

Nov. 11, 1958

T. F. ARONSON ET AL

2,859,964

SHEET FEEDING MECHANISM

Filed Feb. 19, 1957

3 Sheets-Sheet 2

Fig. 2.

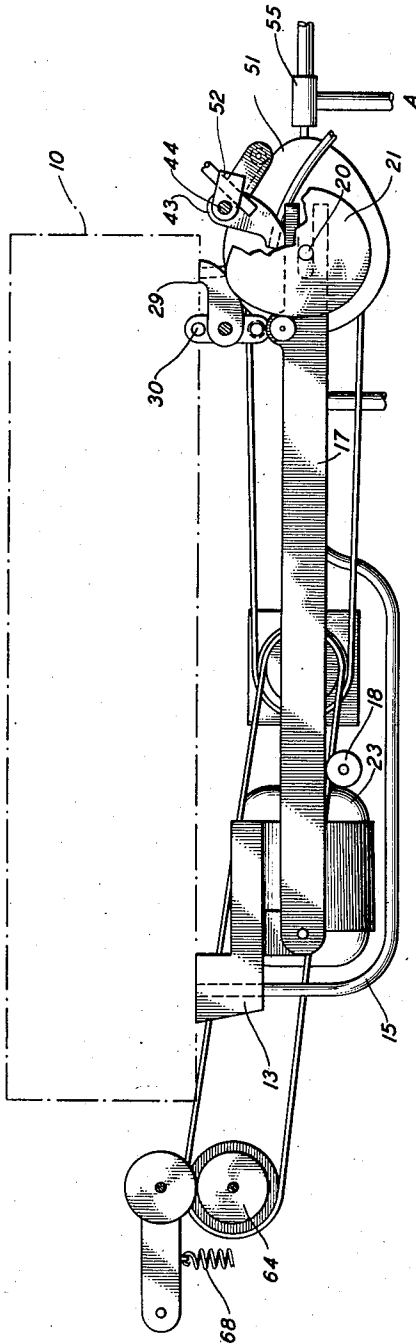
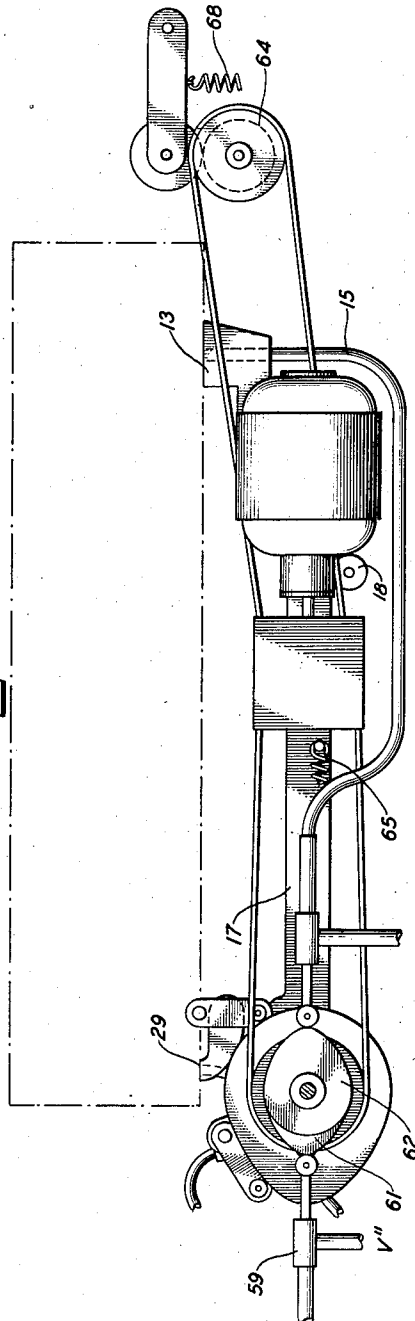


Fig. 3.



