

Jan. 29, 1952

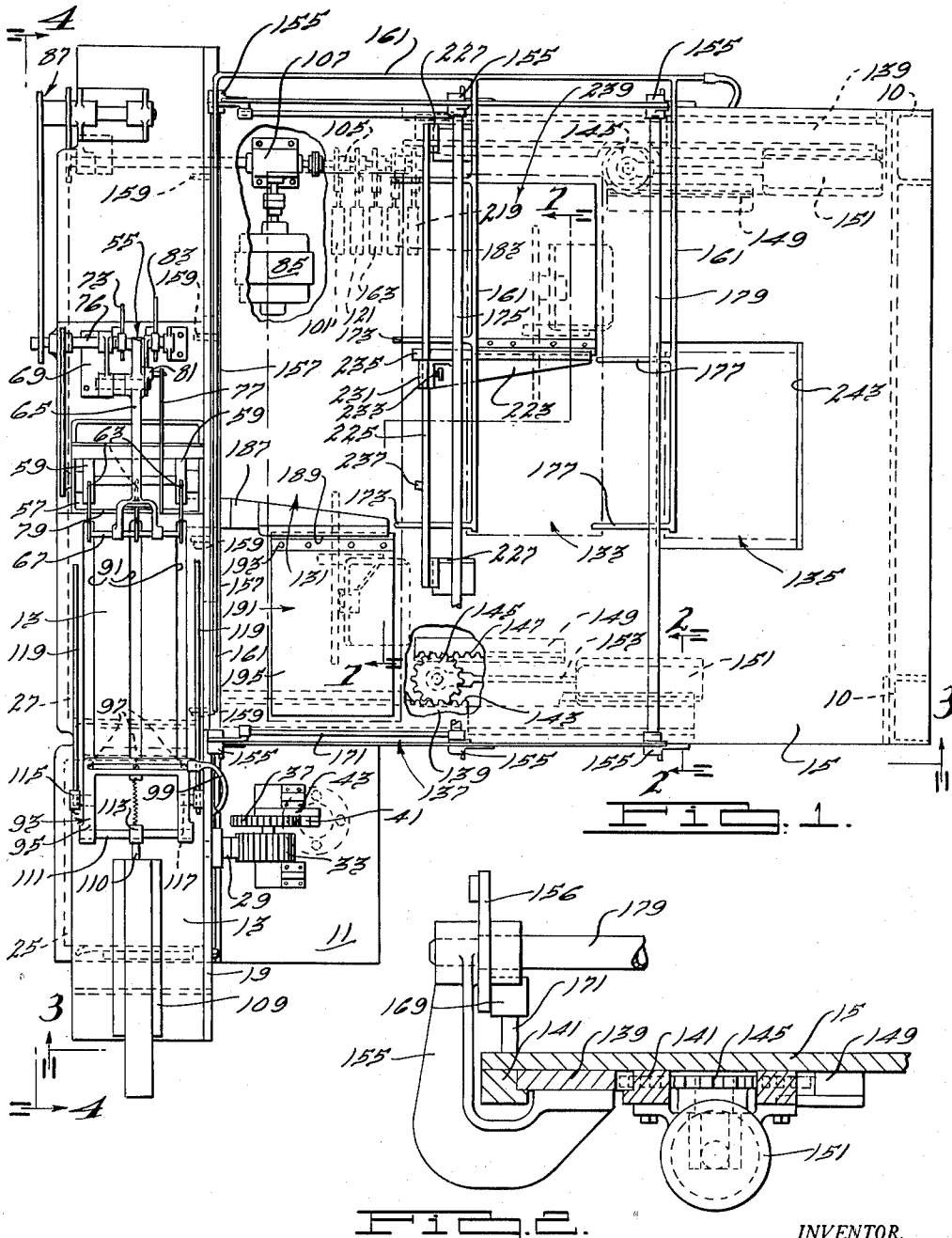
E. W. PETERSON

2,583,746

SHEET ASSEMBLING AND FOLDING MACHINE

Filed Sept. 13, 1948

4 Sheets-Sheet 1



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Jan. 29, 1952

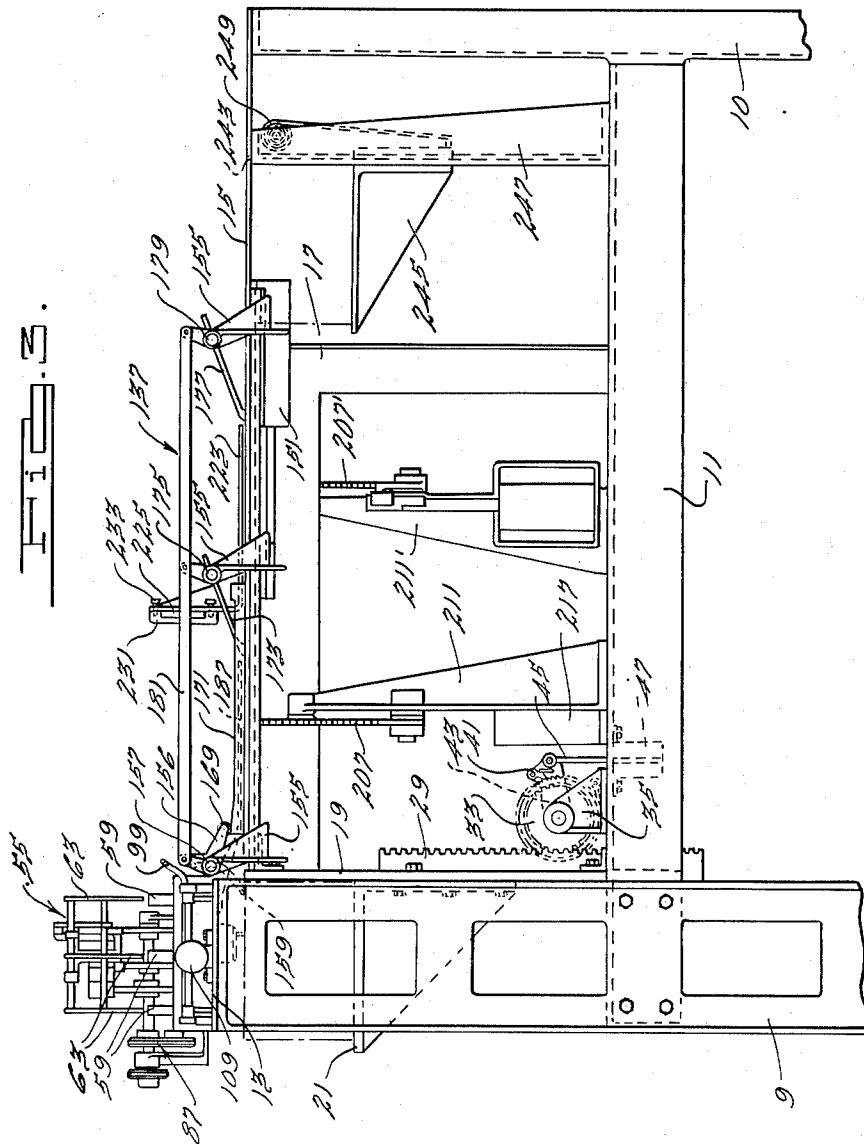
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SHEET ASSEMBLING AND FOLDING MACHINE

