

May 14, 1968

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3,383,103

PAPER MARRIAGE CONSTRUCTION AND METHOD

Filed Nov. 22, 1965

2 Sheets-Sheet 1

FIG. 1

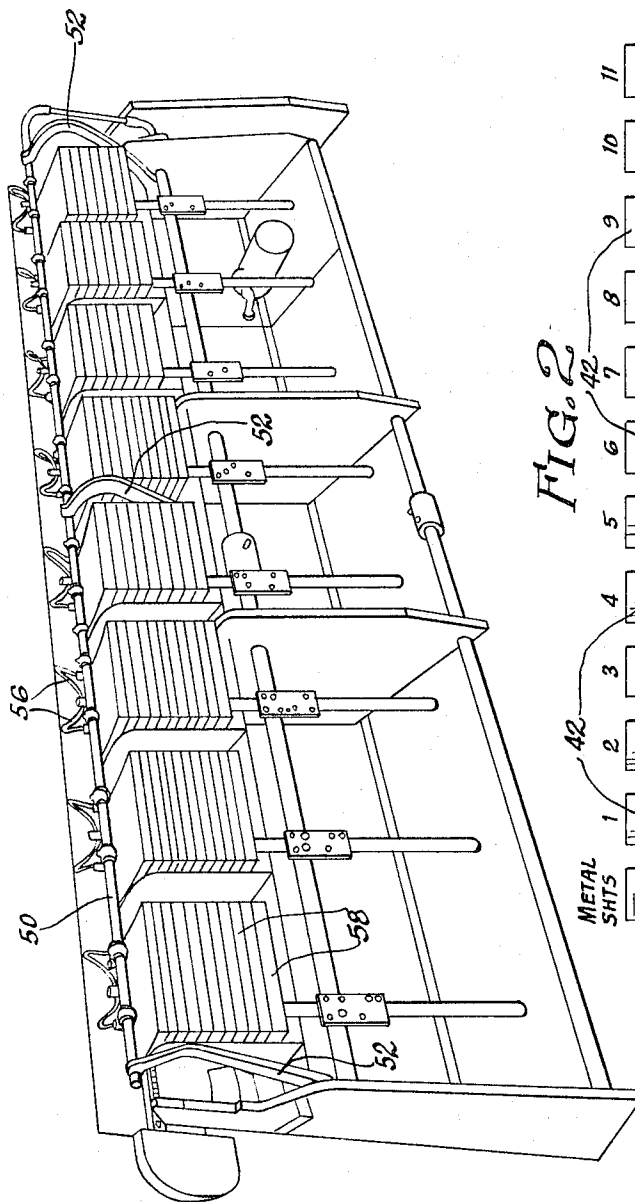


FIG. 2

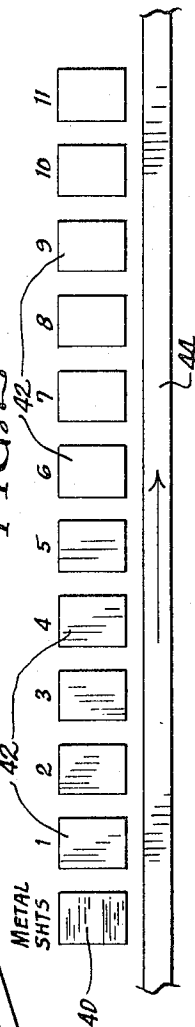
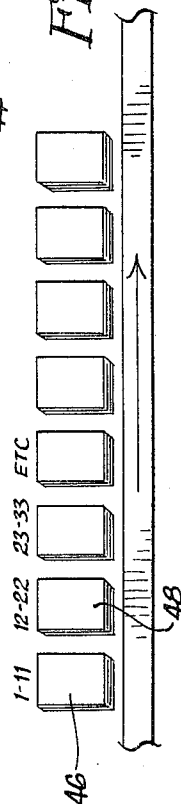


