over giving him credit has tended to obscure the work he did to introduce offset printing on paper in this country and in Europe. That man, whose name is not known to many printers today, was Ira Washington Rubel of Chicago.

David Greenwood and Helen Gentry in their book on the chronology of printing carried this entry:⁸

1905—Offset technique for lithographic press is introduced; credit for its discovery being generally given to Rubel, Jersey City.

Similar credits also appear in books on journalism. For example, this paragraph is in a text on picture editing:⁹

A better method of printing, however, was required before photolithography could come into its own. This development did not occur until recent times. When Ira W. Rubel, a New Jersey printer, discovered he could print onto a rubber blanket and then offset the impression on almost any kind of paper, he gave surface printing the tool which was to change the older forms of photolithography into the modern rapid planograph process.

In tracing the origins of articles crediting Ira Rubel with either invention or discovery of offset printing, this investigator often found that English or Belgian printing journals were mentioned. This also was true of U.S. Government publications, as shown by this excerpt from a letter to this author from an official of the Department of Commerce:¹⁰

⁷ *Chronology of Books and Printing* (New York: The Macmillan Company, 1936), p. 127.

⁸ Laura Vitray, John Mills Jr. and Roscoe El-lard, *Pictorial Journalism* (New York: McGraw-Hill Book Company, 1939), p. 172.

⁹ H. B. McCoy, chief, Specialties Division, U. S. Department of Commerce, in letter dated Aug. 4, 1939.

¹ Atkins, *op. cit.*, p. 153.

The reference to Ira W. Rubel on page 121 of our *Foreign Graphic Arts Industries* was an expression of opinion from Belgian lithographers with respect to Mr. Rubel's accomplishments in the field of offset printing.

The credit given Rubel in the European printing industries came about as a result of his attempts to gain abroad the fame and fortune which were denied him in the United States. His difficulties stemmed from these facts:

1. He did not patent a printing press in the United States.

2. He did not license, nor did he succeed in building, a press in this country which he could sell in his own name or through his own firm.

Who was this man Ira Rubel, and what did he do?

Information given this author by his sister, Mrs. M. M. (Bessie) Marks of 1115 South Linden Avenue, Highland Park, Ill., shows that Rubel was born in Chicago on August 27, 1860.¹¹ He was one of four sons born to Mr. and Mrs. Moses Rubel. He attended a Chicago high school and the University of Chicago. He was graduated as a lawyer but at the death of his father he took over the family business, the American Cutlery Company. Later, however, he and his brothers sold their interest in this business and established a printing concern under the name of Rubel Brothers. This flourished, but in connection with the establishment of a paper mill the entire plant was moved to Nutley, N. J. The Rubel brothers—Ira, Charles, Levi, Simon and Nathan—had serious financial difficulties and some of them worked at occupations other than printing to get money to put into the business. Charles seems to have been the most active printer and to have been manager of the business.

Ira Rubel worked as attorney and as

accountant, but spent some time in the Nutley, N.J., printing plant. An anecdote on how Rubel came to "discover" the possibility of printing by offset on paper was reported by Nelson F. Funk of Elkhart, Ind., who in 1911 made a study of offset activities for Robert Hoe, the press manufacturer. Funk was told that Rubel was at the printing plant in Nutley when a girl press operator was feeding a machine which had a rubber blanket on the impression cylinder. Flustered by his genial remarks, the girl failed to insert a sheet. The next sheet was printed as usual but also had ink impressed on the back which had been deposited by the blanket. The girl threw the double-printed sheet down in disgust, but Rubel examined the sheet and remarked that the offset side was as well done as the other—or better.

Probably little credence should be given to this story. But it became known in the family that Ira was tinkering with plans for a rotary three-cylinder press using the offset principle. His sister, Mrs. Marks, wrote that it was her recollection that her brother Simon also had a part in developing the press plans.

