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DEDICATION

People with ideas and the courage and energy to carry them out are invaluable. Companies which provide a favorable environment so both the people and their ideas can grow are equally important.

As you read this book, you will meet many people who had ideas and the courage and energy to carry them out. You will also become aware that the 3M Company is one of those firms which provides the necessary environment for the man with ideas.

To such men and to companies like 3M which offer opportunities for them, this book is dedicated.

FOREWORD

Not long ago a young sales trainee of the 3M Company's Microfilm Products Division spent a day studying an advanced system for storing and retrieving engineering drawings on microfilm aperture cards in a plant at Cedar Rapids, Iowa. Told that the system he was seeing was not yet in general use, he could hardly contain his enthusiasm. "It's wonderful," he exclaimed, "to get in on the ground floor of a business like this."

This remark may come as a surprise to or provoke a smile from those of us who have been in the microfilm business as suppliers or users for fifteen years or more. We were in on the ground floor of microfilm back in the late Forties and early Fifties, weren't we? But isn't it also true that with the horizons stretching before us it still is possible to be in on the ground floor today? This feeling among many people of being in at the start of microfilm reflects an awareness of the ever-expanding future of microfilm and microfilm products, including the microfilm aperture card. Despite the notable sales successes of the past, I maintain we have just begun to tap the potential of the microfilm market.

But in looking to the future we must not ignore the past. It is important to know where we are going. We should also know where we have been. One phase of microfilm history is treated between the covers of this book. This is the story of the aperture card – "The Hole in the Card." It really is several stories in one.

First, it is the story of people, both users and suppliers, from all walks of business, industry, government and education, who had the vision to see the possibilities of the aperture card and who had the dedication to work with an almost missionary-like spirit for its eventual acceptance and success as an active tool of modern information management.

Secondly, it is the story of an idea. Mounting a frame of microfilm in a card was a good idea, but it was no simple achievement. The story of the aperture card is also the account of technological development in terms of the cards themselves and the equipment necessary to produce and use them. Once the aperture card became a reality it opened the door to the invention of the processor-camera. Together with modern reader-printers, the card and the camera changed microfilm from a passive material stored in archives to an active tool of information handling suitable for use in office and factory.

In another sense, the development of the aperture card is a business history, a story of profit and loss and, eventually, commercial success.

Finally, it is the story of two companies. The Filmsort Company, which had to struggle to survive during all of its short life, left the aperture card as its legacy. The other is the 3M Company, which produced equipment and perfected the aperture card to contribute greatly to making microfilm the active tool of information management we know today.

These stories are intertwined in this book. They include frustration, failure, fun, faith and fulfillment. They are exciting, too, because they unfold within the framework of the American free enterprise system, which provides the opportunity for you to build a better mousetrap but which also allows people the freedom *not* to beat a path to your door.

I hope you enjoy reading this book as much as those of us who were in on the ground floor enjoyed living the events it chronicles.

D. W. McArthur
Vice-President
Microfilm Products Division
3M Company
St. Paul, Minn.

May 1, 1966

INTRODUCTION

An aperture card is an electronic data processing card with a hole or aperture (sometimes more than one aperture) in which a frame of microfilm can be mounted. An aperture card contains graphic information identical to that contained in the original document (the microfilm) with the key to locating the information (the tab card).

The ability of microfilm aperture cards to handle total graphic information, combined with the ability of computers to handle quantitative indexing information, has resulted in some of today's most efficient and extensive information management systems. Today the aperture card is an accepted and rapidly growing tool of information management. It is actively used to record, retrieve and reproduce records and documents throughout business, industry, government and education.

Despite this, the aperture card still is relatively new. Its history as a practical method of managing graphic information dates back only to the early 1940s. And for that matter, microfilm itself, invented in the early 19th century, was introduced as a commercial product only a little more than a decade before the advent of the aperture card.

That was in 1929. Then, as now, banks posted cancelled checks in ledger accounts before returning the checks to depositors. However, the banks had no way of proving the existence of a check once it left the bank. Depositors, through error or intention, could claim they had not written certain checks and demand that their accounts be credited. With no recourse to documentary evidence other than an entry in a ledger, banks sometimes were forced to take a loss in the interests of maintaining customer good will.

Microfilm provided a method of graphically rerecording cancelled checks, protecting banks from later false claims. In addition, it was then, just as it is today, the most efficient and least expensive method of copying from the standpoints of low material costs, speed and storage density.

The banking industry readily accepted the concept, and microfilm as a commercial product was born. The same principle of documentation was applied during the 1930s to similar commercial tasks such as billing and recording sales receipts before returning them to customers as proof of sales.

The microfilm used for these accounting jobs was 16 millimeter size and in roll form. The microfilm system involved nothing more than a camera and film and a device for positioning the documents to be recorded. During the Thirties 35 millimeter film was developed as a microfilm medium for recording larger documents such as engineering drawings in industry and newspapers and other publications in libraries.

By the beginning of World War II, there were a great many organizations and institutions using microfilm, primarily in 16mm but also in 35 mm roll form. Generally the voluminous information

being recorded on microfilm was "filmed, filed and forgotten." It was often only after the period of most active reference had passed that documents were microfilmed. For example, a library might keep issues of a popular magazine for three years in bound and loose form, but copies more than three years old were stored on microfilm because it was felt there would be relatively little call for them.

Microfilm was generally considered to be a "high paper, low reference" storage medium. It replaced great quantities of paper documents while using only a fraction of the space formerly required, thereby making it easier and less expensive to file and store information. It did this at minimum sacrifice in usability because, although it was important that the information recorded on microfilm be kept in permanent form, the times when the data actually had to be referred to were relatively few. Thus the use of microfilm followed the principle of "management by exception."

Uses of microfilm were thus basically passive. Microfilm records were designed neither for easy nor active use. Access and reference were, of course, possible through the use of simple microfilm readers of the time. But no information was stored on microfilm if it were known in advance that the data would frequently have to be "looked up." This was because microfilm was simply harder to handle and refer to than the original paper documents it replaced. Secondly, documents were microfilmed collectively on a roll. This meant that a whole roll might have to be searched to find a particular document's microfilm image. This was time consuming. It is no wonder that many operations utilizing microfilm during these years were unfortunately referred to as "record destruction" programs.

The major reason for the invention of the microfilm aperture card was to develop a system for using microfilm as an active tool of information management rather than simply as a passive "dead storage" device. The use of microfilm as an active tool of information management has continued to be the reason for the microfilm aperture card's growth and success. In fact, "active use" has progressed to the point where today the microfilm aperture card, in many cases, is eliminating the intermediate "paper" step in managing information and is becoming a replacement for paper itself.

The story of the microfilm aperture card begins in the early Forties. It is basically the story of what is known today as the "Filmsort" aperture card, for from its invention in the early 1940s until recent years this was the only microfilm aperture card on the market.

By the time the Sixties rolled around, years and years of trials and tribulations, experience and know-how had conclusively and finally established the present and future information management capabilities of what is affectionately known as "the hole in the card."

CHRONOLOGICAL TABLE

DATE	EVENT
Early 1800s	Invention of microfilm.
1929	Commercial introduction of microfilm.
1934	Atherton Seidell proposes aperture card concept.
1940	John Langan begins aperture card experiments.
1942	Langan joins OSS, becomes chief of Washington office of the Pictorial Records Division of OSS soon afterward that same year.
1943	Langan begins development of aperture card.
	First aperture card system goes into operation in OSS.
1945-1946	Atherton Richards and Bill Casey acquire license from Langan and form Film 'N File, Inc.
1946	Barkley-Dexter, Inc. begins building aperture card machine.

	Langan begins work on aperture card system at *Look* magazine.
1947	St. Louis Police Department installs aperture card system.
1948	Idaho Title installs aperture card system.
1949	Arthur H. Rau of General Electric offers idea, suggestions for placing engineering drawings on aperture cards.
	Hamilton Standard, Division of United Aircraft Corp., installs first aperture card system for engineering drawings.
	Heald Machine Company installs aperture card system, becomes largest user of cards in 1950s.
1950	First reader designed for engineering drawings installed at Hamilton Standard.
	D. W. McArthur joins Film 'N File in New York City.
	Film 'N File introduces microfilm jacket.
1951	Russ Ellsworth becomes general manager of Film 'N File.
	Film 'N File, Inc. becomes Filmsort, Inc. Company moves to schoolhouse on property of Dexter Folder Company.
	Dexter Folder Company acquires controlling interest in Film 'N File.
	E. P. Bassett sells microfilm jacket system to Inter-County Title, Guaranty & Trust Company.
1954	Ellsworth forms Microdealers.
	Standardization meeting held at Hotel New Yorker.
1956	Filmsort becomes Filmsort Division, Dexter Folder Company, a Division of Miehle Printing Press and Mfg. Co.
1957	McArthur becomes general manager of Filmsort Co.
	Filmsort sponsors seminar of military, industry, and suppliers in Spring Valley, N. Y.
	Filmsort becomes the Filmsort Company, Division of Miehle-Goss-Dexter, Inc.
	3M introduces first low-cost reader-printer (selling for less than $1,000), the Model 23, later renamed the "Filmac 100" Reader-Printer.
1959	Filmsort sponsors meeting of military and industry to launch development of improved diazo films.
	3M acquires Filmsort, and following equipment: hand mounter, semi-automatic mounter

(SAM), "085 Uniprinter," "Designer 184" and other readers.

3M introduces first reader-printer designed to turn out engineering size prints quickly and economically. This was the Model 29 (later renamed the "Filmac 200" Reader-Printer), which sold for less than $1,000.

"Filmac 100" and "Filmac 200" Reader-Printers replace old names, Model 23 and Model 29.

1960 — 3M and Filmsort product lines are merged under McArthur as Microfilm group of Duplicating Products Divison of 3M.

DOD 0009 committee publishes microfilm aperture card standards.

1961 — 3M introduces the following equipment: "Filmac 200R" and "Filmac 300" Reader-Printers, "Uniprinter 086" Copier, "041" Automatic Card-to-Card Printer and new hand mounter.

1962 — Microfilm group becomes Microfilm Products Division of 3M.

3M opens MicroForum, a microfilm systems development laboratory, in St. Paul, Minn.

3M introduces the "Filmsort 1000" Processor-Camera, a machine which films documents, automatically develops the film and produces it ready for use mounted in an aperture card.

1964 — 3M introduces "Filmsort 1000d" Processor-Camera, which films, develops and produces film in aperture cards in 54 seconds.

3M introduces Dry Silver Printing process, which makes it possible to produce 8½" by 11" prints from microfilm at about 2c a copy.

3M introduces the following products: "The Quadrant" Dry Silver Printer and the "Filmac 400C" Cartridge Reader-Printer.

1965 — 3M opens MicroForum in Washington, D. C. to bring its microfilm systems development laboratory to government and East Coast users.

3M introduces complete line of "Filmac 400" Reader-Printers, the "222" Dry Silver Printer, the "Filmsort 2000" Processor-Camera and "3M" Microfilm.

"111" Dry Silver Printer replaces "The Quadrant."

1966 — 3M introduces the "333" Dry Silver Printer, which provides low-cost prints automatically on Dry Silver paper.

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CHAPTER 1

IN TIME OF WAR

It was early 1942, soon after the Japanese attack on Pearl Harbor. The United States, suddenly plunged into World War II, needed every bit of intelligence it could gather about enemy-occupied territory. This responsibility fell upon a new organization, the Coordinator of Information (COI) in Washington, D.C., headed by playwright and author Robert W. Sherwood. Sherwood's voluntary advisor was Richard de Rochemont, producer of the newsreel feature "March of Time."

Meanwhile, on the West Coast a classification expert named John F. Langan was trying to develop an efficient method of filing and retrieving stock films held by the motion picture industry. De Rochemont was familiar with Langan's work because of its possible application to the "March of Time" film file and because the two men had been friends since boyhood. In the spring of 1942 at de Rochemont's request Langan joined the COI in Washington.

Rapid growth soon caused some functions of the COI to be transferred to a new agency, the Office of Strategic Services (OSS) headed by the legendary William "Wild Bill" Donovan. In the summer

of 1942 Langan became chief of the Washington office of the Pictorial Records Division of OSS.

The Pictorial Records Division's job was to acquire as rapidly as possible all photographs of strategic military value and make them available on request to Army and Navy intelligence. A properly identified photograph of an enemy bridge or hydroelectric installation was, almost literally, dynamite in the hands of the Allies.

Every possible source of photographic information was tapped. OSS agents searched the files of United States firms with factories in Axis territory. Photographs were forwarded to Washington from agents in neutral countries or from counterintelligence agents who took the pictures on the spot in occupied countries. The OSS also appealed to American tourists for any pictures they might have taken abroad. Even in the 1930s it was quite easy to identify an American tourist by the camera slung around his neck.

The result of that appeal exceeded expectations. Americans, possibly gratified to know that somebody actually *wanted* to see their vacation pictures, responded nobly. The OSS was buried under an avalanche of photographs ranging from the tiny snapshots to large prints. Useless pictures of monuments and crowds waving from tour buses were weeded out. Standard 8" x 10" glossy prints were made from those which were considered valuable.

By the end of 1942 more than half a million photos were received each month by the OSS. Four hundred thousand were discarded, leaving 100,000 to file. When the spring of 1943 arrived, the number of photographs to be filed each month had risen to 250,000. Photographs were stacked on floors because of the shortage of space and filing clerks. It was impossible to fulfill requests from Army and

Navy intelligence properly and promptly. The overburdened system had broken down.

At that time the Pictorial Records Division was transferred to the control of the OSS Central Information Division headed by Dr. Wilmarth Sheldon Lewis. An internationally known scholar and a national educational figure, Lewis threw the full weight of his prestige and influence into finding a successful solution to the problem. Roll microfilm could not be used because the photograph files had to be readily accessible so that new material could be added and specific photos removed when they were required for intelligence. But that did not preclude the use of microfilm in some other form.

In 1940, while working on the problems of the motion picture industry, Langan had begun experimenting with the possibility of mounting a frame of film in a tabulating card. Although the idea was not new — it had been suggested as early as 1934 by Dr. Atherton Seidell — it had never been made practical.

Early in 1943, with Lewis' encouragement, Langan began experimenting in earnest with ways of adhering a frame of microfilm in an aperture cut into a tabulating card. Using an IBM installation in the Central Information Division, he located a neutral area on the card which would not come into contact with transporting mechanisms in the equipment. That area was selected for the aperture.

Next it was necessary to find an adhesive to adhere the microfilm in the aperture. The cards were uniformly 6.7 thousandths of an inch thick, and the standard thickness of cellulose acetate film was 5.5 thousandths. The difference left more than a thousandth of an inch, which was ample room for an adhesive.

Every known pressure-sensitive adhesive was

tried without success. Then luck entered the picture. Langan happened to see large sheets of plastic adhesive in the basement of the National Archives Building to which his unit of the OSS had been moved. Used to laminate valuable documents for preservation, this material proved to be the very thing Langan needed.

He immediately made some three hundred microfilm aperture cards by cutting rectangular holes in tabulating cards with a razor blade, cutting microfilm frames, and adhering them in the apertures with the adhesive material found in the Archives. After running those microfilm aperture cards many times on IBM equipment without jamming the machines, he concluded that the project was feasible. It was a far cry from the technically perfect aperture card we know today, but it marked the birth of this exciting new microfilm format.

Langan proposed to Lewis that the Pictorial Records Division's tremendous file of photos be microfilmed and mounted in punched cards. He also presented the outline of a series of coding schemes for indexing the 80 columns in each punched card in such a way that cards would be automatically machine-selected by longitude, latitude, geographic location, and many other classifications. Lewis immediately approved the project. The next step was to call in IBM representatives concerned with government operations.

IBM proved of inestimable service in helping with the development of microfilm aperture cards at the OSS, although at first the firm's representatives said the project was impossible. If it were possible, they indicated, their firm would have done it years before. But after seeing the cards run on IBM equipment in the Central Information Division, they agreed to send them to IBM in Endicott, New York, for further testing. There the cards were run until they were almost worn out without jamming the equipment. IBM announced that it was ready to assist the microfilm aperture card project in every possible way.

The first microfilm aperture card system went into operation in the OSS in 1943. IBM provided punched cards with die-cut apertures. A crew of girls hand-mounted the microfilm in the holes. Without the new system, it is unlikely that the OSS would have been able to manage its voluminous files of strategic photographs.

Soon thereafter the Presentation Branch of the OSS requested that the system also be used to keep track of motion picture film taken from the enemy and obtained from other sources. In Lisbon, for example, an OSS agent bribed local movie house managers into letting him make overnight duplicate prints of all Axis newsreels. Of course, German agents were doing the same thing with Allied newsreels which were being shown with the Axis news films in the same Lisbon theaters.

Rushed to Washington by plane, the Axis newsreels were classified by scenes. A representative frame of each scene was duplicated from the film with a special camera devised and constructed by Langan. These film frames, mounted in aperture cards, were used for many purposes. For example, if a request were received for a shot of a bridge in occupied France that the allies wanted blown up, the cards were mechanically sorted at high speed to segregate all "bridge" cards. The film in the cards was then projected on a screen to select the exact shot wanted. The card itself contained the number of the can of film from which the shot had been duplicated.

A number of other government agencies expressed interest in the microfilm aperture card system. They included the Navy Photo Science Laboratory at Anacostia, the Department of Foreign Languages of the U. S. Naval Academy, the Map Section of the OSS, the Bureau of the Budget, the Marine Corps, the War Crimes Commission, and the FBI. The microfilm aperture card system invented by Langan had a significant impact on government wartime operations. In the Fifties and Sixties government was to become a major user of aperture cards.

Like so many other developments of the early Forties, "the hole in the card" was a war baby spawned by the urgent needs of national survival. It was one more bit of proof that necessity is the mother of invention. The situation changed, however, when the war ended. Like many other veterans, the microfilm aperture card had to look for a job. This reversed the adage. The microfilm aperture card became an invention in search of a need.

CHAPTER 2

FILM 'N FILE FORMED

The deputy director of the OSS during World War II was Colonel Atherton Richards, a man of independent wealth, high connections and vast imagination. As president of the Hawaiian (now Dole) Pineapple Company in the early Thirties, he had been mainly responsible for the development of the United States as a market for pineapple juice. He also had deep roots in Hawaiian real estate and banking and was active in the operation of a number of mainland firms, including the Intercontinental Hotel Corporation which he served as a member of the board of directors.

Richards had a penchant for developing new products. He also had capital to invest and a tax incentive to invest it. During his tour of duty as OSS deputy director, Richards was impressed with the information-handling potential of the microfilm aperture card system developed by Langan. He discussed the system with a friend, William J. Casey, who was OSS Chief of Intelligence in the European Theater. Following the war Richards and Casey decided to invest in the system's commercial development.

They acquired a license from Langan, who had

applied for patent rights on the system during the war, and formed Film 'N File, Inc. There were none of the usual trappings of a commercial enterprise. There was no manufacturing plant, no sales force, and no office staff. There wasn't even a market. But the men believed that the system which had served the wartime intelligence purposes of the OSS so well could do a similarly good job in peacetime.

The first step was to develop a product line. Barkley-Dexter, Inc., an engineering consulting firm in Boston, was initially requested to undertake the design and development of equipment for making aperture cards, mounting the microfilm in the cards, and viewing the unitized product. Langan had this project under way before he licensed Richards and Casey.

About this time Langan, who did classification work for various publishers, was asked by *Look* magazine to develop a system to handle the publication's voluminous picture files. *Look* envisaged making prints directly from microfilm. However, the quality of prints made from the microfilm of that time could not be brought up to the magazine's high standards. Eventually an aperture card system was installed at *Look*, but it was not used as originally planned.

On a tour of *Look's* printing facilities, Richards noted the extensive paper-handling equipment in the magazine's bindery. It occurred to him that a firm which could build that kind of machinery might be able to design and manufacture equipment for making, mounting, and reading aperture cards.

The paper-handling equipment manufacturer was the Dexter Folder Company of Pearl River, New York. Its president, George Heintzemann, was

a far-seeing executive interested in developing new products. He saw microfilm as a means of reducing printing costs because, if printing plates could be stored on microfilm instead of in "standing" form, a great storage saving could be effected. When Richards approached Dexter, Heintzemann agreed to design and manufacture a line of microfilm equipment.

What were the requisites for successfully selling microfilm? From the founding of Film 'N File, that was a subject of continuing discussion. The aperture card represented a "marriage" of systems and microfilm. Would the ideal salesman be a man experienced in systems work? Or should he be a microfilm expert? The controversy was to go on for years.

The first continuing sales effort on behalf of Film 'N File was conducted by an independent microfilm dealer in New York City, Richard W. Batchelder, president of Graphic Microfilm Corporation. In 1937 Batchelder set up and incorporated his own commercial photographic studio and laboratory in Cleveland, Ohio. He sold out in 1941 to establish the original microfilm laboratory of the Microstat Corporation of Ohio. In 1943 he joined the Graphic Microfilm Corporation as general production manager. Two years later he became its president and major stockholder. During the war Batchelder served the OSS as a part-time civilian microfilm expert. Consequently, he came into contact with Langan and his aperture card system.

The operations of Film 'N File later centered in New York City where Richards had many business interests. Casey was an executive with the Research Institute of America, and Langan was doing consulting work. So Batchelder's Graphic Mi-

crofilm Corporation was a logical choice as Film 'N File's first sales agent.

The results of sales efforts in this early period were practically nil. For a time Langan worked on sales out of the Graphic offices but his luck was no better than Batchelder's. The inventor did, however, make the initial approach to the McBee Company which later agreed to handle nationwide distribution of Film 'N File microfilm aperture card systems.

All the essential ingredients of commercial success – except one – were present. There was a product: the Film 'N File microfilm aperture card system. There was a manufacturing facility: Dexter Folder Company. There was a national sales and distribution arm: McBee Company. What was missing? A market. Who would use microfilm aperture card systems?

At that point Film 'N File hired its first employee. A former newspaper reporter on the *Boston Evening American*, A. X. "Robbie" Robbins, had been attached to General Eisenhower's headquarters during the war. Throughout his Army experience, he had been impressed by the fact that the paper-work "explosion" caused by the war effort had made the problems of operating an Army in the field almost unmanageable. The microfilm aperture card concept evolving in the OSS independently occurred to Robbins as a possible method of handling administrative paper work.

Putting his newspaper career behind him after the war, Robbins went job-hunting in New York City. Chance took him to Casey's office at the Research Institute of America. There was no writing job open at the Institute, but Casey was looking for a man to study aperture card applications.

"You're not really interested in a writing job, are you?" he asked as the conversation moved along.

Robbins agreed.

"What are you interested in?"

It seemed like nothing more than an opportunity for conversation, but Robbins told Casey his idea for a unitized business record combining microfilm and punched cards.

"I've got just the man for you," Casey said.

The man, of course, was Richards, who hired Robbins after a brief interview. By then Film 'N File had an office at 330 West 42nd Street in the McGraw-Hill Building.

The company's first employee was given the job of making application studies in business and industry. The problem was that nobody seemed to know what to do with microfilm aperture cards. In all of American enterprise there was no one who could even visualize a potential use, much less justify the installation of a system. The aperture card was a completely new and utterly different type of product. It was so new, so far ahead of its time, that it repelled potential customers.

It is one thing to sell a man using an accounting machine on the additional benefits he can derive from a computer. The computer is a logical and orderly step forward. It was an entirely different thing to sell a man an aperture card system which required the complete disruption and replacement of his previous paper-work procedures. There were few people who could be convinced that a little patch of microfilm mounted in a card was a more efficient record keeper than a piece of paper.

This still is an obstacle, so it can be imagined what a problem it was in the Forties. Nevertheless, the people at Film 'N File reasoned, they

had combined two proven and successful products — the punched card and microfilm. How could the aperture card fail?

The picture was not all negative. In 1947 the St. Louis Police Department, working with the McBee Company, installed a Film 'N File microfilm aperture card system for "mug" shots. The system tremendously improved and speeded up criminal identification. It came to the attention of hundreds of police officials throughout the country but led to no immediate sales. It was an isolated instance of success, a brief glimmer of things to come.

How success was to be achieved was not apparent in 1947. It was to be almost twelve years before sales of microfilm aperture cards were to produce a profit.

"We really had little or no experience in the microfilm field," recalls Robbins, who still is in the business of developing new uses for aperture cards as a market supervisor for the Microfilm Products Division of the 3M Company in St. Paul, Minnesota. "The whole microfilm business was, of course, in roll form. The big advantage of the roll was absolute security. Individual items or documents couldn't get lost or misplaced because they were all recorded collectively in a batch. Yet there we were, without experience, telling people they should cut up their microfilm in little pieces and put it in cards. We had a lot of faith but not much market research."

CHAPTER 3

THE "TAKE-OFF"

John B. Bell had a problem. He wanted to open title offices throughout Idaho, but a state law required that each office have a complete record of all titles in its area. Bell, who was president of Idaho Title Company, Boise, needed a fast, inexpensive method of "taking off" abstracts of recorded deeds.

At that time he was using a manual method. One of his clerks would go to the courthouse and "take off" abstracts in summary in shorthand. The abstracts were brought back to Idaho Title's office and posted in tract indices for examination purposes. It was time consuming, laborious, and often inaccurate. It also cost about 19½ cents an instrument.