INVENTORS
THEODORE F. ARONSON
FLOYD A. LYON
BY *Albert F. Kronman*
ATTORNEY

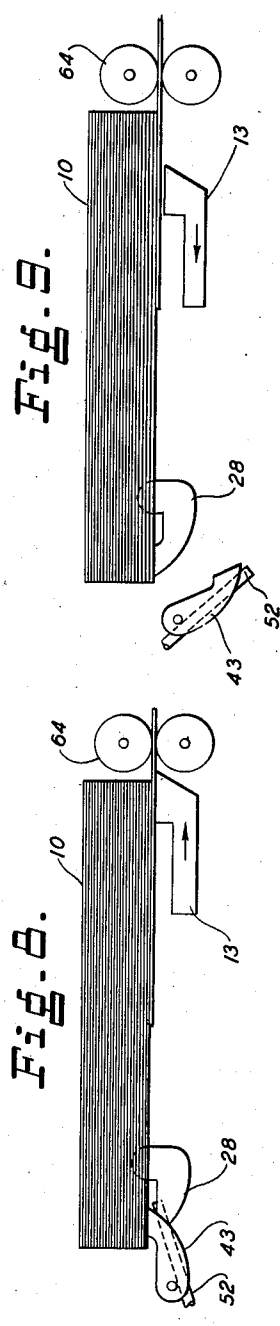
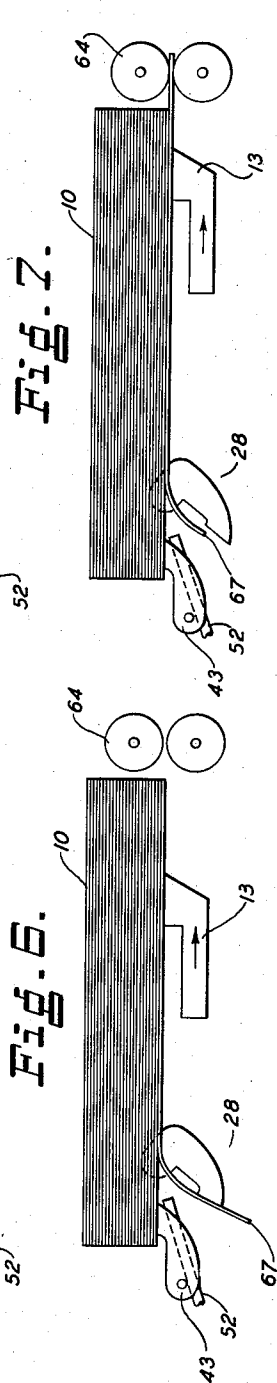
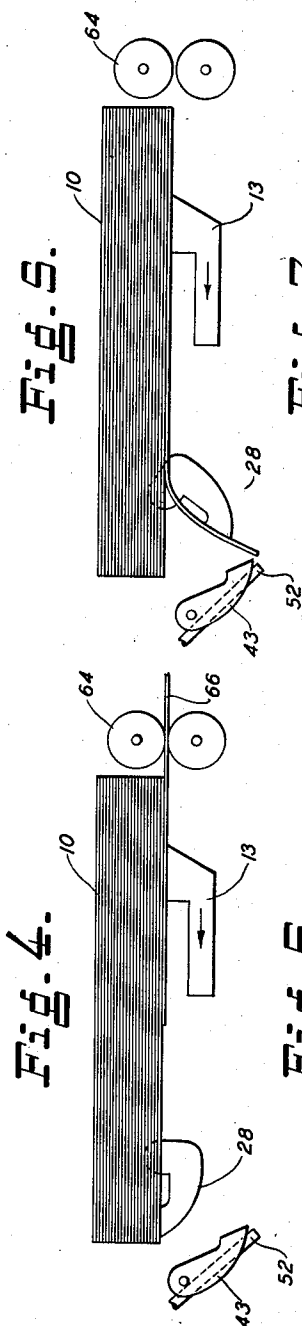
Nov. 11, 1958

T. F. ARONSON ET AL
SHEET FEEDING MECHANISM

2,859,964

Filed Feb. 19, 1957

3 Sheets-Sheet 3



INVENTORS
THEODORE F. ARONSON
FLOYD A. LYON
BY *Albert F. Kronman*
ATTORNEY

1

2,859,964

SHEET FEEDING MECHANISM

Theodore F. Aronson, Glen Cove, and Floyd A. Lyon,
Brookville, N. Y.

Application February 19, 1957, Serial No. 641,091

11 Claims. (Cl. 271—29)

This invention relates to a device for automatically feeding paper from a stack into a printing press, folding machine or other suitable mechanism.