Filed Sept. 13, 1948

4 Sheets-Sheet 2



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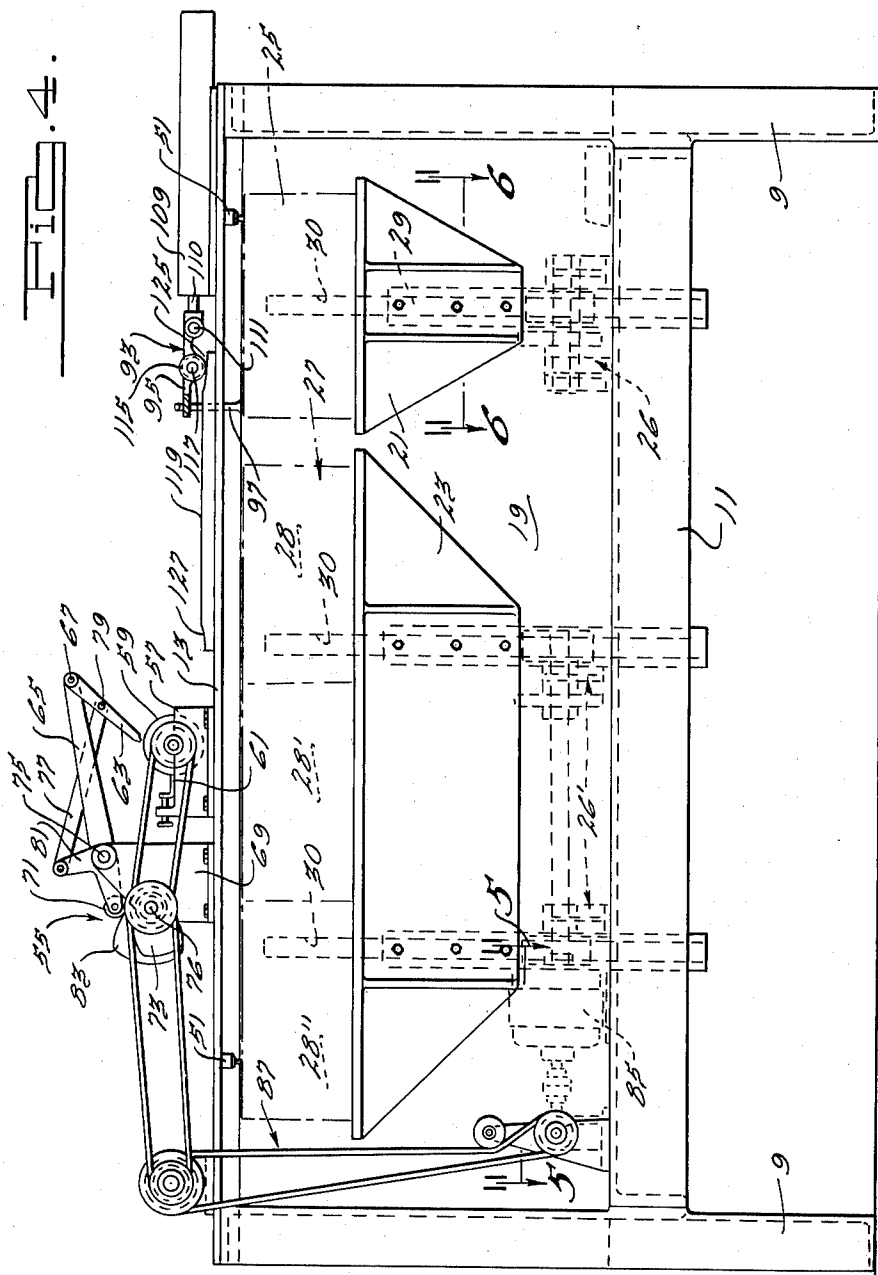
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SHEET ASSEMBLING AND FOLDING MACHINE

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4 Sheets-Sheet 3



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SHEET ASSEMBLING AND FOLDING MACHINE

Filed Sept. 13, 1948

4 Sheets-Sheet 4

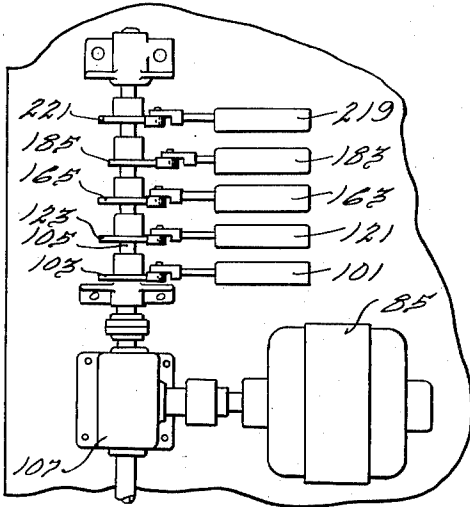


FIG. 5.

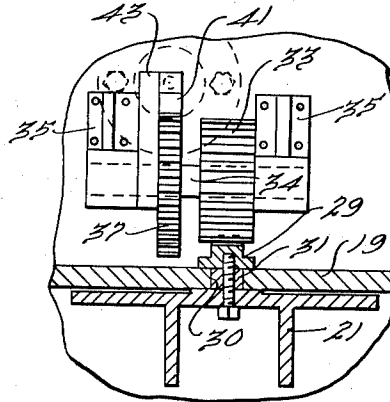


FIG. 6.

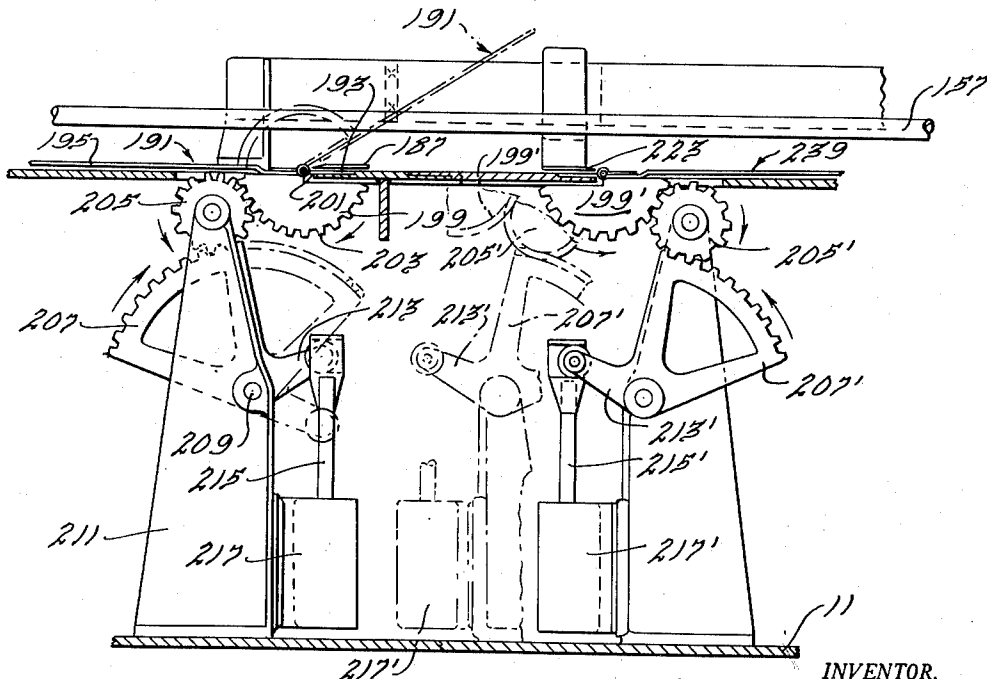


FIG. 7.