The obvious answer was photography, which was not new to the title field. Photography, however, had drawbacks. If a paper photocopy method was used, the material cost was high. To save money on photocopy paper, some title companies used reduced-size photoprints. But that made title information difficult to examine.

Microfilm had none of the disadvantages of photoprints. It was inexpensive and small, but could be

viewed at the same size as the original or larger. However, only roll microfilm was used in the title field at that time. Consequently, instruments needed for examination could be on two or more rolls. Several rolls of microfilm, each containing 1,600 pages of deeds, might be tied up while one title chain was being traced.

"Roll microfilm is a big savings on take-off, but it slows up examining," Bell said. "It is too inflexible, too inaccessible, too much trouble."

The fact that a roll film system wasn't practical had been proved in 1943 at Commonwealth, Inc., Portland, Oregon, where Russell Ellsworth, one of Bell's officers, installed the first microfilm system ever used by a title company. Both Bell and Ellsworth then experimented, trying to put film on a card or in strips.

About that time Ellsworth heard of aperture cards. He contacted Business Engineers, a Salt Lake City consulting firm and McBee-franchised distributor of Film 'N File systems. Bell and Ellsworth were given a demonstration and were impressed. But it was immediately apparent that new cameras, mounters and viewers would have to be designed and built to handle instruments in the title field. And the hole in the Film 'N File card was too small for oversized titles and abstracts. Another factor was that a camera would have to be installed in each county in Idaho. Since it would be used only about an hour a day, this equipment would have to be inexpensive. In addition, it would be necessary to remove as few as ten or twenty frames of exposed film each day without exposing the rest of the roll. These problems appeared minor, however, compared to the advantages of aperture cards.

Bell and Ellsworth moved swiftly. They set up a subsidiary, Micro-Record, Inc., and made ar-

rangements with McBee for sole distribution rights for Film 'N File systems in the title and abstract business. The two men from Idaho agreed to purchase millions of aperture cards if Business Engineers could deliver 300 inexpensive viewers and 100 inexpensive cameras with cut-off devices. After several months, Bell and Ellsworth decided that McBee could not produce the equipment. In the meantime, they experimented unsuccessfully on their own with a small 35 millimeter camera and several readers.

Then at a meeting with William Bracy, president of Business Engineers, they asked Bracy if he knew anyone capable of designing and building a microfilm camera and viewing equipment for use with aperture cards and applicable to the title field.

"We have a man in the back room who can do it," Bracy told them. The man in the back room was Donald W. "Scotty" McArthur, Business Engineers' service manager. A native of Park City, Utah, McArthur had attended the University of Utah and was the recent recipient of an International Correspondence School engineering degree. He had distinguished himself through his "back room" ability to modify and improve equipment serviced by Business Engineers, but of photographic or microfilm experience he had none. Yet Bell and Ellsworth commissioned Business Engineers and McArthur to build a microfilm camera and viewer.

Rostenberg's, Inc. was selected as the subcontractor, and McArthur was given space in that firm's Salt Lake City plant. He hired a draftsman and went hunting for microfilm knowledge at the Temple of the Church of Jesus Christ of Latter Day Saints in Salt Lake City. At that time, as it is today, the Mormon Church was one of the biggest

microfilm users in the country because of its extensive genealogical records of its member families.

Most microfilm cameras of the period used as much film per frame as needed, varying according to the size of the document being photographed. There was no such thing as "constant pull-down." McArthur designed the first microfilm camera geared specifically to aperture cards. The length of film "pulled down" for each frame was constant and matched the size of the aperture.

McArthur's camera also allowed the exposed film to be removed each day without affecting the rest of the roll. The exposed film used for the day's "take-off" was in a magazine equipped with a cut-off device. A simple turn of the light-tight magazine released it from the camera. In addition, the camera was capable of making "partial" exposures so the front and back of a document could be photographed on the same frame of microfilm. Finally, and most important, it was extremely inexpensive, selling for less than $700.

McArthur also went on to develop a low-cost aperture card reader.

Early in 1948 Bell installed the first aperture card system in the title, abstract, and insurance business. McArthur's camera and viewing equipment, and a card mounter built by Dexter Folder Company, comprised Bell's system. Later installed in each of Idaho Title's nine branches, the system enabled the title company to substitute microfilm for drudgery, complete records for sketchy abstracts, and accuracy for guesswork. In addition, the aperture card system cut "take off" costs from 19.5 cents to 3.9 cents per instrument and greatly speeded up and simplified title examinations.

Meanwhile, operating through Idaho Title's Micro-Records subsidiary, Ellsworth went on the road

to sell aperture card systems to other title companies in the Far West. Within three years more than fifty firms installed them.

On a trip East to visit the McBee Company in New York City, Ellsworth stopped off in Pearl River at the Dexter Folder Company. There he told Heintzemann about the camera and viewing equipment developed by McArthur. The Dexter president asked to see the drawings. Ellsworth phoned McArthur and told him to come East.

McArthur visited the Pearl River plant in July, 1949, and showed Dexter's chief engineer, Leonard Baker, the equipment drawings. Dexter Folder contracted to build 300 units over the next several years. This was in addition to the 100 units which were built by Rostenberg's in Salt Lake City.

In November, McArthur was back East as a representative of Micro-Records to demonstrate a microfilm aperture card system at a title company show in Atlantic City. It was on this trip that he and Robbins began a friendship which still exists.

The trip was not without its misadventures. McArthur had to be in Rochester, Minnesota, early the next week for a demonstration at the Mayo Clinic, and in Spokane, Washington, later in the week for another title company show. A Sunday in New York was open, so he, Ellsworth, and Robbins agreed to attend the last game of a best-of-three series between the Boston Red Sox and the Yankees. The winner would claim the American League pennant. Robbins was a Red Sox fan dating from his days in Boston. McArthur, then as now, backed the Yankees. Before the game Robbins had to handle the chore of getting the microfilm equipment which had been exhibited in Atlantic City on a train to Minnesota.

The equipment arrived late Saturday night at Grand Central Station. Robbins was there Sunday morning to transport it cross-town to Penn Station for the trip to Rochester. As luck would have it, that Sunday was the day of the Pulaski parade in Manhattan. It was impossible to get a taxi.

Robbins had given up hope of getting to the ball game when a Nedick's vending truck, laden with hot dogs and soft drinks, parked at the curb in front of Grand Central. Robbins quickly propositioned the driver. For a sum of money he no longer can remember, he bought the entire stock of buns, hot dogs, mustard, and soda pop. With the help of the driver he stacked them on the curb and loaded the microfilm equipment into the truck.

After an agonizingly slow trip down to the Bowery, across the island and back up to avoid the parade, Robbins arrived at Penn Station, quickly consigned the equipment, and caught a subway to Yankee Stadium. He arrived in time to see the Sox bow to the Yankees in a late inning.

McArthur and Ellsworth left for Rochester that evening, but McArthur and Robbins were soon to be reunited. In the summer of 1950 Richards came through Salt Lake City and met McArthur for lunch. Later the two men sat in a park in front of the Temple and discussed the future of microfilm aperture cards. Richards offered McArthur a job as chief engineer at Film 'N File. It was an offer which McArthur seriously considered and finally decided to accept. In October he drove to New York City ahead of his family and found a room in a little hotel on Times Square from which he reported for work.

That decision set in motion a chain of events which led McArthur to his present position as vice-

president of the Microfilm Products Division of the 3M Company. The division is a direct descendant of Film 'N File, which 3M acquired in November, 1959. But in 1950 when McArthur joined Robbins and a recently hired sales manager at Film 'N File, the eventual acceptance and success of the aperture card in later 3M years was not even a dream. The immediate business at hand was finding out where the next sale was to come from.

CHAPTER 4

BY THE MILLIONS

Although microfilm was a striking success in the title business, that first major break-through represented only a narrow strip of the potential for microfilm in all of America's business and industry. Title companies were to remain an important source of microfilm aperture card sales, but Film 'N File management soon recognized that no real future could be built on this market alone. So even as the title business was growing other uses for microfilm aperture cards were actively explored.

Among Richards' many high-level business acquaintances was Charles E. Wilson, president of the General Electric Company, Schenectady, New York. One day Richards showed Wilson a Film 'N File microfilm aperture card. Did GE, he asked, have a possible use for such an item? Wilson sent the colonel to Arthur H. Rau in the firm's general engineering division.

Impressed, Rau began searching for possible uses for the interesting card. Richards had discussed with Rau a variety of cards with many different kinds of apertures. For example, the original OSS unitized microfilm records were on conventional punched cards. So were the cards used

by the St. Louis Police Department. Idaho Title was using 3"x 5" McBee "Keysort" cards for its records. There were many other cards, varying in size, number, shape, and location of apertures.

Richards and Robbins were persistent. They visited Rau frequently in 1947 and 1948. They kept repeating their theme that conventional business record keeping represented an immediate market for aperture cards. These included records in the areas of accounting, purchasing, sales, production and inventory control, personnel, and so forth.

But early in 1949 it dawned on Rau that the biggest potential application of the cards was for engineering drawings. At that time GE was recording all its engineering drawings and documents on roll microfilm for security purposes. Rau had begun to suspect, however, that all the roll microfilm which was being "squirreled away" might, because of its inflexibility and inaccessibility, prove to be utterly unusable in the event of an actual disaster.

It was simple arithmetic to work out the requirements for a microfilm aperture card for engineering drawings. First of all, Rau told Richards and Robbins, Film 'N File would never be able to get anything bigger than a B size (12" x 18") engineering drawing on 16mm microfilm. They had better start thinking about 35mm microfilm, Rau said.

Secondly, Rau asked, what was the minimum reduction ratio which would be required for General Electric engineering drawings to be photographed on 35mm microfilm? At that time GE's largest drawing size was 36" by 48". Rau performed the necessary calculations and came out with a reduction ratio of about 29 to 1 (29X).

Now, he continued, what was the maximum reduction an engineering drawing could undergo and still be readable when enlarged? That, Rau said from his experience with roll microfilm, was in the neighborhood of 30X.

Supposing a reduction ratio of 30X is selected, Rau suggested. He pointed out that this automatically established the size of the aperture required to microfilm a 36" x 48" maximum-size engineering drawing. In rounded fractions, this came to 1¼" x 1⅝".

Finally, Rau concluded, there was no point in using a lot of different hole sizes. He urged Film 'N File to standardize on one hole size and vary reduction ratios to handle different size drawings.

It is interesting to note that eleven years later, after countless thousands of man-hours had been expended on the development of uniform microfilm aperture card standards for engineering drawings, the final specifications for aperture size varied less than one-quarter inch from the figures Rau worked out on his desk top in 1949. In addition, the eventually published standards included 30X as the maximum of four specified reduction ratios.

Richards examined Rau's calculations and asked him to estimate the potential for aperture cards at GE. "If you can develop microfilm aperture cards that will handle engineering drawings," Rau told him, "the General Electric Company will buy them by the *millions.*"

Richards and Robbins flew back to New York City. Whether they required an airplane is not clear. With GE as the starting point, the market for engineering drawings on microfilm would be tremendous. Development began at once.

Before Rau made his pronouncement in Schenectady, engineering drawings had been consid-

ered only vaguely as an aperture card application, but sales and engineering efforts were to be increasingly directed at that first big market for aperture cards. Rau's vision led to an eventual usage measured in hundreds of millions of aperture cards. And 100,000,000 of that total was to be accounted for by GE alone.

The prospect of such a potentially vast new market accented Richards' dissatisfaction with Film 'N File's past sales record. Richards had arranged a sales and distribution tie-up with the McBee Company because its salesmen were experienced in office systems. Yet, with few exceptions, McBee sales people had failed to persuade business and industry to switch from the known quantity, paper, to the unknown aperture card. Actually the agreement between Film 'N File and McBee was not profitable for either. By mutual consent it was terminated in 1949. At that time McBee's microfilm sales manager, Dave Decker, transferred to Film 'N File.

McBee indirectly contributed to the future of Film 'N File. In McBee's product line was the "Keysort" card. One day Casey and Robbins were "brainstorming" to find a trade name other than "Film 'N File" for microfilm aperture cards. They came up with "Filmsort," which has worn well through the years. Eventually Film 'N File became the Filmsort Company, and today "Filmsort" still is a 3M trademark.

At the beginning of the 1950s other changes were taking place. The inventor of aperture cards, Langan, sold his patent rights to Richards and moved to Georgia to raise cattle. The Dexter Folder Company was increasingly taking stock instead of cash in payment for the microfilm aperture card equipment it developed and produced for Film

'N File. Dexter was gradually escalating from a junior to a senior partner in the firm.

In addition, when the McBee relationship was terminated, Richards asked Ellsworth of Micro-Records and Idaho Title Company to take on the added responsibility of setting up independent distributors around the country. Ellsworth was selling microfilm aperture card systems to title companies throughout the Far West. As the only salesman who was actually achieving some success, he seemed a logical choice to the colonel.

Over the course of time Richards had become just about convinced that the market for aperture cards would only be cracked by "systems" salesmen. However, he saw some wisdom in occasionally picking up independent microfilm as well as business systems dealers, if only to test their experience, know-how, and sales results. The vast engineering market was beckoning. He was willing to try any possible sales avenue.

Up in Waltham, Massachusetts, there was a microfilm dealer organization called Graphic Microfilm of New England, Inc. Once the main office from 1936 to 1942, it became the branch office of the New York headquarters and later of Batchelder's Graphic Microfilm Corporation in New York. In 1949 Richards placed a long distance call to Joseph F. Curtin, the firm's president. It was one of the most important phone calls the colonel ever made for Film 'N File. It led to the first sale in the engineering drawing market.

CHAPTER 5

A DOLLAR'S WORTH OF GAS

Graphic Microfilm of New England, Inc. perches on a rolling incline overlooking State Highway 128 in Waltham. From that location outside Boston it serves the states of Maine, New Hampshire, Vermont, Rhode Island, and Connecticut, as well as Massachusetts. The second oldest microfilm company (Recordak is the oldest), the firm does approximately $1,000,000 worth of business, employs 65 people, and operates one of the largest and most modern microfilm laboratories in the country.

The backbone of the company's sales growth over the past fifteen years has been the aperture card. "It is today our major source of business, the key to our success," Curtin says.

Some would say that fate played a part. Curtin might agree. For example, one lazy New England afternoon in the summer of 1949 the future sales success of his firm hinged on a dollar's worth of gasoline.

The story begins in 1940 when Curtin joined Graphic. Founded in 1936 with six people, the firm had just moved to Waltham from its original loca-

tion in Boston. After World War II began, there was a tremendous demand for microfilm. In 1943 Graphic Microfilm, grown to forty-five employees, moved its main office to New York City, where it could better serve the Empire State and government agencies in Washington, D. C. The Waltham location was retained as a branch to serve New England.

In 1945 Batchelder became president of the company. Curtin returned from duty with the Air Force. The war had ended, and the demand for microfilm began to shrink. By 1947 there were only six people working in Waltham, and the branch became a separate corporation with Curtin as president. Batchelder's New York operation became Graphic Microfilm Corporation.

The following year Curtin was sitting in the lobby of a New England clock manufacturer. Next to him a salesman was talking to the office manager. The salesman was holding a McBee "Keysort" card with a frame of microfilm mounted in it. It was the first aperture card Curtin had ever seen. He couldn't help overhearing the ensuing conversation as the McBee salesman explained the principle of attaching the record to the key to its location. Curtin, his mind working furiously, got the general impression that the salesman didn't know any more than the office manager about what to do with the card.

At that time a large volume of work being done by Graphic Microfilm of New England was recording engineering drawings on roll microfilm for security. Curtin immediately saw the possibility of using aperture cards to provide drawing accessibility as well as security.

Back in Waltham, he dropped in on the local McBee sales manager and offered to supplement

his coverage in the New England states. The manager was delighted because his own men didn't call on engineering departments, but McBee's home office scotched the proposal. Headquarters said pointedly that it had a national sales organization with direct distribution.

Although his interest was undiminished, Curtin was unable to do anything further until early 1949. Then, while on a sales call in Bangor, Maine, he received a long-distance phone call. On the other end of the line was Richards in New York City.

Film 'N File had just terminated its relationship with McBee. The firm was still going the "systems" route but was also picking up a few selected microfilm dealers around the country. It now looked like engineering drawings might be a major aperture card application. Would Curtin be interested in taking on a New England dealership for Film 'N File?

The answer was yes. Curtin had decided that only through the "systems" approach would the microfilm field grow and prosper. The aperture card seemed to be the key to this approach.

However, Curtin felt that teaching "microfilm" to "systems" people was putting the cart before the horse. He believed that the best approach was to get "microfilm" people and teach them "systems." To prove his point he made a major decision. He decided to devote 50 per cent of his sales time to attempting to convert present engineering drawing customers to aperture cards. That conversion was to take time.

Meanwhile, Film 'N File was working closely with Rau of General Electric in the development of card-mounting and processing equipment. However, no sales of microfilm aperture cards for en-

gineering drawing applications were being made anywhere.

Six months elapsed. Then one day Curtin received a phone call from Decker, Film 'N File's new sales manager. Decker wanted to spend a day in the field visiting Curtin's "hottest" engineering drawing prospects. Curtin suspected that Decker was really on a mission to scratch Graphic Microfilm of New England from Film 'N File's distributor list. He could almost feel the ax.

Curtin's three "hottest" prospects were in three counties and two states. Nevertheless he set up the appointments for Decker's arrival. Only recently departed from McBee, Decker was still used to talking to twenty-five or fifty salesmen at a crack in the field. Curtin had only six people in his whole company. When Decker arrived, Curtin brought his vice-president and his office manager to an early morning meeting with the Film 'N File sales manager. The three tried to act like thirty. Then Curtin went with Decker for a ride – possibly his last as a Film 'N File distributor.

The Graphic Microfilm president realized Film 'N File wanted no more talk, but that was all he and Decker got at their first two stops in Ashland and Worcester, Massachusetts. The reception at both companies was the same. "These cards are fascinating," they were told. "Maybe some day we'll be able to sell management."

Decker was not pleased. Not only were prospects saying the wrong thing, but he was spending a whole day being driven all over the countryside, from county to county and state to state, to hear them say it.

It was mid-afternoon when Curtin pointed his car in the direction of East Hartford, Connecticut, fifty-five miles southwest of Worcester. In East

Hartford was the Hamilton Standard Division of United Aircraft Corp., the last call of the day.

An uncomfortable silence settled in the car as it nosed into the setting summer sun. Gentle peaceful farm lands rolled by as Curtin grimly considered the possibility of six months concentrated sales effort going down the drain. He returned from his reverie at the sound of the motor coughing and cutting off. The car had run out of gas.

Curtin glanced at his watch. It was 3:30 P. M. That was when he decided it was just going to be one of those days. Fortunately there was a farmhouse close by. He and Decker walked back and bought a dollar's worth of gasoline. They arrived at Hamilton Standard at 4:00 and were ushered into the office of the supervisor of engineering records, Henry H. Clark.

Hamilton Standard was in a very overcrowded location in East Hartford. The firm had run out of space for storing original engineering drawings. Clark had been toying with the idea of using microfilm as a method of storing original but inactive or obsolete tracings. He knew the space-saving advantages of microfilm because Hamilton Standard had for many years been using it in roll form for security purposes. However, to find drawings stored on microfilm rolls required the development of an extensive indexing system, a cumbersome and complicated procedure which Clark wanted to avoid. It was at this time that Curtin had made a call and dropped a "Filmsort" aperture card on Clark's desk. From Clark's standpoint, it couldn't have been at a more opportune time, for the "Filmsort" cards could be filed and found by location, eliminating the need for an index.

Now Curtin and Decker sat down in Clark's office. The engineering records supervisor turned to

Curtin. "I have good news for you. I have been authorized to issue an order for 25,000 'Filmsort' microfilm aperture cards," Clark said. The Graphic Microfilm president almost fell off his chair. "We will use them to replace inactive and obsolete drawings. This will enable us to remove these drawings from our files but still retain accessible reference to them by means of the microfilm aperture cards. At the same time we will be making room for newly created tracings. I talked this over with our management and they simply said: 'Anything you can do to save space, go ahead.'"

It was the first sale of aperture cards for an engineering drawing application. In terms of the futures of Graphic Microfilm of New England, Film 'N File, and the engineering drawing market for aperture cards, it was an occasion to be recorded in history.

Elated, Curtin and Decker left to celebrate. The fact that the order amounted to less than $200 was forgotten. The significant point was that now there was a user.

Over cocktails, Decker admitted to Curtin that the sale had relieved him of the unpleasant duty of cutting off Graphic Microfilm's dealership. He added that he was personally pleased because he had great faith in the future of microfilm aperture card systems. Several years later Decker joined Graphic Microfilm of New England and worked out of Waltham until 1955.

Hamilton Standard mounted microfilm frames of engineering drawings in 3¼" x 5" cards. Drawing numbers and other engineering data were manually entered on the cards. Initially the firm converted an existing roll microfilm viewer to read the aperture cards. Simultaneously it placed an order with Graphic Microfilm for a new reader adapted

to its needs. This reader, the first one designed specifically for engineering drawings, was installed at Hamilton Standard in 1950. It had a 14" x 14" screen on which drawings were viewed, a section at a time. It also had variable magnification. Out of the initial experience of Hamilton Standard with this unit grew further viewer refinements and improvements.

For example, Curtin reported to Richards, who was now frequently consulting with the Graphic Microfilm president, that a viewer was needed which would show the largest engineering drawing in its entirety in addition to providing the variable magnification necessary for selected "blow-ups" of drawing details. Curtin also noted the growing need for a small viewer which might be placed at draftsmen's drawing boards in decentralized locations.

Following the sale to Hamilton Standard, other orders began coming in. Heald Machine Company in Worcester, the second stop on Curtin's one-day sales swing with Decker, bought 25,000 "Filmsort" cards later in 1949. Under the direction of engineering records supervisor Philip Hensel, Heald's initial use of the cards, which was basically the same as Hamilton Standard's, was to increase tenfold over the next couple of years, making the firm the largest user in the country in the early Fifties.

In succeeding years additional microfilm aperture card systems were installed at other New England firms, including Jones & Lamson Machine Company, Springfield, Vermont, Cone Automatic Machine Company, Windsor, Vermont, Brant Chucking Grinder Company, Springfield, Vermont, and General Electric's Medium Steam Turbine, Generator, and Gear Department in West Lynn,

Massachusetts. In 1947 the latter plant was to install the first mechanized and integrated microfilm aperture card system for reproducing engineering drawings by means of electrostatic printing. This was the advent of the microfilm aperture card's use as an active tool of information management rather than as simply a "passive" or "limited-access" storage device.

Today the Hamilton Standard Division of United Aircraft which provided the initial impetus for this revolution in engineering drawing management is located in a modern plant in Windsor Locks, Connecticut, where it relocated in 1952. Several hundred thousand microfilm aperture cards now take the place of original tracings and blueprint paper in the division's completely mechanized and decentralized engineering data-handling system.

Looking back on that summer day in 1949 when he placed the first engineering drawing order for "Filmsort" cards, Clark says: "It was anticipated that microfilm aperture cards were going to develop because they were the answer and solution to a problem. The way everybody is getting into the act now, you know they've come a long way. I'll tell you that."

CHAPTER 6

THE JACKET

Film 'N File entered the Fifties struggling to survive. The firm's sales were counted in tens of thousands of dollars, yet the combined investment in the microfilm aperture card business was rapidly approaching $1 million.

One of McArthur's first jobs when he joined the company as chief engineer in October, 1950, was to design a new line of improved microfilm aperture card equipment, including units tailored to engineering drawings. Out of this came the "Filmsort" Inspector, a small table-top viewer with an 11" x 11" screen, and two models of the "Filmsort" Surveyor, a larger unit with an 18" x 24" or a 24" x 36" screen. This equipment, manufactured by a New York subcontractor, Microtronics, and other "Filmsort" gear accounted for a significant increase in Film 'N File income during the early and middle Fifties.

Another "Filmsort" product unknown in the Forties played an equally important role in boosting sales. This was the microfilm jacket, consisting of two sheets of clear cellulose acetate bonded by ribs of extruded acetate to provide channels for inserting strips of 16mm or 35mm film. It came in

various sizes, including 3" x 5", 4" x 6", and 5" x 8". As many as 120 pages 8½" x 11" in size could be reduced to strips of 16mm microfilm and fitted into a single 5" x 8" "Filmsort" jacket. Capable of being viewed on a reader just like a microfilm aperture card, the jacket provided a way to store multipage documents in a compact, unitized microfilm record.

The idea for the jacket had occurred to McArthur while he was in Idaho developing microfilm aperture card equipment for the title field. As Film 'N File chief engineer, he directed the expenditure of considerable time and money in developing the new microfilm medium.

The job of introducing the jacket fell to Earl P. Bassett, a sales manager hired by Richards in mid-1951 when Decker, who formerly held the title, left Film 'N File to join Curtin's New England microfilm operation. Bassett had a typically abrupt introduction to the microfilm aperture card field. Discharged from the United States Coast Guard in 1946, he worked as a printing salesman in Los Angeles until 1950. Then he answered a newspaper ad for a salesman in the business forms field. He was interviewed by the owner of Business Systems, Inc., a man named Nelson, who took him to a back room where a jumble of equipment was pushed up against a wall.

"See this stuff?" Nelson gestured. "Some guy with a wide tie out of the hills of Idaho brought it in here and I don't know anything about it. Do you?"

Because he had been a photographer in the Coast Guard, Bassett was able to identify the equipment as microfilm gear. He was hired on the spot.

