TECHNICAL DEVELOPMENT REPORT NO. 335

EVALUATION OF A DITTO MODEL D11A DUPLICATOR FOR PRINTING FLIGHT PROGRESS STRIPS IN ARTC CENTERS

FOR LIMITED DISTRIBUTION

by

Russell M. Andrew

Navigation Aids Evaluation Division

December 1957

CIVIL AERONAUTICS ADMINISTRATION
TECHNICAL DEVELOPMENT CENTER
INDIANAPOLIS, INDIANA

EVALUATION OF A DITTO MODEL D11A DUPLICATOR FOR PRINTING FLIGHT PROGRESS STRIPS IN ARTC CENTERS

SUMMARY

In an effort to reduce the workload in ARTC Centers of producing several thousand flight progress strips daily, means of printing the repetitive information on each flight strip are being evaluated. The Ditto duplicator appeared to be an "off-the-shelf" device which might assist in manual preparation of these strips. Two Model D11A duplicating machines were modified with feed trays to accommodate the one-inch flight progress strips. These machines were given extensive in-service trials in the New York and Memphis ARTC Centers. The results of these trials indicated that the Model D11A duplicator is not satisfactory for reproducing flight progress strips in an ARTC Center. The adjustments on the paper feed magazine were too critical and resulted in excessive waste of strips. The fluid-flow control was not entirely satisfactory. It was concluded that use of the machine increased, rather than reduced, the workload in the preparation of flight progress strips.

INTRODUCTION

An average of four to five flight progress strips are prepared for each flight operating in an Air Route Traffic Control Center's area. At present, these strips are handwritten, and about two-thirds of the written data entered on flight progress strips are common to all strips for a particular flight. Hence, a major portion of the workload involved in strip preparation results from duplication of identical data. The increasing number of aircraft flying on instrument flight rule (IFR) flight plans has increased the problem. For example, on a busy day in the New York ARTC Center, more than 13,000 strips may be prepared for use on the controllers' display boards.

In an effort to reduce this manual workload, the Special Committee for Improved Air Traffic Control - New York area, in a meeting in September 1956, stated an immediate requirement for equipments to assist in the job of preparing flight progress strips. Several reproduction machines were considered, among them the Ditto duplicator. Although these machines were not considered as the final answer to the problem, it was felt that they might give some immediate relief. Two

advantages, logically expected, were

1. That the advantage of writing one strip as opposed to five or six, would permit the writer more time to produce a neat original and result in more legible data on all strips.

2. That errors caused by copying from the original would be eliminated.

At about this same time, an employee of the Aeronautical Center, Oklahoma City, Oklahoma, submitted a suggestion for use of Ditto duplicator equipment based on the experience of the ATC training school in using a similar machine.

To evaluate this type of equipment, the CAA Technical Development Center obtained two Ditto Model D11A duplicator machines with Masterwriters. Figure 1 is a photograph of the duplicator machine, and Fig. 2 shows the Masterwriter. One machine with a Masterwriter was shipped directly to the New York ARTC Center. The other machine was delivered to the Technical Development Center where it was used to a limited extent by the Indianapolis ARTC Center and the Airways Operations Evaluation Center. Later it was evaluated by the Memphis ARTC Center, where a centralized flight data position is used to produce most of the flight progress strips for the Center.

EQUIPMENT

The basic Ditto D11A duplicator, with automatic feed, is designed to handle sheets of paper up to 10 1/2 inches in width. The machine was modified as follows:

1. The felt wick for applying Ditto fluid to the master copy was covered, except for a one-inch width, to match the width of standard flight progress strips.

2. The master clamp on the rotating drum was slotted to assist the operator in positioning the master strip accurately.

3. The impression roller was modified on one machine (Memphis) to apply pressure to the strips being fed through the machine only.

4. A double feed tray, shown in Fig. 3, for the standard 1- by 8-inch flight progress strips was provided to permit duplication of the strips on either buff or green stock.

5. The Masterwriter was provided with an adapter plate to allow only one flight progress strip to be placed over the carbon paper roll.

Other supplies required included carbon rolls (Dittmark Hi-Gloss), Ditto fluid, Ditto cream liquid soap, and ballpoint pens (fine-line).