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UNITED STATES PATENT OFFICE

2,583,746

SHEET ASSEMBLING AND FOLDING MACHINE

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Application September 13, 1948, Serial No. 49,105

13 Claims. (Cl. 270-45)

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This invention relates generally to duplicating supplies and more particularly to a novel machine for assembling duplicator master sets.

For many years practically all of the manufacturers of hectograph duplicating supplies have produced what is known as a duplicator master set. The ordinary master set generally comprises a strip of master paper which is folded longitudinally in half with one of the folds carrying hectograph carbon dye, carbon paper, or some other suitable pressure transferable coating. With this type of master set, the carbon dye bleeds off of the sides of the paper and as a result the person handling the same gets the carbon dye on his hands because the dye has a direct affinity for moisture. This, of course, results in the necessity of frequent washing of the hands with a special soap. The dye also has a tendency to transfer to desks and clothing because after the master set has been typed, and the panel or fold which carries the carbon dye or carbon paper thrown away, it is not surrounded by any sort of jacket or protective covering. Thus, after the master set has been duplicated and put into a file cabinet or the like, the dye on the reverse side of the master sheet transfers to other papers in the file cabinet and creates a very messy condition.

Very recently a new type of duplicator master set has been developed, which is disclosed and claimed in patent application of Roy W. Le Moyne, Serial No. 40,510, filed July 24, 1948. This master set is formed from a strip of master paper which is divided by perforations into three interconnected end to end sections. The carbon paper or carbon dye is attached to one of the end sections, and the two end sections are folded over the intermediate section so that even after the section carrying the carbon dye or carbon paper is thrown away, a protective covering is provided for the reverse side of the duplicating intermediate section. This new type of duplicator master set has the carbon paper attached to the one end section of the master paper in such a way that it is indented on all four sides of the section, so that the dye therefrom will not transfer to the hands of the user while the master set is being typed or being handled before and after the duplicating process.

While this new type of duplicator master set is far superior to the ordinary master set, no suitable machine has been developed for automatically assembling the carbon paper to the master paper and folding the structure into its assembled form. In the past, several types of master set assembling machines have been employed for

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assembling the ordinary two-fold type of duplicator master sets. Most of these, however, are of the carbon coating type, wherein carbon dye is placed on half of a sheet of master paper and subsequently the master paper is folded over longitudinally against the dye section and cut off into desired lengths. Another method of making the two-fold type of master set has been to bring an individual roll of carbon paper into contact with an individual roll of master paper, spot gluing the two together longitudinally, and then cutting the assembled strip into desired sections. Neither of these machines or methods would be at all satisfactory for producing a three-fold master set of the type above described.

It is, therefore, an object of this invention to provide a machine for assembling duplicator master sets of the aforementioned three-fold type, in a completely automatic and continuous manner so as to eliminate need for any manual handling or work in the assembly operation.

It is a further object of this invention to provide a machine of the aforementioned type which will, when a stack of master paper and a stack of carbon paper are positioned on the machine, automatically feed individual sheets of carbon paper onto individual sheets of master paper, spot glue the carbon paper to the master paper in a desired position, and automatically fold the structure into the aforementioned three-fold arrangement.

It is a further object of this invention to provide, in a machine of the aforementioned type, an improved device for glue spotting the master paper prior to the attachment of the carbon paper.

It is a further object of this invention to provide, in a machine of the aforementioned type, an improved and novel arrangement for automatically positioning the carbon paper in its proper indented position on one section of the master paper, and for transferring and moving the glued structure through various folding stations, prior to depositing the finished master sets at a final stacking station.

It is a further object of this invention to provide, in a machine of the aforementioned type, simple and efficient mechanisms for folding the aforementioned master set structure into its three-fold form.

It is a further object of this invention to provide simple and efficient means for synchronizing the operation of the working elements of the machine so that the component parts of the master set are assembled in the proper relationship with

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respect to each other, before the structure passes through the folding mechanisms, and so that, when the machine is in full operation, each operating cycle of the machine will produce a finished duplicator master set.

It is a further object of this invention to provide a machine of the aforementioned type which can be easily and quickly adjusted so as to handle and form master sets of different sizes.

It is a further object of this invention to provide a machine of the aforementioned type, which is relatively inexpensive to manufacture, efficient in operation, durable in construction, and which will produce master sets of the aforementioned type in an efficient and inexpensive manner.

These and other objects of this invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a top plan view of the machine of this invention with some parts broken away for purposes of clarity;

Fig. 2 is an enlarged sectional view of the structure illustrated in Fig. 1, taken along the line 2—2 thereof;

Fig. 3 is a side elevational view of the structure illustrated in Fig. 1, taken along the line 3—3 thereof;

Fig. 4 is a front elevational view of the machine illustrated in Fig. 1, taken along the line 4—4 thereof;

Fig. 5 is an enlarged view of the structure illustrated in Fig. 4, taken along the line 5—5 thereof;

Fig. 6 is an enlarged sectional view of the structure illustrated in Fig. 4, taken along the line 6—6 thereof; and

Fig. 7 is a sectional view of the structure illustrated in Fig. 1, taken along the line 7—7 thereof.

Referring now to the drawings, it will be seen that the machine includes a suitable supporting base or frame work, including front legs 9, rear legs 10, a casting 11 which interconnects the legs 9 and 10 intermediate their ends, a transverse main top plate 13, a longitudinal main top plate 15, a stiffener 17 between the longitudinal main top plate and the casting 11 and a vertical plate 19 which is disposed adjacent the forward end of the longitudinal top plate 15 and is connected to the front legs 9, casting 11 and the top longitudinal plate. A vertically movable platform 21 is provided below and adjacent one end of the transverse top plate 13. A similar vertically movable platform 23 is provided below the transverse top plate 13, inwardly of the platform 21. The platform 21 is adapted to support a stack of carbon sheets 25, while the platform 23 is adapted to support a stack of master paper strips 27 which are divided into three interconnected end to end sections 28, 28' and 28'' by suitable perforations. Each sheet of carbon paper 25 is narrower in width than the paper strip and substantially the same length as each paper strip section.