The "guy with the wide tie out of the hills of

Idaho" was, of course, Ellsworth carrying out Richards' instructions to set up independent dealers around the country. Soon afterward Ellsworth came back to Los Angeles, took Bassett and a bottle of bourbon up to his hotel room, and wound the young salesman up "tighter than a tick" about the future of "the hole in the card." Fired up, Bassett charged out to sell microfilm aperture card systems. He met the same response wherever he went: "It's a heckuva idea but who's using it?" Aside from title companies, there were no other users on the West Coast.

Bassett did sell a title company in San Bernadino, California, and such "oddball" applications as a "film clip" installation at Warner Brothers studios. When Ellsworth switched the Film 'N File dealership from Business Systems to a Los Angeles stationery supplier, Grimes-Stasfuth, Bassett went along as the aperture card salesman. Late in 1950 at Ellsworth's request he left Grimes-Stasfuth, went on the payroll of Micro-Record (the subsidiary set up by Idaho Title), and began selling title companies all over the Far West. This was a period when dollars were scarce in the aperture card business; Bassett traveled by bus from town to town carrying a viewer and a hand mounter as demonstrators. When he sold his demonstrator, a phone call to the home office alerted them to send another on the next bus.

Bassett, who was originally from the East, decided to go back there in July, 1951. He had met Richards on a previous trip, but Ellsworth told him there were no openings on the Film 'N File New York staff. Determined to return home, Bassett resigned.

A few minutes later, Ellsworth called him. "The

Colonel wants to see you when you get there," he said.

Bassett got the job, but he paid his own travel expenses to New York. "It was a concise lesson in corporate cost-cutting," Bassett said years afterward.

In New York he joined McArthur and Robbins in Film 'N File's three-man office in the McGraw-Hill Building. Richards directed company operations from the office he occupied as a board member of Intercontinental Hotel Corporation in the Columbia Carbide Building next to Grand Central Station.

The problem confronting the new sales manager was the usual one: how to get more business. There were approximately fifty title companies in the Far West using "Filmsort" microfilm aperture cards. Curtin had sold Hamilton Standard and Heald Machine, and Batchelder's Graphic Microfilm Corporation was actively beating the bushes. But the engineering drawing market in the New York area was a tough nut to crack.

Bassett decided to continue to sell title companies. He was advised against this because the title field in the East was radically different from the West where Bassett had gained his experience. For one thing, the daily "take-off," common in the West, was not prevalent in the New York area. Secondly, eastern title companies were old and settled; those in the West were booming.

Bassett made one call at New Jersey Realty and Title Insurance Company in Trenton, and another at Inter-County Title, Guaranty and Trust Company on Church St. in Manhattan. At the latter firm he met Tom Quinn, president. Because aperture cards weren't moving, Bassett pulled out one of the jackets developed by McArthur – a 3" x 5"

acetate unit with two 16mm microfilm channels – and showed it to Quinn.

The Inter-County president, who had seen roll microfilm, thought the jacket for storing microfilm strips was an improvement. Bassett and Ellsworth were invited to make a presentation at a meeting of Inter-County branch managers. One manager opposed the "jacket" idea, but the others liked it. Quinn asked Bassett to prepare a formal presentation, including prices, for a meeting of the board of directors.

At Richards' suggestion Bassett called a microfilm service company in Syracuse, Hall & McChesney, Inc., which was one of Film 'N File's independent dealers, and asked that a survey be made of Inter-County's title records in Floral Park, Long Island. That afternoon Richard de Bronkart of Hall & McChesney arrived to begin the study. The job turned out to be huge, requiring an estimated $75,000 for filming alone, in addition to 50 "Filmsort" Inspector readers at $300 each, and more than a quarter of a million jackets at three cents apiece.

The morning before his formal presentation at the Inter-County board meeting, Bassett found himself talking to his mirror. He had never before even come close to a $100,000 order. Now he repeated those six remarkable round figures over and over, as if to convince himself he wasn't dreaming.

The presentation went off without a hitch. Inter-County Title, Guaranty & Trust Company rented a store front in Floral Park several blocks from its title records location. Microfilm rolls of the company's records were shot in the store, delivered to Hall & McChesney in Syracuse for processing, and then returned for inserting in jackets by a crew of fifteen girls. In charge of the project for Inter-

County was William Smith, the only branch manager who had opposed jackets.

Smith became one of the microfilm medium's greatest boosters. One day he sent a private limousine to pick up key executives at New Jersey Realty & Title Insurance Co. in Trenton and bring them to Floral Park for a private showing of Inter-County's jacket operation. This trip eventually resulted in another title company sale for Bassett of 25 readers and 100,000 microfilm aperture cards.

Inter-County Title, Guaranty & Trust Company was the first major jacket sale, but many others followed in the early and mid-Fifties. A typical example was Duke University Hospital which installed a complete "Filmsort" microfilm jacket system to reduce its voluminous medical records library to a compact and quickly accessible format. The sale to Duke University, in the opinion of some, was actually the one which opened the jacket market.

But the jacket was not a controlled item; it could be made by any firm. Because it was a moneymaker, many competitors soon flocked in, making it impossible to develop and hold the "jacket" market. Although jackets accounted for more than 30 per cent of sales in 1953 and 1954 and outsold aperture cards from 1953 through 1955, interest in jackets began to die in 1954. Since then, of course, microfiche – a sheet of microfilm on which multiple images are photographically recorded – has increasingly replaced the jacket.

Nevertheless Bassett's sale to Inter-County was of great importance because it opened the "jacket" market and helped tide Film 'N File over a number of lean years. It also set Bassett on his way as the new sales manager of Film 'N File, Inc. And this way was eventually to lead Bassett to the general sales manager's office of 3M's Microfilm Products Division. Today McArthur, Robbins and Bassett, who originally came together at Film 'N File in 1951, still work together in the aperture card orchard under the 3M aegis. And it goes without saying that, although the pickings are now more plentiful, the sales are no less sweet.

CHAPTER 7

WASHINGTON, AHOY!

In October, 1951, Richards decided to return to Hawaii to tend more closely to his business interests there. During his tenure as head of Film 'N File, the basic foundation was laid for future growth of aperture card systems. In the Fifties his efforts began to coincide with major changes in information management concepts which were taking place in business, industry, and government.

It was, for example, the Age of Television. People were becoming more used to viewing images on a screen, whether it was attached to a television set or a microfilm reader. In addition it was to be only a little more than a year before the country was to become "copying-conscious" because of the introduction of 3M's "Thermo-Fax" copying machine. This was the first of the inexpensive, easy-to-use, image-forming copying tools that were to transform information management procedures in office and factory.

It was a period of transition, and the colonel's leaving brought a number of rapid changes in its wake. First, Dexter Folder Company, which had entered the microfilm aperture card field as a contract manufacturer of equipment for Richards and

had since shifted from the role of contract supplier to that of direct principal, assumed a controlling interest in Film 'N File, Inc. Next, Richards and Casey brought Ellsworth to New York to serve as executive vice-president under a five-year contract. In addition, the whole Film 'N File operation was moved out of New York City and into a vacated schoolhouse on the grounds of the Dexter Folder Company in Pearl River.

One of the first things Ellsworth did was suggest a change in the firm's name, because the phrase, "Film 'N File," had been found through experience to be practically unintelligible over the phone. For example, Film 'N File opened a Washington, D. C. office in late 1951 and called up a sign artist to come in overnight and paint the firm's name on the door. The following morning the words "Film 'N Fun" identified the address. The painter had captured the spirit of the thing, but his work emphasized the difficulty of intelligibly pronouncing the name "Film 'N File" over the telephone.

The firm name was changed to Filmsort, Inc. to match the trade name adopted in the late Forties. Richards and Casey, now a partner of former Republican national chairman Leonard Hall in the New York City law firm of Hall, Casey, Dickler and Howley, retained ownership in Filmsort, Inc. until the mid-Fifties when Heintzemann bought out their remaining interests. At that time the firm became the Filmsort Division of Dexter Folder Company.

On becoming executive vice-president, Ellsworth also decided that a broad base of government business was needed to help spur Filmsort's growth. He dipped back into his past and picked a man named Carl Rose to head the Washing-

ton office. During the war Ellsworth had been in Washington as a loan and credit manager with the Reconstruction Finance Corporation. At that time Rose was a senior RFC official. After the war Rose had suffered a heart attack and had become unemployable by the government because he was unable to pass the physical examination. On a trip through Tennessee setting up dealers for Film 'N File, Ellsworth found Rose selling refrigerators and vacuum cleaners. He plucked the former RFC official out of Tennessee and placed him in Washington to sell "Filmsort" aperture card systems to the government.

Rose knew nothing about microfilm, but he was an excellent salesman. And he had contacts throughout government. He had hardly arrived in the capital when he had a major project under way with the Meat Inspection Service of the United States Department of Agriculture. The USDA had to maintain a complete file of 205,000 original labels covering 9,500 different products put out by 1,000 meat-packing firms under 7,500 brand names. The labels came in a wide variety of shapes, sizes, and colors and were printed on cartons, films, artificial casings, and even in the form of stamp impressions on fresh meats. The task of filing and finding these hundreds of thousands of label originals had become an impossible nightmare when Rose called on Charles Finnegan, methods examiner for the Meat Inspection Service.

Rose sold Finnegan a "Filmsort" microfilm aperture card system which was simplicity itself. A black-and-white or color microfilm frame was shot of each meat label. It was the first time color was used in a "Filmsort" system, and a special camera was designed for that purpose. Color was used to help USDA officials spot deceptive labeling practices, such as the use of red, wavy lines on transparent bacon packages to simulate lean streaks in fat meat. The microfilm frames were mounted in punched cards which were filed in a fraction of the former space required. In addition duplicate decks of punched cards were prepared which enabled the Meat Inspection Service automatically to search its files in a matter of seconds or minutes instead of hours or days. As a result, the time it took the Meat Inspection Service to approve labels was cut tremendously and the over-all efficiency and economy of the operation greatly improved. This "Filmsort" application, still in operation, was the first big postwar installation of a microfilm aperture card system in government.

Meanwhile, back in New York the home office staff was also making a concentrated sales "push." In early 1952 Bassett hired a new salesman, Larry Lassins. Bassett, Lassins, and Batchelder's Graphic Microfilm Corporation then went to work to sell the Otis Elevator Company on a microfilm aperture card system for engineering drawings. The elevator company had run out of space in its executive office building in Manhattan. It had been forced to transfer its file of 150,000 engineering tracings to its Yonkers plant — 15 miles from its engineering department. This meant that engineers were often delayed in getting prints. The result was costly holdups in meeting engineering and production schedules.

The firm's Ulysses C. Blackwood wanted an economical method of setting up reference files for engineering drawings in Manhattan, where they would be readily available to Otis engineers. He liked the "Filmsort" idea, but one day in a talk with Bassett he expressed serious doubts about aperture cards.

"How can we be sure we won't open a file drawer some day," he asked, "and find all the film has fallen out of the cards?"

There had never been a complaint of this sort in the six or seven years that "Filmsort" cards had been on the market. Bassett picked up a card from Blackwood's desk and asked the executive to place the tip of his index finger firmly against the microfilm window. Bassett then proceeded to push Blackwood, who was seated on a swivel chair mounted on rollers, all the way across his office. The card finally tore, but the adhesive bond between the card and the microfilm remained intact. Blackwood was convinced and the ball began rolling.

In April, 1952, a special Otis staff began the conversion of the firm's file of 150,000 tracings to 3¼" x 5" "Filmsort" microfilm aperture cards. Compactly stored in Manhattan in three filing cabinets, the cards and accompanying readers provided Otis engineers with quick and ready access to engineering drawings. That installation was the biggest engineering drawing application Filmsort had sold.

In the meantime, Ellsworth decided that more independent microfilm service companies were needed as "Filmsort" dealers, and he went out to get them. This effort soon began to pay off. Robert Boylan, president of The Microfilm Corp., one of the firms Ellsworth set up, sold a "Filmsort" 3" x 5" microfilm aperture card system to Thompson Products Company, an aircraft and automotive parts firm. Thompson used the cards to replace 100,000 engineering drawings with a limited reference factor. Eighteen months later another 50,000 drawings were converted to the new system.

Other sales began dropping into the basket, some in the nonengineering area. For example, the Boston office of Dun & Bradstreet microfilmed its credit reports, which were stored in 19 filing cabinets, each with five double-sectioned drawers, and mounted the film in 75,000 3½" x 5" McBee "Keysort" cards which fitted into two cabinets. The 450 square feet of reclaimed space was converted into an employee snack bar.

And, of course, there were title company sales which continued to be the mainstay of Filmsort growth.

But the most significant activity in the latter part of 1952 was taking place in Washington, D. C. There Rose, using his Department of Agriculture installation as a springboard, was expanding his missionary work on behalf of the microfilm aperture card to include the United States Department of Defense. Specifically that meant the Air Force, Navy, Ordnance Corps, and Signal Corps, the largest potential users in the country of aperture cards for engineering drawings.

These efforts were just beginning to bear fruit when Rose became the unfortunate victim of the ailment which had plagued him in the Forties. Rushing to make an appointment, he suffered a heart attack and died before the cab in which he was riding could reach a hospital.

Filmsort's first Washington salesman was sorely missed by the firm. However, his efforts proved not to have been in vain. Aperture card systems were to revolutionize the military engineering drawing field in years to come.

CHAPTER 8

THE MILITARY MAKES ITS MOVE

Early developments of aperture card systems for engineering drawings were largely pioneered by industrial organizations such as Hamilton Standard Division of United Aircraft, Heald Machine Company, Thompson Products Company, and others. These were basically passive or limited-access systems. Engineering drawings converted to aperture cards were generally inactive or obsolete.

Otis Elevator Company was one of the first industrial firms to convert its complete tracing file to microfilm aperture cards. This, of course, was because of the space problem it had to overcome in its Manhattan-based engineering department. The Otis installation was more active than the others because its microfilm system was used for drawings with both high and low reference requirements.

These systems were manual. They utilized plain or McBee "Keysort" file cards in which film was mounted semiautomatically. There were viewers and readers available for visual reference, but there was no machine designed to enlarge or "blow back" microfilm images onto paper. If an

engineer wanted a print, it had to be made by conventional photographic or photocopy processes. In addition there was no way to make duplicates of original microfilm aperture cards.

These limitations severely hampered the truly "active" use of microfilm aperture cards in engineering. This was particularly vexing to the military. In the early Fifties the growing logistical missions of the Air Force, Navy, Army Signal Corps, and Ordnance were demanding ever-increasing punch card automation to manage engineering drawing files.

The Department of Defense's interest in microfilm was first evidenced with the formation in the early Forties of a service organization called the Ad Hoc Committee of Microfilm Standards for Engineering Drawings. Following the war, a tremendous number of engineering drawings were on file throughout the government as well as in industry. There was a rush on the part of all concerned, including the committee, to put those drawings on roll microfilm.

However, the microfilm industry, particularly the segment composed of small service companies which shot up like mushrooms, was still relatively new and inexperienced. It could not cope with the volume of work suddenly thrust upon it. As a result, the microfilming work was often poor. In many cases it was impossible to make prints from the developed rolls.

There were, in addition, the problems of indexing microfilm rolls and the increasing suspicion that all this "squirreling away" of microfilm, as GE's Rau called it, would eventually prove pointless.

The need in government for a way to automate the handling of engineering drawings continued to

grow. The distribution of military engineering drawings was becoming more complex, and the Korean War brought the problem to a head. Many members of the military as well as people in business and industry decided that existing engineering drawing procedures simply would not work. "I'm up to my neck in blueprints," said one military officer, expressing the general sentiment.

As early as 1948 the Office of Naval Research used microfilm aperture cards for engineering drawings. However, it wasn't until 1953 that the Navy launched a full-scale development program. That was when Commander (now Captain) F. Heremiah Gibson was appointed to take charge of the engineering drawing files in the Navy Department's Bureau of Aeronautics. He and George Hamp and John Player, also of the Navy Department, saw unitized "Filmsort" punched cards as the automated answer to the obvious disadvantages of roll microfilm.

They discussed their program with the U. S. Air Force at Wright-Patterson Air Force Base in Dayton, Ohio. The idea, the two services agreed, was to microfilm original drawings and eliminate blueprint files entirely, in effect replace paper with microfilm in aperture cards.

The Air Force had conceived its own aperture card program in 1951. Under the direction of Colonel Andrew Adman, with the help of Thomas Korte (now in charge) and Marvin Toll, the program had developed by 1953 to the point where equipment needed to make it a practical reality could be clearly visualized. Frank Borden of the U. S. Army Signal Corps at Fort Monmouth, New Jersey, was also investigating the use of microfilm aperture card methods of handling engineering drawings at this time. So it was that the Navy,

Air Force, and Signal Corps all had feasibility studies of microfilm aperture card systems in process during the early Fifties. Later various arsenals of the U. S. Army Ordnance also became involved.

During 1953 and 1954 as studies proved successful, the military let contracts for the development of various pieces of needed equipment. These contracts were awarded to Filmsort, Inc. for the development of an automatic card mounter (previous "Filmsort" mounters had been manual or semiautomatic), and to The Haloid Company and RCA Victor for the development of high-speed "blowback" equipment which would automatically produce a continuous paper web 24" wide of enlarged engineering drawings from microfilm aperture cards.

The Haloid Company had previously produced a semiautomatic xerographic (electrostatic) printer for the Air Force's engineering drawing program in 1951. Designed for roll microfilm, this device produced enlargements on 24" x 36" individual sheets. In 1952 at the request of the Navy, Haloid had built an automatic, xerographic printer which "blew back" engineering drawings from roll microfilm on a continuous paper web 11" wide. This machine was introduced commercially under the trade name "Copyflo." RCA Victor was also included in the contracts awarded by the military because it had developed an electrostatic printing process, called "Electro-Fax," which was adaptable to microfilm aperture card reproduction.

Thus throughout the Armed Services there was an increasingly wide acceptance of the aperture card method of managing engineering drawings. And the proposed introduction of the program in the Armed Services promised to directly and indi-

rectly affect many thousands of military contractors.

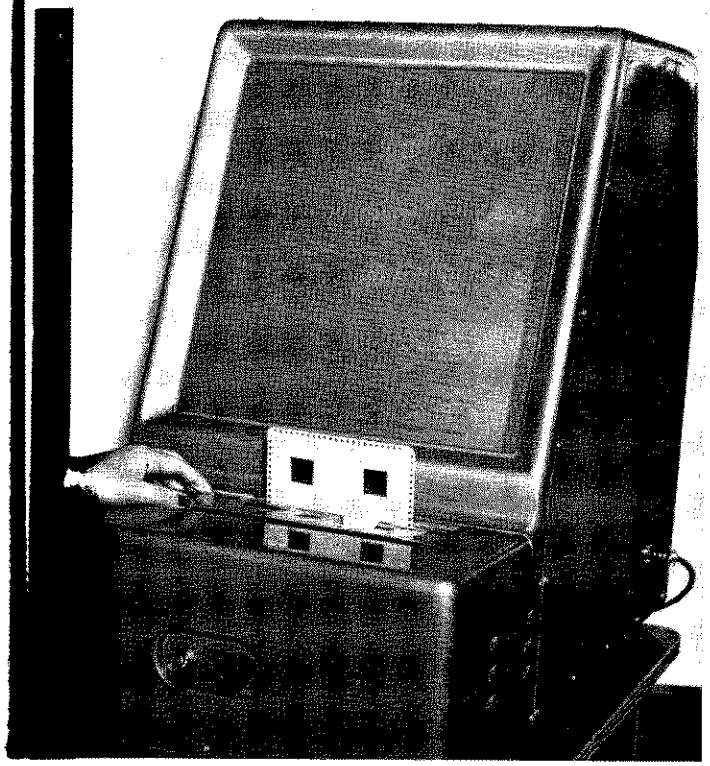
To capitalize on and focus this growing interest, Filmsort, Inc., sponsored a meeting of the combined services and industry at the Hotel New Yorker in New York City on September 16 and 17, 1954. The purpose of the meeting was to begin the development of uniform standards in order to help ensure that the microfilm aperture card systems and equipment being developed would be as compatible as possible.

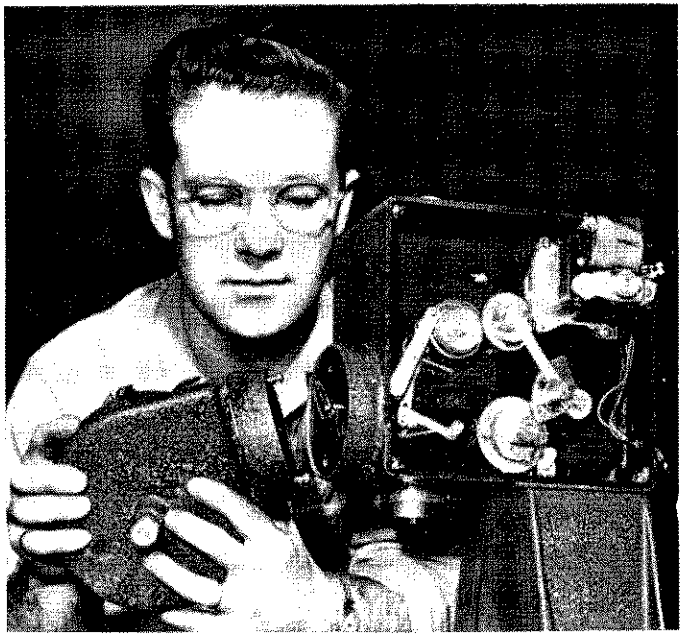
It was one of the most significant moves the company had ever made. For out of this meeting, at the suggestion of McArthur, grew the Department of Defense 0009 Committee. This is the committee which eventually published the first military specifications for the use of microfilm aperture cards for engineering drawings on April 15, 1960.

But in the intervening years the initial standards information worked out at this and succeeding meetings was to provide basic guideposts along which development work proceeded as swiftly and efficiently as possible. Such variables as reduction and enlargement ratios, frame sizes, and aperture locations were thoroughly discussed by representatives of practically every known user and supplier in the microfilm aperture card field. Organizations represented included the Navy, Air Force, Signal Corps, Central Intelligence Agency (successor to the wartime Office of Strategic Services where microfilm aperture cards were first used), Western Electric, Recordak, Remington Rand, IBM, Haloid, RCA Victor, Graphic Microfilm, and Filmsort.

One of the critical decisions which had to be made was the determination of a punched-card ap-

Old school building on Dexter Folder Company property at Pearl River, N. Y. (above), was early home of Filmsort Company. Reader built by the Dexter Folder Co. in the late 1940s (below) is believed to be the first for use with aperture cards.

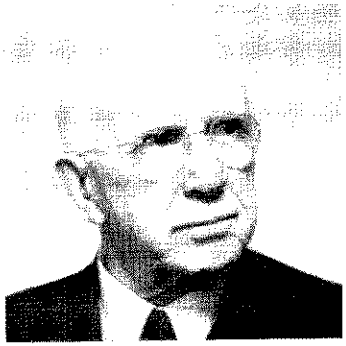




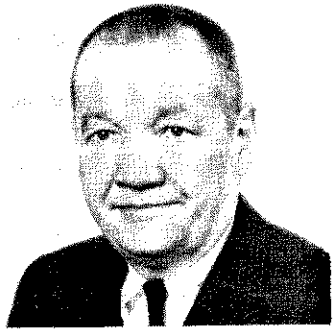
D. W. "Scotty" McArthur and first low-cost microfilm camera for aperture cards he designed and built in 1949 for use in the title industry.

Earl P. Bassett (left) and a convention visitor discuss a small reader built by Filmsort for the Navy in the early 1950s. It was priced at less than $100.

John B. Bell (right), president, Idaho Title Company, and Russell Ellsworth with Filmsort reader with a 14" x 14" screen designed and built by McArthur. It, McArthur's camera, a Dexter mounter and aperture cards comprised first practical microfilm system for title applications.



