

Nov. 30, 1965

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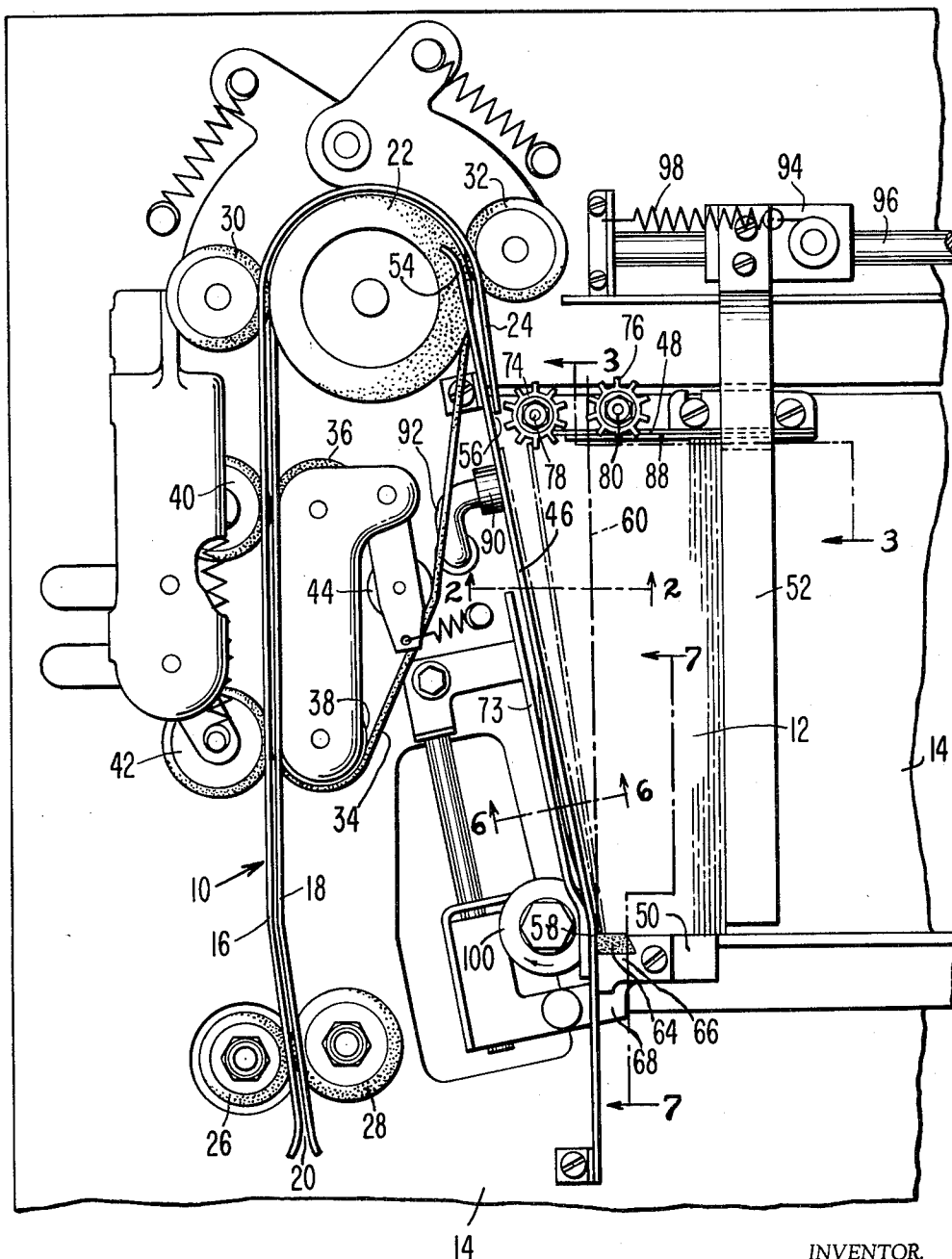
3,220,724

SHEET STACKER

Filed May 22, 1964

3 Sheets-Sheet 1

Fig. 1.



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3 Sheets-Sheet 3

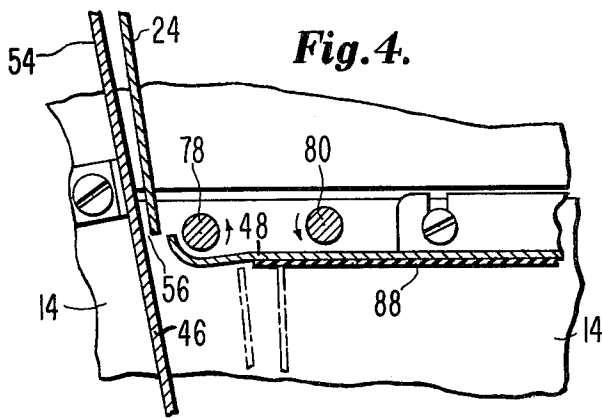


Fig. 6.