Where it is desired to feed sheets of paper from a stack particularly at high speed, many problems arise which have heretofore severely limited the rate of handling of such material. Papers stacked together have a tendency to adhere to one another and also to be affected by certain conditions of static electricity. In removing one sheet from the stack, adjacent sheets are often displaced with respect to the reference points so that succeeding operations are out of register with the mechanism to which the sheets are applied.

Accordingly, it is an object of the present invention to provide a sheet feeding and handling device which is capable of high speed operation, due to the fact that all oscillating parts are back in feed position and the next sheet is separated ready to feed before the bottom sheet is out of the stack. Sheets could be fed end to end. This action gives slower arm movements than the average separator which has to come in and out between trailing edge of one sheet and leading edge of next sheet.

Another object of the present invention is to provide a sheet feeding and handling device which will be in accurate register throughout successive operations.

A further object of the present invention is to provide a sheet feeding and handling device in which there will be no relative displacement of the sheets in the stack due to the withdrawal of individual sheets during the feeding operation.

A feature of the present invention is its novel bed and stack gripping structure.

Another feature of the present invention is its use of suction means and air blast for separating individual sheets from the stack.

The invention consists of the construction, combination and arrangement of parts, as herein illustrated, described and claimed.

In the accompanying drawings, forming a part hereof is illustrated one form of embodiment of the present invention, and in which:

Figure 1 is an isometric, somewhat diagrammatic, view of a complete embodiment of the present invention showing the stack of papers in phantom and with the machine supporting structure omitted for the sake of clarity.

Figure 2 is a view taken on line 2—2 in Figure 1, looking in the direction of the arrows.

Figure 3 is a view taken on line 3—3 in Figure 1, looking in the direction of the arrows.

Figures 4, 5, 6, 7, 8 and 9 are diagrammatic views illustrating the sequence of steps in the feeding of a single sheet from the stack of papers for the purpose of the present invention.

Referring to the drawings, and specifically to Figure 1, the dashed lines 10 indicate a stack of sheets of paper placed upon a support table 11. The sheets of paper 10 extend beyond the support table 11 as indicated at 12. A slot is provided in the table 11 to receive there-

2

through a sheet grasping and advancing structure 13. The sheet grasping structure 13 is somewhat pipe shaped and is provided with a bore 14 which communicates with the bottom of the structure 13 and also a tube 15. The tube 15 is connected to a source of vacuum indicated by the letter V immediately below the valve 16. The sheet advancing structure 13 is carried by an elongated arm 17 which in turn is supported by a roller 18. The end of the arm 17 opposite the sheet grasping structure 13 is forked as indicated at 19. The forked structure 19 straddles a shaft 20, which shaft also supports a plurality of cams, hereinafter more fully described. The elongated arm 17 is slidably moved with respect to the shaft 20 by means of one of the cams 21, which is keyed to the said shaft 20, and a small follower 22 which is carried by the arm 17. Rotary motion is imparted to the shaft 20 by means of the motor 23 through the reduction gear mechanism 24 which in turn is coupled to a pulley 25 carried upon the output shaft 26 of the said reduction gear device 24. A second pulley 27 is driven by a belt member 28 which links the pulleys 25, 27. Sheet grasping members 29 are disposed on either side of the arm 17 and consist of internally bored arms rotatably mounted upon a crank shaft 30. The pivot point 31 of the crank shaft 30 is disposed in the plane of the bottom of the stack of papers. The crank shaft 30 is supported upon upstanding bearing members indicated at 32. The bores 39 in the sheet engaging members 29 are connected to flexible vacuum tubes 40 which in turn are connected to pipes 41 leading to a cam operated valve 42. The cam operated valve is in communication with a source of vacuum indicated at the letter V' in Figure 1, but otherwise not shown. Spaced stack retaining members 43 are disposed adjacent the members 29 and are similarly bored and connected to a source of vacuum indicated at V'' in Figure 1. The stack retaining members 43 are rotatably mounted upon a shaft 44 which shaft is in turn supported upon bearing members somewhat diagrammatically illustrated at 45. Suitable motion to the crank shaft 30 and the shaft member 44 is provided by means of cam members 51 and 46 respectively. Cam members 51 and 46 are carried upon the shaft 20 and are rotated thereby. The crank shaft 30, 31 is provided with an arm 47 to which is secured a follower roller 48. Thus, as the cam 46 rotates it swings the arm 47 which in turn swings the crank shaft 30, 31.