G. A. Heintzemann

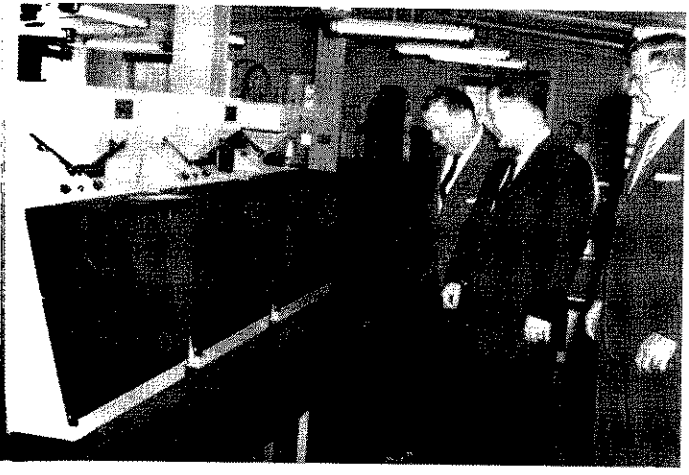


John Langan

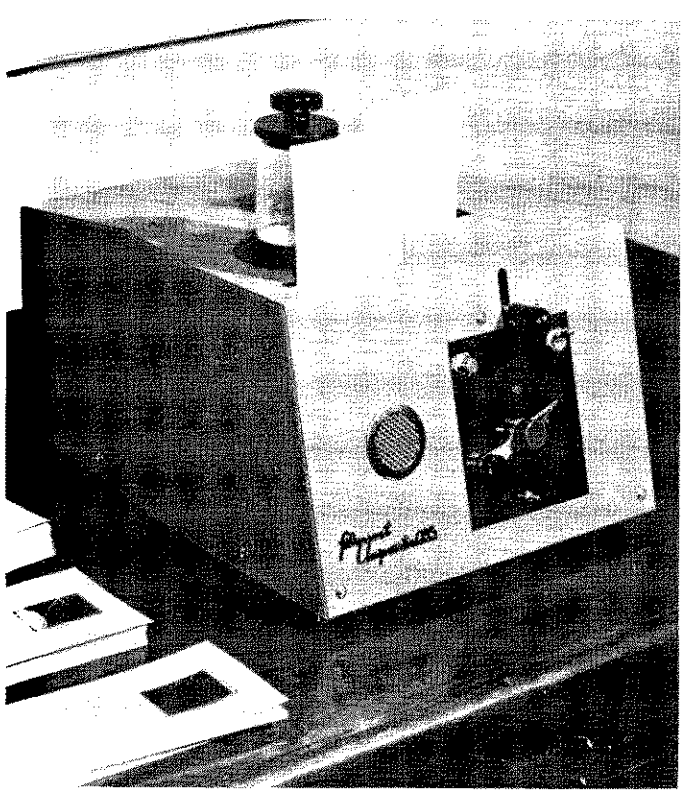
McArthur (right), the designer, and Fred Hushen of Filmsort pose with the "Surveyor" Reader in 1950 or '51. A floor model with a 24" x 36" viewing screen, it represented a new concept for that period.

One of the early desk top readers was the "Inspector 100," designed for Filmsort by Ernest Taubs of Microtronics. Despite its small screen, it was popular and many were sold.

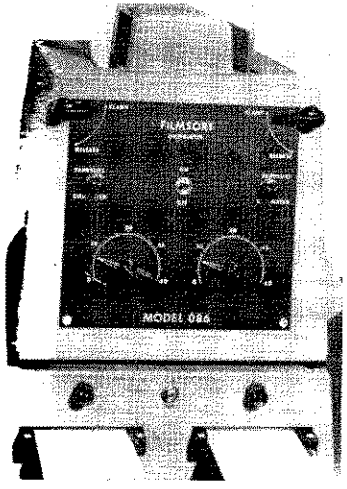
Al Thomas (left), Recordak; McArthur and Paul Slattery inspect "Designer 184" Readers at Filmsort in about 1958. This machine was noteworthy because it had a large screen and fit top of desk.

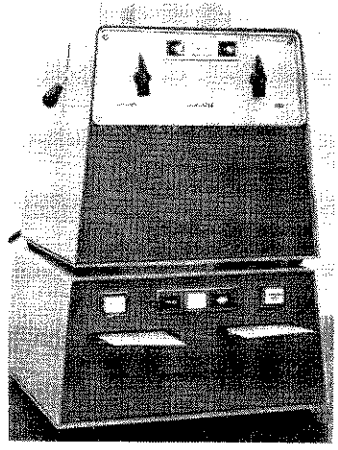


Filmsort manufactured the first card-to-card printer (below) for reproducing images from silver halide film in aperture cards to diazo film copy cards. Both the idea and design were McArthur's. The same principle developed for that printer — expose with light and develop with heat — is used in printers today.

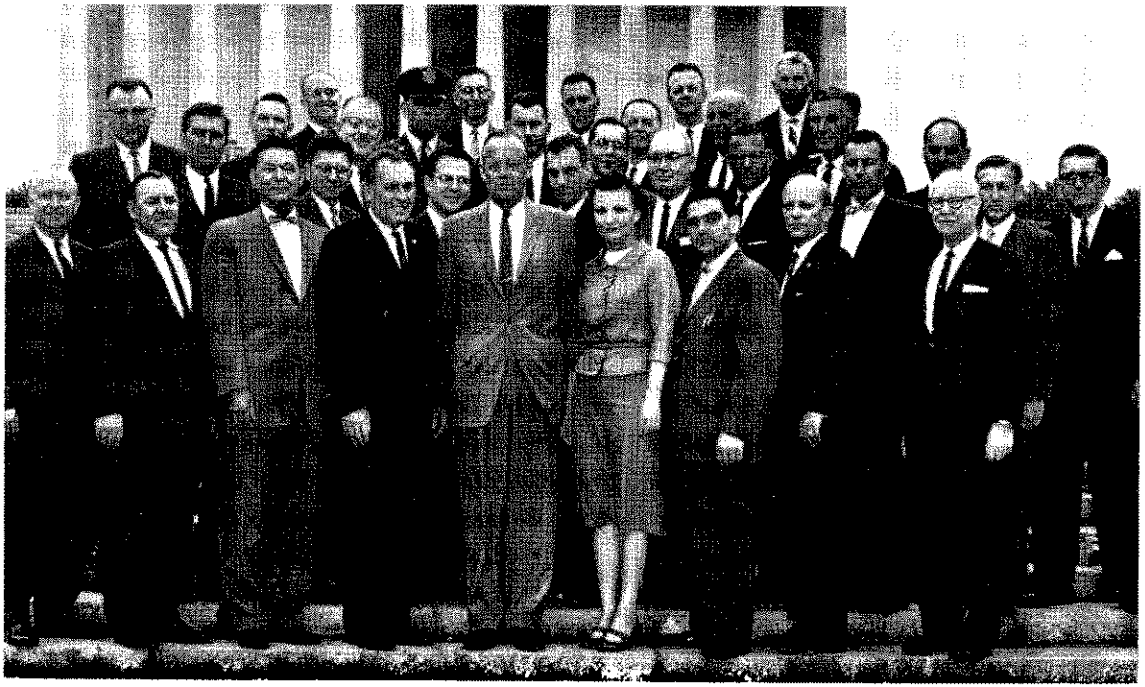


Filmsort's first card-to-card printer evolved into the "Uniprinter 085" card-to-card printer (top, opposite) which used ammonia crystals to produce developing vapors. The original model of the "Uniprinter 086" copier (bottom left, opposite) and the latest model of that series (bottom right, opposite) in use today are shown.

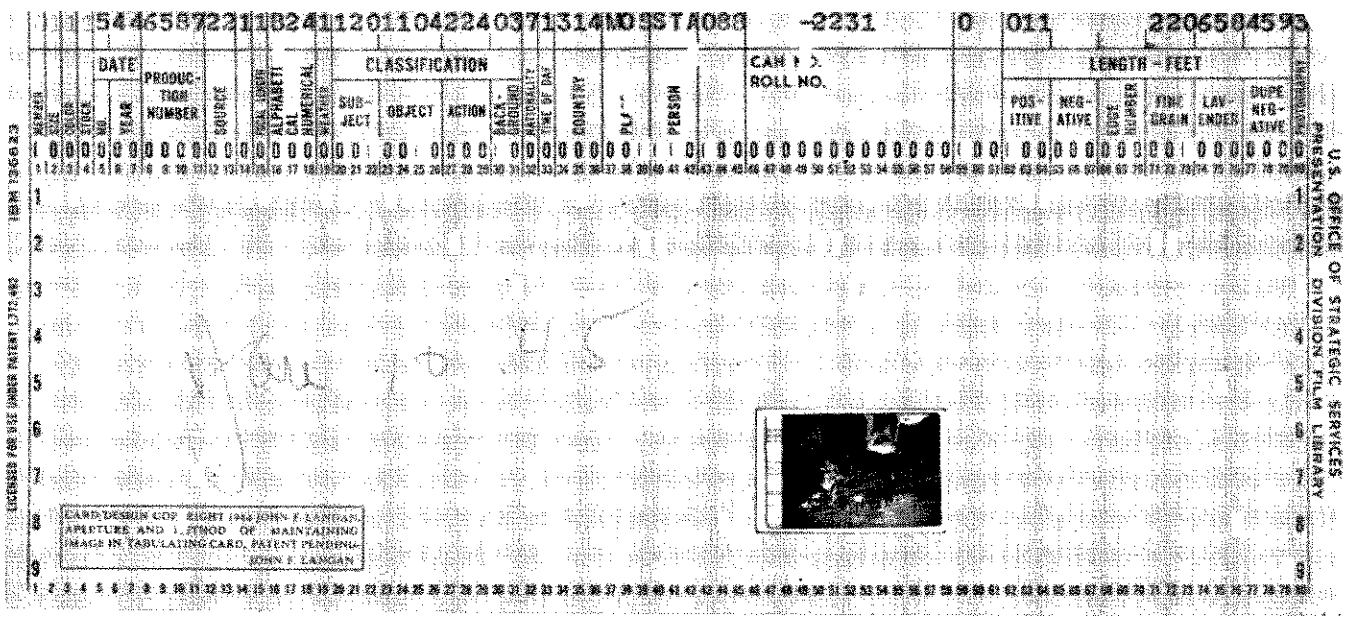


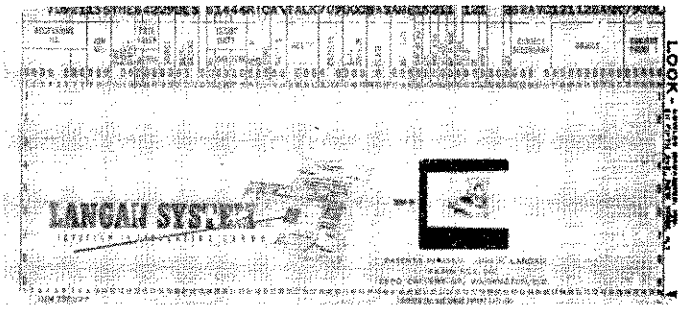


The Department of Defense 0009 Committee published the first military specifications for aperture cards for engineering drawing uses, which spurred the growth of aperture card systems by standardizing the card in the format in use today.

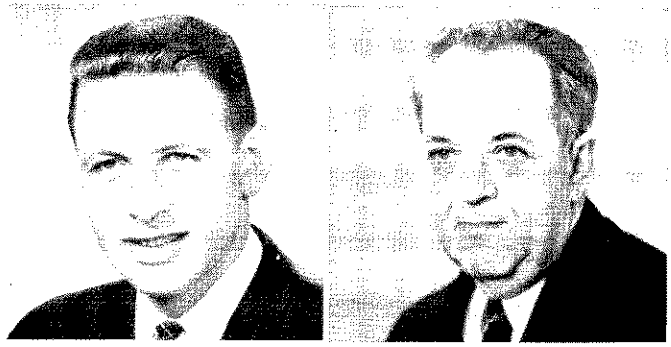


One of the first aperture cards.



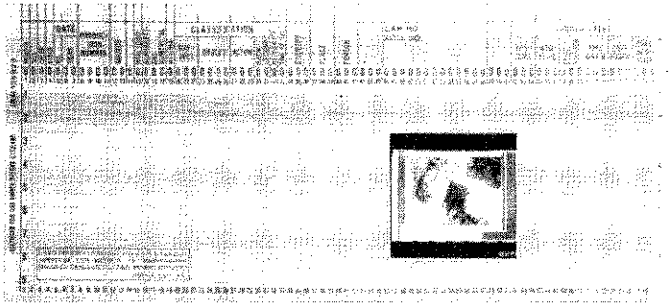


First "A" size aperture card.

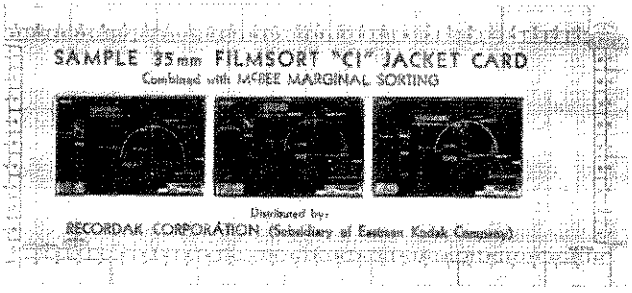


E. P. Bassett

A. X. Robbins

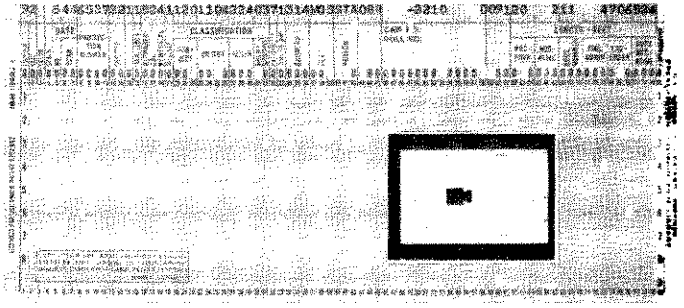


"C" aperture card for OSS.

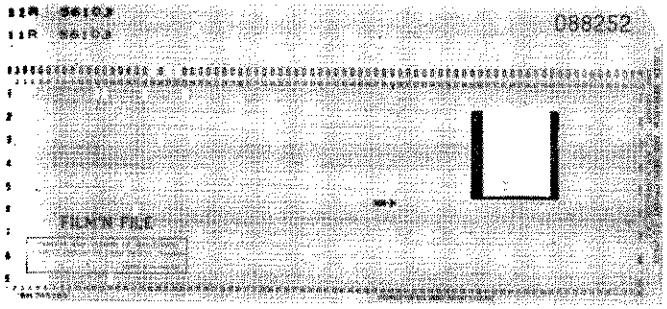


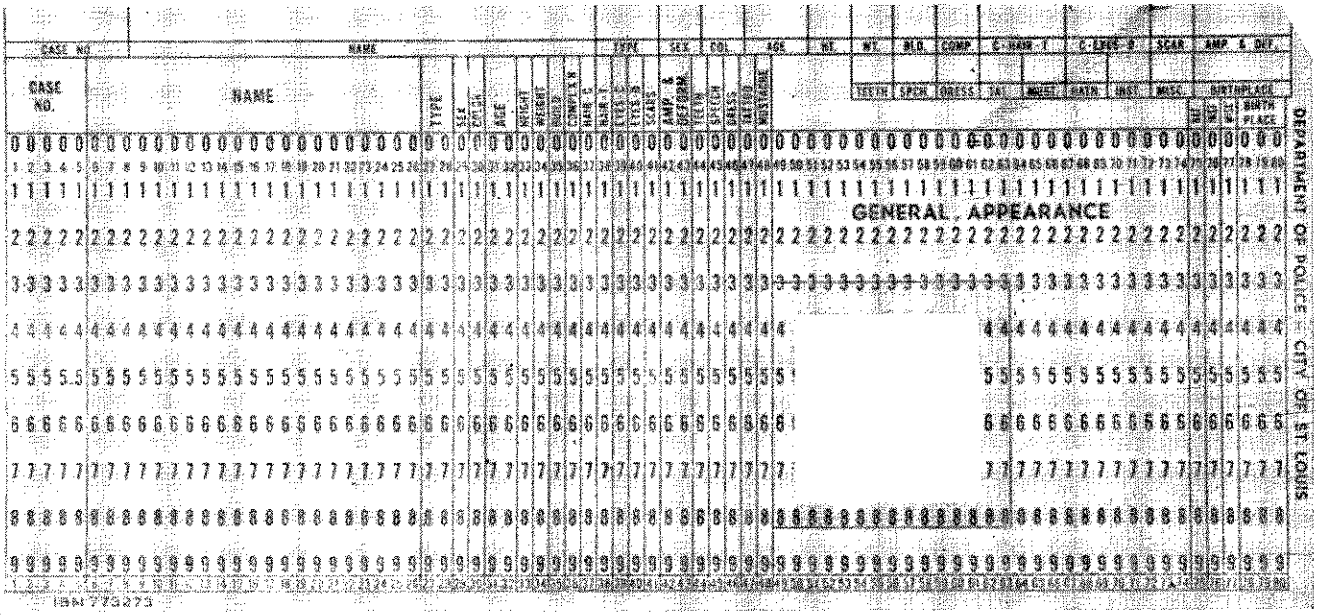
Jacket card produced by Filmsort.

"D" aperture card used by OSS.



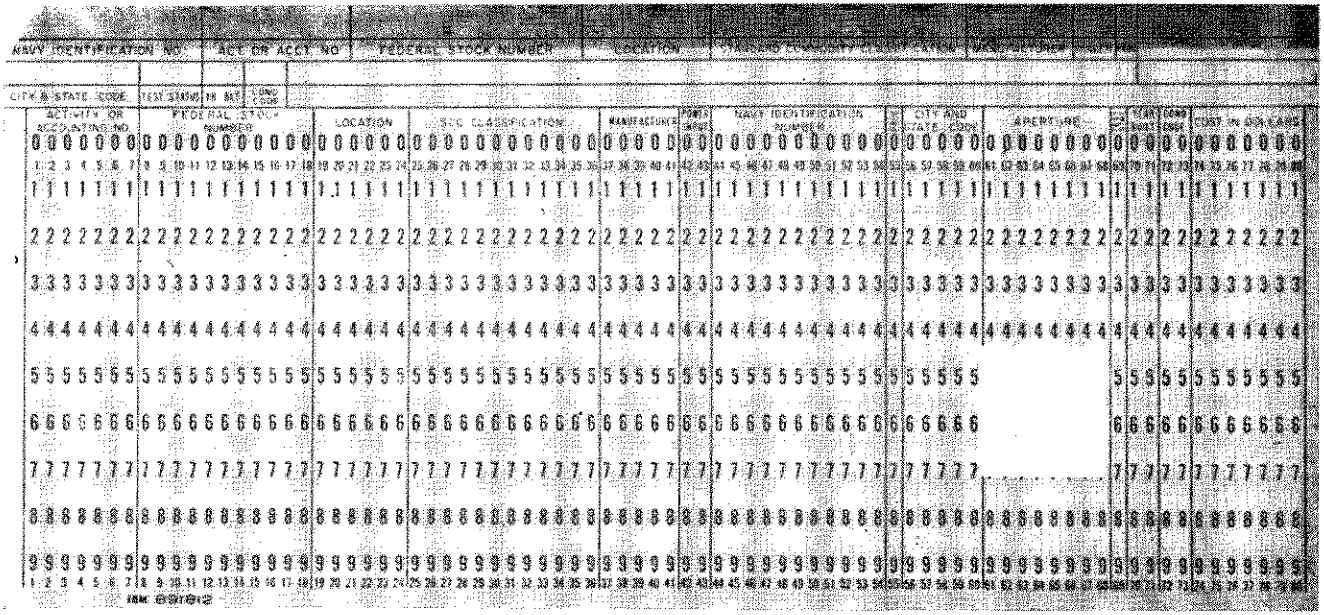
First Film 'N File aperture card.

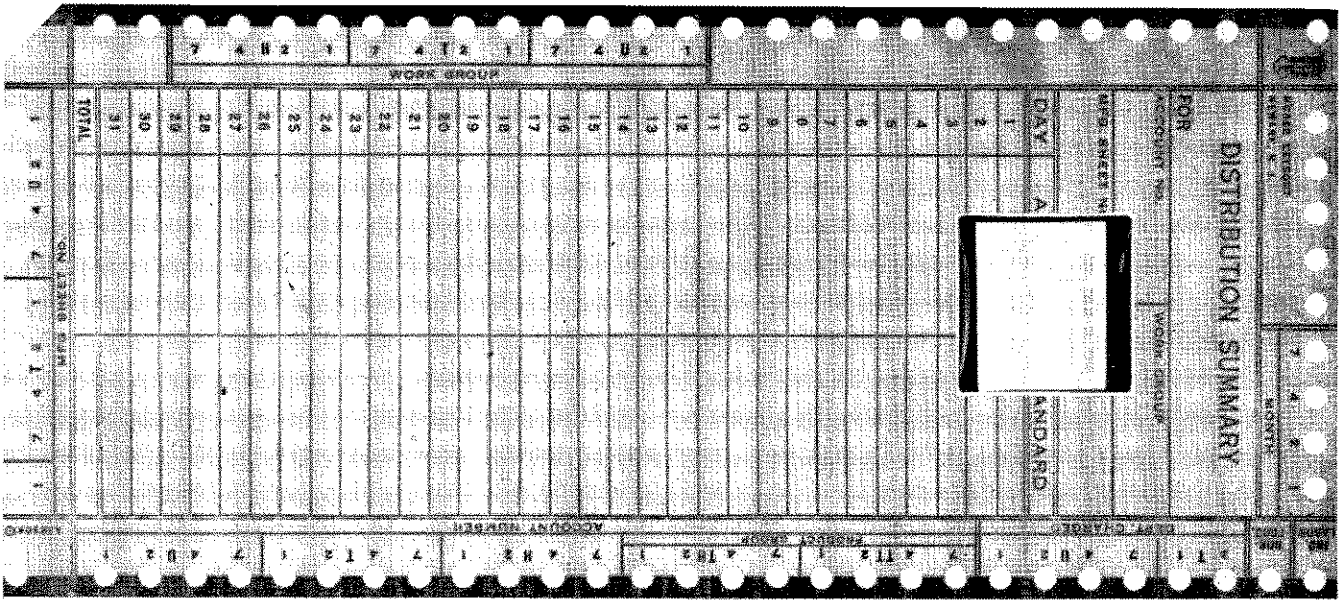




St. Louis police "A" aperture card.

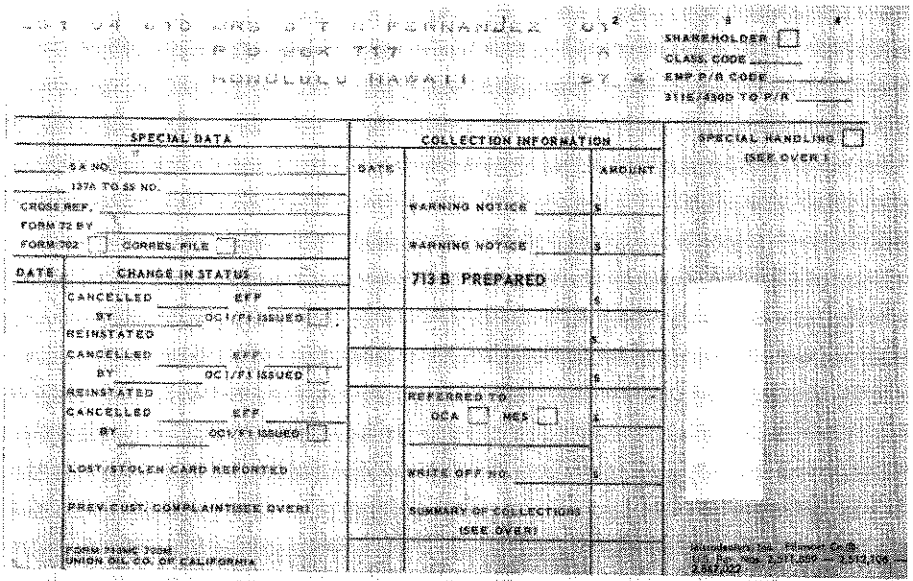
[illegible] aperture card made by [illegible]





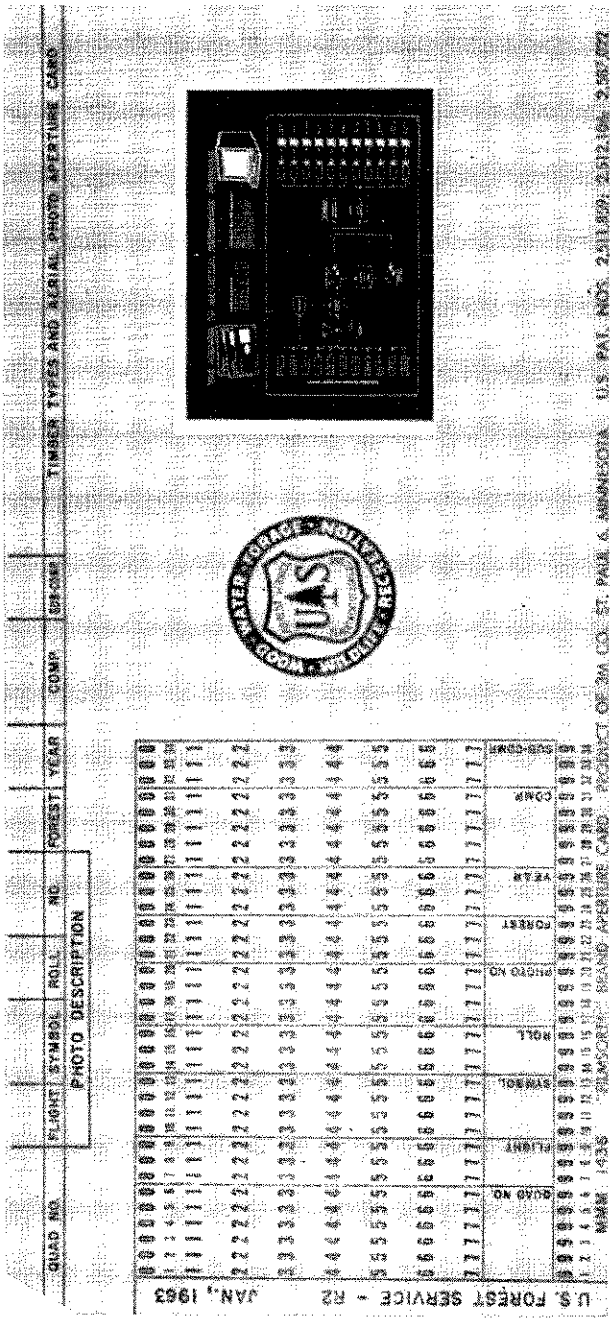
First "A" aperture card produced by McBee.