In order to feed an individual sheet of carbon paper onto the uppermost paper strip 27, it is desirable that the elevation of the uppermost carbon sheet and the uppermost paper strip be maintained at a substantially constant level. This is accomplished by varying the elevations of the platforms 21 and 23 by means of gear and rack mechanisms 26 and 26' respectively. As the mechanisms 26 and 26' are substantially identical only the mechanism 26 will be described in

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detail. The vertical plate 19 is slotted at 30 to receive a gib 31. The platform 21 is connected to the gib and to a vertical rack 29, on the opposite side of plate 19, by any suitable means. The vertical rack 29 meshes with a gear 33 which is carried by a shaft 34. Shaft 34 is rotatably supported on the casting 11 by means of brackets 35. As can be best seen in Fig. 6, a ratchet 37 is carried on the shaft 34 and is normally engaged by means of a pawl 41, which is carried on a bracket arm 43. Bracket arm 43 is rotatably connected at its forward end to the shaft 34 and at its rear end to an operating link 45 of a solenoid 47. The solenoid 47 is normally open and tending to pull the bracket arm 43 downwardly so as to cause the pawl 41 to rotate the ratchet 37 and raise the rack 29. Connected to the under side of the main transverse top plate 13 above the carbon sheet stack 25 and the paper strip stack 27 are switches 51. When the stacks 25 and 27 reach the desired elevation, they engage and actuate the switches 51. The actuation of the switches 51 deenergizes the solenoids, thus maintaining the platforms 21 and 23 at the desired level until further carbon sheets and paper strips are moved from their respective stacks, by means which will be hereinafter described, at which time the switches 51 will open and will energize the solenoids to cause the platforms 21 and 23 to be raised again until the solenoids are de-energized by the engagement of the stacks with the switches 51.

The first step in assembling the duplicator master set is to secure a single sheet of carbon paper 25 to the adjacent end section 28 of the uppermost master paper strip 27. This may be done in various ways, but in the preferred embodiment herein illustrated, a glue spotting device 55 is provided for applying glue spots to the end section 28 of the uppermost paper strip before the carbon paper is moved from its stack onto the paper strip section, as will be hereinafter described. The glue spotting device herein illustrated includes a glue pot 57, which is mounted on the plate 13 generally above the intermediate sections 28' of the stack of master paper strips 27. Three transversely spaced wheels 59 are rotatably supported on the glue pot 57 and are adapted to rotate through the glue in the pot to pick up glue on the outer peripheries thereof. A scraper blade 61 is adjustably mounted on the glue pot 57 for controlling the thickness of the glue on the peripheries of the wheels 59. Three transversely spaced glue spotting fingers 63 are supported above the glue pot 57 and are adapted to wipe the wheels 59 to pick up glue and apply the same to the end section 28 of the uppermost paper strip 27.

The upper ends of the three glue spotting fingers 63 are fixed at laterally spaced points to a transversely extending shaft 67, which in turn is pivotally connected to the forward end of an arm 65. The arm 65 is rotatably supported intermediate its ends by a shaft 75, on a bracket 69 which is connected to the transverse plate 13. The rear portion of the arm 65 carries a roller 71 which engages a cam element 73, which is also rotatably supported on the bracket 69 by a shaft 76. A second arm 77 is also provided for controlling the motion and movement of the glue spotting fingers 63. The arm 77 is connected at its forward end to the glue spotting fingers, intermediate the ends thereof, by means of a transverse rod 79. The rear end of the arm 77 is pivotally connected to one arm of a bell crank 81,

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which is rotatably supported on the bracket shaft 75. The bell crank member 81 carries a roller on the rearwardly extending arm thereof which engages a second cam element 83. The cam element 83 is rotatably supported on the shaft 76 in the same manner as the cam element 73. The glue pot wheels 59 and the cam elements 73 and 83 are rotatably driven by a motor 85, which is mounted on the casting 11 below the transverse upper plate 13. The motor 85 is drivingly connected to the cam elements and glue pot wheels in any suitable means, such as the belt and pulley arrangement 87 illustrated. In this way, the wheels 59 are constantly being rotated through the glue in the pot 57 and the cam elements 73 and 83 are being rotated at a speed so as to synchronize the movement of the glue spotting fingers 63 with the operation of the other elements of the machine, as will be hereinafter described.

When the cam elements 73 and 83 are rotated, the cam element 83 will actuate the arm 77, so as to cause the fingers 63 to wipe the glue pot wheels 59 and move there beyond into a substantially vertical position. The cam element 73 will then actuate the arm 65 to cause the latter to move downwardly and move the glue spotting fingers downwardly through transversely spaced slots 91 in the upper transverse plate 13, and onto the end section 28 of the uppermost paper strip 27, adjacent the rear edge of the section. It will be noted that the forwardmost of the plate slots 91 is spaced inwardly of the outer longitudinal edge of the paper strips 27 so that the glue spotting fingers 63 will be able to spot paper strips, of different sizes, such as strips to be folded into 8" x 5" master sets, or 8½" x 11" master sets, such as shown in the drawing. It should at this time be pointed out that paper strips for either of these sizes are stacked on the platform 23 in a manner such that the perforated end of the section 28 is in the same position on the transverse plate 13 at all times, for reasons which will hereinafter appear, and in order to enable the glue spotting device to spot the end sections 28, adjacent the perforations, on both sizes of paper strips.

After the uppermost paper strip of the stack 27 has been glue spotted, it is necessary to transfer a sheet of carbon paper from the stack 25 onto the end section 28 of the uppermost paper strip, and secure the same thereto. This may be accomplished by the use of any suitable transfer mechanism, but in the preferred embodiment illustrated in the drawings, a suction foot type of transfer mechanism 93 is provided. The mechanism 93 includes a yoke like member 95, which carries at the inner end thereof three transversely spaced vertically extending tubular members or suction feet 97. The suction feet 97 are transversely spaced in the same manner as the glue spotting fingers 63 and extend downwardly through the transverse plate slots 91 so as to normally engage the uppermost carbon sheet of the stack 25, adjacent the back end thereof. The upper ends of the suction feet 97 are connected to a suitable conduit 99, which in turn is connected to a valve 101 in a suitable compressed air system, (not shown). The valve 101 is operated by suitable means, such as a cam 103 on a cam shaft 105, which is driven by the motor 85 through a gear reduction box 107.

The yoke 95 is moved toward and away from the paper strip stack 27 by means of a piston and cylinder unit 109. The outer end of the piston rod 110 is pivotally connected to a cross shaft 111 of the yoke 95, at 113. The yoke 95 is sup-

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ported for horizontal movement by means of an opposed pair of rollers 115, which are rotatably supported on the yoke by stub shafts 117. The rollers 115 engage and ride on opposed cam trackways 119, which are supported on the transverse top plate 13. The piston and cylinder unit 109 is connected by suitable conduits to a valve 121, which is operated from a cam element 123 on the cam shaft 105. The valve 121 is connected in a suitable hydraulic circuit or the aforementioned compressed air system. The cam elements 123 and 103 are arranged on the cam shaft 105 in such a manner as to operate the transfer mechanism 93 in timed relationship to the continuously operating glue spotting device 55.

Therefore, while the uppermost paper strip 27 is being glue spotted, the cam elements 103 and 123 will cause a vacuum in the suction feet 97, so that the top carbon sheet 25 will be moved with the feet, and will cause the piston and cylinder unit 109 to move the yoke 95 toward the paper strip stack.