AT THIS POINT ANOTHER INVENTOR enters the picture. In the same year or years, about 1903-04, a similar press was being designed for printing on paper by Alexander B. Sherwood of Chicago, then president of the Sherwood Lithograph Company. How Sherwood and Ira Rubel came to form a temporary partnership is apparently unknown. How far each had gone in completing plans, or building a model, before meeting the other is variously estimated. One authoritative source¹² has

¹¹ C. W. Dickinson, manager, Offset Press Division, R. Hoe & Company, Inc., New York, in letter dated Oct. 22, 1948.

¹² From letter dated April 10, 1949.

made this comment about this problem of dates:

I diligently tried to pin both men down to a specific date as to when they conceived the idea of a three-cylinder rotary offset lithographic press. They both positively refused to respond with any date, each claiming to be the originator.

I know the first rotary offset lithographic machine I ever saw was a very crude affair, which had been built for A. B. Sherwood by a local machine shop in Chicago and that date was the summer of 1905. Rubel was alleged to have had a similar machine in operation at approximately the same time.

It is known that Sherwood and Rubel made a working agreement at the time they appeared at the Potter Printing Press Company of Plainfield, N.J., to have a few presses manufactured. Their press was called the Sherbel, a name which caused the writer just quoted to comment:¹³

My own guess is that Sherwood antedated Rubel solely from the fact that the Sherbel press is an abbreviated combination of the two words, Sher-wood and Ru-bel—Sherbel. Is it not likely to assume that Sherwood was the pioneer, because the first syllable of his name appears first in the combined name whereas, if Rubel was the first, why would they not create the name Bel-wood?

Further claims for Sherwood's pioneering work with an offset press were made by C. H. Nelson of the Sherwood Lithograph Company, who was with the firm prior to and during the building of a model. He said:¹⁴

Mr. Alexander B. Sherwood had the necessary plans for the first offset press drawn up by a draftsman in the years 1903 and 1904, and the press built and completed in Chicago and in operation in our plant in the year 1905.

After operating this press for a few

months, it proved that it was a practical and very much improved method. Mr. Sherwood made a trip to Plainfield, New Jersey, and arranged to have presses of this type built by the Potter Printing Press Company on a royalty basis. While on this trip, he became acquainted with Mr. Ira W. Rubel, who had been experimenting on this same method of printing and in fact had built a small model about the size of a typewriter. The result of this meeting was a partnership formed between Mr. Sherwood and Mr. Rubel in which they were to share equally in royalty on these presses, which were to be built by the Potter Printing Press Company, according to new plans drawn up. . . . These presses were completed and shipped in the year 1907 and we still have one of these 28-34 presses in operation in our plant. . . . The first experimental press as explained above was planned and built in Chicago, was destroyed some five or six years back [1933] in order to make use of the space it occupied.

Mr. Sherwood, who had been considered one of the pioneers in the lithographic industry, died in August, 1932.

Rubel's original plans for a press were drawn by a Mr. Tucker at Plainfield, N.J., and the date estimated by Nelson F. Funk of Royal Oak, Mich., chief engineer of the Nagel-Ryan Manufacturing Company, was December of 1902.¹⁵ But these plans apparently were discarded or revised before the Sherbel presses were built.

Mention has been found of three Sherbel presses. Sherwood took one to Chicago, Rubel took one, and the third was installed in the plant of Andrew H. Kellogg and Company of New York City. From the same plant later came a series of larger lithographic presses called the Potter Offset Presses.

■ BUT WHILE THESE FACTS TEND TO establish Rubel and Sherwood as the pioneers in developing an offset press,

¹³ C. W. Dickinson, in letter dated Nov. 4, 1948.

¹⁴ From letter dated Aug. 7, 1939.

¹⁵ From letter dated Aug. 3, 1940.

another significant fact is that, unheralded, the Harris Automatic Press Company had developed a similar machine in its factory at Niles, Ohio. From this factory, in 1906, came the first offset presses built for general commercial use. Test models had been used by lithographers of the Goes Lithograph Company of Chicago after Casper Hermann, a pressman, adapted a Harris automatic. The first Harris Offset press was sold by C. W. Dickinson to the Republic Banknote Company of Pittsburgh.¹⁶ Obviously, press designers for the Harris company, like Rubel and Sherwood, had seen the possibilities for offset printing on paper and their machines were the first available to the trade.