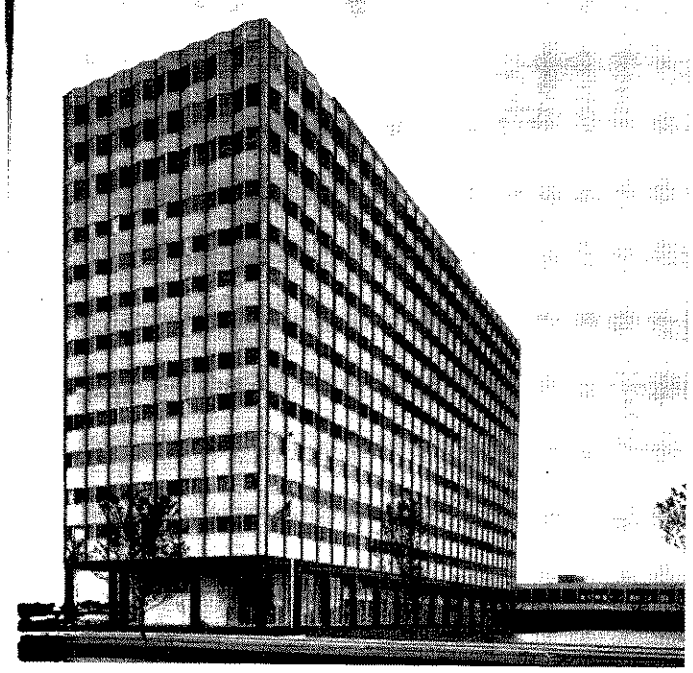
Odd-size aperture card used by CIA and Union Oil Company of California



D. W. McArthur

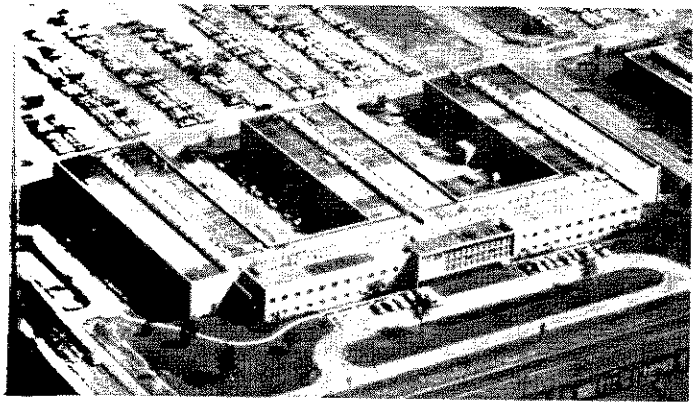
Dick de Bronkart

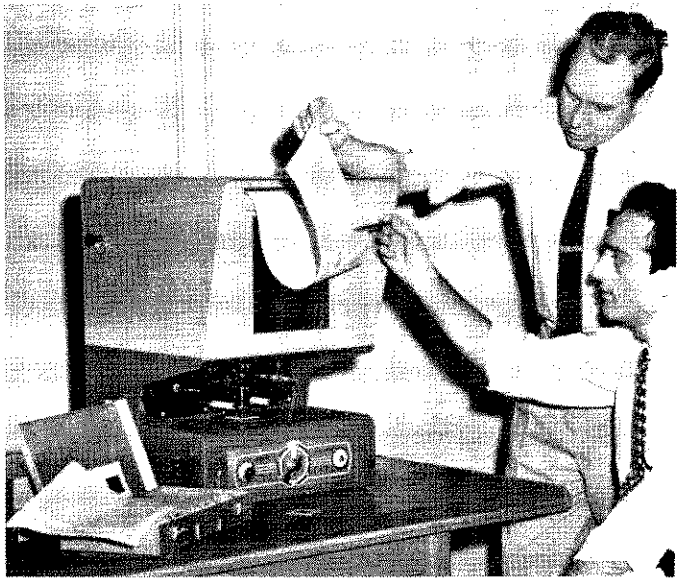




The Microfilm Products Division office is in the 3M Company's 14-story administration building in St. Paul, Minn.

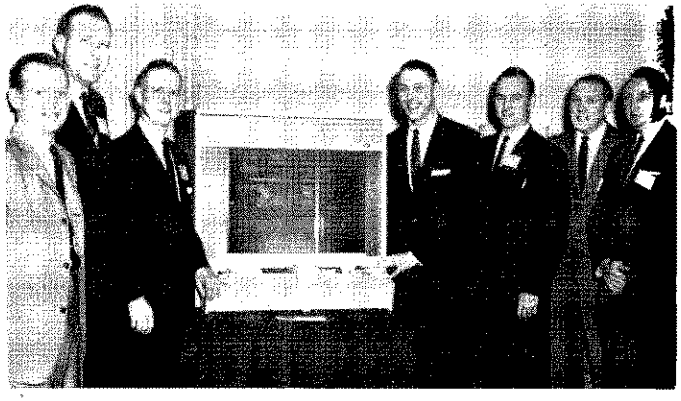
The Microfilm Products Division laboratory occupies one wing (at right) of the 3M Graphic Systems Group laboratory building in 3M's 275-acre research-administration center. A bigger building is under construction.





The first 3M Company reader-printer, the Model 23 (later renamed the "Filmac 100" Reader-Printer) marked a major technological step in the microfilm industry in 1957.

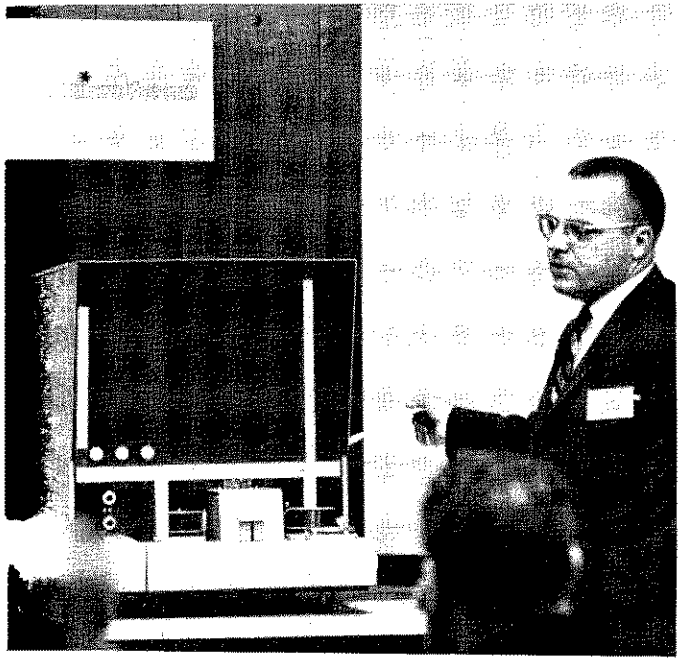
The "Filmac 200" Reader-Printer designed for the engineering drawing market was introduced in 1959. It had immediate impact on the industry because of its capabilities and reasonable price. Shown (l. to r.) with the machine at the National Microfilm Association show in Washington, D.C., are Al Goodman, Roy Bruchman, Dave Woodrow, Paul Suer, Dan O'Neill, Don Derham and Dick Thompson.



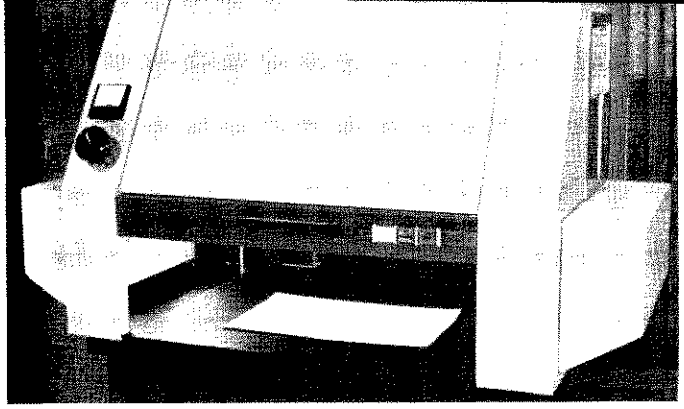
Dr. M. R. Hatfield

Len Lawrence

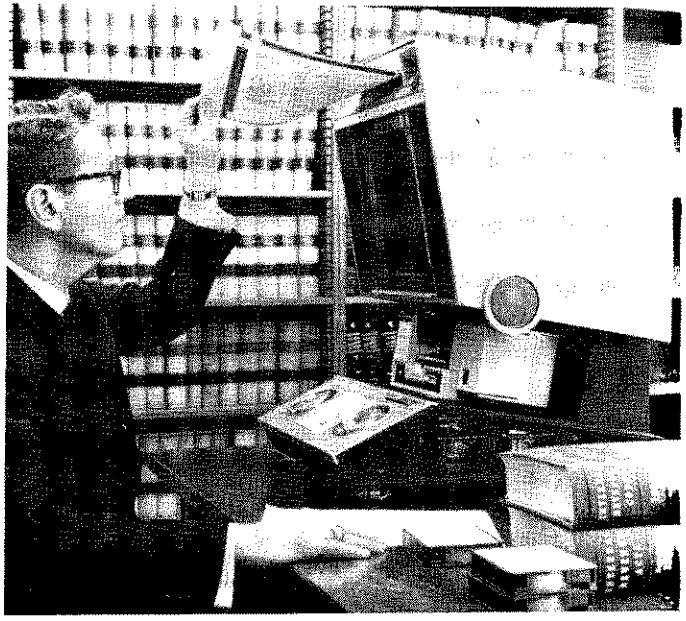
The third reader-printer in 3M's growing line was the "Filmac 300" Reader-Printer, a versatile machine capable of enlarging or reducing a projected image without loss of focus. It is shown with Dr. David Wolf in 3M's MicroForum, a systems development laboratory in St. Paul. Another MicroForum has been in operation in Washington, D.C., since March, 1965.

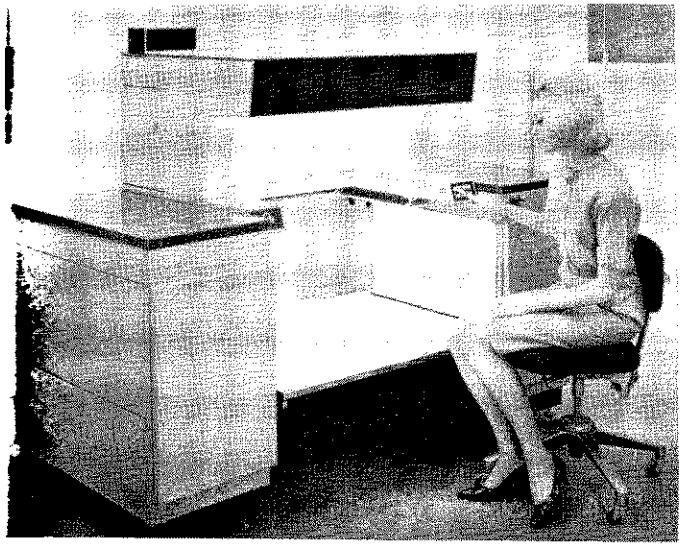


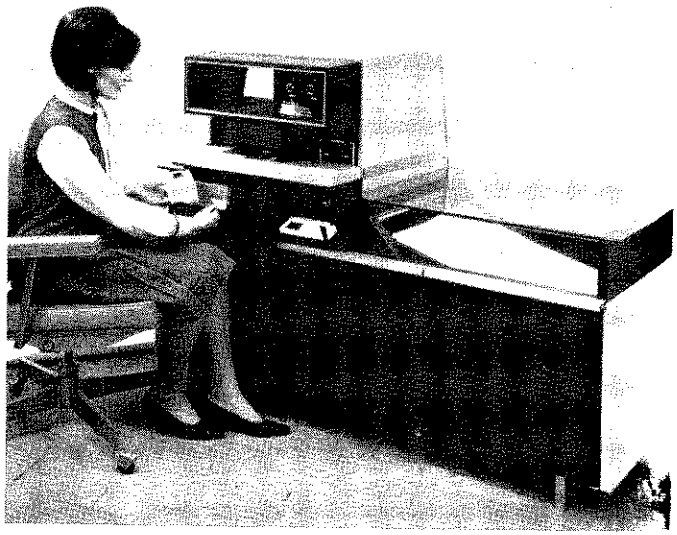
United Air Lines (above) replaced printed maintenance manuals with microfilm in cartridges and the "3M" "400" Cartridge Reader-Printer. An Internal Revenue Service attorney (below) also uses machine.

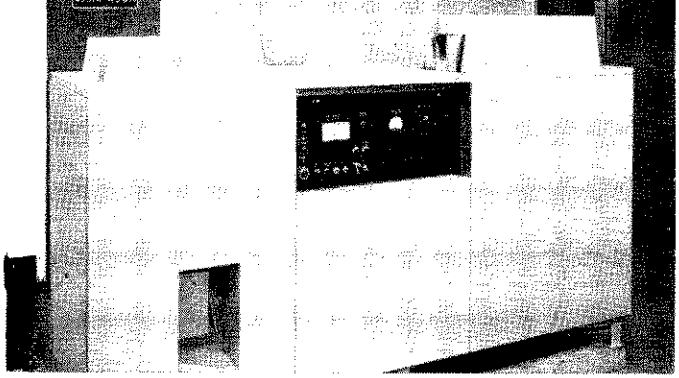


One of several unique microfilm system components invented by 3M's Microfilm Products laboratory is the processor-camera, which does away with separate film processing and mounting. The prototype "Filmsort 1000" Processor-Camera (above) was redesigned before it was sold. The "3M" "2000" Processor-Camera (below), introduced in 1965, is a versatile machine for office or engineering drawing uses.



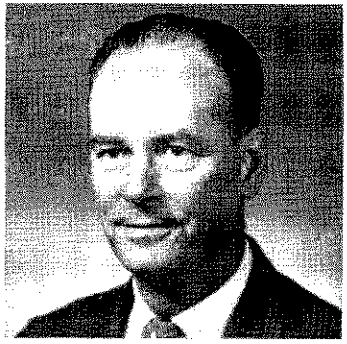






Automatic production of "Duplicard" Copy Cards at the rate of 2,000 an hour is possible with this modern "3M" "041" Card-to-Card Printer.

Dry Silver technology, another 3M scientific development has resulted in the design of several new microfilm printers, including the "333" Automatic Dry Silver Printer (above), which produces low-cost paper copies up to 18 by 24 inches in size from aperture cards. It was introduced in 1966. The "222" Dry Silver Printer (below) produces paper copies from aperture cards for about 2c each.

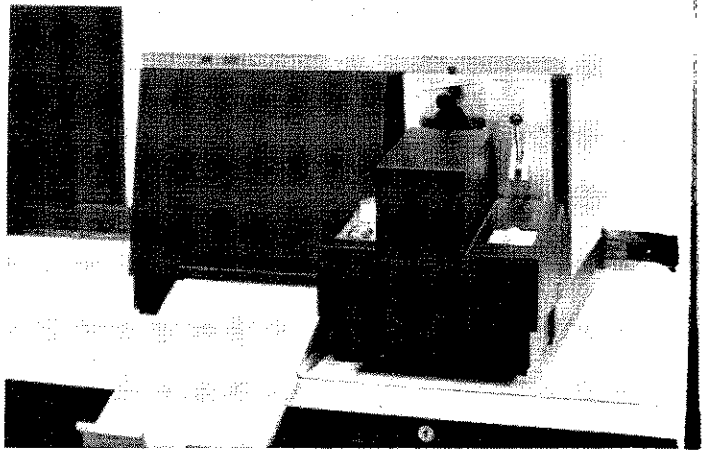


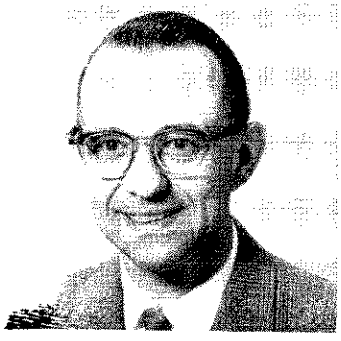
Edgar Johnson

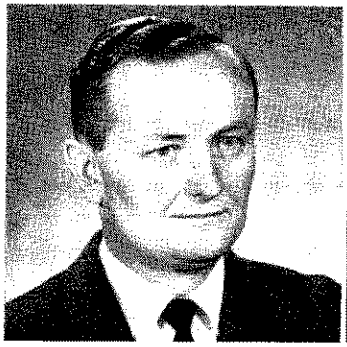
Bryon Neher

Louis Meissner

Donal Kimble





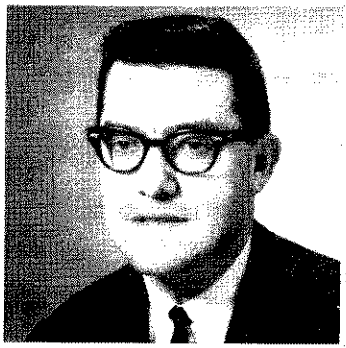


C. O. McMaster

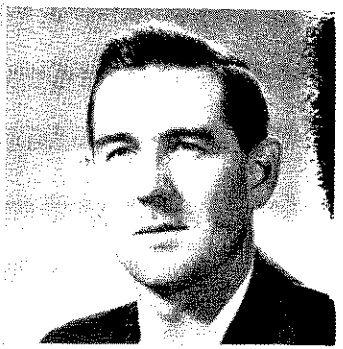
Vern Fosse

Art Kutchera

Les Kruger



Ben Shely



Dave Morgan

erture location. At the time Filmsort used two different locations, one for IBM cards, the other for Remington Rand cards. Both Remington Rand and IBM representatives at the meeting pointed out that the locations in their respective cards were those recommended by their companies as providing the optimum results when used in their own punched-card equipment.

The problem was to standardize on a hole position which would leave the maximum number of columns free for punching. In terms of this consideration, the Remington Rand aperture location was shown to be superior. At this point the IBM representative went on record that the hole position recommended by his firm furnished the optimum results on IBM equipment. However, since the aperture was mutilating the card in any event, he continued, IBM had no particular objection to it being placed anywhere. Moving the hole would undoubtedly increase the percentage of card jams on IBM equipment, the firm's representative warned, but he concluded by saying that he was in no position to state how much of an increase in jams might be involved.

Under the circumstances the recommendation was made to standardize on the Remington Rand aperture location. Following the meeting, both Remington Rand and IBM provided ample machine time and assistance in their Washington offices for extensive tests to be run on their equipment. The tests proved that the hole position selected at the meeting was acceptable, and the services moved "full steam ahead" on their microfilm aperture card system development programs.

CHAPTER 9

THE LONG FUSE

In the early Fifties the major distributors of roll microfilm were Remington Rand, Inc., Recordak Corp., and Diebold, Inc. Their sales pitch was security. Cut up the film, they said, and you start to lose it. Filmsort told its prospects to cut their film into single frames to make it easy to use. Unitization to make microfilm active was inevitable. That fact did not escape the roll microfilm advocates.

In early 1953 the Filmsort sales office was moved to Washington, D. C. Bassett was transferred there to carry on the work Rose had begun. Bassett began working with Adman, Korte, and Toll of Wright-Patterson Air Force Base, Dayton, Ohio, at a time when the Air Force was conducting feasibility studies of microfilm aperture cards.

As the service showed increasing interest in the "Filmsort" system concept, so did the Dayton office of Remington Rand. In addition to microfilm, the concept involved a considerable potential market for Remington Rand punched cards.

Bassett and Robbins went to Dayton to help the Air Force develop its microfilm aperture card program. In addition to a study they made, they retained an analyst from Remington Rand to conduct another. Then the Air Force entered into a series of service tests using Remington Rand punched cards.

Remington Rand requested a "Filmsort" distributorship. Thomas Maggin, chairman of the board of Diebold, Inc., also became interested and asked for a dealership. And, it turned out, Recordak Corp., deeply immersed in a microfilm aperture card study for the Signal Corps, also wanted "in." This brought up the old and continuing controversy of microfilm sales people versus systems sales people. But by this time the advantages of going the microfilm route had been clearly demonstrated. The decision was made to give distributorships to all three firms. So in a period from late 1953 through early 1954 — both before and after Filmsort's May, 1954, meeting which helped to crystallize military and industry thinking on microfilm aperture card systems — Remington Rand, Diebold, and Recordak became "Filmsort" distributors.

Ellsworth then completed the switch to the microfilm sales route. He cancelled the few remaining distributorships held by independent "systems" companies and brought together nine independent microfilm companies, set up over previous years as "Filmsort" distributors. These independents were bonded into a national organization called Microdealers.

The advent of national distribution created a corresponding need for sales training and assistance in the field. Filmsort began hiring people to help open up Remington Rand, Diebold, and Recordak as dealers. Over the next several years the sales staff grew to fifteen.

The figure included de Bronkart, who had left Hall & McChesney in Syracuse to join Filmsort, Inc. in April, 1953; Francis X. McCormack who worked

with Bassett in Washington; Robert Johnson, Will Beringer, and Mark O'Connor, all formerly with Remington Rand; Quent Sharp, formerly of Diebold; Paul Slattery, Ray Monaco, and Andrew MacMillan. In addition to the Washington office, sales offices were set up in New York, Chicago, and Los Angeles. Slattery, Sharp, and Johnson each headed an office. Robbins left the organization in 1954 to enter the apparel business in New York City. Three years later he returned to Filmsort, and he is still in the microfilm business with 3M.

The early Fifties held high expectations. The Air Force, Navy, Signal Corps, and Army Ordnance were rapidly advancing in the development of unitized microfilm systems for engineering drawings. Filmsort developed and introduced both an automatic mounter, capable of operating at a speed of 2,000 frames of film an hour, and a semiautomatic optical mounter as part of the equipment package originally contracted for by the military.

Filmsort also introduced an automatic card-to-card printer capable of reproducing duplicate aperture cards from original cards. A Filmsort automatic Ozacard developer was introduced simultaneously. It was used in conjunction with the card-to-card printer to develop duplicate cards, called "Ozacards" or "Duplicard" copy cards, produced by the card-to-card printer.

The film in the "Duplicard" copy cards was diazo film. Diazo, sold under the trade name "Actifilm," was a new product of the Ozalid Division of General Aniline and Film Corporation.

Filmsort also broadened its line of aperture card readers to include small desk units, in the $100 to $200 bracket, and complex motorized viewers for

engineering drawings. These sold at just under $2,000.

There was continuing optimism that the aperture card market was ready to "explode." One salesman summed up the mood: "I don't know if the market is going to explode," he said, "but I do know that it's got the longest fuse I ever saw."

The experiences of de Bronkart as a Filmsort sales representative in the field were typical. After working for McArthur in Filmsort's Pearl River engineering department for most of 1953, he spent the major part of 1954 on the road helping to open branch offices of Filmsort's three national distributors. His trips lasted six weeks each, and consisted of spending six days in a town working with salesmen from local Remington Rand, Recordak, and Diebold branches.

Bunching sales training in that way created some amusing incidents. In Milwaukee de Bronkart called on Allis-Chalmers three times in one week, each time with a different distributor salesman. The third time around the man at Allis-Chalmers naturally asked, "What, you again?"

Early in 1955 de Bronkart was assigned to the Precision Microfilm Corporation, Detroit, an independent Filmsort dealer. He spent the year on a pilot aperture card project launched by Arthur Even of Army Ordnance's Detroit Arsenal. De Bronkart was also Filmsort's factory representative at the local Recordak branch office. In 1956 he moved to Washington, D. C. to become a factory representative for that Recordak branch. The office was intimately involved in the development of the Signal Corps' aperture card system. Six months later de Bronkart was transferred to the Corps' headquarters in Fort Monmouth, New Jersey, to help make the system work. Then he was returned

to Pearl River to be Filmsort's quality control and customer service manager. So he had a taste of all the activities engaged in by Filmsort's field staff during the period extending from 1954 through 1956.

Even with this outside sales effort Filmsort was still losing its shirt. In 1956, for example, it was heading for a loss of several hundred thousand dollars. Something had to be done. Dexter President Heintzemann decided to hire a management consultant firm to give him a broad, objective view of the business. The New York firm of Cresap, McCormick and Paget was retained on August 20, 1956, to do the job.

The survey had two major objectives: (1) to evaluate the market for the principal products of the Filmsort Division of the Dexter Folder Company, and (2) to recommend any necessary improvements in the marketing operations of the division.

Cresap, McCormick and Paget reported in three months. First, the firm said it estimated that the 1956 unitized microfilm market – including unitizing devices such as aperture cards and jackets, equipment, and related services of mounting, indexing, printing, and microfilming – was approximately $2 million. It predicted that market sales in 1960 would total $6 million. Filmsort, the management firm said, had the most complete product line, consisting of aperture cards, microfilm jackets, readers, mounters, and related services, and was the largest single manufacturer in the unitized microfilm industry. The division's sales at retail prices totaled $850,000, or more than 40 per cent of total industry sales in 1956. It had a record of growth evidenced by the fact that it had tripled its volume in the three years since 1953.