As the yoke 95 starts its movement an upwardly inclined cam surface 125 on the outer end of each cam trackway 119 causes the yoke to move upwardly a short distance and thereby pick up the top carbon sheet, so that the carbon sheet and the suction feet 97 can move across the top of a portion of the paper strip stack 27, without engaging the same. As the yoke 95 approaches the end of the trackways 119, the rollers 115 engage a downwardly inclined cam surface 127 on the rear end of the trackways and the yoke and suction feet 97 move downwardly and deposit the carbon sheet 25 on the end section 28 of the uppermost paper strip 27. The cam trackways 119 and the length of the stroke of the piston and cylinder unit 109 are so arranged that at the end of the extension stroke, wherein the carbon paper is deposited on the paper strip, the suction feet 97 will be directly over the glue spots applied by the glue spotting fingers 63. The cam element 103 will then actuate the valve 101 to force air downwardly through the suction feet 97 to break the vacuum between the carbon sheet and the suction feet and to force the carbon sheet down against the glue spots on the paper strip section 28, so as to thereby positively secure the carbon sheet to the end section of the paper strip in the desired position. The cam element 123 will then actuate the valve 121 to cause the piston and cylinder unit and the yoke 95 to return to their initial position, as shown in Fig. 4. The transfer mechanism is then ready to transfer the next sheet of carbon paper onto the next paper strip, in timed sequence with the remainder of the operating elements of the machine.

After the carbon sheet has been secured to the end section 28 of the uppermost paper strip 27, it is necessary to move the paper strip and attached carbon sheet off of the paper strip stack so that the same may be folded into the three-fold jacket, and so that the next carbon sheet can be attached to the next paper strip. The uppermost paper strip, and attached carbon sheet, is moved from the paper strip stack onto the longitudinal top plate 15, wherein the folding of the paper strip is accomplished. The longitudinal top plate 15 is provided adjacent the transverse plate 13, with a first folding station 131, a second folding station 133, spaced rearwardly from the first station, and a final receiving station 135, onto which the finished master sets are deposited. Any suitable transfer mechanism may be em-

played for transferring the paper strip from its stack to the first folding station, and then to the second folding station, and then to the final receiving station, but in the embodiment illustrated in the drawing, a suction foot type transfer mechanism 137 is provided.

The transfer mechanism 137 is best illustrated in Figs. 1, 2 and 3 and includes a movable rack 139, on the under side of the longitudinal top plate 15, adjacent each transversely opposite edge thereof. The racks 139 are supported and guided for horizontal movement by means of suitable gibs 141 which are connected to the under side of the top plate 15. Each rack 139 is provided with teeth 143 along its inner longitudinal edge, which mesh with complementary teeth of a gear 145, which is rotatably supported on the under side of the plate 15. The gear 145 also meshes with the teeth 147 on one edge of a stationary rack 149, which is connected to the under side of the plate 15 in opposed relation to the movable rack 139. Each gear 145 is operated by a piston and cylinder unit 151, which has a piston rod 153 extending forwardly therefrom and rotatably connected to the gear 145. By providing the stationary racks 149 the length of the piston rods 153 can be comparatively short, and the necessity for an extremely long piston rod is eliminated while the relatively long desired movement of the racks 139 is obtained, due to the use of stationary racks 149.

The movable racks 139 have connected therewith, at longitudinally spaced points, generally L-shaped brackets 155, which extend from underneath the plate 15 around the outer edges thereof so as to have a vertical portion which extends above the top of the plate 15 at the opposite sides thereof. A bell crank member 156 is pivoted to the forwardmost pair of opposed brackets 155 above the top plate 15. Connected to and extending between the opposed bell crank members 156 is a tubular member 157 which is connected to and supports a plurality of generally vertically extending tubular suction feet 159. The suction feet 159 in their normal forwardmost position, extend beneath the transverse top plate 13, so as to engage the uppermost paper strip of the stack 27. Extending through the tubular member 157 is a conduit 161 which is connected to the suction feet and to a valve 163. The valve 163 is connected in the aforementioned compressed air system and is operated by a cam element 165 on the cam shaft 105 to cause the suction feet 159 to pick up the uppermost paper strip 27, in generally the same manner as described for the carbon paper transfer mechanism suction feet. The lower arms of the bell crank members 156 each carry a roller 169 which is supported on and rolls along a cam trackway 171, so that when the suction feet 159 are moved rearwardly they will properly pick up the uppermost paper strip 27 and move the same onto the first folding station 131 on the longitudinal top plate 15.

A second set of suction feet 173 is provided in the transfer mechanism 137, rearwardly of the suction feet 159 and adjacent the second folding station 133. The suction feet or tubes 173 are connected to an opposed pair of the brackets 155 by means of a tubular member 175, in generally the same manner as the first set of suction feet. The suction feet 173 are connected to the conduit 161 and the operation thereof is controlled by the valve 163, in the same manner and in synchronism with the operation of the suction feet

159. Rearwardly of the suction feet 173, a third set of transversely spaced suction feet 177 are provided. The suction feet or tubes 177 are connected to and supported by a tubular member 179, which in turn is connected between a pair of the opposed brackets 155 which are connected to the movable racks 139. The suction feet 177 are connected to the conduit 161 so as to be operated from the valve 163, as previously described. The tubular members 157, 175 and 179 on each side of the longitudinal top plate 15 are interconnected by arms 181 so that all of the suction feet operate in unison at the same time.

The piston and cylinder unit 151 which operates the rack gear 145 is connected by suitable conduit means with a valve 183, which in turn is connected in either the aforementioned compressed air system or a suitable hydraulic system. Valve 183 is operated by a cam element 185 on the cam shaft 105, in timed relation with the remainder of the operating parts of the machine, as will hereinafter appear, in order to operate the gear 145 at the proper intervals and times. When the piston and cylinder unit 151 is actuated by the valve 183, the gear 145 will move the rack 139 rearwardly with respect to the longitudinal top plate 15 and in turn will move the brackets 155 and all three sets of suction feet 159, 173 and 177 rearwardly so as to transfer the uppermost paper strip from the stack 27 to the first folding station, and when the machine is fully loaded, to move a paper strip from the first loading station 131 to the second loading station 133, and a paper strip from the second folding station 133 to the final receiving station 135. Before the piston and cylinder unit moves the transfer mechanism rearwardly the valve 163 is automatically operated by its cam element 165 on the cam shaft 105 to create a vacuum in the suction feet so that the latter will pick up the paper strips and move them to their respective stations. After the transfer mechanism has completed its rearward movement the valve 163 relieves the vacuum in the suction feet 159, 173 and 177 so that the paper strips will be deposited at their respective stations. The valve 183 then causes the piston and cylinder unit 151 to return the entire transfer mechanism 137 to its initial starting position, as shown in Fig. 3.

A stationary folding shoe 187 is provided at the first folding station 131 and has its forward end connected to the main transverse top plate 13 and its rear portion extending rearwardly therefrom just above the longitudinal top plate 15. The outer edge 189 of the stationary folding shoe 187 is positioned so as to be in alignment with the perforations between the paper strip sections 28 and 28', which perforation, as previously pointed out, is always positioned at the same location on platform 23, regardless of the size of the paper strip. Therefore, when the suction feet 159 move the paper strip from its stack onto the longitudinal top plate 15, the paper strip will slide beneath the stationary folding shoe 187 and be deposited with the perforated end of its outermost section 28 beneath and in alignment with the outer bottom edge 189 of the shoe.