The *American Pressman* said that the Harris press, too, resulted from the accidental discovery of the merit of offset printing.¹⁷

One day as Alfred Harris was erecting a new press, he noticed the irritation of a nearby lithographic pressman, when a girl feeder missed the sheet, and the impression "offset." Mr. Harris observed that the back of the sheet, which was printed in reverse, was a better job than the printing on the face of the sheet. The pressman said he wished he had a press which would duplicate this offset impression every time. . . . Here was the germ of an idea. The Harris brothers intensified their experimenting. In July of 1906, after much trial and error, the first commercially practical offset press ever produced was shipped to the Republic Bank Note Company in Pittsburgh. It is interesting to note that this first press was in operation in Pittsburgh until 1940.

The "Pressroom" column of *Inland Printer* conceded in 1908 that "the offset press has passed the experimental stage and is considered by many the

only machine for commercial work."¹⁸ At that time, said the same writer, offset press manufacturers in the United States were the Harris Automatic Press Company, Chicago; R. Hoe Company, New York; Potter Printing Press Company, Plainfield, N.J.; and Walter Scott, Plainfield.

Ira Rubel's name appeared with some regularity in trade publications as the sole originator of the offset press—an erroneous assumption, as was shown above. But things went badly for him. The Rubel Brothers business in Nutley, N.J., failed. He was unable to patent the Sherbel press and to license his press. The reason was simple; similar presses had long been under patent for printing on fabrics and metals. That no manufacturer had promoted the use of the press for printing on paper was of no importance.

Keenly disappointed, Ira Rubel went to England in 1906 with his press in the hope that British laws would permit sale of royalties. There, his presses were to be manufactured by the Lancashire engineering firm of Bentley and Jackson.¹⁹ His death in 1908 caused the collapse of his plans. However, other manufacturers—who like Harris in the United States had machines for printing on metals and fabrics—took up the idea of printing on paper and turned out presses which were successful. But Rubel was credited with installing in England the first offset press built to print on paper, and his efforts to find backers in that country caused him to be credited with "discovery" of the process.²⁰

The best comment on this phase of

¹⁸ 42:413, November 1908, pp. 22-24.

¹⁹ G. W. Venner Dear, director, Hunter-Penrose Ltd., London, in letter dated Aug. 9, 1939.

²⁰ Harry Porter, "The Story of the Invention and Development of Offset Printing," *Share Your Knowledge Review*, 3:23 (June 1936), p. 25.

¹⁶ C. W. Dickinson, from letter dated Oct. 22, 1948.

¹⁷ In issue for February 1950, pp. 53-56.

Rubel's life found by this investigator was an article by Frederick W. Sears in the 1908-1909 issue of *Penrose's Pictorial Annual* of London:²¹

Commercial work has come back to the lithographer to stay, and Ira Washington Rubel was the man who brought it back. . . . Little did I think when I commenced this article that before I had finished my friend, the inventor of the offset lithographic press, would have passed "beyond the vale," but so it was.

On September 4th, 1908, at the Derby Hotel, Bury, Lancashire, Ira Washington Rubel, the inventor of the offset lithographic press, passed to the silent land of the great departed. Rubel was a native of Chicago and a University man; he studied for the Bar, but, although he became a barrister, Rubel was at heart a mechanic, and his first rotary offset lithographic press was the outcome of his interest in printing and lithography. He applied for patents in the U.S.A. but was unable to obtain them through some technical bungling. There is no doubt, however, that Rubel was the man who showed the world what the offset machine could do, and although there are several makers of these machines today, Rubel's stands out in front of them all.

I met him the first day he arrived in England, some three years ago. I was the first to see his machine run in London and I joined business with him, and was with him to the last.