Cresap, McCormick and Paget then listed the division's weaknesses. These included:

- Narrowness of the over-all product line which necessitated that its products be sold in conjunction with other microfilm products and limited the division's freedom of choice in selecting methods of distribution.
- Lack of formal procedures for orderly planning and development of new products.
- Excessive breadth of individual product lines such as aperture cards. Reducing the number of aperture sizes and positions could produce substantial savings in both manufacturing and distributing costs, the consulting firm said.
- Several "Filmsort" products were overpriced. Conversely, aperture cards were underpriced and could possibly support a 30 to 40 per cent price increase.
- The division's policy of distribution through two national distributors, Remington Rand and Recordak (the dealer tie-up with Diebold had been terminated earlier in the year), and through nine local distributors (Microdealers) was realistic and sound. However, the management consultant firm said, the fact that the division continued to entertain the possibility of direct sales prevented it from obtaining the wholehearted interest and support of its distributors. In addition there were significant distribution gaps.
- Direct selling expense was running at a rate of more than 17 per cent, substantially higher than the 5 to 10 per cent which would be typical. This was largely attributable to the direct selling and promotional expense which Filmsort provided to its distribution organizations.

Cresap, McCormick and Paget then made the following major recommendations:

- Clearly define the objectives of the division on a long term basis.
- Formalize and strengthen new product development activities.
- Offer a distribution franchise to the Ozalid Division of General Aniline and Film Corporation. This new franchise, the management consultant firm said, would enlarge the market for "Filmsort" products, particularly in applications requiring the duplicating of original microfilm aperture cards.
- Reduce selling expenses by eliminating the Washington sales office and minimizing direct selling assistance to distributors. Place major reliance on these distributors to pick up an increasing share of the sales effort.

This was Cresap, McCormick and Paget's report. All the recommendations were important. The last was a bombshell.

Ellsworth, who disagreed with the recommendation to cut back the sales effort, immediately approached the management of Ozalid, which had just been appointed a "Filmsort" distributor on the basis of the report. He convinced Ozalid management that it should get into the microfilm business with both feet on the basis of its diazo development.

A month later Ellsworth left Filmsort and became manager of Ozalid's newly formed Microline Products Group. He took Bassett with him as sales manager, de Bronkart as technical service manager, Johnson as western manager, MacMillan as mid-central manager, and Beringer as a diazo expert. Others like Slattery, Sharp, and Monaco also read the handwriting on the wall and scattered.

Many were to return to Filmsort when it was a division of Miehle-Goss-Dexter, Inc. in 1959 or in later 3M years. Bassett returned in 1959 as Filmsort's Washington sales manager; de Bronkart joined 3M's Washington sales office in 1960 and is now microfilm products sales manager for the Photographic Film Division of 3M in St. Paul; Slattery is microfilm manager of 3M's Government Services office in Washington, and MacMillan is a microfilm products salesman.

Others remained in the microfilm or systems field. Sharp now heads Copytron sales for the Bruning Division of Addressograph Multigraph Corporation. O'Connor is a part owner of NB Jackets Corporation on Long Island. Beringer is employed by Douglas Aircraft in microfilm applications. Johnson is with IBM.

Ellsworth, who led the exodus, remained at Ozalid, and later went to a firm called Datagraphic Systems, Inc., jointly owned by General Aniline and Film Corp. and Douglas Aircraft, until the late Fifties. He then joined Richards in Hawaii and is there today working in his original field, the title business.

So in hardly any time at all the Filmsort Division of Dexter Folder Company effectively reduced its selling expenses. The reduction was so effective in fact that when McArthur, who had been made assistant general manager in 1954, was promoted to general manager in 1957 he found there was hardly anyone left to manage. He was practically alone at Pearl River.

CHAPTER 10

THE TOTAL SYSTEMS CONCEPT

Immediately after World War II when Film 'N File first tried to introduce aperture cards hardly anyone could come up with a use for them. A decade later the situation was reversed. By early 1957 in many major government agencies and industrial concerns, highly advanced systems utilizing aperture cards had evolved for managing engineering drawing files. Those systems, for all practical purposes, eliminated reproducible tracings and blueprints from the engineering drawing production and distribution cycle. Tracings and blueprints were replaced by aperture cards because government and industry people had decided cards were more economical and efficient than paper for information management.

Although details varied from installation to installation, the basic aperture card system concept for engineering drawing included the following:

1. Original engineering drawings were photographically reduced to 35mm microfilm.
2. The microfilm was processed automatically. Key punch equipment was used to place identifying data from the drawings on the aperture cards. The original drawings were returned to the file.

3. Each frame of microfilm containing the developed engineering drawing image was mounted in the corresponding punched and printed aperture card.
4. Those cards were then used to create one or more duplicate aperture cards. Diazo film was used in the duplicate cards, which had been identified with the same punched data as the original. This was done in a high-speed "Filmsort" automatic card-to-card copier.
5. The original aperture cards were stored in a master security file. One or more of the duplicate diazo cards were distributed to working files in point-of-use locations.
6. At point-of-use locations:
   (a) The duplicate cards could be placed in a high-speed continuous printer to mass produce engineering drawing prints if they were needed.
   (b) Or the duplicate cards could be placed in a low-speed intermittent printer to produce prints to satisfy low-volume print requirements.
   (c) Or the duplicate cards could be placed in a low-speed card-to-card printer to produce a "second-generation" duplicate card for a variety of look-up or print uses.

The total systems concept eliminated paper except as a print at point-of-use locations. It reflected a simple but vital premise. People in the engineering field expressed it this way: one piece of paper is inexpensive but a million pieces will "kill" you. The cost of a piece of paper may only be a penny. The real cost is the money spent in handling it.

Microfilm aperture cards were replacing paper

in the engineering drawing field because they provided: (1) Uniformity – engineering drawings varying in size from 8½" x 11" to 36" x 48" are reduced to the same size card; (2) Compactness – microfilm has a greater storage capacity than any other record medium; (3) Accessibility – aperture cards are easy – and fast – to file and find; (4) File Uniformity – microfilm aperture card files are always complete; out-of-file conditions are completely eliminated; (5) Low cost – microfilm is the least expensive of any record medium.

The military and industrial organizations which had evolved the total systems concept for using aperture cards in their respective engineering drawing fields were each at varying stages of development in terms of actual installations. Some were only on a limited trial basis. Others were expanding rapidly. In addition much of the equipment or hardware which would be needed to operate total aperture card systems was not even developed. It was a time when an informal exchange of experience and ideas could be extremely beneficial to all concerned. Or at least McArthur thought so.

One of the first things he did when he became Filmsort's general manager in 1957 was to sponsor a seminar for representatives of the military and industry and supplier companies. The seminar was held May 15 and 16, 1957, in Spring Valley, New York. Military agencies represented at the meeting were the Navy, Air Force, Army Signal Corps, and Army Ordnance. Industry representatives included Bell Telephone Laboratories, Western Electric (the Bell System's manufacturing subsidiary), General Electric Company, and Otis Elevator Company. Among the suppliers who attended were Recordak Corporation, The Haloid Company, and Filmsort.

Throughout the session the need for new equipment was stressed time and time again. The Navy, for example, in the fall of 1956 had installed a 24-inch high-speed continuous printer (Copyflo Model 24C) developed by the Haloid Company. This printer, it said, gave every appearance of being fully capable of handling high-volume print reproduction requirements. But the service also pointed out that many of its engineering drawing files were becoming more and more decentralized. The low-volume print production requirements in these locations could not justify the installation of a high-speed, and high-cost, continuous printer. The Navy cited the need for low-cost printers and viewers at decentralized point-of-use locations.

The Air Force expressed interest in a small-volume aperture card printer for handling reproduction requirements in decentralized engineering drawing file areas. It pointed out there was equal need for a small-volume, low-cost card-to-card printer, another piece of equipment in the aperture card system concept which was not yet developed. A small card-to-card printer, the Air Force said, would be used in file areas to reproduce second-generation diazo duplicate cards for engineers. This would allow working files containing first-generation duplicate cards to remain intact.

Of the industrial aperture card users at the seminar, GE also emphasized the need for new or better card-to-card printers (both high- and low-volume), economical high- and low-speed devices for printing out engineering drawing prints, and low-cost readers.

In October, 1957, the firm began operation of the first commercial, mechanized, integrated, engineering data handling system in the country utilizing aperture cards. Installed in GE's Medium

Steam Turbine, Generator and Gear Department in Lynn, Massachusetts, the system included a 24-inch Haloid continuous printer similar to the Navy's. A number of other GE departments quickly followed that pioneering venture.

The first GE system was devised by Arthur H. Rau, the man who had come up with the idea of using aperture cards for engineering drawings in his discussions with Richards and Robbins in 1949. It was discussed at length by Rau in a paper he presented to Technical Drawing Associates in Pittsburgh, Pennsylvania, in October of 1957.

"My principal mission here today," Rau told the group, "is to discuss a brand new concept of Integrated Data handling, which, I believe, offers considerable opportunity for increased productivity and lower costs in all functions of the business.

"Since this concept principally concerns the handling, reproduction and dissemination of engineering documents, let me start with some magnitude figures so that you will be in a better position to appraise its significance and potential value to the total engineering and production effort.

"In General Electric's files, both active and inactive, there are between 12 and 15 million original engineering drawings.

"New original drawings are produced at the rate of 400,000 per year.

"The multiple prints from these originals are turned out at the rate of 75,000,000 square feet of paper per year, which would make a band of paper three feet wide around the equator.

"A few of the features of this system are:

> "Original drawing is reduced to microfilm and stored. Handling of the original eliminated except when required for revision.
>
> "Strip or roll microfilm automatically unitized and mounted on IBM cards.

> "Cards automatically duplicated at rates up to 2000/hour, and sorted and stored. Cost less than 5c each versus 18c for the average print.
>
> "Cards can be used by engineering, manufacturing and finance in data processing equipment and viewers.
>
> "If required, paper enlargements can be produced from the microfilm in a continuous process at the rate of 20 ft./min. This is roughly 800 working prints/hour.

"An aperture card can be produced, reproduced, filed and sorted mechanically and quickly, and can be used instead of full-size prints in low-cost readers located wherever the drawing itself would be used. The implications are very great.

"Not the least will be the saving of wear and tear on our originals, which we now must handle far too much for either their own good or our own efficiency.

"The potentialities of this microfilm aperture card system in alleviating the enormous record-handling burden of present day methods are almost unlimited. The cost of searching, handling, and the refiling of full-size drawings and prints — plus the expense of reproducing multiple full-size copies for distribution — can be substantially reduced by this system.

"To sum up this portion of our discussion, I would like to review a few of the benefits of this system:

> "Eliminates the need for full-size prints completely.
>
> "Saves about 20 minutes search, wait, reproduce and refiling time on each drawing and specification requested from file.

"Completely mechanizes filing and refiling of drawings.

"New and revised drawings available for production uses, in less time at lower cost.

"Eliminates clerical work in preparing parts breakdown and listings.

"Parts lists of complex apparatus can be speedily compiled accurate-to-yesterday without a single human referral to the drawings.

"Once data is punched into cards, which can be done at normal typewriting speeds, currently available machines can provide data at the following speeds:

"Sorting Cards –
650 per min.
"Collating Cards –
100 per min.
"Reproducing Cards –
100 per min.
"Printing Parts Lists, etc. –
150 per min.

"Substantial savings in floor space and filing equipment investment.

"You will be interested to know that a number of government agencies are exploring similar systems. The Signal Corps at Fort Monmouth already has an installation in operation involving approximately 300,000 engineering drawings and the Air Force and Navy also have projects well under way.

"One of the principal reasons why the Services are interested in this system is because in all previous national emergencies, the conventional methods used for reproduction and dissemination of engineering drawings were a serious bottleneck in the

procurement of equipment essential to wartime operation and communications. Moreover, even in times of peace, by comparison, current processes are a time-consuming and costly method of supplying widespread depots and repair bases with the information necessary for day-to-day repairs and procurement of equipment. Under this new system the engineering drawings are supplied to the repair and supply bases as 35mm film images mounted on tabulating aperture cards. Every base will have a duplicate set and can reproduce its own paper enlargements, on the site, as needed.

"Many departments of the General Electric Company engaged in government contracts are faced with the same problems and cost of reproducing engineering drawings in large volume. Government projects often require as many as fifty prints from thousands of drawings. The microfilm aperture tabulating card, with its potential safeguards and promise of maximum economy, will greatly facilitate such requirements.

"In closing, I would like to say that I believe that practical mechanization or automation of our paper work is one of the answers to many of today's problems of expanding markets, competition and growing labor shortages and presents one of the greatest challenges and opportunities of today. The potential applications are almost limitless and any investigation is bound to bear fruit if it is only the uncovering of obsolete methods and procedures. Simplification of our paper-work routines and practices is a prime requisite that will eventually lead to automation."

Rau's predictions have come true in the Sixties.

At the Spring Valley seminar called by McArthur, Bell Telephone Laboratories made its require-

ments for a low-cost, high-volume aperture card printer quite specific. A Bell representative put it this way: "At a conference in Rochester, I happened to sit next to a chap from a government agency. He said 'If you can get one of those (low-volume printers) down within a reasonable cost, we need 300 of them right now.' Another man mentioned he could use 50. We need this lower-cost printer. That fact impresses me more and more as we get into this thing. Tremendous interest has been shown in this smaller machine. People everywhere could use it."

As McArthur summed up the seminar, total systems concepts involving the use of aperture cards had far outdistanced available equipment. In some cases prototypes had been developed but production was lacking. In other cases the equipment was still on the drawing boards.

Basically the seminar established three things:

1. Military and industrial organizations in the engineering drawing field became convinced that aperture cards were the solution to their problems.
2. Equipment vitally needed to complete the aperture card system concept included low-priced card-to-card printers and both high-and-low-volume aperture card printers.
3. In a little more than a decade the "hole in the card" had changed from an invention in search of a need to a vital necessity spurring new inventions.

Later that year McArthur made a major decision based on the results of the seminar. It was to be a primary reason why Filmsort achieved its first profitable year in 1959. The decision was to put all of Filmsort's eggs in one basket— to concentrate solely on producing aperture cards and equipment for the engineering drawing field, eliminating the

uneconomical handling of different aperture card shapes, hole sizes and locations, and the costly tooling changes.

There were other factors, too, in Filmsort's climb to profits. After becoming general manager, McArthur raised aperture card prices. He also revamped Filmsort's production.

In addition Robbins began editing an external publication, "Filmsort Facts." At the time it was the only publication devoted exclusively to microfilm. Its editorial content consisted primarily of articles about successful applications of microfilm aperture cards in the engineering drawing field. "Filmsort Facts" was influential in promoting the benefits of aperture cards and other microfilm products. It also caused systems and reproduction trade magazines to begin running their own articles on microfilm and "the hole in the card." By May, 1962, "Filmsort Facts" had worked itself out of a job. The publication was discontinued, and the field was left in the able hands of half a dozen trade magazine editors.

In January, 1959, McArthur rehired Bassett to handle sales in Washington. Earlier a new sales office was set up in New York City with a new sales manager, Henry Petersen, in charge. And following another merger in late 1957, Filmsort had become The Filmsort Company, a Division of Miehle-Goss-Dexter, Inc.

But the most critical happening in this period, from a business point of view, was the entrance of the 3M Company into the microfilm field in November, 1957, after years of unpublicized research. From that point on the fortunes of both Filmsort and 3M, and indeed the entire industry, were to be interdependent, as ensuing chapters will divulge.

CHAPTER 11

THE FIRST READER-PRINTER

Minnesota Mining & Manufacturing Co. — now more familiarly known as the 3M Company or simply as 3M — began research in the field of microfilm many years ago. Its Central Research Laboratory's graphic arts basic research group conducted the exploratory efforts.

The beginning was inauspicious. The researchers noted microfilm's increasing usage and could see its vast potential. They kept repeating a basic 3M-type question: where is the need that is being unmet that we can fill in the microfilm industry? The answer was not long in coming: develop an *efficient* and *economical* method of reproducing microfilm images on paper. The industry needed a low-cost reader-printer.

The 3M graphic arts basic research group was headed by Dr. Carl Miller, who invented the "Thermo-Fax" copying process to meet a known need for a fast, easy method of copying. With the commercial introduction of the "Thermo-Fax" copier — the first low-cost office dry copying machine — American business was on its way to becoming

"copying-conscious." This served to stimulate the need for fast copies from microfilm. The desired result was no mystery, but the way to achieve it was. Years of development work — trial and error, test, retest, and test again — were required before the need could be translated into a commercial reality. The first low-cost reader-printer was introduced by 3M in 1957.

Four scientists were assigned to the original project — Donal Kimble, Byron Neher, Louis Meissner, and C. O. "Mac" McMaster. Two processes were developed for printing microfilm images — one by Kimble, Neher and McMaster, the other by Edward Johnson, a scientist in the physics group, and Neher a chemist in the graphic arts group of 3M's Central Research laboratory.

The processes were similar, yet different. In each, a photoconductive paper with zinc oxide as a photoconductor was stored in the dark in a highly non-conductive form. A light image was directed onto the paper and light-struck areas became conductive and remained so for a short period. In both processes a material was deposited on these light-struck, conductive areas to form an immediately available visible image.

The difference between the two processes was in the method of depositing. In the first process, a vaporized dye was deposited through the action of a high-voltage field. In the second process, metallic compounds were plated out of an electrolytic solution.

Both processes had commercial potential. However, the first one, being electrodynamic, required applied voltages of up to 10,000 volts because depositing was done in the air. The second, being electrolytic or wet, required only the voltages normally associated with electroplating, almost always

under 100 volts. The second process seemed to offer the best control of all conditions necessary to produce good images from different types of microfilm.

This second electrochemical process was chosen for commercialization. Additional basic research continued and the project was transferred from Central Research to the Duplicating Products Laboratory. The move signified a change to product development. The commercial concept called for a general-purpose, microfilm reader-printer capable of handling all forms of microfilm, including 16mm and 35mm roll film, aperture cards, jackets, and microfiche. As a result a prototype called the Model 23 Reader-Printer was developed. It was the first reader-printer offered which was capable of printing blown-up microfilm images at the touch of a button.

The prototype was tested in the office of the Central Intelligence Agency, the organization which had helped to develop the aperture card more than a decade before.

The CIA placed a multiple order for the new reader-printer. To produce stable images, gold and silver were used in the electrolytic solutions because these, by their very chemical natures, would be least likely to reverse and disappear. So when the Model 23 Reader-Printer was introduced in November, 1957, at the National Business Show in New York City, a gold chloride electrolytic solution was used as activator. Later, silver was substituted for gold.

First deliveries of the Model 23 Reader-Printer were made in the spring of 1958. From that point on the units sold as fast as they could be built. The original analysis that there was a crying need

for efficient and economical microfilm "blow-back" equipment was justified.

The Model 23 – later called the "Filmac 100" – was a major technological development in the industry. As a general purpose machine that made 8½" x 11" prints from a universal variety of microfilm formats, it helped tremendously to broaden and expand the microfilm market.

CHAPTER 12

THE SECOND READER-PRINTER

The 3M "Filmac 100" Reader-Printer introduced the electrochemical method of enlarging or "blowing back" microfilm images onto paper. Previously the only commercial microfilm reproduction techniques had been xerographic or electrostatic printing and wet photo processing using either conventional or diazo print paper. As a general purpose unit designed for use with all roll and unitized microfilm, the "Filmac 100" tremendously broadened the potential applications of microfilm in government, business, industry, and education. It made it convenient for microfilm users to make fast, inexpensive prints from any type of microfilm at the touch of a button.

But the screen and print size were only 8½" x 11", so it did not meet the requirements of microfilm aperture card systems in the engineering drawing field. There still was a need for a larger reader-printer designed to make reproductions of engineering drawings from aperture cards.

This need had been spelled out in May, 1957, at the "Filmsort" seminar in Spring Valley. The

largest government and industry users of microfilm aperture cards in the engineering drawing field had pleaded for a low-cost, low-production printer that would complement the 24" mass-production Xerox (formerly Haloid) Copyflo Model 24C continuous printer. It had been estimated that hundreds of units could be sold immediately if the price was right.

The market was known to every manufacturer and distributor in the industry. Because of the standardization work begun and carried forward by the DOD 0009 Committee since 1954, the equipment specifications, in terms of such variables as enlargement capabilities, print sizes, and magnification ratios, were reasonably well defined. The result was, as might be expected, an outpouring of aperture card viewing and printing machines designed to meet the needs of users in the engineering drawing field.

There was, for example, the "Micromatic," a combination viewer-enlarger-processor marketed by the Microline Products Group of the Ozalid Division of General Aniline & Film. This monobath unit had a reader screen size of 24" x 36" and produced 18" by 24" prints in one minute. The floor-mounted "Micromatic" weighed approximately 700 pounds and cost $7,975.

Charles Bruning Company, Inc. marketed an electrostatic printer called the Copytron Model 1000. The unit produced 18" x 24" prints, but utilized a magnifying scanner rather than a viewing screen for reading drawings. The Copytron, also floor mounted, weighed 850 pounds and cost $9,750.

Recordak introduced the Recordak Viewer-Printer, manufactured by the Cardo Company, a $7,250 machine that produced a 17" x 22" print

in 57 seconds. Because succeeding microfilm aperture card images could be exposed while the first print was being photographically processed, subsequent prints took only 30 seconds to produce.

Meanwhile 3M, following its introduction of the "Filmac 100" Reader-Printer in late 1957, began developing a larger reader-printer aimed at the engineering drawing market. That work was directed by Vern Fosse under the project leadership of McMaster. Using the same electrochemical process developed for the "Filmac 100," 3M produced a reader-printer called the Model 29, which later was renamed the "Filmac 200."

All these new machines were shown at the National Microfilm Association convention in Washington, D. C., in the spring of 1959. Because of the widely known, highly publicized need for an economical and efficient reader-printer for engineering drawings, pre-show interest was tremendous.

The excitement was shared by 3M salesmen, who were told about the new Model 29 the day before the show opened. The announcement was made at the end of a sales meeting. A large cake was wheeled into the room and cut open. 3M's entry in the engineering sweepstakes gleamed and glistened for all to see.

After 3M introduced the Model 23 ("Filmac 100") Reader-Printer, most people in the industry recognized the firm's capability to produce a bigger unit for engineering drawings. However, few apparently actually visualized the capabilities of the equipment. The impact of the Model 29 Reader-Printer on the NMA convention was phenomenal. The show had hardly opened when a human log jam blocked the aisle in front of the 3M booth.

One competitor immediately removed his machine from the show. Another placed a sign on his machine: "Go see the 3M reader-printer."

The story is told of a vice president who rushed into his booth and accosted his sales manager. "I just saw the 3M Model 29," he said breathlessly. "It's one one-tenth the cost of our machine, it's six times as fast, and the prints cost half as much. How are you going to sell against that?"

"I don't know," the sales manager said matter of factly while shaking the executive's hand. "Good-by and good luck."

That feeling was shared by many. After the show closed for the night, the sales manager was administering liquid tranquilizers to himself in consort with a few associates. A siren was heard in the street.

"What was that?" he asked.

"Our reader-printer must have jumped off the roof," was the reply.

The Model 29 had everything. It was priced at $919 ("3M could have at least charged a thousand dollars for it," was the irate comment of one competitor.) Prints cost 20 cents apiece. It was fast, it produced a print in six seconds. It had an 18" x 24" viewing screen and produced both full-size 18" x 24" prints and 12" x 18" half-size prints. It weighed 300 pounds and was designed for table-top operation. It was "push-button easy" to operate. It had few moving parts and low maintenance requirements. Most important of all, it had an extremely good exposure latitude, enabling it to make acceptable prints from films of widely varying quality without a change in its nominal six-second setting.

Affectionately known to 3M people as "Little Marie," the unit was the culmination of years of

relatively unheralded 3M research and development, which is possibly why it caused the surprise that it did. And even though the machine was more or less a prototype, it did not fail at the National Microfilm Association show.

The Model 29 or "Filmac 200" capped a basic change in microfilm aperture card systems. For the first time it was possible for small as well as large engineering drawing departments to change from passive or limited-access microfilm aperture card systems to truly active systems of information management. It was a major step toward a total system concept in the microfilm aperture card field.

In addition, the "Filmac 200" was the chief product in the evolution of 3M's Microfilm Products Division. The introduction of the reader-printer was also the major factor leading to the incorporation of "Filmsort" aperture cards as an integral part of this growth. From the time the "Filmac 200" was introduced at the show, the merger of the 3M Company and the Filmsort Company was only a matter of time, for it was what the industry needed to maintain the development impetus which for so long had failed to move at the rate its supporters had hoped for and worked toward.

CHAPTER 13

THE MICROFILM HORSE

The year 1959 was a good one for the Filmsort Company. The firm grossed $900,000 and, for the first time, finished in the black. Filmsort salesmen, who called themselves "hole salers," convinced an ever-widening circle of people in business and industry that the aperture card was an active, efficient tool of information management.

The trend toward more active uses of microfilm begun by the Department of Defense 0009 Committee was taking hold. Full implementation of microfilm's active role in business and industry communications was to take place in 1960. A big swing to this new information-handling medium would begin in 1961.

But, paradoxically, the firm responsible for this switch in industry thinking found itself in danger of being left behind in the rush to satisfy this rapidly-increasing demand for aperture cards and equipment. The Filmsort Company's base of operations was too narrow to capitalize on the new profit potentials.

The Cresap, McCormick and Paget report of 1956 pinpointed the weaknesses. The key problem was the company's narrow product line, which forced the line to be sold with other manu-

facturers' products and limited the choice of methods of distribution. Furthermore, as the management report noted, there was insufficient capability for planned, orderly development of new products and markets.