In order to fold the end section 28 of the paper strip over the intermediate section 28', a movable folding shoe 191 is provided. The folding shoe 191 includes a stationary end portion 193, which is secured to the top plate 15 adjacent the stationary shoe 187 and a movable portion 195 which is hingedly connected to the stationary portion. The movable portion 195 is connected to

the upper flat edge of a gear segment 199 which is disposed below an opening 201 in the plate 15. The lower portion of the gear segment 199 is toothed at 203 to mesh with the teeth of an idler gear 205. The idler gear 205 meshes with the teeth of a gear segment 207, which is rotatably connected at 209 to a bracket 211, which in turn is supported on the casting 11. The gear segment 207 is connected by means of a link 213 to the upper end of a piston rod 215 of a piston and cylinder unit 217. The piston and cylinder unit 217 in turn is connected by suitable conduit means to a valve 219, which is operated by a cam element 221 on the cam shaft 105. The valve 219 may be connected in either the aforementioned compressed air system or a suitable hydraulic system, so that its actuation will cause extension or retraction of the piston rod 215. The cam element 221 is arranged on the cam shaft 105 so as to cause the piston and cylinder unit 217 to operate after the paper strip has been moved into its proper position at the first folding station 131. Thus, when the piston and cylinder unit 217 is actuated, the piston rod 215 will move downwardly and will rotate the gear segment 207 to the right, as seen in Fig. 7, and will cause the movable portion 195 of the folding shoe 191 to swing over the stationary folding shoe 187 and thus fold the end section 28 of the paper strip, which carries the carbon sheet, over the intermediate strip section 28'. After the folding shoe has folded the paper strip the valve 219 will be actuated to return the piston rod 215 to its initial substantially horizontal position.

After this folding operation has been completed the valve 183 will actuate the piston and cylinder unit 151 and the suction feet 173 will move the partially folded paper strip to the second folding station 133. The second folding station is likewise provided with a stationary folding shoe 223, under which the partially folded paper strip is moved. The stationary folding shoe 223 is adjustable transversely of the top plate 15, in order to accommodate various sized master sets which it may be desired to form. The forward end of the folding shoe 223 is connected to a transversely extending vertical plate 225, which is supported at its opposite ends by suitable brackets 227. The folding shoe 223 is adjustably connected to the plate 225 by means of a channel shaped bracket element 231, which fits over the plate 225 and is connected to the forward end of the folding shoe by bolts 233', as best seen in Fig. 3. The plate 225 has a pair of spaced stop elements 235 and 237 thereon. The stop 235 is employed when it is desired to fold 8½" x 11" master sets and the stop 237 is employed when it is desired to fold 8" x 5" master sets. Thus, if 8½" x 11" master sets are being folded, the stationary shoe 223 is moved into engagement with the stop 235, so as to properly position it. However, if 8" x 5" master sets are being folded, the shoe is moved to engage the stop 237 so as to properly position it for folding this size master set. Other stops may of course be provided, in accordance with the sizes of the master sets to be formed. A movable folding shoe 239 is provided adjacent the stationary folding shoe 223, and the movable folding shoe 239 is identical in construction with the shoe 191 previously described. The movable folding shoe 239 is actuated by gears, a piston rod, and a piston and cylinder unit, all of which are identical with those previously described, and are indicated on the drawings with prime numbers corresponding to those

of its adjacent identical mechanism. The piston and cylinder unit 217', for the folding shoe 239, is connected with the valve 219 in the same manner as the unit 217 for folding shoe 191, and is operated and actuated simultaneously therewith, so as to fold the opposite end section 28'' of the paper strip over the intermediate paper strip section 28' and the end section 28 which carries the carbon sheet. It will be appreciated that the folding shoe 239 and its operating mechanism can be easily adjusted, as shown in dot and dash lines in Fig. 7, to accommodate either size master set, as set forth above. Thus, when the machine is in full operation one paper strip will be folded at the first folding station while a second paper strip will be simultaneously folded at the second folding station. It will, of course, be appreciated that, by a mere reversal of certain of the elements, the end section 28'' could be folded over the intermediate section prior to the end section 28, and for certain purposes such a folding arrangement may be desirable.

After the paper strip has been folded at the second folding station, the valve 183 will be actuated to create a vacuum in all of the suction feet and the valve 163 will actuate the piston and cylinder unit 151, causing the transfer mechanism 137 to move to the rear with the suction feet 177 carrying the completely folded master set from the second folding station to the final receiving station 135. The final receiving station 135 comprises an opening 243 in the plate 15, through which the folded master set drops when released by the suction feet 177. Below the opening 243, a vertically movable platform 245 is provided, which is guided for vertical movement in ways in a vertical bracket or stanchion 247. The vertical movement of the platform 245 is controlled by means of a clock spring 249 which is connected between the platform and the stanchion 247. Thus, the platform 245 is normally disposed just below the plate opening 243, but as finished master sets are deposited thereon their weight will move the platform 245 downwardly against the action of the spring 249 until it engages the casting 11, at which time an operator removes the stack of finished master sets.

It will, of course, be appreciated that the cam elements on the cam shaft 105 are so shaped and related with respect to each other as to operate the suction feet, transfer mechanisms and folding mechanisms of the machine in a co-ordinated relationship with respect to each other, so that for each operating cycle of the machine one finished master set is produced. It must be appreciated and understood that when the machine is in full operation each of the stations or operating portions of the machine are operating substantially simultaneously, that is, while a carbon sheet is being attached to one paper strip, another paper strip is being folded at the first folding station, still another paper strip is being folded at the second folding station, and still another paper strip is being deposited in the final receiving station, so that the machine rapidly assembles the master sets and produces at least one finished master set for each cycle of its operation.

It will also be appreciated that this machine is relatively simple in construction and will automatically and continuously handle a large number of master sets and will eliminate any manual operations whatever in the forming of the finished master sets. Thus the master sets can be manufactured in a much more inexpensive manner

than has been heretofore possible, and various sized master sets may be formed in this one machine by making relatively simple adjustments of a few of the parts thereof.

While the machine of this invention is primarily designed to assemble three-fold duplicator master sets of the aforementioned type, it will be appreciated that the machine may be used for assembling other types of duplicator master sets without departing from the scope of the invention. For example, if it is desired to assemble a duplicator master set of the two-fold type, in which a sheet of carbon paper is attached to one section and the other section folded thereover to provide a protective covering, the machine of this invention could easily form such a master set if one of the folding stations were eliminated therefrom. Similarly, other types of master sets could be formed in this machine by either adding or eliminating one or more of the folding stations.