He was the kindest and most gentle-natured man I have known, and everyone with whom he came in contact liked or loved him. Some twelve months ago he had a slight stroke of paralysis at the Derby Hotel, Bury, when we were at tea, but with great care he pulled through, and was able to visit his native land, returning to England in February, last. He was never the same man; occasionally he appeared to be himself again, and we all tried to believe the worst was over, but the warning had been given, and our hopes were vain. On Wednesday, the 2nd September, 1908, the hand of death was laid on him whilst we were sitting at lunch. He

dreamily closed his eyes, and we carried him to bed, and he never opened them again. He was conscious only occasionally, and died at 9:10 p.m. on the 4th September, 1908. His body was cremated at Manchester on the following Monday, and the ashes are to go to his native place to be laid at rest in the family vault beside his father, mother, and brother.

From the above statement it is obvious why Rubel was given greater credit in England for the offset press than he was in the United States, where the work of Sherwood, the Harris brothers and others was known. And in England, more than in this country, he was influential in promoting the discovery he shared with others—that the rotary offset press had great possibilities for printing on paper in both black and in color.

THE MORE RECENT DEVELOPMENT of photo-offset lithography needs little elaboration here. Its expansion in the commercial printing field was slow but steady for more than two decades, then its present acceleration began. Offset has never lived up to its promise in newspaper printing, although for many years 50 or more weeklies and a daily or two have been so reproduced. It is a popular medium for printing of company magazines and periodicals up to newspaper size. Webendorfer, Hoe and other press manufacturers have brought out web-fed presses, some of them turning out a complete 16-page publication. For magazines and special applications, there are eight-color presses of the perfecting type.

Offset printing is commonly called the youngest and fastest growing of the three major printing processes. Bureau of Census reports show that in the nine-billion-dollar printing and publishing industry offset printing gets 13% of the business, letterpress 80%, gravure 5%

²¹ Vol. 14, 1908-1909, pp. 22-24.

and other processes 2%. In commercial job printing, however, offset printing accounts for 30% of the gross. The process gets 10% of the gross in printing of books and booklets. Lithographic sales volume for 1954, forecast in data supplied by the Bureau of the Census and printed in the annual report (1954) of the Harris-Seybold company, is estimated at \$1,170,000,000.

Of the three major branches of the printing business, photo-offset lithographic has been most active in research—a fact to which much of its progress can be attributed. The Lithographic Technical Foundation was organized in 1924 to conduct cooperative research. One unit of this was placed at the University of Cincinnati on a cost-sharing basis. Research projects, short courses, reports, patents and a constant exchange of information have marked the course of the program. *Inland Printer*, in detailing a progress report of the Lithographic Technical Foundation made in Chicago, included the following subjects:²¹ New plate coatings, bimetal plates, improved etch solutions, improved press inkometer, new types of damping roller surfaces, new papers. It said more than 700 plant inquiries were answered in 1954.

A web offset section of the Printing Industry of America, Inc., is active. Much literature on offset lithography is distributed by the Lithographers National Association, Inc., the National Association of Photo-Lithographers, and Amalgamated Lithographers of America. Much significant research has been done by the Rochester Institute of Technology, which has a department of printing and a graphic arts research department.

Qualitatively, offset lithography has done well. Color fidelity and contrast, once criticized, compete quite well with

good letterpress printing. Short life of plates, once a principal problem, led to perfection of deep-etch plates, from which impressions have run into the millions. Large plate size and high-speed automatic feeding have given offset a virtual monopoly in some fields. Its gay colors and uninhibited art work are everywhere found in advertising materials, direct mail, postcards, calendars, posters, greeting cards, labels, cartons, catalogs, maps and containers which the average American sees throughout his day.

Dry offset, which omits the damping rollers, is a subject of ANPA research. Combined with the ANPA-Dow high speed etching process, this method of printing holds some promise for fast, economical reproduction on web-fed presses. Admittedly, there are still problems to be solved here, especially in printing of halftones from curved plates. Press tolerances are very close, but life of a plate is long because it does not touch paper.