The possibility of a merger with another firm was considered. Ideally, that firm's product line would complement Filmsort's, plus supplying money and manpower to mount a major marketing effort.

Coincidentally, out in St. Paul, the 3M Company was studying its future in the microfilm industry. The company's management was convinced that success would depend on 3M's ability to change microfilm from a storage medium to an active method of managing information. To accomplish that, an active microfilm format was needed to complement 3M's new machine technology. The "Filmsort" aperture card was considered and found interesting.

After a series of talks instigated by Miehle-Goss-Dexter, 3M bought Filmsort in the fall of 1959. McArthur, Bassett, Robbins and several other Filmsort employees were invited to join 3M.

The sale took place on Saturday, two days before the opening of the National Business Show in New York City. Earlier that week, a meeting of Technical Drawing Associates was held in Rochester, N. Y. Representatives of 3M, Filmsort, Recordak and Xerox, had assembled their equipment to show TDA engineers and draftsmen a complete microfilm aperture card system.

Because of its small size, almost every Filmsort employee knew the firm was to be sold to 3M. That was not the case at 3M. So, when 3M managers asked 3M sales and technical representatives at the Rochester meeting to help carry Film-

sort equipment to New York City for the business show, the request was not received with boundless enthusiasm. One scene remains vivid in many memories: a 3M man angrily kicking a Filmsort viewer, trying to make it fit into the back of his crowded station wagon.

The acquisition was announced at a 3M sales meeting in the Barbizon-Plaza Hotel, New York City, prior to the business show. It was the first time the Filmsort and 3M organizations assembled together.

Robbins' most vivid recollection of that meeting shows the striking difference between the two. That meeting, Robbins recalled recently, in addition to providing a forum for news of the Filmsort acquisition, was the occasion for announcing a number of new copying products. Seated behind Robbins was a gentleman who greeted each announcement with an enthusiastic and vociferous cheer and a rolling, roisterous "Va-va-va-voooom!" Robbins, accustomed to the quiet atmosphere of Filmsort's schoolhouse at Pearl River, was impressed by the youthful, "college" enthusiasm of his new colleague. Unable to contain his curiosity, Robbins turned to introduce himself and learn the name of his spirited new associate.

"Ernie Bovermann, general sales manager!" was the reply.

The Filmsort acquisition, and the employees which it brought to 3M has been described by Raymond H. Herzog, now a 3M corporate vice-president and the head of 3M's Graphic Systems Group,* as a "wonderful association."

*He was vice-president of 3M's Duplicating Products Division in 1959.

At one time, Bassett had likened the aperture card field to a horse. "A number of firms have the camera – or mouth," he explained. "We at Filmsort have the middle or digestive system – mounting and viewing equipment. And you people at 3M are the horse's tail." He was referring, of course, to 3M's reproduction capabilities, although the image was not entirely flattering.

However, in Bassett's words, the horse was partly assembled when Filmsort joined 3M. In the early 1960s, the "front end of the horse" – the "Filmsort" processor-camera – was added. The steed was complete and ready to begin galloping.

CHAPTER 14

A "STICKY" BUSINESS

"There has been a rebirth of interest and enthusiasm in microfilm. We at 3M are proud to join with Filmsort in this revolutionary trend in the business equipment industry." That was how Herzog, vice-president of 3M's Duplicating Products Division, greeted the Filmsort merger.

"Unsurpassed as an economical and convenient method of storing information, microfilm promises to unfold even more dramatic applications in the coming few years," he continued. "It is a superb tool for use in active records applications for day-to-day office activity – at a lower cost and with more flexibility than anything currently in use. With new machines that bring microfilm records to life in seconds, and new ideas that will put us in the jet age of office management planning, I am confident that more and more firms will want to take advantage of microfilm's enormous potential.

"We need to put microfilm to work, and only when we do will we begin to enjoy the economies and benefits it has in store for business and industry."

Herzog's optimism concerning the future of Filmsort under the 3M banner was shared by McAr-

thur. "The acquisition of the Filmsort Company by Minnesota Mining & Manufacturing Company is a forward step to make microfilm a definite factor in retrieval and reproduction for data accessibility," he said. "The research facilities, manufacturing ability, and marketing experience of 3M have now become available to the Filmsort Company. In addition, the decision by 3M to maintain as a self-contained unit the executive and management staff of the Filmsort Company in its new headquarters in St. Paul is both a tribute to the efforts of the Filmsort team and an incentive to increase and continue our contribution to the growing usage of microfilm as a low-cost tool for better methods."

The actual physical move of Filmsort to St. Paul was quite easy. There was no extensive plant. There was only a limited amount of equipment. Ease of relocation was, in fact, an attractive feature of the merger. Approximately 15 to 20 Filmsort employees, including McArthur, Bassett, Robbins and other key people such as Henry Petersen, Lester Kruger, and Leonard Lawrence were involved in the move.

Establishing a Microfilm Products Department was the first organizational task. McArthur became manager. David Woodrow became product manager, but soon was promoted to general sales manager of the Duplicating Products Division, where he was responsible for sales of 3M's copying products. He still holds that position today.

Filmsort contributed to 3M its aperture cards, a hand aperture card mounter, a semiautomatic mounter (SAM), the "085" Uniprinter card-to-card printer, the "Designer 184," and other readers. The 3M Company, in turn, had its "Filmac

100" and "Filmac 200" Reader-Printers. Several Filmsort products, primarily viewers, were discontinued because of 3M's goal of developing unique new products, such as its line of reader-printers, rather than comparatively common readers.

Filmsort had developed a systems approach to microfilm sales; 3M was known for its ability to sell microfilm hardware. The Pearl River operation had been primarily dependent on supply items such as cards and jackets for its income; 3M took a machine approach to sales. The merger of the two product lines and respective marketing organizations and philosophies therefore broadened the base of operations of both Filmsort and 3M.

"Without the merger, both microfilm programs would have collapsed," Herzog said recently. "Filmsort's unit sales simply could not justify the marketing and research effort necessary to make the cards more usable and expand their applications. Conversely, lacking control of the basic records medium – the aperture cards – 3M could not have profitably promoted the active uses of microfilm."

Distribution was another area in which significant changes came about as a result of the merger. In the late 1950s Filmsort had discontinued distribution through Remington Rand and Diebold. However, it had retained Recordak and Microdealers and had added the Charles Bruning Company as a distributor. These distribution channels were continued by 3M. It also assigned Filmsort products to Thermo-Fax Sales, Inc.,* a business machine retailing organization and a 3M subsidiary.

Bassett stayed in Washington as Microfilm Prod-

*Changed to 3M Business Products Sales, Inc., in September, 1965.

ucts sales manager. Robbins continued to edit "Filmsort Facts." And for the first time an extensive advertising campaign on behalf of aperture cards was launched in major business publications.

One significant thing occurred in April, 1960. The Department of Defense 0009 Committee announced its long-awaited military standards and specifications for engineering drawing micro-reproduction systems.

At first no basic changes were made in the Filmsort product line, but research was beginning to develop a new and better adhesive for the aperture card. There was no pressure on this program, because it was not believed to be a pressing problem. However, at the start of the 1960s aperture cards were being expected to do more jobs better and faster. Machine handling of cards increased. A number of information management systems utilizing punched aperture cards were initiated and expanded.

"Filmsort" aperture card reject rates rose sharply to 30, even 40, per cent. The situation became critical at both manufacturing and customer levels.

At first glance an aperture card is a simple assembly. A hole is cut in a data processing card and adhesive tape is applied around the outside edge of the aperture. A glassine cover is adhered to the tape to keep cards from sticking together. Mounting the microfilm simply involves removing the glassine and replacing it with the film. This simplicity is deceiving. Aperture cards are manufactured to critical tolerances. One is the amount and characteristics of the tape adhesive.

The problem was this: it was found that the adhesive tended to "bleed" past the glassine cover and cause adjacent cards to stick together. In some

cases, cards became sealed to each other in solid "blocks." When the amount of adhesive used was reduced, the glassine covers "popped off" as the cards were run through a machine.

These problems taxed 3M Company's sales and service capabilities to the utmost. Fortunately the firm had the resources to provide prompt correction of all problems in the field. The delays or setbacks in customer aperture card programs were minimized.

Meanwhile, a crash program was begun under the direction of McMaster to develop a new adhesive formulation. This was a co-operative effort involving several 3M divisions. The development of "Scotch" brand Cellophane tape was, of course, the foundation of 3M's modern growth. Tape technology had not been a significant consideration in the acquisition of the Filmsort Company, but now it became of major importance.

While the old Filmsort Company had limited research facilities, 3M was able to spend for research to develop a nonbleeding adhesive strong enough to hold the glassine covers to the cards, but still allow the glassine to be removed easily to mount the microfilm. The adhesive had to be pressure-sensitive rather than a heat-seal type, because it had to be flexible and could not become brittle and lose its bond with expansions or contractions of the cards due to changes in heat or humidity.

Such an adhesive was developed and the problem was solved. That was only the first of a number of technical problems which arose as increasing demands were made on "Filmsort" aperture cards because of improvements in microfilm systems and operations. In each case 3M was able to create technological advancement.

Even with the technological problems encoun-

tered in its first year of operation, the 3M Microfilm Products Department was able to finish in the black. Since then, as Herzog put it, the group has never been allowed to get "too far in the black." Instead profits have been plowed back to produce progress. A succession of new technological breakthroughs, each calculated to "take the mystery out of microfilm" by making it ever simpler and easier to use, has been the result.

CHAPTER 15

THE CARD-TO-CARD PRINTER

"If you think salesmen have it tough, you should see the problems customers have," E. F. Bovermann, vice-president and general sales manager of 3M Business Products Sales, Inc., has been quoted as saying. His remark is appropriate when applied to microfilm aperture card systems for engineering applications at the start of the 1960s.

Engineering drawing files and distribution systems which had not been converted to microfilm – and the vast majority of them had not – were becoming increasingly cumbersome and inefficient. It could take as long as two weeks to obtain a print, as much as four weeks until a change could be reflected in a drawing.

Microfilm in an aperture card was far superior to paper for storing and retrieving engineering data. Consequently, although there were still big gaps in the microfilm system for engineering drawings, a number of users had turned from paper to film. Those users were convinced that the deficiencies in the system would be overcome. Furthermore, their engineering drawing problems were so

great they were willing to do anything to make the new system work. Their confidence was a tremendous contribution to the development of successful aperture card systems. As is true with many new technologies, it was the users who made the system work.

A critical need at the beginning of the decade was a faster, better method of reproducing high-quality "Duplicard" copy cards. In August of 1959 a meeting had been held in the Filmsort Company plant in Pearl River to discuss the problem. Representatives of the Armed Forces and Bell Telephone Laboratories as well as Filmsort attended.

The purpose was to agree on the desired features of a duplicate film and to set standards which would meet the requirements of the Armed Forces. There was no argument that the absence of an acceptable duplicate film restricted the interchange of data and jeopardized manufacturing economies which might accrue with a sudden demand for expansion of microfilm systems for engineering drawings.

One result of that meeting was a decision to ask diazo film manufacturers to concentrate on developing a film which would be compatible with all reproduction techniques, and would enable three and even four generations of duplicate cards to be made from a copy card. Other requirements, such as contrast, transmission, resolution, exposure speed, and shelf life, also were specified.

As a result of that industry-wide effort there is today only a minute loss of resolution in a first-generation diazo "Duplicard" made from an original aperture card. In second-, third-, and fourth-generation reproductions there is even less loss and often there is no deterioration at all. Therefore, even a fourth-generation duplicate card is for

all practical purposes as good as the original silver image. This achievement was necessary before present-day high-volume, high-use aperture card systems could be implemented.

The next challenge was to develop a fast, automated method of producing duplicate cards. The Filmsort Company had considered the problem in the mid-Fifties and had come up with the "Filmsort Uniprinter 075" copier – the first card-to-card printer ever built. That unit was a dry process, exposing the diazo film to ultraviolet light, then developing the latent image with heat.

Filmsort followed with the "Filmsort Uniprinter 085" copier, which employed another principle. After the film was exposed, the card was placed in a heated chamber. Ammonium carbonate crystals were dropped on a hot surface in the chamber. The resulting decomposition of the crystals formed ammonia and carbon dioxide which developed the image on the film. The process had limitations. It required up to 30 seconds to reproduce a card. The equipment was manual. And it lacked stability. For example, if the operator put in too many crystals, the film became hazy.

After Filmsort joined 3M a new card-to-card printer was introduced. That printer, the "Filmsort Uniprinter 086" copier, utilized a temperature-controlled energy source and had an automatic metering device for controlling the entry of ammonia and moisture. In the hands of a skilled operator, the printer could turn out 300 duplicate aperture cards in an hour. That was triple the printing speed of any other unit at the time the "Uniprinter 086" was introduced.

Despite this, the new printer was a low-volume unit. True, it solved card-to-card reproduction problems for small- and medium-sized engineering

drawing systems, but the need for a high-volume, automatic card-to-card printer still remained. Development of such a unit by 3M was aided by cooperation of the Bell Telephone Laboratories. Bell established the requirements and standards to suit its needs, and 3M developed the equipment.

Bell Laboratories was an ideal test facility for microfilm. Since the middle 1940s, Bell had been interested in microfilm as a means of improving its systems of handling engineering drawings. For years it had been microfilming inactive materials. Frames of microfilm representing more than half a million drawings were cut and placed in individual glassine bags to provide unitization and increased access. But Bell Laboratory personnel concerned with information management continued to seek ways in which microfilm could be used to actively replace paper copies of engineering drawings.

The laboratory was involved in the development of aperture cards from their very inception. It had worked closely with the DOD 0009 Committee to develop aperture card standards. In 1956 it had begun limited test trials of aperture cards at three locations. Those trials indicated that significant cost savings and improvements in service could be achieved with aperture cards. The chief benefit, it was decided, would be a reduction in the time engineers had to spend looking for drawings. That saving alone represented millions of dollars.

The initial trial tests were expanded to more locations. In addition Bell Laboratories began the successful development of a small desk-top reader which individual engineers could use to read aperture cards.

By the time the 1960s arrived, Bell Laboratories had converted hundreds of thousands of drawings to "Filmsort" aperture cards and was committed

to an aperture card system for handling engineering data. It was at this point that 3M developed the last piece of hardware needed to complete the system.

The unit which evolved was the "Filmsort Uniprinter 041" automatic card-to-card copier, capable of producing duplicate cards at the rate of 2,000 an hour. Furthermore, it was entirely automatic.

The two "Filmsort" copiers were introduced by 3M in the spring of 1961 at the National Microfilm Association convention. Other 3M equipment shown for the first time at that show were the "Filmac 200R" Reader-Printer, capable of handling 35mm roll microfilm in addition to aperture cards, the "Filmac 300" Reader-Printer, which makes 11" by 14" legal-size copies of all types of microforms, and a new hand mounter.

The introduction of the two copiers made it possible to file and retrieve engineering data at or near the point-of-use. This was extremely important in a nationwide system the size of the Bell Telephone Company.

In July, 1961, the Bell System, which bought the first automatic card-to-card printer from 3M, began full distribution of microfilm aperture cards instead of prints of engineering drawings. In just two years — 1961 and 1962 — nearly 30,000,000 aperture cards were produced to fill the Bell System's engineering drawing needs. The cards replaced prints of approximately a million drawings and were distributed to about 125 locations. At the time it was the largest microfilm system in the world. Since 1962 the network has grown to 210 locations, using 6,000 desk-top readers, with an annual production of 15,000,000 "Duplicards" a year.

It was with the help of highly innovative users such as Bell that 3M was able to develop the full potential of microfilm aperture cards for engineering drawing systems. The Bell program proved that aperture cards were efficient, that they could improve service and create substantial savings. Quite naturally, the Bell microfilm program became of vital interest to all users of engineering information.

CHAPTER 16

MICROFILMING MADE EASY

From the beginning of its interest in microfilm, 3M had realized that microfilm must be made easy to use if it was to gain broad acceptance. One snag in the systems of the 1950s was the necessity for a darkroom or developing unit to process microfilm. At best this was a bother. At worst it caused resistance because would-be users realized that operating a microfilm system required technical skill or necessitated sending undeveloped film to an outside processing plant. In addition to those complaints, there was an obvious advantage in being able to use the microfilm immediately without having to wait hours or days for the film to be returned from darkroom or processing station.

The "Filmsort 100" Reader-Printer had made it easy to make prints from microfilm in seconds. It should be equally easy to record images on microfilm. The directive from management had a theme: take the mystery out of microfilm; get rid of the darkroom. Everyone realized that was a big order.

In the 1950s 3M researchers were trying to define the requirements to fill that order. After the

merger with Filmsort, the research included the aperture card. It provided the laboratory project team with a format – unitized microfilm. The researchers began building research around the aperture card. The result was a unique machine which not only combines the functions of microfilming and film processing, but also film mounting, in a single push-button operation. It turned microfilming into an office procedure.

When a young scientist named Arthur Kutchera joined 3M his research materially aided the development of the "Filmsort 1000" Processor-Camera. The "Filmsort 1000" Processor-Camera, a prototype, was quickly followed by the "Filmsort 1000d," which could photograph a document and produce the finished film mounted in an aperture card in just 54 seconds. All that was necessary was to touch a single button. The processor-camera's copyboard could handle any document or series of documents up to 18" x 24" in size. Its reduction ratio was 16 to 1.

A still bigger, faster processor-camera was needed, 3M felt, so research on that project was supported. The result was the "Filmsort 2000" Processor-Camera, introduced in 1965. It has a 24" x 36" copyboard (as well as one 18" x 24") and produces processed film in 46 seconds. Reduction ratios with that camera are both 16 to 1 and 24 to 1.*

The development of the processor-camera was not without the problems generally associated with bringing such a complex new product to life. One embarrassing moment occurred in the Bell Labor-

*In 1964 3M produced the "Filmsort 1000dx" Processor-Camera, which was capable of reductions of 24 to 1. It was, however, a standard "1000d" model secured to a larger stand in order to lower the copyboard to provide the greater reduction ratios.

atory, where a unit was being tested. One job was to learn the processor-camera's reactions to power failures of various duration. When the power failed, a quirk of design caused the machine's developing fluids to dump within one-half to one second after the unit was turned on. The laboratory floor was nearly flooded before that problem was solved.

With the development of the processor-camera which sold for $3,200 – a bargain price compared to the costs of other microfilming systems – the use of microfilm for engineering applications was broadened considerably. Many firms, which had balked at paying upwards of $12,000 to $15,000 for a microfilm system, were not hesitant about getting into microfilming for the price of a processor-camera.

The development of the processor-camera also led to internal changes in 3M's microfilm products group. The company is made up of more than thirty divisions and subsidiaries. The divisions traditionally have developed through evolution. As soon as a product department reaches a point where it can stand on its own profit and loss, it is awarded division status. It is a point of pride and prestige within the company, because it indicates the department has demonstrated its ability to grow.

In the case of the microfilm products group, growth was rapid. Factors that helped were the standardization of the aperture card format by the DOD 0009 Committee and the positive effects produced by active support of microfilm systems from the military and private organizations like Bell Laboratories. This, of course, allowed 3M and others in the industry to produce cards, reader-printers, mounters, card-to-card copiers, and other equipment, secure in the knowledge that they

would not be made obsolete by changes in standards and that there was a market for their wares.

By 1962 3M was convinced that the merger with Filmsort had been beneficial. Aperture cards and sales continued upward. Furthermore, the microfilm group had succeeded in developing an entirely new product, the "Filmsort" Processor-Camera. That provided the group's independent ability to expand the microfilm market.

In August of that year at a national dealer sales meeting in Miami, an announcement was made that McArthur's department had been given division status by 3M's Board of Directors meeting in St. Paul. "It was a great day for all of us," McArthur said recently. "We had won our freedom."

McArthur became vice-president of the Microfilm Products Division. Bassett was named general sales manager. It is not difficult to imagine that at sometime during the celebration which followed, both men thought back to the day they first turned to microfilm. McArthur must have relived that day in 1947 when Bell and Ellsworth commissioned him to build a microfilm camera in Salt Lake City. Bassett surely recalled vividly that day in 1950 in Los Angeles when the owner of Business Systems, Inc. showed him his first microfilm gear.

The time for celebrating was short, however. McArthur, Bassett, and others had new titles and a new division, but they still had the same big job to do. One problem that had vexed McArthur for some time was to convince prospective customers that microfilm was capable of doing a job for them. Part of this was the fact that microfilm was strange and unknown to many people, and was thought of as something for use only in libraries and archives.

Moreover, management personnel who were interested in microfilm found it necessary to travel widely to study complete microfilm systems in operation. As many as five or more separate suppliers of equipment had to be consulted to obtain essential facts and learn requirements. And because methods of keeping records are nearly as numerous as the offices in which they are kept, no one microfilm system could be applied to all. It was decided that a microfilm systems laboratory was needed to do that job.

Such a facility was set up in the microfilm laboratory at 3M headquarters in St. Paul in February, 1962. Called MicroForum, it included everything necessary to program any type of microfilm system. So complete was MicroForum that it even included competitors' equipment designed for jobs 3M machines could not do.

Under the direction of Dr. David R. Wolf, MicroForum became the only place in the world where a potential user could bring his documents and see them handled in a microfilm system tailormade to fit his needs. Between 1962 and 1965 some 600 persons representing 200 commercial organizations and government agencies visited MicroForum. With that proven interest, 3M saw the need for a systems development laboratory closer to federal government and major eastern users of microfilm. In March, 1965, another MicroForum was opened in the 3M Federal Government Services offices at 1750 Pennsylvania Avenue, Washington, D. C., with John Mill as manager.

"Both MicroForums will be used to explore the requirements of people whose future needs exceed specific capabilities that exist today," McArthur said at the opening of MicroForum in Washington.

CHAPTER 17

A NEW PROCESS FOR LOW-COST PRINTS

Make it simple and easy to use is one guide for 3M researchers. Simplicity and ease of use were evident in the development and evolution of 3M microfilm reader-printers and the unique processor-camera. The idea of making it simpler and easier to use helped 3M researchers produce a new technology with implications much broader than the field of microfilm or information management alone. This technology was aptly christened Dry Silver printing.

Dry Silver printing used as guidelines the "Thermo-Fax" infrared copying process, which 3M developed in the early 1950s. One big advantage of that copying process was that it was dry; no chemicals were required to produce a copy image.

A similar dry copying processing for microfilm became a 3M goal. In the meantime, however, the "Filmac 100" Reader-Printer copying process was developed. Although it was essentially dry, the electrolytic process used to produce copies from the "Filmac 100" and other 3M reader-printers delivered a damp, if not wet, print to the user. Perhaps only a nit-picker would argue the point

strongly, but it was for a fact a wet process. For a few seconds after the print was in the hands of the user it was damp, although it dried quickly at room temperatures.

Despite the success of the "Filmac" products, the development of a truly dry printing process for microfilm continued to occupy the minds of many in the microfilm products laboratory.

To David A. Morgan and Benjamin L. Shely goes the credit for solving this problem. Shely, a 3M chemist in the Duplicating Products laboratory, had been involved in the early work, continued to explore new facets and found a very significant lead. Morgan, a 3M chemist in the Duplicating Products laboratory before he joined the microfilm laboratory, combined the technology of 3M's microfilm and duplicating products researchers to successfully formulate a new, commercial process.

In addition to being dry and of high quality — the paper used in the process is comparable in quality to conventional photographic paper — the process is economical. Paper prints produced by microfilm blow-back equipment cost six to eight cents a square foot. The new dry silver process produces prints for three cents a square foot.

Just as the processor-camera brought a "new look" to microfilm equipment when it was introduced in 1962, the new Dry Silver Printer also added an entirely different looking piece of equipment to the industry's line of hardware. Because the printer produced an economical dry silver print, it became both convenient and economical to eliminate the intermediate reference step of viewing microfilm images on a screen. Therefore the screen was eliminated.

The first machine was called "The Quadrant,"

indicating its capability of printing a nearly full-size copy of any of four 8½" x 11" documents microfilmed on a single aperture card. In 1965 an even more sophisticated dry printer was introduced by 3M. This was the "222" Dry Silver Printer, which can reproduce any one of eight letterhead-size documents on a frame of 35mm film mounted in an aperture card at the same cost of about two cents a copy in 10 seconds. With the introduction of the "222" Dry Silver Printer, the earlier machine was renamed as the "111" Dry Silver Printer.

The two new printers point the way to new markets for microfilm. They make it possible for practically any paper-work operation, even that in a small office, to enjoy the benefits of a microfilm aperture card system at a cost competitive with conventional copying machines.

This technology also led to the development of the "333" Dry Silver Printer, which was introduced in 1966 at the National Microfilm Association convention in Washington, D. C. This printer produces low cost dry silver prints up to 18" x 24" in size from aperture cards, can be operated automatically or manually and, like the other dry silver machines, requires no chemicals, toners or powders.

The "333" printer was designed basically for engineering drawing uses, but 3M also sees it as an office reproduction machine.

The man in charge of 3M's Microfilm Products Division laboratory during this period of accelerated product production was – and is – Dr. Marshall R. Hatfield. He has been division technical director since 1962.

"Little by little the line broadens," Herzog said. "One thing leads to another. It's a typical 3M pro-

gram. Eventually microfilm will catch on as copying has and the market will truly be explosive."

In 1965 3M not only announced its new "Filmsort 2000" Processor-Camera and its new "222" Dry Silver Printer, but also introduced two new "Filmac 400" Reader-Printers to complete the line started with the "Filmac 400C" Cartridge Reader-Printer, which had been on the market since 1964.