OPERATIONAL USE

A master copy for duplication is prepared by placing a standard paper flight progress strip in the open slot of the adapter plate on the Masterwriter. See Fig. 2. A flight plan in its normal format is hand-written on the flight progress strip using a hard lead pencil or a fine line ballpoint pen. Firm writing pressure is required to produce a good master copy. A portion of the carbon from the Masterwriter roll is picked up on the back of the flight progress strip.

After the master copy is made, it is placed face down on the drum of the duplicator, and aligned with the special slot on the master clamp. To start the machine, the motor switch located under the feed tray is turned on, and, to make copies, the machine operating handle is moved to the RUN position. The drum will rotate until the operating handle is moved to the STOP position.

A portion of the carbon from the master copy is dissolved by means of direct-process fluid. This fluid is fed from a reservoir through a wick which wets the master-copy strip. The impression roller, under the drum, forces blank strips against the master copy as the drum is rotated. The double-feed tray, Fig. 3, is loaded with green and buff strips so that color selection for the direction of flight can be made by the proper positioning of the feed tray.

The blank paper strips are held in place by rubber cushions or pads on the feed tray. The pressure adjustment of these cushions on the D11A duplicator proved to be very critical. If the cushions were adjusted too tightly against the strips, they would not feed. If adjusted too loosely, several strips passed into the machine together.

In normal motor-driven operation, strips are duplicated at the rate of two per second. A counter on the machine can be preset to reproduce the desired number of strips. The reproduction of only four or five strips from each master is usually accomplished by the operator holding the operating handle in the RUN position while counting the number of strips produced.

In the New York Center, excessive wear of the impression roller occurred in the area where the one-inch flight progress strips were fed through the machine. The machine sent to Memphis was modified by removing the rubber from both ends of the impression roller, leaving only a section approximately one-inch wide in the center.

RESULTS OF TRIALS

New York Center.

The trials in the New York Center began in November 1956, and extended over a period of about 60 days. During these trials, the Ditto duplicator was used exclusively at the A positions, preparing flight progress strips for flights departing the New York metropolitan area. Initial use was hampered somewhat by the difficulty experienced in obtaining supplies. It was found that Government-issue duplicator fluid contained a substance which formed a crystaline deposit in the fluid feed tube, which eventually stopped the fluid flow. Hence, it was necessary to use Ditto duplicator fluid exclusively. Also, the carbon rolls used in the Masterwriter were not easily obtainable in the New York area.

After the supply problem had been overcome, the Center experienced a number of other difficulties. These included the following:

1. The machine required frequent adjustment of the feed-tray pressure pads.

2. The drum became saturated with carbon ink.

3. Too many motions were needed to prepare strips.

4. Three men were required to run the Ditto operation properly. These same three men could handwrite strips and exceed the output of the Ditto duplicator.

5. There was excessive wastage of strips.

The machine used in the New York Center was equipped with a standard, full-width impression roller. After approximately 60 days, the strips would not feed through the machine. It was found that the one-inch-wide area on the impression roller, where the strips were fed, had worn down so that new strips were not being gripped firmly. This condition could by overcome only by installing a new roller, or by having the balance of the roller machined to a diameter consistent with the worn section.

After the trial period in the operating quarters, it was concluded that the machine was unsatisfactory for regular operations in the Center. The machine was retained for use in the training program.

Memphis Center.

The trials in the Memphis Center began in February 1957, and extended over a period of approximately 40 days. The equipment was used at the centralized flight data position (FLIDAP) where most of the strips for the Center are prepared. During the trial period many of the same difficulties experienced in the New York Center occurred. At Memphis, the local Ditto Company representative worked closely with Center personnel trying to resolve difficulties. The results were as follows:

1. For satisfactory operation, the feed trays of the machine could hold a stack of strips not more than 3/4-inch high. If the height of the stack was increased beyond 3/4-inch, the strips would not feed into the machine properly but would double against the feed roller. When the stack was reduced to a height of 1/8- to 1/4-inch, the strips either were fed in bunches or stopped feeding. This meant that the average usable stack was approximately 5/8-inch high. The relatively small number of strips that could be used at one loading required frequent replacement of stacks and delayed the operation.