As the crank shaft 30, 31 is swung the sheet engaging members 29 are brought into contact with the bottom surface of the stack of sheets or drawn away therefrom in accordance with the direction of motion of the crank shaft 30, 31. A rotating motion is provided for the stack retaining members 43 by way of the shaft 44 to which a rocking arm 49 is secured. The rocking arm 49 is supplied with a small roller 50 which rides upon the surface of the cam 51. The cam 51 is secured to the shaft 20 and rotates with said shaft in accordance with the previously described structure. The roller 50 follows the contour of the cam 51 and rotates the shaft 44 so as to bring the stack retaining members 43 into contact with or away from the stack as directed by the cam 51.

An air blast nozzle member 52 is also secured to the shaft 44 and moves in accordance with the rotation of said shaft so as to be directed at the stack of papers or pulled away therefrom during the operation of the device. It is within the purview of the present invention to use more than one air blast nozzle for this purpose. The air blast nozzle 52 is connected by means of a flexible hose 53 to a pipe 54 connected to a source of compressed air indicated at "A" in Figure 1. The compressed air is controlled through valves 55 by means of the roller 56 which rides upon the surface of the cam 57. The valve 55 is one of three valves, 55, 42, 59, which are controlled

3

by cams 57, 60 and 61, all mounted upon the shaft 20. The shaft 20 also supports a cam 62 which is employed to control the valve 16, governing the vacuum to the sheet grasping device 13.

Referring to Figures 2 and 3, there is shown the position of the sheet grasping device 13 and the engaging members 29 at the start of the feeding cycle. The arm 17 is in the retracted position and is pulled away from the feed rollers 64 by means of the spring 65 shown in Figure 3. The sheet engaging members 29 are swung upwardly into a position where they engage the lowermost surface of the stack of sheets 10. At this phase of the operation of the device the valves 16 and 42 are open so as to apply a suction to the lowermost sheet through the bores in the sheet grasping member 13 and the sheet engaging members 29. The machine is now in the position diagrammatically illustrated in Figure 4. As the shaft 20 is rotated by the motor 23 the cam member 46 will cause the crankshaft to rotate, thereby swinging the sheet engaging member downwardly to the position shown in Figure 5. The axial disposition of the pivot point with respect to the bottom of the stack 10, permits a portion of the bottom sheet 66 to be pulled down and separated from the stack without moving it rearwardly on the table 11 (see Figure 5).

Further rotation of the shaft 20 causes the cam 45 to swing the stack retaining members 43 upwardly from the position shown in Figure 5 to that shown in Figure 6. The stack retaining members 43 thereupon grasp the remainder of the stack firmly to prevent it from being displaced by the sliding motion of the sheet grasping structure 13 in its travel towards the feed roller 64. As the stack retaining members 43 move upwardly, a blast of air is directed through the nozzle 52 at the stack of paper 10. The blast of air is controlled by means of the cam 57 which operates the valve 55. The blast of air serves to separate any sheets that may have adhered to the lowermost sheet of paper; it also directs a film of air between the lowermost sheet and the remainder of the stack 10 upon which the stack floats. As a result of the film of air, frictional contact between the sheet which is being withdrawn and the remainder of the stack is substantially eliminated. During the next phase of the operation the suction to the sheet engaging members 28 is removed and the sheet grasping device 13 is pushed forward by the operation of the cam 21 until the leading edge of the lowermost sheet 66 is engaged by the rollers 64. As soon as the trailing edge 67 of the lowermost sheet clears the sheet engaging members 28, the said sheet engaging members are swung upwardly as shown in Figure 8 to contact the remainder of the stack 10 and suction is again provided at this point to aid in holding the remainder of the stack throughout the sheet withdrawing operation. In this manner the stack of paper 10 is never released by the vacuum holding means at any time, either before, during or after the withdrawal of the paper from the stack. Relative motion of the remainder of the stack 10 with respect to the machine is thereby prevented and positive control over the position of said stack upon the table 11 is assured. After the bottom sheet 66 has been substantially removed from the stack, the stack retaining or hold back members 43 are swung downwardly as shown in Figure 9. The sheet engaging members 28 remain in contact with the lowermost sheet and are in position to resume the next cycle as shown in Figure 4.