What the offset camera can copy, the process can economically reproduce. Vari-Typer copy has long been used, but photo-composing offers greater flexibility and a professional look. Offset's greatest room for expansion appears to be in the newspaper and magazine fields, but probably its greatest dollar gains for some time will be in commercial printing, where the use of more art and more color are well within lithography's natural scope.

Alois Senefelder made quite a discovery when he applied the principle that grease and water do not mix. But the impressive growth of photo-offset photography today must be credited to many other men who liked the process and contributed to it—the photographers, lithographers, screen makers,

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viewed on today's problems of news coverage in Russia.

MONTAGNES, JAMES. Canada. Bdcstng. 49:3 p55 July 18.

Comprehensive report of economic conditions and of radio and television in major Canadian cities.

MORRIS, JOE ALEX. Home-town TV makes a hit. Sat. Eve. Post 228:10 p43 Sept. 3. *Station in Lubbock, Texas, emphasizes informality and community service.*

PAULU, BURTON. Audiences for broadcasting in Britain and America. JQ 32:3 p329 Summer.

QUIGLEY, MARTIN. Home-grown TV in St. Louis. Harper's 211:1262 p39 July. *Former manager of educational television station summarizes "nerve-wracking and magnificent experiment."*

SEILER, JAMES W. Sponsors are discovering TV audiences don't tire. Bdcstng. 49:10 p35 Sept. 5. *American Research Bureau claims viewing does not decrease when novelty of ownership wears off.*

SERLING, ROD. TV's sacred cows. Writer's Digest 35:8 p36 July.

TV writer reviews the numerous restrictions, with emphasis on cautious approach used to avoid offending anyone.

SHAYON, ROBERT LEWIS. Why are we going? Sat. Rev. 38:29 p37 July 16. *Critic reviews broadcasting innovations of the summer season.*

SMALL, BILL. A "hold for release" may be silly but breaking one is not a popular answer. Quill 43:7 p7 July.

Radio news director summarizes adverse reaction to breaking of release time on Salk polio vaccine story.

WINTER, WILLIAM. What stills can do for TV. Bdcstng. 49:7 p52 Aug. 15. *San Francisco commentator finds sequences of still pictures effective.*

Research Techniques and Media Analysis

ALLEN, WILLIAM H. Research on film use: Class preparation. AV Com. Rev. 3:3 p213 Summer.

CARTER, RICHARD F. Writing controversial stories for comprehension. JQ 32:3 p319 Summer.

OTHER BOOKS AND PAMPHLETS

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U. S. DEPARTMENT OF COMMERCE. *Newsprint Production from Hardwood: A Study of Newsprint Expansion: Part II.* Washington: Government Printing Office, 1954.

Second progress report concerning the factors impeding the expansion of newsprint production in the U.S. and the possibilities of utilizing new raw materials and technologies in newsprint manufacture.

U. S. SENATE. COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE. *Investigation of Television Networks and the UHF-VHF Problem.* Washington: Government Printing Office, 1955. 72 pp. Free.

Progress report by Robert F. Jones, special counsel.

U. S. SENATE. COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE. *Television Network Regulation and the UHF Problem.* Washington: Government Printing Office, 1955. 44 pp. Memorandum about UHF operation prepared by Harry M. Plotkin for the Committee.

RE-BIRTH OF LITHOGRAPHY

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photo-engravers, tin-printers, chemists and researchers. Actual introduction of the three-cylinder offset press brings to mind names of men associated with printing on paper—Alexander B. Sherwood of Chicago, Ira Washington Rubel of Chicago and Nutley, N.J., and Alfred F. and Charles G. Harris of Niles, Ohio. Of these, Rubel had the only tragic history, as we have seen. Sherwood continued to run a successful lithography plant in Chicago. The Harris brothers took a leadership in lithographic press building which has never been relinquished.

If Alois Senefelder could walk into a big photo-offset plant today he would recognize the basic importance of his original concept, but he would be amazed by the tremendous strides in the lithographic industry since its re-birth through photo transfers, the offset principle and the rotary press.