2. The adjustment of the pad pressure on the stack of strips was too critical. The side of the feed tray must be opened each time a stack of strips is added. The slightest maladjustment of the sponge rubber cushions would not permit proper feeding. Thus, it was necessary to adjust the tension each time by trial. Although the set screw was marked so that the same adjustment could be made at each loading, this adjustment did not preclude the malfunctioning of the feed system. Many times before the proper adjustment was reached, it was time to reload. The inability to regulate the feed because of this critical pressure setting contributed heavily to the percentage of waste.

3. There were times when the feed did not function properly even when the adjustments (Items 1 and 2 above) apparently were set correctly. When a space was skipped, the roller became wet, and the strips that followed would be damp.

4. Difficulty was encountered in reproducing written items in the proper blocks on the strips. Frequently, the reproduced strip would have the printed material either to the right or left of the proper box and could not be used. This also contributed to wastage.

5. Occasionally, for no apparent reason, the fluid would flow from the tank onto other parts of the machine. The Ditto Company maintenance man was unable to correct this.

6. After approximately 1 1/2 to 2 hours of use, the completed strips would come out of the machine wet, causing the ink to smear. Various remedies were tried to counteract this, but the only effective solution was to let the machine stand idle for a short time to allow the fluid to evaporate.

7. The Memphis controllers did not believe that the strips reproduced on the Ditto machine were as easy to read as those prepared by hand.

8. Erratic printing of strips made it difficult for the operator to determine the number of strips required for each flight, so that enough readable strips would be reproduced. As in New York, more manpower was required, when using the Ditto machine, than normally was needed for manual writing of strips.

9. Each day that the machine was operated, the number of flights handled, the number of strips required for proper posting on the sectors, and the number of strips wasted for any reason whatsoever were recorded. The wastage averaged about 22 per cent.

Other Trials.

The Ditto duplicator was used by the Indianapolis ARTC Center for preparation of flight progress strips for military missions. For many of these mission-type flights, large areas must be blocked at specific altitudes, and multiple strips are required for posting in several sectors.

The Technical Development Center used the Ditto duplicator to reproduce flight progress strips for simulation projects. Many simulation problems require repeat runs of the same traffic sample.

In both of the above locations, no time element was involved, and personnel could take the necessary care in adjusting and readjusting the feed trays to obtain proper feeding of strips. However, experience in both facilities indicated an excessive waste of strips.

An employee suggestion, which originated at the Aeronautical Center, had been received which pointed out the advantages of using the Ditto duplicator for printing duplicate flight progress strips. In this

recommendation, it was pointed out that the machine had been in use for about two months with successful results. Later reports from the Aeronautical Center indicated that many of the feed problems experienced in other facilities also had been encountered at Oklahoma City. For training purposes, where many strips having the same data must be printed, the machine may offer some advantages over hand preparation.

The Indianapolis representatives of the Ditto Company have indicated that their company is interested in the development of an improved duplicator for flight progress strips. They believe their new machine, Model B-70, may be more suitable for reproducing flight progress strips than the Model D-11. Tests will be conducted by the Ditto Company, and the Technical Development Center will monitor the progress of this work. Some other companies, active in this field, have been contacted and encouraged to study the problem of reproducing flight progress strips.

Several other ways of preparing flight progress strips semiautomatically are being tested, including use of electronic data processing equipment, such as the IBM-650 computer in the Indianapolis ARTC Center and the IBM Cardatype equipment installed in the New York ARTC Center.

CONCLUSIONS

The composite experience at the facilities where the Ditto duplicator Model D11A was used to duplicate flight progress strips indicates that:

1. The machine requires an excessive amount of adjustment to obtain satisfactory operation.

2. Due to the speed of reproduction necessary in an operating Air Route Traffic Control Center, the Model D11A is not satisfactory for producing flight progress strips. Where time is not a critical factor, multiple flight progress strips can be duplicated with some reduction of workload.

3. The method of feeding flight progress strips into the duplicator was unsatisfactory and caused excessive wastage of strip material. A better means of accurately positioning the feed trays for alignment with the master copy probably would increase readability and eliminate clipped letters.