The feed rollers 64 are yieldably pressed into contact with one another by means of springs 68. Rotary motion is imparted to the rollers 64 through a pulley 69 which is secured to the roller shaft 70 and is driven by a belt 71. The belt 71 is slipped over a pulley 72 which is carried on the outer end of the shaft 26 of the gear reduction member 24. The pulleys 69, 72, are of a size which will drive the rollers 64 at a speed equal to or slightly faster than that of the advancing sheet of paper 67.

4

While the present invention has been described and illustrated as a bottom feeding device it is within the purview of the present invention to rotate the said structure 180° to feed the topmost sheet from a stack of papers. All of the mechanism hereinabove described will operate on any position of the stack of papers due to the fact that the feeding device does not depend upon the action of gravity for the handling of the foils. When the table on support 11 is on top of the stack 10, a stack elevator (not shown) will be necessary to keep the stack against the support 11.

Having thus fully described the invention, what is claimed as new and desired to be secured by Letters Patent of the United States, is:

1. A sheet feeding mechanism comprising, a support table adapted to carry a plurality of sheets thereon, a bored, sheet grasping member swingably mounted adjacent one end of the table, a source of vacuum connected to the bore in the grasping member, means to bring the grasping member into contact with one of the outermost sheets and grip said sheet, a reciprocating arm adjacent the said outermost sheet, a bored sheet advancing structure on said arm, vacuum means connected to the sheet advancing structure, a bored sheet retaining member adjacent the grasping member end of the table, a source of vacuum attached to the retaining member, means to alternately swing the retaining member into contact with and away from the sheets to positively engage the sheet adjacent the grasped outermost sheet, a sheet separating air blast nozzle, movable with the sheet retaining member and directed at the edge of the sheets, a source of compressed air connected to the nozzle, valve means between the vacuum and compressed air sources on the respective sheet grasping, advancing, retaining and separating members and a source of rotary power coupled to the feeding mechanism for regulating the valves, swinging the grasping and retaining members and reciprocably moving the advancing arm in a sequential cycle.

2. A sheet feeding mechanism comprising, a support table adapted to carry a plurality of sheets thereon, spaced bored, sheet grasping members swingably mounted adjacent one end of the table, a source of vacuum connected to the bore in the grasping members, means to bring the grasping members into contact with one of the outermost sheets and grip said sheet, a reciprocating arm adjacent the said outermost sheet, a bored sheet advancing structure on said arm, vacuum means connected to the sheet advancing structure, bored sheet retaining members adjacent the grasping member end of the table, a source of vacuum attached to the retaining members, means to alternately swing the retaining members into contact with and away from the sheets to positively engage the sheet adjacent the grasped outermost sheet, a sheet separating air blast nozzle, movable with the sheet retaining members and directed at the edge of the sheets nearest the retaining members, a source of compressed air connected to the nozzle, valve means between the vacuum and compressed air sources on the respective sheet grasping, advancing, retaining and separating members and a source of rotary power coupled to the feeding mechanism for regulating the valves, swinging the grasping and retaining members and reciprocably moving the advancing arm in a sequential cycle.

3. A sheet feeding mechanism comprising, a support table adapted to carry a plurality of sheets thereon, an elongated shaft adjacent one end of the table, spaced bored, sheet grasping members swingably mounted upon the shaft adjacent one end of the table, a source of vacuum connected to the bore in the grasping members, cam means adjacent the shaft to bring the grasping members into contact with one of the outermost sheets and grip said sheet, a reciprocating arm adjacent the said outermost sheet, a bored sheet advancing structure on said arm, vacuum means connected to the sheet advancing structure, bored sheet retaining members adjacent the grasping member end of the table, a source of vacuum attached to the

retaining members, means to alternately swing the retaining members into contact with and away from the sheets to positively engage the sheet adjacent the grasped outermost sheet, a sheet separating air blast nozzle, movable with the sheet retaining members and directed at the edge of the sheets nearest the retaining members, a source of compressed air connected to the nozzle, valve means between the vacuum and compressed air sources on the respective sheet grasping, advancing, retaining and separating members and a source of rotary power coupled to the feeding mechanism for regulating the valves, swinging the grasping and retaining members and reciprocally moving the advancing arm in a sequential cycle.