FIG. 3



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FIG. 4

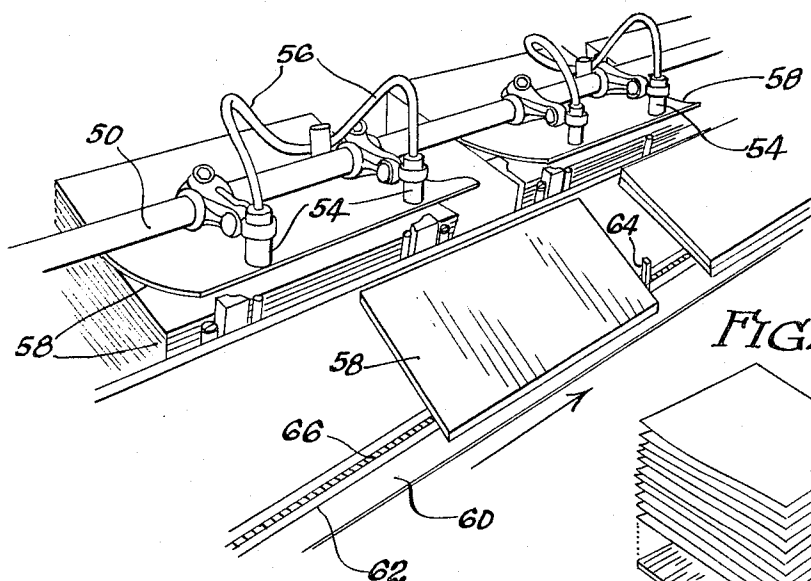


FIG. 5

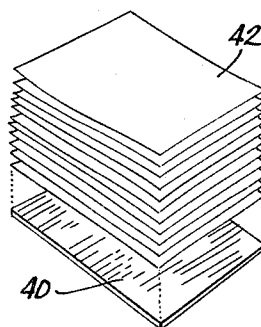


FIG. 6

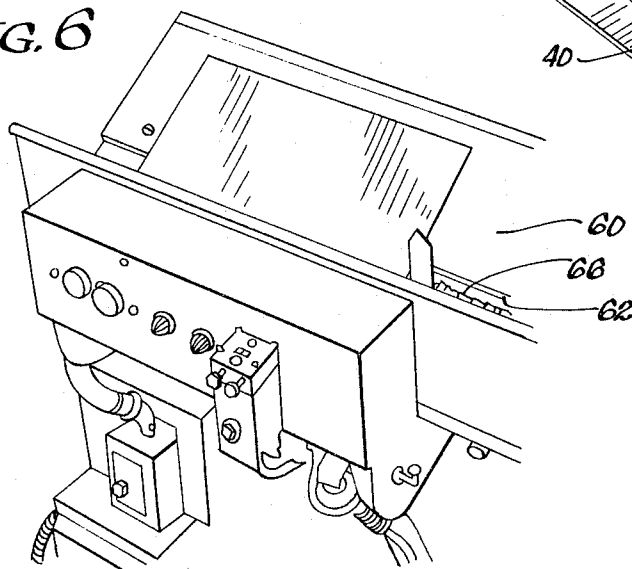
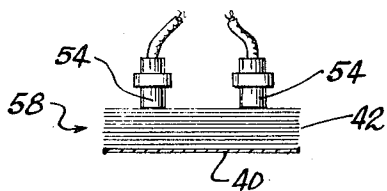


FIG. 7



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3,383,103 PAPER MARRIAGE CONSTRUCTION AND METHOD

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10 Claims. (Cl. 270—58)

ABSTRACT OF THE DISCLOSURE

A paper marriage construction wherein a plurality of paper sheets are collated into individual units and wherein the units are thereafter collated into a completed assembly. In the formation of the individual units, a metal sheet is included in each unit as the bottom sheet thereof. In the formation of the assembly, magnetic heads are employed for picking up each unit through attraction of the metal sheet, and the heads successively deposit respective units, one on top of the other, to form the assembly.

This invention relates to an apparatus adapted to be employed for the handling of sheets of material such as paper. In particular, the construction of the instant invention is adapted to be utilized as a paper marriage machine whereby assemblies of paper sheets can be achieved in a highly efficient manner.

The instant invention is also directed to improved methods for the assembly of sheets of material such as paper.

There are many applications which involve the handling of paper sheets and like materials. The instant invention will be described with reference to the production of books wherein the pages of the books are automatically assembled in proper order whereby the pages can be bound together to form the completed book. In considering the operation of the construction of this invention, reference will be made to the handling of paper and to the assembly of books. It will be appreciated, however, that reference to paper in the appended claims is intended to cover materials of similar characteristics adapted to be handled by the mechanisms of this invention. Furthermore, assemblies other than books can obviously be produced in accordance with the techniques to be described herein.

In the manufacture of books, it is necessary to print or otherwise reproduce a large number of copies of each page of the book. The pages must be separated and reassembled whereby they will appear in sequence in the completed assembly.

It is common practice to provide collators such as the Harris Intertype Macey machine, which are capable of collating the individual pages into stacks. The number of pages in a particular stack depends upon the size of the machine and, in a typical operation, the stacks produced contain 12 pages. Accordingly, one operation of the collating machine will involve the production of stacks each containing pages 1 through 12, for example. A separate collating operation will involve the production of stacks each containing pages 13 through 24. Additional collating operations are required depending upon the size of the book involved.

After production of the individual stacks in the manner described, the stacks are assembled by hand. This assembly operation can be extremely time-consuming and costly, particularly where books of several hundred pages are involved.