What is claimed is:

1. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper, which is divided into three interconnected end to end sections, including means for supporting a stack of paper strips, means disposed adjacent said paper strip stack supporting means for supporting a stack of carbon sheets, a device for glue spotting one end section of the uppermost paper strip of said stack, mechanism for transferring a single carbon sheet from its stack and positioning it on said glue spotted paper strip section so that said carbon paper will adhere to said section, a plurality of stations adjacent said paper strip stack at which each paper strip with its attached carbon sheet is folded, mechanism for transferring said uppermost paper strip and attached carbon sheet from said paper strip stack to the first folding station, a device at said first folding station for folding one end section of said paper strip over said intermediate section, mechanism for transferring said partially folded paper strip from said first folding station to a second folding station, a device at said second folding station for folding said third paper strip section over said other two sections, transfer mechanism for moving said folded paper jacket away from said second folding station, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strips from their prior stations to a subsequent station and a carbon sheet from its stack to a paper strip; and synchronizing means for co-ordinating the operation of said transfer mechanisms and said folding devices so that each master set is automatically moved through said machine and each operating cycle of said machine will produce a finished duplicator master set.

2. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper, which is divided into interconnected end to end sections, including means for supporting a plurality of stacked paper strips, means for supporting a stack of carbon paper sheets, transfer mechanism for moving a single sheet of carbon paper from its stack on to one section of the uppermost paper strip of said stack, a device for applying means to said paper strip section to cause said carbon sheet to adhere to said section when positioned thereon, means including a generally flat surface adjacent to and extending angularly from said

paper strip stack supporting means for supporting said individual paper strips and attached carbon sheets for folding, transfer mechanism for moving said uppermost paper strip and attached carbon sheet from said paper strip stack onto and along said supporting means flat surface, a plurality of folding devices spaced along said flat surface, for folding the sections of said master set relative to each other, each device including an element having a substantially flat surface movable toward and away from the plane of said supporting means flat surface for engaging the master set and folding the latter, transfer mechanism including means adjacent each folding device for simultaneously moving an individual paper strip from its stack to the first folding device and from one folding device to another, means for operating said transfer mechanism so as to cause simultaneous movement of the paper strips from device to device and a carbon sheet from its stack to a paper strip and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding devices so that each operating cycle of said machine will produce an assembled duplicator master set.

3. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper divided into interconnected end to end sections, including a mechanism for positioning a sheet of carbon paper on one of said sections, a device for applying means to said paper strip section to cause said carbon paper to be connected to said section when positioned thereon, mechanism for folding the master set including a stationary folding shoe, a movable folding shoe adapted to fold one of said paper strip sections over said stationary folding shoe, mechanism for operating said movable folding shoe, transfer mechanism including means adjacent said positioning mechanism and folding mechanism for simultaneously moving a carbon paper onto a paper strip, and a paper strip and attached carbon paper to said folding mechanism, and means for operating said transfer mechanism to cause simultaneous movement of the carbon paper to a paper strip and the paper strip to the folding mechanism and synchronizing means for co-ordinating the operation of said positioning mechanism, said folding mechanism and said transfer mechanism so that each cycle of said machine will produce a finished duplicator master set.

4. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into interconnected end to end sections, including a glue spotting device for applying glue to one end section of said paper strip, mechanism for positioning a sheet of carbon paper on said glue spotted section so that said carbon paper adheres to said section, mechanism for folding a master set including a stationary folding shoe, a movable folding shoe adapted to fold one of said paper strip sections over said stationary folding shoe, mechanism for operating said movable folding shoe transfer mechanism including means adjacent said positioning mechanism and folding mechanism for simultaneously moving a carbon paper onto a paper strip, and a paper strip and attached carbon paper to said folding mechanism, and means for operating said transfer mechanism to cause simultaneous movement of the carbon paper to a paper strip and the paper

strip to the folding mechanism and synchronizing mechanism for co-ordinating the operation of said folding mechanism, and positioning mechanism and transfer mechanism so that each operating cycle of said machine will produce a finished duplicator master set.

5. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into three interconnected end to end sections, including vertically movable platform means for supporting a plurality of stacked paper strips, vertically movable platform means for supporting a stack of carbon paper sheets adjacent to said platform means for said paper strip stack, transfer mechanism for moving a single sheet of carbon paper from its stack onto one section of the uppermost paper strip of said paper strip stack, means for varying the vertical position of said platforms so as to maintain the uppermost carbon sheet and uppermost paper strip at a pre-determined elevation at all times, whereby the uppermost sheet of carbon paper and the uppermost paper strip are maintained in the proper position to enable said transfer mechanism to properly operate, a glue spotting device for applying glue to the end section of said paper strip on which said carbon sheet is positioned so as to cause said carbon sheet to adhere to said paper strip section, means adjacent to said paper strip platform for supporting individual paper strips and attached carbon sheets for folding, transfer mechanism for moving said uppermost paper strip and attached carbon sheet from said paper strip stack to said folding supporting means, a device for folding one end section over said intermediate paper strip section, a device for folding said third section over said other two sections, transfer mechanism including means adjacent said folding devices for simultaneously moving a paper strip from one folding device to another, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strips from one folding device to another and a carbon sheet to a paper strip and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding devices, so that each operating cycle of said machine will produce an assembled duplicator master set.

6. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into three interconnected end to end sections, including means for supporting a plurality of stacked paper strips, means for supporting a stack of carbon paper sheets, transfer mechanism for moving a single sheet of carbon paper from its stack onto one section of the uppermost paper strip of said stack, a device for applying means to said paper strip section to cause said carbon sheet to adhere to said section when positioned thereon, a plurality of folding stations spaced transversely of the direction of movement of said transfer mechanism, one behind the other and including a first folding station adjacent said paper strip stack for supporting an individual paper strip with a carbon sheet attached thereto, a second folding station adjacent said first folding station for supporting a partially folded paper strip and attached carbon sheet, a transfer mechanism for simultaneously moving an individual paper strip from its stack

to said first folding station, a partially folded paper strip from said first folding station to said second folding station, and a finished master set away from said second folding station each of said transfer mechanisms including an element for engaging the paper strip so as not to be movable relative thereto until released therefrom, means for operating said transfer mechanism so as to cause simultaneous movement of the paper strips from their prior position or station to the subsequent station, a device at said first folding station for folding one end section of said paper strip over said intermediate paper strip section, a device at said second folding station for folding said third paper strip section over said other two sections, and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding devices so that each operating cycle of said machine will produce an assembled duplicator master set.

7. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into three interconnected end to end sections, including means for supporting a plurality of stacked paper strips, means for supporting a stack of carbon paper sheets, transfer mechanism for moving a single sheet of carbon paper from its stack onto one end section of the uppermost paper strip of said stack, a device for applying means to said paper strip section to cause said carbon sheet to adhere to said section when positioned thereon, a first folding station adjacent said paper strip stack for supporting an individual paper strip with a carbon sheet attached thereto, a second folding station adjacent said first folding station for supporting a partially folded paper strip and attached carbon sheet, a transfer mechanism for simultaneously moving an individual paper strip from its stack to said first folding station, a partially folded paper strip from said first folding station to said second folding station, and a finished master set away from said second folding station, means for operating said transfer mechanism so as to cause said simultaneous movement of said paper strips to each of said stations, a device at said first folding station for folding one end section over said intermediate paper strip section, including a stationary folding shoe, a movable folding shoe adapted to fold said paper strip section over said stationary folding shoe, mechanism for operating said movable folding shoe, a device at said second folding station for folding said third section over said other two sections, including an adjustable stationary folding shoe, means adjustably supporting said stationary folding shoe so that the latter may be adjusted for folding various sized master sets, an adjustable movable folding shoe for folding said paper strip section over said stationary folding shoe, mechanism for operating said movable folding shoe, and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding devices so that each operating cycle of said machine will produce an assembled duplicator master set.

8. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into three interconnected end to end sections, including a frame work supporting structure, a transverse plate supported by said struc-

ture and having a plurality of transversely spaced longitudinally extending slots therein, a longitudinal plate located adjacent said transverse plate and supported on said supporting structure, means below said transverse plate for supporting a stack of paper strips, means below said transverse plate for supporting a stack of carbon sheets, a glue spotting device supported on said transverse plate and including a plurality of spaced glue spotting fingers adapted to move down through said transverse plate slots and spot one end section of the uppermost paper strip of said stack, a transfer mechanism for moving individual sheets of carbon paper from their stack onto the glue spotted end section of the uppermost paper strip, said mechanism including a plurality of spaced suction feet extending downwardly through said transverse plate slots so as to engage the uppermost carbon sheet, means for causing said suction feet to pick up said uppermost carbon sheet and transfer it to said paper strip end section, means for operating said glue spotting device in timed relationship to said transfer mechanism, a plurality of folding stations on said longitudinal plate, transfer mechanism for moving the uppermost paper strip and attached carbon sheet from its stack and onto the first folding station on said longitudinal plate, mechanism at said first folding station for folding one end section over said intermediate paper strip section, transfer mechanism for moving said partially folded paper strip from said first folding station to a second folding station, mechanism at said second folding station for folding the third end section of said paper strip over said other two sections, transfer mechanism for moving said folded paper strip away from said second folding station, and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding mechanisms so that each operating cycle of said machine will produce an assembled duplicator master set.

9. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper which is divided into a plurality of interconnected end to end sections, including means for supporting a stack of paper strips, means for supporting a stack of carbon sheets, a device for glue spotting one section of the uppermost paper strip of said stack, mechanism for transferring a single carbon sheet from its stack and positioning it on said glue spotted paper strip section so that said carbon paper will adhere to said section, one or more stations adjacent said paper strip stack at which each paper strip with its attached carbon sheet is folded, mechanism for transferring said uppermost paper strip and attached carbon sheet from said paper strip stack to one folding station each of said transfer mechanisms including an element engageable with the paper strip so as to be rigidly connected therewith until released therefrom for moving the paper strip, a device at said folding station for folding the sections of said paper strip relative to each other in a desired manner said device including a shoe for folding one paper strip section relative to another, mechanism for transferring the folded paper strip away from said station, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strips from their prior station to a subsequent station and a carbon sheet to a paper strip and synchronizing means for co-ordinating the operation of said

positioning and transfer mechanisms and said folding device so that each master set is automatically moved through said machine and each operating cycle of said machine will produce a finished duplicator master set.

10. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper divided into a plurality of interconnected end to end sections, including vertically movable platform means for supporting a plurality of stacked paper strips, vertically movable platform means for supporting a stack of carbon paper sheets, mechanism for moving a single sheet of carbon paper from its stack onto one section of the uppermost paper strip of said paper strip stack, means for maintaining the vertical positions of said platforms in substantially the same horizontal plane so as to maintain the uppermost carbon sheet and uppermost paper strip at a substantially pre-determined elevation at all times, whereby the uppermost sheet of carbon paper and the uppermost paper strip are maintained in the proper position to enable said transfer mechanism to properly operate, a glue spotting device for applying glue to the section of said paper strip on which said carbon sheet is positioned, so as to cause said carbon sheet to adhere to said paper strip section, means including a substantially flat surface adjacent the said paper strip platform for supporting individual paper strips and attached carbon sheets for folding, transfer mechanism for moving said uppermost paper strip and attached carbon sheet from said paper strip stack to said supporting means flat surface, a device adjacent said flat surface for folding said paper strip sections relative to each other and in a desired manner, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strip from its stack to said folding device and a carbon sheet to a paper strip and synchronizing mechanism co-ordinating the operation of said transfer mechanisms and folding device so that each operating cycle of said machine will produce an assembled duplicator master set.

11. In a machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket, formed from a single strip of paper which is divided into three interconnected end to end sections, a first folding station for supporting an individual paper strip with a carbon sheet attached to one end section thereof, a second folding station adjacent said first folding station for supporting a partially folded paper strip, a transfer mechanism for simultaneously moving an individual paper strip to said first folding station, a partially folded paper strip from said first folding station to said second folding station, and a finished master set away from said second folding station, means for operating said transfer mechanism so as to cause said simultaneous movement of said paper strips to each of said stations, a device at said first folding station for folding one end section of said paper strip over said intermediate paper strip section, including a stationary folding shoe, a movable folding shoe adapted to fold said paper strip section over said stationary folding shoe, and mechanism for operating said movable folding shoe, a device at said second folding station for folding said third section over said other two sections, including an adjustable stationary fold-

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ing shoe, means adjustably supporting said stationary folding shoe so that the latter may be adjusted for folding various size master sets, an adjustable movable folding shoe for folding said paper strip section over said stationary folding shoe, and mechanism for operating said movable folding shoe and synchronizing mechanism co-ordinating the operation of said transfer mechanism and folding devices so that each operating cycle of said mechanisms will produce a properly folded duplicator master set.

12. In a machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper divided into a plurality of interconnected end to end sections, means for supporting one or more paper strips having a pressure transferable coating on one section thereof, one or more folding stations adjacent said means, mechanism for transferring the uppermost paper strip from said means to one folding station, a device at said folding station for folding the sections of said paper strip relative to each other and in a desired manner, said device including a stationary folding shoe, a movable folding shoe adapted to fold one section of said paper strip over said stationary folding shoe, and mechanism for operating said movable folding shoe, mechanism for transferring the folded paper strip away from said station, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strips from their prior station to a subsequent station and synchronizing means for co-ordinating the operation of said transfer mechanism and folding device so that each operating cycle of said mechanisms will produce a properly folded duplicator master set.

13. A machine for assembling duplicator master sets of the type in which a sheet of carbon paper is attached to and folded into a unitary paper jacket formed from a single strip of paper divided into a plurality of interconnected end to end sections, including means for supporting a stack of paper strips, means for supporting a stack of carbon sheets, a device for glue-spotting

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one section of the uppermost paper strip of said stack, mechanism for transferring a single carbon sheet from its stack and positioning it on said glue-spotted paper strip section so that said carbon paper will adhere to said section, one or more folding stations adjacent said paper strip stack, a device at said folding station for folding the sections of paper strip relative to each other and in a desired manner, said device including a stationary folding shoe, a movable folding shoe adapted to fold the paper strip over said stationary folding shoe, and mechanism for operating said movable folding shoe, transfer mechanism including means adjacent said folding station for simultaneously moving an individual paper strip from its stack to the folding station, mechanism for transferring the folded paper strip away from said station, means for operating said transfer mechanisms so as to cause simultaneous movement of the paper strips from their prior station to a subsequent station and a carbon sheet from its stack to a paper strip, and synchronizing means for coordinating the operation of said transfer mechanisms and folding device, so that each operating cycle of said mechanisms will produce a properly folded duplicator master set.

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