The reader-printers can handle all forms of microfilm – in cartridges, aperture cards, roll, jackets, crofiche – and they have exposure controls which allow the machines to produce hard copy prints in six seconds despite variations in film densities. On the cartridge and motorized versions, a 100-foot roll of film can be scanned in 15 seconds. The hand-operated version is inexpensive, costing less than $1,100.

Maintenance on all machines is limited to replacing rolls of paper and bottles of activator fluid, and occasional cleaning. A cover on the side of the cabinet is lifted to insert the activator fluid bottle into two tubes which pump the solution up to the copy area. This is quite a change from the first 3M reader-printer, the "Filmac 100," which required the operator to squirt activator fluid on a sponge now and again during a day of operation.

"Right now," McArthur said not long ago, "the microfilm industry in general and 3M in particular have the hardware on hand to solve any information management problem. Of course, there will be refinements in the future, but the equipment available today should satisfy anyone's needs – at least for the moment."

CHAPTER 18

MICROFILM APERTURE CARDS TODAY

Somewhere in the Atlantic Ocean a crewman on a Polaris submarine must repair a malfunction of the sub's missile system. To do the job he will have to refer to one or more of thousands of weapons system engineering drawings carried aboard the atomic submarine. It would take this sailor considerable time and effort to find the proper drawings in a paper file. Fortunately that is not necessary. He will simply go to a small file drawer, quickly find and remove a microfilm aperture card, and insert it in a nearby reader-printer for a "look" or a copy.

This is possible because the United States Navy has replaced conventional paper engineering drawings with microfilm aperture cards on Polaris submarines. As a result, the subs are able to carry engineering drawings of their systems with a minimum sacrifice of space and weight. A one-inch-thick deck of aperture cards is the equivalent of 70 engineering drawings. In addition, the cards cost less than full-sized prints and provide fast, easy access to engineering data.

The Polaris missile system is just one of many

weapon, target control, and launching systems carried by Navy ships at sea. Hundreds of contractors and subcontractors supply hardware for those systems. As installations are made or modified, it becomes a tremendous job to determine which ships should be given which new or revised engineering data.

To solve that problem, the Navy uses computers to keep track of every part in every system on each ship in each fleet. Contractors submit new and revised engineering information on aperture cards. Accompanying the cards are key-punched data cards. The data cards are fed into a computer, which automatically determines distribution requirements and punches those requirements into new cards. These cards, in turn, are used to control and direct the reproduction of the required number of duplicate aperture cards for distribution to the ships at sea.

Conversely, at the United States Army's Redstone Arsenal in Huntsville, Alabama, an automated, computer-driven microfilm file is now being installed as part of the arsenal's procurement program. Each new engineering drawing prepared at the arsenal will be entered in the automated information management system as a microfilm aperture card.

This card will be converted into a diazo microfilm "chip," which will contain both an image of the engineering drawing and an optical code reproduced from drawing identification data punched in the aperture card. At the direction of the computer, the automated system will mechanically file this microfilm chip for future reference. The conversion of engineering drawing data to the automated microfilm file will take place daily. Thus Redstone's engineering information manage-

ment system will always be up-to-date and responsive to procurement needs.

When a request for procurement data is received from a contractor, the arsenal will simply feed the request data to its computer. A "generation breakdown" will automatically be performed by the computer to determine every engineering drawing number required to implement the request. The computer will also automatically direct the mechanical selection of appropriate microfilm chips from the file.

Engineering drawings recorded on these chips will be reproduced on duplicate microfilm aperture cards which will be distributed to contracting agencies for procurement purposes. Thus with a single entry of request data into its computer, Redstone Arsenal will be able instantaneously to issue bid sets. This fast, automated information management system will save a tremendous number of man-hours, as well as ensure that procurement data issued by the Arsenal is as accurate and current as possible.

A similar but less automated microfilm procurement system is now used by the U. S. Air Force at its San Antonio Air Matériel Area (SAAMA) to reproduce some 2,000,000 engineering drawings each year in microfilm aperture card format. It takes SAAMA only two or three days to reproduce a microfilm aperture card bid set, compared to an average time of 27 days formerly required to reproduce full-sized engineering drawing paper prints. Thus the Air Force's microfilm procurement program is 900 per cent faster than its previous conventional blueprinting methods.

In addition, the cost of reproducing a microfilm aperture card is only five cents. It costs 20 cents to make a full-size paper print. SAAMA saves 15

cents a drawing or $300,000 a year. Other savings result from reducing procurement lead time.

Business and industry also profit from increased speed and efficiency made possible by aperture card systems in handling engineering drawing information. One of the largest users, the Bell System, annually produces 15,000,000 duplicate aperture cards to satisfy the informational needs of engineers at more than 200 point-of-use locations throughout the country. Among smaller users, De Zurik Corporation of Sartell, Minnesota, microfilms 50 to 60 engineering releases a day.

Although it is the largest application, the management of engineering drawing information is by no means the only use for aperture cards. Ideal National Life Insurance Company in Salt Lake City, Utah, turned to aperture cards to replace policy folders to save storage space and provide additional protection for policy records. More important, the firm discovered it saved a lot of what it calls "can't find" and "browsing" time. The result was faster, better service to policyholders and more efficient use of office personnel. Five different departments need to use the policy files regularly; in some instances several wanted the same file simultaneously. With its old system, there was a lot of needless "can't find" time expended in hunting for a file from department to department.

Furthermore, virtually everything ever written about each policy was placed in the manila policy folder, so a number of unnecessary records were accumulated. While contributing to the confusion connected with the retrieval of information of policy jackets, the unneeded records also contributed to browsing. Because correspondence and other papers make interesting reading for anyone using a file, valuable time was wasted. Even if browsing

were no problem, the need to glance through unimportant papers to find pertinent ones slowed down service.

With its new microfilm system, Ideal National films the original application, medical report, underwriter's work sheet, insurance schedule, and other pertinent papers when the policy is written. Documents representing policy changes also are microfilmed. Despite this, aperture cards average only two to a policy and seldom number more than three. Correspondence not representing policy changes is kept temporarily by the writer, then destroyed when the transaction is completed.

The aperture card records are stored in a central file. When someone in a department needs policy information, the Central Records Station operator is called. Using either the policy number or the policyholder's name (the cards are cross-indexed), she can find the aperture card in seconds. The operator can fill the request with a reader-printer print or a "Duplicard" copy card, or she can read the information to the requester. And when the requester is finished with either the hard copy or the "Duplicard," he can throw it away, saving time previously needed to return a file.

M. W. Houck, Inc., an eastern food brokerage firm, uses aperture cards to analyze customer merchandising of its products. In this unique application, published retail grocery advertisements are filmed with a processor-camera. The card is key punched to show the customer's name, product, date, size of the ad, and the unit price. This information is recorded not only for items Houck sells, but also for all competitive items.

For example, if Houck wants to know how much advertising leading grocery merchandisers have given to a certain brand of peas, compared

with a competing brand over a six-month period in the New York area, it's simply a matter of analyzing the cards, which are retrieved with a tabulating machine.

Opportunities for improving a customer's ad are easy to spot. Vital information also can be gathered to make a personalized presentation to the customer. Salesmen study the patterns of advertising both by product and customer before making important calls. At that time they are equipped to discuss or detail the information gained from a check of the aperture card file.

Dakota County Title and Abstract Company, Hastings, Minnesota, got an easy start into the business several years ago with the help of aperture cards and a processor-camera stationed in the Register of Deeds office in the Dakota County courthouse. The firm started in a corner of the Register of Deeds office, but soon realized it had outgrown that location.

"Microfilm wasn't the only way to get started," said L. L. Thyen, vice-president and manager, "but it certainly was the most economical."

The company debated between microfilm in jackets or aperture cards. "We chose aperture cards for availability," Thyen said. "We didn't want one employee to have to wait for a jacket being used by another employee." He figured that to place two pages of records on an aperture card cost the firm 20 cents. It would cost a minimum of 50 cents, he said, to reproduce two pages in hard copy form, plus the cost of additional storage.

The firm, staffed by six women employees, is housed in a small building that once was a bank. The aperture card records are stored in the compact vault. "We've got more than 300,000 documents on microfilm in one file cabinet," Thyen

said. "Can you imagine how much space those records would require if they were on paper? We'd never be able to get along in this small building."

At Proviso Township high schools in suburban Chicago, an aperture card system provides economical and efficient handling of the district's large and rapidly growing file of student records. Chief benefits are security, space saving, and simplicity of use.

Microfilm was considered for some years before the system was installed. The first concern was protection, but a shortage of filing space and an increased number of transcript requests – some referring to records thirty and forty years old – also were factors. Proviso was reluctant to use roll microfilm because it would be impossible to inter-file records alphabetically or to find them if the exact year of leaving school was unknown. Aperture cards gave the school district its answer.

The district uses a "Filmsort 1000d" Processor-Camera, a "Filmsort Uniprinter 086" Copier, and a "Filmac 100" Reader-Printer.

Two aperture cards are produced for each student's records. One deck of cards is the work file. A tab card containing information not on the student record also is key punched and made part of the record. The data cards are used to process academic research projects on tabulating equipment, eliminating the tedious time-consuming job of preparing reports manually.

Requests for transcripts are filled in seconds with a print made on the reader-printer. And the microfilm file, because it is compact, is located conveniently close to the administrative offices.

In another school use, microfilm equipment and aperture cards are teaching tools in the drafting department of Brigham Young University, Provo,

Utah. "An engineering drawing in this age is only as good as it will reproduce," said Wilford J. Tolman, design and drafting instructor. "And in most instances this means the reproduction must be readable to at least the third generation from the original camera microfilm."

Special techniques for drafting for microfilm are taught in Tolman's classes. When a student completes a drawing, he is able to see his work on microfilm and have it reproduced immediately. In the classroom for use in this phase of the training are a processor-camera and a "Filmac 200" Reader-Printer.

Educators are also using aperture cards to improve the quality and currentness of educational materials. For example, teachers at Nova High School, Fort Lauderdale, Florida, bring pertinent magazine articles, newspaper clippings, and other documents to the school library, where they are recorded on aperture cards, coded, and filed. When these materials are needed for class assignments, students can view them on a reader-printer in the library or make paper copies in seconds at the touch of a button for use in the classroom or at home. This microfilm information management system provides limitless opportunities for teachers to expand and tailor study materials to the educational needs of their students.

In the San Diego County school system in California, a similar aperture card system enables educators to up date scientific teaching materials day-by-day. In this fast-changing space age, this is an increasing need.

In the Clerk of Court's office in Sumter County, South Carolina, a processor-camera and aperture cards make it possible for an attorney to file a land transaction in minutes instead of days. In the past

in Sumter County – as in many other counties – it took a day or more for a document to be recorded and mailed back to an attorney. Now a document brought to the office is microfilmed with a processor-camera in less than one minute, and two duplicate microfilm records are made in less than one minute more. Identifying information – book and page number, time and date, grantors and grantees – is typed on the three aperture cards. That completes the transaction and the original document is handed back to the attorney.

The original card is sent to the state archives in Columbia. One duplicate card, produced on a "Filmsort Uniprinter 086" Copier, is stored in the clerk's office vault as a security file. The other duplicate is placed in a 300,000-card capacity elevator file for use by attorneys and office personnel.

A printed form on the back of each aperture card used to microfilm chattel or real estate mortgages allows the clerk's office to record subsequent activities on the original card. For example, when an assignment is filed it is microfilmed and duplicated in the usual manner, but the transaction is noted on the back of the original aperture card. This information includes the date of filing, the initials of the office worker who handled the transaction, and the card number of the new document. The new card or cards are filed in sequence with the original aperture card and indexed with the same book and page number.

An attorney who wishes to review a record checks the clerk's index book to find the book and page number, which are used with the microfilm system because they are the traditional indexing system and could easily be applied to the microfilm file. With microfilm "books" are decks of 1,000

aperture cards, and "page numbers" indicate the position of the individual cards in the book.

Four readers with 18" x 24" lighted viewing screens are available to attorneys for skimming a microfilmed document. If a copy is required, it is produced in seconds on a "111" Dry Silver Printer or a "Filmac 200R" Reader-Printer, depending upon the size of the original document. Up to legal-sized documents are copied on the printer, which uses a new dry copying process and makes prints for about two cents each. Larger prints up to 18" x 24" in size are produced on the reader-printer.

Advantages to Sumter County are obvious:

1. Attorneys get fast service in recording and searching for recorded documents.
2. Although Sumter County's population is growing, the present staff will be able to handle the increased work load without additional hiring.
3. Better control of the working file.
4. The security file assures that no document will ever be lost, stolen, or inadvertently destroyed.
5. By charging for copies, the county makes a profit.

Aperture cards solved a big problem for the Department of Sanitary Engineering of the District of Columbia by protecting valuable maps and making copies of them available when and where they are needed. In the past, it was often necessary in an emergency to go miles to the District building to find a needed map. If it was out of the file, perhaps on a designer's or draftsman's table, additional time was lost in looking for it. Furthermore, time and use were damaging the valuable and in most cases irreplaceable sewer and water maps of the District of Columbia.

After a test, maps and other construction records

on file were filmed, and a program of microfilming new construction maps on aperture cards was instituted. Decks of "Duplicard" copy cards were dispersed to several offices where ready access was needed to the information they contained. Roll film was used for the security file.

Advantages of this system are:

1. Increased accessibility.
2. Lower costs due to a big saving in drafting and retrieval time.
3. Old drawings and records are preserved.
4. A security file was made possible.
5. File integrity was made possible.

There are other uses of aperture cards which, for the sake of limiting the size of this volume, are listed only briefly here.

A mail order firm in Chicago does "bookless" bookkeeping. When it receives a purchase order, it records it on an aperture card. This card becomes the company's "books" for collecting payments and controlling delinquencies.

A Midwest insurance firm follows the same basic procedure, filing approximately 600 dailies and related documents on aperture cards every day. The results of this microfilm information management system include annual savings of $20,000, a reduction of filing personnel from fourteen to seven, and a 50 per cent reduction in filing space.

A university uses aperture cards to file nontext materials ranging from archival material found in libraries to sea creatures found in oceanographic studies. A building inspector in Pennsylvania keeps township building records on aperture cards. A Midwest office of a national advertising agency copies storyboards and layouts on microfilm in aperture cards and uses reader-printer copies instead of photostats for copies. A technical library,

made up of laboratory reports, is kept on aperture cards, which are readily available for use by scientists in the company. A police department in Ohio has its records on aperture cards. A newspaper in Iowa makes advertising proofs by microfilming cold type paste ups of ads with a processor-camera, then producing copies with a reader-printer.

So we can see that in government, business, industry, and education, the aperture card is a valuable tool of information management. Millions upon millions of cards are produced every year for a constantly broadening number of individual and unusual applications.

CHAPTER 19

APERTURE CARDS ARE INTERNATIONAL

In recent years aperture cards have become international. As in the United States, the first sales were for engineering drawing applications, but today public records, medical and other information also are being preserved on aperture cards.

The expansion of microfilm in general and aperture cards in particular throughout the world market from Stockholm to Sydney and from Tokyo to Cape Town is not surprising. The same needs to make data flexible, to reduce file space, and adapt information retrieval systems to automatic business machines are felt wherever people conduct business. Offices and manufacturing plants in more than one hundred countries are using the latest microfilm and aperture card systems developed in the United States.

"Most Americans would be astounded at the modern business operations in even remote parts of the world," John Hensel, who is marketing manager for microfilm products in 3M's International Division, said recently. "And we've just scratched the surface in the international market. The need for microfilm systems will continue to expand at an accelerated rate throughout the world."

And, as in the United States, the 3M processor-camera has greatly enhanced interest in the use of aperture cards. Because of the unique film-and-develop feature of the processor-camera, the fact that a business might be separated from a microfilm processing center by many miles is not a deterrent to the use of microfilm.

In Japan, where aperture cards are being used by many big industries, Chiyoda Chemical Engineering & Construction Company, Limited, has converted more than 100,000 drawings to aperture cards. And new drawings are microfilmed as they are produced.

Chiyoda figures that aperture cards have reduced by 90 per cent the time required to retrieve drawings and fill requests for copies. "Duplicard" copy cards are used to fill requests from areas equipped with readers or reader-printers. Hard copies are distributed to the others. By integrating aperture cards with a copier in a micro-reproduction system, the need for transparent drawing paper was eliminated, and paper costs were reduced 80 per cent. The special paper was essential to reproduction of the drawings by the method formerly used. Other financial savings have been made through lower mailing and delivery costs in sending the plans to customers and engineers.

As is the case with similar systems in the United States and elsewhere, there have been numerous intangible benefits gained from the micro-reproduction system. Direct access to data is possible, changes in drawings can be made easier, wear and tear on originals has been reduced. Abolishing unnecessary old originals has diminished the need for storage space. Maintenance of security files has been made possible. Because retrieval time has been cut sharply, a contribution has been made to the constant effort to shorten construction time.

British Overseas Airways Corporation had a problem. Its drawings ranged in size from quarto to nine-foot streamers or larger. There was no uniformity in recording, retrieval, or reproduction. Drawings were not only difficult to handle, but expensive to distribute. Adequate storage space was at a premium.

When BOAC purchased Boeing 707 airliners a few years ago, it found that its problems could be solved. The 40,000 or more drawings required for the new airplane were available from Boeing Aircraft Corporation in microfilm mounted in aperture cards. The entire drawing file could be stored in a space normally occupied by a small filing cabinet. The cards supplied by Boeing were punched and referenced for sorting and selection by automatic data-processing machinery, if required. The Boeing system sold BOAC on aperture cards.

At Borg-Warner (Australia) Ltd., a microfilm system resulted in the elimination of five different file areas. And, it is estimated, filing space requirements have been reduced 90 per cent.

Following the lead of the United States and Canada, the Swedish Defense Department adopted an aperture card system for its engineering drawings. Other countries have since followed that lead.

Other companies which could be added to the list of aperture card users would include Massey-Ferguson, Canadian Westinghouse Company Ltd., Sud-Aviation, The Broken Hill Proprietary Co. Ltd., in Newcastle, N. S. W., Australia, Japan Air Lines, Honda R & D Co., Ltd., Bristol Siddeley Engines Ltd., Deutsche Shell Aktiengesellschaft Daimler-Benz Aktiengesellschaft, Contraves AG Zurich, and many others.

In Peru a processor-camera has been put to use in the city office in Arequipa, where the civil reg-

istrar is turning paper containing vital statistics records into microfilm in aperture cards.

Nordiska ADB in Sweden uses a processor-camera and aperture cards in highway planning and construction throughout Europe.

Microfilm in aperture cards also helps save lives in France. In a case of accidental poisoning, minutes are important. An antidote must be administered as quickly as possible or a life can be forfeited. Microfilm plays its part in this battle at the Centre Francais d'Informations Toxicologiques — the first European "Anti-Poison" Center in Fernand Widal Hospital, Paris.

When a child swallows a toxic substance, the distraught mother can telephone the center. In the past an intern on duty had to extract the necessary emergency therapeutic instructions from books, reports, and so forth. In 1964 the center handled 10,000 calls of that nature, an average of 30 a day. With the old system, it was not uncommon for the search to consume half an hour. With microfilm aperture cards, only a few minutes are required. Furthermore, file space has been reduced 80 per cent.

Documentation collected from cases solved every day, plus research on the subject, is filmed on camera cards with a processor-camera. References (title of article, name of paper it comes from, and other pertinent data) are typed on the card. Key words are used for indexing. The camera cards are held in a security file. "Duplicard" copy cards are used as the center's work file. "Duplicards" also are distributed to other centers in hospitals in Europe. The information, of course, is retrieved with reader-printers or readers.

As it can be seen from these few brief examples, microfilm in aperture cards has girdled the globe.

CHAPTER 20

WILL THE PROMISE BE FULFILLED?

John Langan cut the first hole in a card back in 1943 to solve a paper-work problem which was making it impossible for the Office of Strategic Services to carry out one of its jobs.

The government had appealed to Americans to submit photos they had taken in Europe so they could be evaluated by military intelligence. The response was overwhelming. By 1943 the number of photos to be classified and filed each month totaled about a quarter of a million. That was the reason for the ready acceptance of Langan's aperture card, a pitiful ancestor of today's highly sophisticated card, but a lifesaver for the OSS. The piles of photographs littering the floor of the Pictorial Records Division were placed on microfilm and handmounted in handmade aperture cards. The key-punched cards could be stored mechanically on tabulating equipment. The fact that all the photos were reduced to a single size also facilitated filing. The problem was solved.

The creation of the aperture card under those conditions was fitting in view of its career in the next twenty-three years. Ever since, aperture cards have won the widest acceptance most often

in situations where a paper-work explosion threatened to seriously disrupt the business, whatever it might be. Until that point is reached, however, in government agency, private business, or educational institution, aperture cards are not readily accepted.

Government agencies will use millions of aperture cards in defense and space efforts this year. They turned to aperture cards at the point where they were becoming swamped with handling information on paper.

Engineering departments were the first industrial users of aperture cards. Why? Because the massive amounts of engineering data they were forced to handle placed them closest to ground zero in the paper-work explosion.

The county official most likely to switch to aperture cards for filing documents is the one whose office is nearly stacked full of record books.

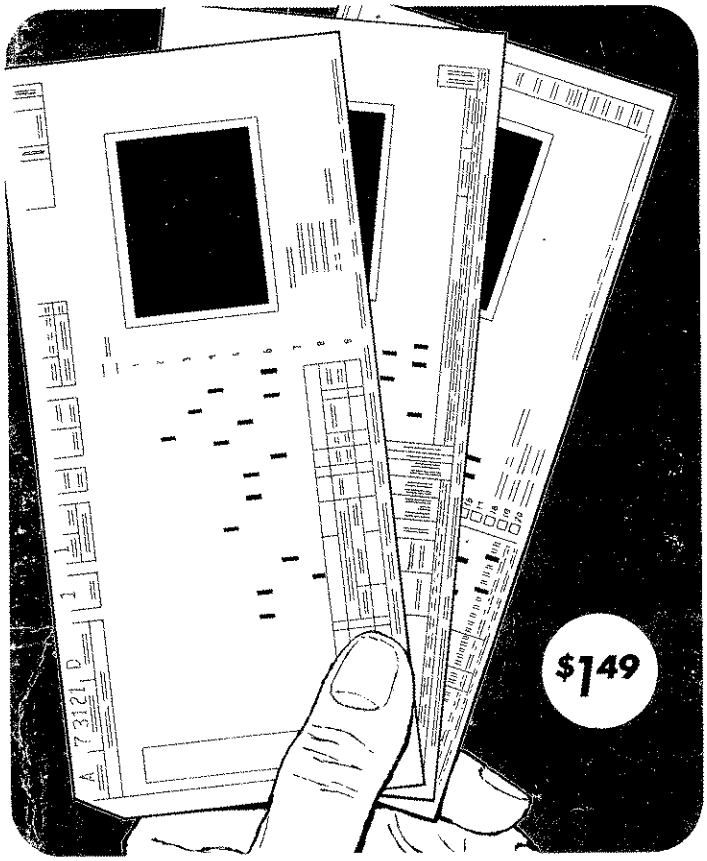
Microfilm in aperture cards has made inroads into many areas — courthouses, insurance companies, schools, air bases, navy shipyards, department stores, restaurants, and banks, to name a few. These applications have proved the need for microfilm and its efficiency in many area of business, but when it comes to the number of applications versus the number of opportunities, the surface has been hardly rubbed let alone scratched.

This indicates a broad, bright future for microfilm aperture cards. If many engineering departments rely on microfilm to solve their information management problems, it seems logical that all departments could profit by adopting aperture cards. If a relative handful of county offices find aperture cards economical, easy to use, and space savers as well, isn't it likely that many county offices should profit by their example?

The future of microfilm aperture cards (and the future of microfilm in general, for that matter) is limited only by man's need for information in graphic form. This is as true as is the fact that the future of electronic data processing is limited only by our need to store and manipulate data in alphabetical and numerical form. The tie-in is interesting. Microfilm systems handle information in graphic form with the same relative speed, efficiency, and economy that computers handle data in alphabetical and numerical form. It is, to be sure, the ability of microfilm aperture cards to manage qualitative graphic information combined with the ability of computers to manipulate quantitative indexing data that has resulted in today's most efficient and comprehensive information management systems.

More graphic information can be recorded on microfilm than on any other known storage medium, including magnetic tape. Data-processing cards are easy to handle, can be filed compactly, and can be identified by several methods. These are two reasons why aperture cards will be used as the primary means of recording, storing, retrieving, and reproducing graphic information in the foreseeable future.

This and the paper-work explosion, which will mushroom in the coming decades even more than it has in the past, will make microfilm the office tool of the future. And because of the ease with which they can be handled, aperture cards promise to be the most popular format.



THE HOLE IN THE CARD

By Neil MacKay

THE STORY OF THE MICROFILM APERTURE CARD

An aperture card is an electronic data-processing card with a rectangular opening – "the hole in the card" – in which a frame of microfilm is mounted.

Invented of necessity to solve an otherwise impossible problem of handling intelligence information in World War II, the aperture card and equipment developed to utilize it changed microfilm to the active tool of information management it is today.

"The Hole in the Card" is the story of the aperture card, the men who pioneered it and the card's impact on business and industry in the Unite