It is an object of this invention to provide an improved method and apparatus for the handling of sheets of material such as paper whereby the sheets can be efficiently formed into an assembly.

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It is a more particular object of this invention to provide a method and apparatus adapted for the handling of stacks of paper assembled on a collating machine or the like whereby such stacks can be automatically assembled to form a book or the like.

These and other objects of this invention will appear hereinafter and for purposes of illustration, but not of limitation, specific embodiments of this invention are shown in the accompanying drawings in which:

FIGURE 1 is a perspective view illustrating the rear side of a machine which can be employed in the operation of this invention;

FIGURES 2 and 3 comprise schematic illustrations of the manner in which sheets are assembled to provide the results of this invention;

FIGURE 4 is a perspective view illustrating a stage in the assembly of stacks of sheets;

FIGURE 5 is an exploded view illustrating the nature of stacks adapted to be handled in accordance with the techniques of this invention;

FIGURE 6 is a perspective view illustrating a misfeed detector construction adapted to be employed in combination with the apparatus of the instant invention; and,

FIGURE 7 is a detail view illustrating the operation of pick up means utilized in the construction of this invention.

The techniques of the instant invention involve the use of a paper marriage construction adapted to assemble a plurality of paper sheets into individual units. The separate units formed by the marriage construction are then adapted to be assembled to form a book or the like. The particular improvement of this invention involves the use of a metal sheet in combination with each of the individual stacks of paper sheets. Magnetic pick up heads are employed whereby the combination of the metal sheet and associated paper sheets can be picked up as a unit. Means are provided for the simultaneous handling of a number of such units whereby automatic assembly of the various units can be accomplished. The metal sheets can be easily removed before binding of the assembled paper sheets. The system of this invention, therefore, eliminates virtually all of the manual labor required for assembling of paper sheets into books. The invention, thus, provides substantial improvements from the standpoint of efficiency of operation and cost.

FIGURES 2 and 3 of the drawings provide general illustrations of the manner in which the instant invention is practiced. In the arrangement shown in FIGURE 2, it is assumed that a conventional collating machine having 12 stations is available.

In the use of the collating machine, a stack of metal sheets 40 is located at one station of the machine. Paper sheets 42 are located in each of the other 11 stations. It will be appreciated that each of these paper sheets may comprise one page in a book. FIGURE 2 illustrates the assembly of pages 1 through 11, and it will be understood that subsequent groups of 11 pages are formed in the same manner.

The collating machine includes a conveyor 44 in accordance with standard practice, and the pick up means for the machine, usually suction elements, are adapted to deposit the respective sheets. The pickup means at the first station will deposit a metal sheet 40 while the pick up means at the other 11 stations will deposit one of the paper sheets 42. All of the depositing operations take place simultaneously with the conveyor indexing the sheets one position between each depositing operation. Accordingly, the first page will always be deposited over a metal sheet with the subsequent pages being deposited in order. Each stack delivered at the end of the conveyor will comprise a metal sheet at the bottom with 11 pages located thereon. Obviously, the order of deposition could

be reversed as long as the metal sheet is at one end of the stack.

After completion of a set of stacks all having the same pages therein, the sets of stacks are each placed in position as shown in FIGURE 3. Thus, the first position comprises a plurality of stacks 46 with each stack including pages 1 through 11. The second position holds a similar group of stacks 48 with each stack containing pages 12 through 22. Subsequent stacks are provided in accordance with the size of the completed assembly.

A construction of the type shown in FIGURES 1 and 4 is employed for automatic assembly of the stacks into a book. The machine includes a plurality of stations, each of which carries supporting means for stacks such as the stacks 46 and 48. In one contemplated form of the invention, the supporting means for the stacks are mounted on screws, and drive means are provided for rotating the screws during each cycle of the machine operation. This provides for raising the top stack into position for removal in accordance with the concepts of this invention. It will be appreciated that this particular machine structure does not form a part of the instant invention in that such operations are common to collating machines and the like. A mounting bar 50 is provided in the machine, and this bar is adapted to be pivoted about its axis by means of rocker arms 52. Suitable drive means for such mechanisms are also employed in collating machines, and the operation thereof is preferably directly synchronized with the conveyor operation of the machine.

Pick up heads 54 are attached to the bar 50. These pick up heads have magnetic characteristics, and they are preferably electromagnets. Wires 56 are provided for energizing of the electromagnets. Stacks of paper sheets 58 are located in a pile beneath the electromagnets whereby the top stack is adapted to be picked up in the manner to be described.

A bed 60 is provided for holding stacks 58 which are removed from the respective piles. An elongated slot 62 is formed in this bed, and the pins 64 extend upwardly through this slot. The pins are connected to a chain 66 whereby a conveyor arrangement is provided for moving the stacks along the length of the construction.