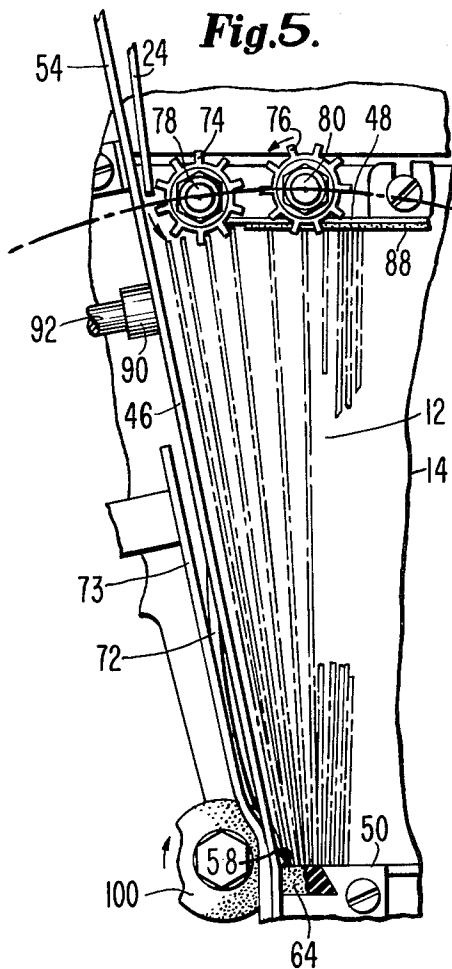
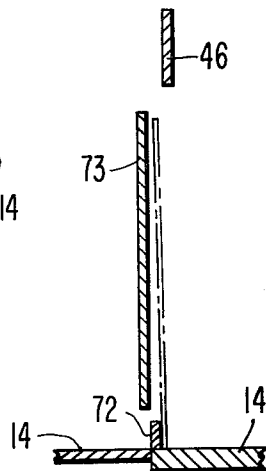
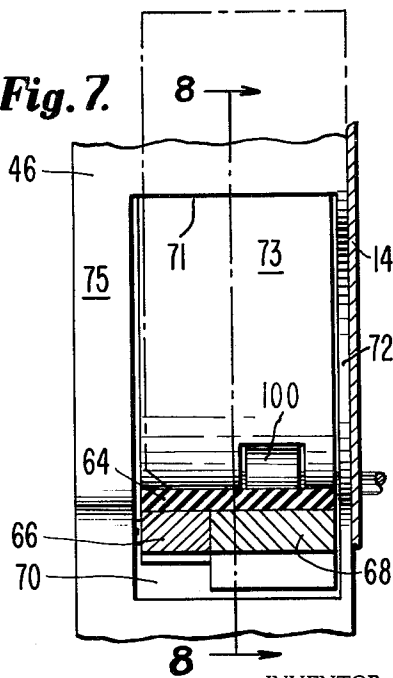


Fig. 7.



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SHEET STACKER

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10 Claims. (Cl. 271—68)

This invention relates generally to sheet transport apparatus and particularly to a sheet stacking device therefor.

The principal object of the invention is to provide an improved sheet stacking device for stacking sheets on edge and for successfully stacking cards that have become soft through use, or damage, or have received a set curvature.

Another object of the invention is to provide a sheet stacking device of the above mentioned character in which undesirable sheet pressure in a sheet stacking bin is relieved to decrease the possibilities of sheet jamming.

Another object of the invention is to limit retrogressive movement of the stacked sheets.

A further object of the invention resides in the cooperative relationship of sheet stacker elements including a sheet fulcrum about which sheets are pivoted to the stack.

Other objects of the invention will become apparent from the following detail description, taken in connection with the accompanying drawings in which:

FIG. 1 is a plan view of a sheet stacking device embodying features of the invention;

FIG. 2 is a vertical sectional view, partly in elevation, taken along the line 2—2 of FIG. 1;

FIG. 3 is another vertical sectional view partly in elevation, taken along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary horizontal sectional view, taken along the line 4—4 of FIG. 2;

FIG. 5 is a fragmentary plan view of the sheet stacker illustrating certain structural features thereof and the stacking of sheets;

FIG. 6 is a vertical sectional view, taken along the line 6—6 of FIG. 1;

FIG. 7 is a vertical sectional view, taken along the line and in the direction of the arrows 7—7 of FIG. 1, and

FIG. 8 is an enlarged fragmentary sectional view, taken along the line 8—8 of FIG. 7.