4. The control of fluid flow on the Model D11A duplicator was not satisfactory for the narrow (one-inch) flight progress strips.

5. Many operators felt that the feed trays should have greater strip capacity, to obviate frequent reloading.

6. Due to the unsatisfactory operation of the duplicator, controller workload in the preparation of flight progress strips was increased rather than decreased.

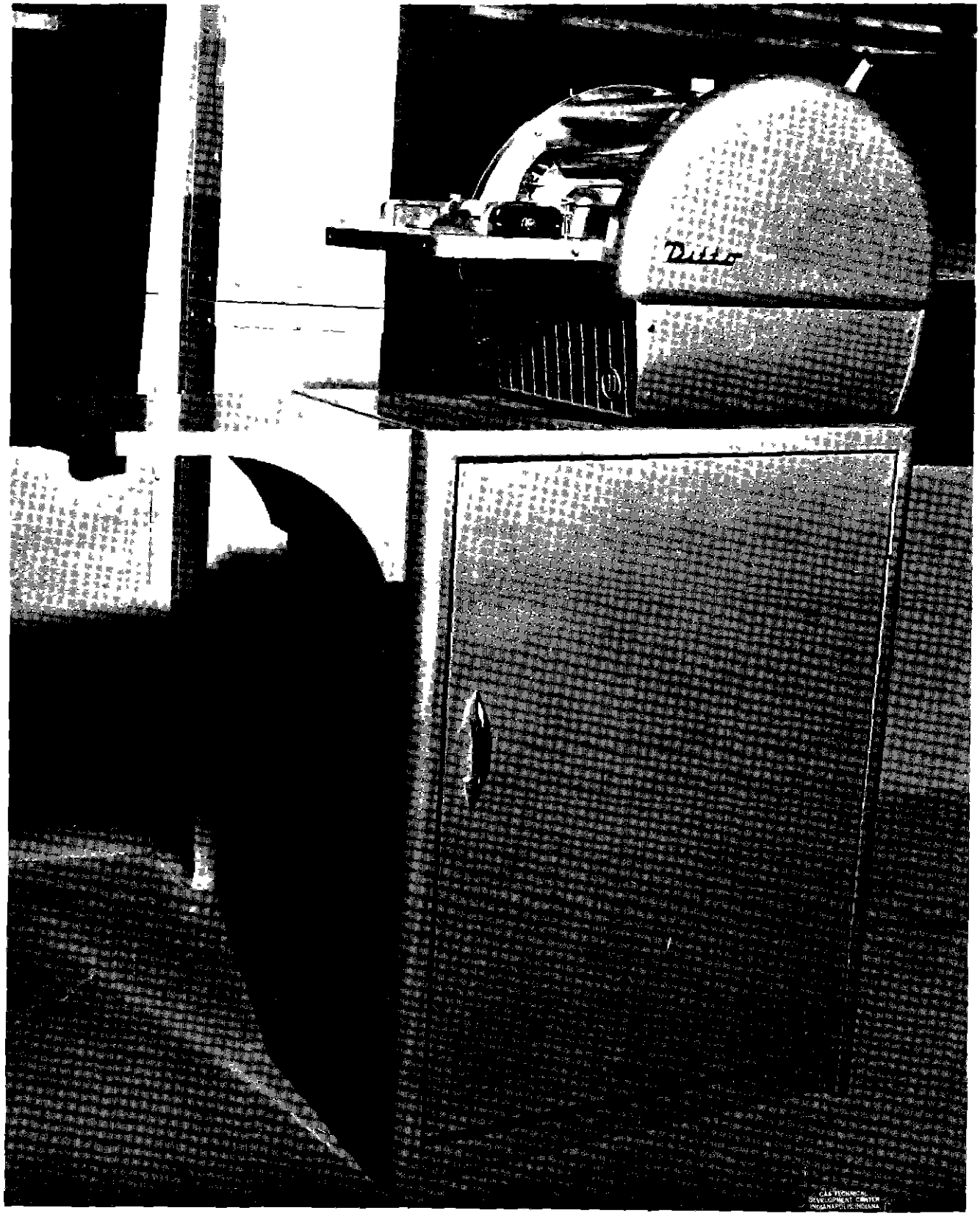

FIG 1 MODEL D11A DUPLICATOR

FIG 2 DITTO MASTERWRITER IN USE

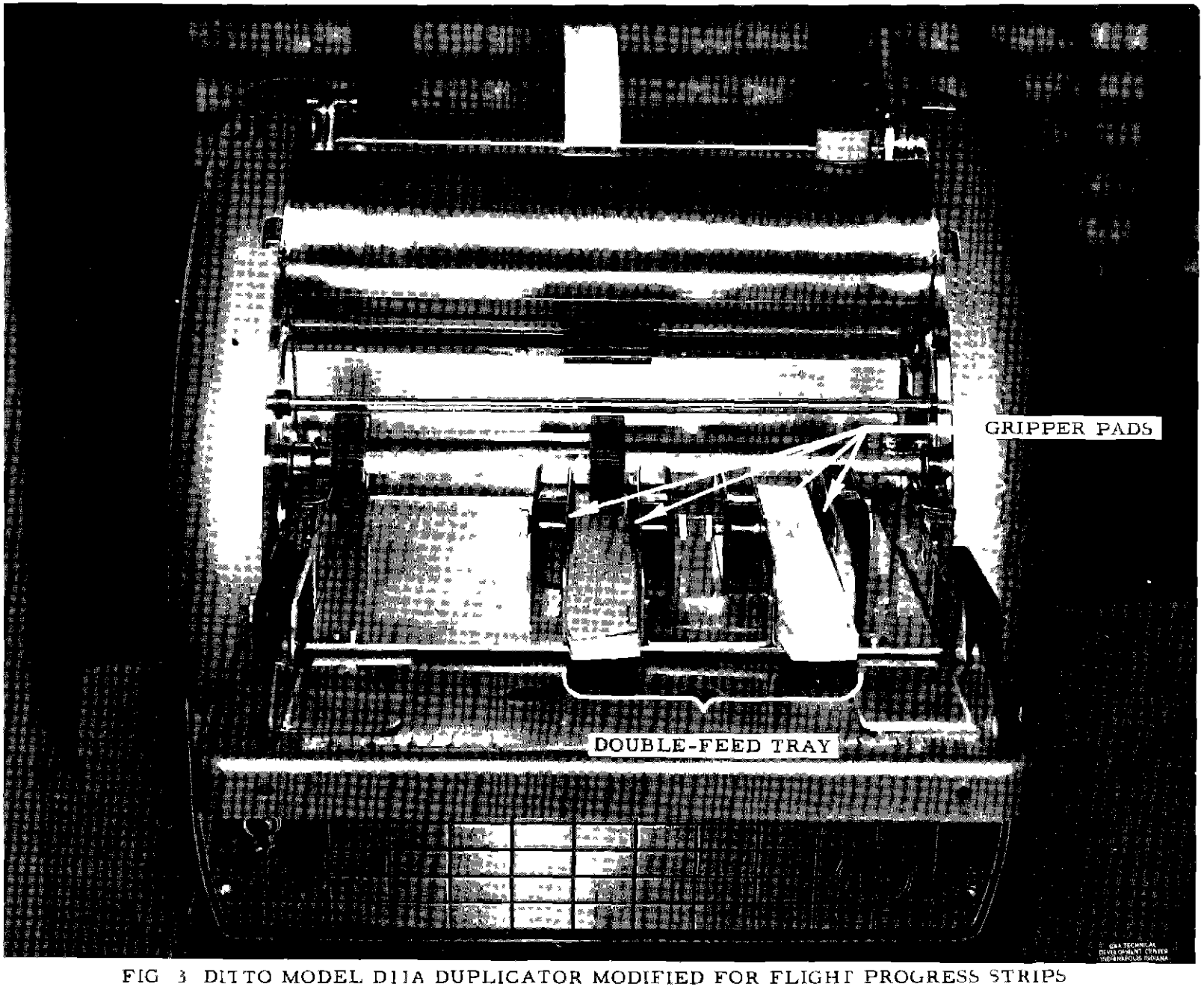

FIG 3 DITTO MODEL D11A DUPLICATOR MODIFIED FOR FLIGHT PROGRESS STRIPS