In the operation of the construction, a stack 58 at the first station of the machine is placed on the bed 60. A pin 64 is adapted to engage this stack whereby the stack will be moved away from this first station. When this stack has been moved to the second station, the construction is adapted to operate whereby a second stack is deposited on top of the first stack. Obviously, if the first stack contains pages 1 through 11, the second stack will contain pages 12 through 22. Subsequent stacks are deposited along the length of the construction whereby the completed assembly, with the pages in proper sequence, is achieved.

The construction of this invention is adapted to handle the complete stacks due to the presence of the metal sheet 40 in each stack. Thus, the metal sheet is attracted by the electromagnets, and the paper sheets are held between the faces of the electromagnets and the metal sheet. It will be apparent that the metal sheet is located at the bottom of the stack to achieve this result. The electromagnets can be regulated with ease whereby sufficient magnetic force will be provided for purposes of attracting the metal sheet through the thickness of the intervening paper sheets. The magnetic intensity is maintained below a certain level so that the second stack in the pile will not be picked up at the same time as the uppermost stack. As indicated, control means are available which will readily accomplish such regulation of the magnetic intensity.

It will be appreciated that the figures given regarding the number of stations in the collating machine and in the marriage machine employing electromagnets have been presented solely for purposes of illustration. These figures

can obviously vary considerably depending upon the type of equipment available and depending upon the particular assembly operation involved.

It will be understood that various changes and modifications may be made in the above described construction which provide the characteristics of this invention without departing from the spirit thereof, particularly as defined in the following claims.

That which is claimed is:

1. In a paper marriage construction wherein a plurality of paper sheets are first collated into individual units and in which the individual units are then again collated into a completed assembly, the improvement comprising means for including a metal sheet adapted to be picked up by a magnet in association with the sheets of each unit as the bottom sheet thereof, an array of stations for holding a plurality of said units, and magnetic pick up means at said stations for successively picking up each of said units and depositing each of said units on top of units deposited from preceding stations.

2. A construction in accordance with claim 1 wherein said paper sheets are assembled into individual units by means of a collator having a plurality of separate operating stages, and wherein said metal sheet is included in each of said units in one stage of the operation of said collator.

3. A construction in accordance with claim 2 wherein said magnetic pick up means comprises a plurality of magnetic heads, holding means for said units located in position adjacent said heads, and conveyor means moving adjacent said heads, one of said heads being adapted to deposit a unit on said conveyor means to thereby form the bottom unit in said assembly, the other heads being adapted to deposit units on top of previously deposited units.

4. A construction in accordance with claim 3 wherein the units in each of said holding means comprise different segments of said assembly, and wherein said heads are adapted to deposit said segments whereby the order of said units corresponds to the desired order of the sheets in the assembly.

5. A construction in accordance with claim 4 including a bar mounted for pivoting movement about its axis, said heads being mounted in side-by-side relationship on said bar, and wherein said holding means comprise bins for holding a plurality of units with each unit in a particular bin comprising the same segment of said assembly, said conveyor moving along the length of said bar whereby the respective heads are adapted to act in unison to pick up units from associated bins for successively depositing said units on said conveyor.

6. In a method for forming a completed assembly of paper sheets wherein a plurality of paper sheets are first collated into individual units and wherein the individual units are then again collated into the completed assembly, the improvement comprising the steps of including a metal sheet adapted to be picked up by a magnet in association with each of said units as the bottom sheet thereof, providing a magnetic pick up means, successively picking up each of said units with said pick up means, and depositing each of said units on top of units from preceding stations which were previously deposited by said pick up means to thereby form said completed assembly.

7. A method in accordance with claim 6 wherein said units are initially formed in a collator, and including the step of locating one of said metal sheets in each of said units as a step in the operation of said collator.

8. A method in accordance with claim 7 wherein said pick up means comprise a plurality of magnetic heads, providing holding means for said units and locating said holding means in position adjacent said heads, providing a conveyor and moving said conveyor adjacent said heads, operating one of said heads to deposit one of said units on said conveyor for thereby forming the bottom unit in said assembly, and operating the remainder of said heads

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for depositing the other units on top of previously deposited units.

9. A method in accordance with claim 8 wherein the units contained in a particular holding means comprise the same segment of said assembly, and including the step of operating said heads to deposit said units whereby the order of said units corresponds to the desired order of the sheets in the assembly. 5

10. A method in accordance with claim 9 wherein said heads are each mounted on a common member, and in-

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cluding the step of operating drive means for said heads whereby said heads simultaneously deposit said units.

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10 P. WILLIAMS, *Assistant Examiner.*