Referring to the drawings by characters of reference, and first to FIG. 1, there is shown a sheet or card handling apparatus including a sheet transport guideway 10 and a sheet stacking device including a bin 12. The guideway 10 and the bin 12 may be mounted on a suitable horizontal bed plate or plates 14 which in turn may be mounted on a base 15. As shown, the guideway 10 is arranged for directing sheets on edge into the bin 12, the sheets being injected into the bin in free flight at high velocity.

The guideway 10 may be defined by a pair of spaced apart upright plates 16 and 18 having a flared sheet inlet 20 from which the plates extend to the periphery of a sheet feed drum 22 which is power driven about a vertical axis. The guide plate 16 extends partway around the periphery of the drum 22 and has an end portion 24 extending back toward the bin 12. Adjacent the sheet inlet 20 there is a pair of driven sheet feed rollers 26 and 28 to feed the sheets along the guideway 10, and co-operating with the drum 22 there is a pair of similar pressure rollers 30 and 32, constituting other feed members of the sheet transport system. In addition, a belt 34, driven from the shaft of the drum 22 is guided along the guideway plate 18 by a pair of spaced apart guide rollers 36 and 38, the belt cooperating with pressure

rollers 40 and 42 to feed sheets to the drum periphery. Preferably a belt take-up roller 44 is provided for the feed belt 34.

The sheet stacking device includes a stationary sheet guide means which defines one side of the bin 12, the guide means including an upright plate or rail 46. The bin also includes parallel front and rear walls 48 and 50 which extend transversely to the pin rail 46, and normal to the bin front and rear walls there is a movable back-up member 52 providing an expandible bin. The stationary bin side plate 46 extends forwardly of the bin front wall 48 to the drum 22 and in part forms a sheet inlet 56, to the bin, with the end portion 24 of the sheet transport guideway, the portion 24 and the bin side 46 converging, as shown, to the inlet. From the sheet inlet 56, the bin side plate 46 extends toward the bin rear wall in converging relation with and at an acute angle to the back-up member 52.

With reference particularly to FIG. 7, the sheet guide plate 46 is provided with a rectangular opening 70 therein which extends from substantially midway of its ends to and, in this instance, beyond the bin rear wall 50. The purpose of the opening 70 is to provide more sheet clearance in the area of the apex of the converging throat formed by guide wall 46 and the sheets, and thus decrease sheet pressure and accompanying tendency toward the occurrence of sheet jams. The sheet clearance and pressure relief opening 70 is provided particularly for cards which through long use or misuse have received a set curvature, as illustrated in FIG. 8, as I have found that they are the principal cause of sheet jams. The provision of the opening 70 results in the guide plate 46 having a step at the edge 71 of opening 70, FIG. 7, down to a lower rail portion 72 which extends along the bottom of the bin 12 to the bin rear wall 50 and forms a junction 58 with the rear wall. The use of the term "step" is considered justified by the fact that the upper portion of plate 46, as at 75, has no sheet guiding function as it is above the upper edges of the sheets and functions solely as a structural member. Also, edge 71 of plate 46 is considered the terminus of the plate since obviously the lower rail 72 need not be integral therewith. Instead, as will be apparent to those skilled in the art, the stationary side of the bin 12 may be constructed, if desired, by vertically spaced rails of which only the lowermost would extend to the bin rear wall 50.

In the present construction, the guide rail 72 forms a junction 58 with the bin rear wall 50 or with a rubber bumper 64 which in part forms the bin rear wall. Also the junction provides a fulcrum about which sheets may be pivoted toward the back-up member 52.

To enhance sheet pressure relief in the area of the opening 70, the rail portion 72 is offset outwardly, preferably curving outwardly from a point adjacent the plate edge 71 and sweeping back to the junction 58 with the bumper 64, as shown in FIG. 8. The sheet guide means includes another upright plate 73 which is spaced outwardly of the guide rail portion 72 and overlies the opening 70 for engagement by sheets that have the above mentioned curvature. As illustrated in FIG. 8, the lower curved portion of guide rail 72 is spaced inwardly from plate 73 thus providing a space between these plates to receive a card in the area of the opening 70.