4. A sheet feeding mechanism comprising, a support table adapted to carry a plurality of sheets thereon, an elongated crank shaft adjacent one end of the table, an arm secured to the crank shaft, bored, sheet grasping members swingably mounted upon the shaft adjacent one end of the table, a source of vacuum connected to the bore in the grasping members, cam means adjacent the shaft and in contact with the arm to bring the grasping members into contact with one of the outermost sheets and grip said sheet, a second shaft to support the said cam, a reciprocating arm adjacent the said outermost sheet, a bored sheet advancing structure on said arm, vacuum means connected to the sheet advancing structure, bored sheet retaining members secured to the second shaft adjacent the grasping member end of the table, a source of vacuum attached to the retaining members, cam means to alternately swing the retaining members into contact with and away from the sheets, a sheet separating air blast nozzle, movable with the sheet retaining members and directed at the edge of the sheets nearest the retaining members, a source of compressed air connected to the nozzle, valve means between the vacuum and compressed air sources on the respective sheet grasping, advancing, retaining and separating members and a source of rotary power coupled to the feeding mechanism for regulating the valves, swinging the grasping and retaining members and reciprocally moving the advancing arm in a sequential cycle.

5. A sheet feeding mechanism according to claim 4 in which the pivot point of the crank lies in the plane of the sheet being withdrawn.

6. A sheet feeding mechanism according to claim 1 in which the sequential cycle is arranged so that the plurality of sheets are grasped by at least the grasping members or, the retaining member, at all times.

7. The method of feeding individual sheets from a stack which comprises supporting the said stack upon a table, grasping a lowermost sheet and bending a portion thereof away from the stack, floating by means of a film of air, the remainder of the stack from the grasped sheet, grasping the remainder of the stack above the bent portion, and thereafter advancing the outermost sheet in a path which will lead it away from said stack.

8. A sheet feeding mechanism comprising, a slotted support for a plurality of sheets, a bored sheet grasping and separating member movably mounted adjacent one end of the support, a source of vacuum attached to the bored member, means to bring the grasping member into contact with one of the outermost sheets, a reciprocating

arm adjacent the support and in register with the slot, a sheet advancing structure on said arm receivable within the slot, a sheet hold back member adjacent the grasped end of the sheets, means to alternately move the hold back member into contact with and away from the sheet, and means to grasp and separate the outermost sheet and advance the sheet in a direction away from the stack in timed relationship with the motion of the hold back member.

9. A sheet feeding mechanism comprising, a slotted support for a plurality of sheets, a bored sheet grasping and separating member movably mounted adjacent one end of the support, a source of vacuum attached to the bored member, means to bring the grasping member into contact with one of the outermost sheets, a reciprocating arm adjacent the support and in register with the slot, a bored sheet advancing structure on said arm receivable within the slot, a source of vacuum attached to the said arm bore, a sheet hold back member adjacent the grasped end of the sheets, means to alternately move the hold back member into contact with and away from the sheet, and means including a plurality of valves connected to the vacuum sources to grasp and separate the outermost sheet and advance the sheet in a direction away from the stack in timed relationship with the motion of the hold back member.

10. A sheet feeding mechanism comprising, a slotted support for a plurality of sheets, an elongated shaft adjacent one end of the support, a bored sheet grasping and separating member movably mounted upon the shaft, adjacent one end of the support, a source of vacuum attached to the bored member, means to bring the grasping member into contact with one of the outermost sheets, a reciprocating arm adjacent the support and in register with the slot, a bored sheet advancing structure on said arm receivable within the slot, a source of vacuum attached to the said arm bore, a sheet hold back member adjacent the grasped end of the sheets, means to alternately move the hold back member into contact with and away from the sheet, and means including a plurality of valves connected to the vacuum sources to grasp and separate the outermost sheet and advance the sheet in a direction away from the stack in timed relationship with the motion of the hold back member.

11. The method of feeding individual sheets from a stack which consists of the steps of grasping an outermost sheet adjacent one end thereof, separating the portion of the sheet so grasped from the stack floating the stack from the sheet by a blast of air, holding the remainder of the stack against movement with respect to the outermost sheet and thereafter removing said sheet from the stack without releasing the hold upon the remainder of the stack.

References Cited in the file of this patent

UNITED STATES PATENTS

2,085,612	Spiess	June 29, 1937
2,110,175	Reinartz	Mar. 8, 1938
2,282,224	Harrold	May 5, 1942
2,406,766	Harrold	Sept. 3, 1946