In order to urge each sheet, entering the bin, toward the back-up plate 48 and thus remove each sheet from the path of sheet entrance to the bin, I provide a sheet stacker member 74 and a second sheet stacker member 76 both of which are located at and spaced along the bin front wall 48. The sheet stacker member 74 and the sheet stacker member 76 may be alike and may be in the form of paddle wheels or pinions, as illustrated. In FIGS. 1

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and 2, the paddle wheels 74 and 76 are shown as being affixed to upper end portions of vertical shafts 78 and 80 respectively. These shafts 78 and 80 are supported by conventional journals in casings 82 and 84 on base plate 15 and one of them is power driven and drives the other through a pulley and belt connection 86. As shown in FIG. 1, the paddle wheels 74 and 76 are arranged such that their paddles or teeth project into the bin 12 through the bin front wall 48, the paddle wheel 74 closing the opening between the adjacent ends of the inlet guide portion 24 and the front wall 48. Also, it will be noted that the paddle wheel 74 is adjacent the sheet inlet 56 on one side of a plane 64, which is parallel to back-up member 52, whereas the paddle wheel 76 is located on the other side of the plane 64, or between the plane and the back-up plate 52. The axes of rotation of the paddle wheels 74 and 76 are on an arc which has its focal point coincident with the junction 58 of the guide rail portion 72 and the sheet bumper member 64 and the lineal distances from the junction point to the hubs or root diameters of the paddle wheels 74 and 76 are the same and preferably about .08 inch greater than the length of the sheets being stacked. With respect to the normal plane 64, it will be seen that the axial planes of the respective paddle wheels 74, 76 normal to the plane 64 are displaced from each other with the axial plane of the slightly rearwardly located paddle wheel 76 being displaced slightly rearwardly of the axial plane of the forwardly located paddle wheel 74 in relation to the direction of card or sheet travel.

To insure against the possibility of the sheets retrogressing and developing a pressure against the paddle wheels 74, 76 the inner surface of the bin wall 48 is faced with a sheet of material 88 having a high coefficient of friction, such as rubber. The distance from the inner face of the sheet friction member 88 to the inner face of bin end wall 50 is made equal to the lengths of the sheets or may be slightly less than the lengths of the sheets. The consequence of this arrangement is frictional engagement between the face of sheet 88 and the adjacent card edges so as to keep the sheets from creeping to the left facing FIG. 5.

To insure that the trailing edge of a sheet being fed into the bin 12 will engage between the teeth of the paddle wheel 74, an air head 90 having one or more outlet jets is preferably provided. The air jet head 90 is located back of an opening in the guide rail 46, near the paddle wheel 74, and the jet or jets are directed crosswise of the bin 12 or toward the back-up plate 52 to blow the trailing edge of the sheet into the paddle wheel 74. A pipe or tube 92 connected to head 90 may connect the head to any suitable compressed air system.

The back-up plate 48 is supported at one end thereof on a bushing 94 which is slidable along a stationary guide rod 96. A spring 98 is provided to bias the back-up plate 52 toward the stationary side 46 of the bin in broadside relation and is overcome by the pressure of accumulating sheets within the bin 12.

The sheets are fed successively at high speed into the bin 12 and bounce back from the rubber bumper 64 and so a feed roller 100 is preferable provided to return the sheet to the bin rear wall portion, or bumper member 64. The roller 100 is a power driven roller which projects into the bin 12 near the bumper member 64. As indicated, the roller 100 is driven in a clockwise direction to move a sheet toward the bin end wall.

Operation

In the operation of the above described apparatus, sheets are fed successively along the guideway 10 in spaced relation and through inlet 56, enter the bin 12 in free flight. The tapered sheet inlet 56 directs the sheet angularly toward the sheet side guide plate 46 to guide the leading edge of the sheet to the junction 58 of the guide rail 72 and the bumper 58. To clear the path of sheet

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travel for the next sheet, air from the air jet head 90 blows the trailing end portion of the sheet away from the guide plate 46 into the teeth of the power driven paddle wheel 74. This paddle wheel flicks or relays the trailing edge of the sheet to the teeth of the stacker paddle wheel 76 and forces the trailing edge of the sheet to scrape against the rubber sheet 88, as a buffer, to oppose a tendency of the sheet to creep back toward the paddle wheel 76. The sheets are pivoted on the bumper 64, as a fulcrum, the trailing edges of the sheets being fed from the paddle wheel 74 to the paddle wheel 76 and by the paddle wheel 76 to the stack. The spring 98, acting through the back-up plate 52 and the sheet stack, exerts a force which, because of the inclination of the bin side plate 46, is concentrated at the junction 58 which tends to cause sheet jam, particularly if one or more successive sheets or cards happen to have set curvatures at the leading edge portions thereof. However, by curving the lower rail 72 outwardly and providing the offset plate 73, the sheet pressure is reduced in the throat, and clearance behind each sheet introduced into the bin is maintained to receive the next sheet.

I claim:

1. An apparatus for stacking sheets on edge comprising stationary sheet guide means forming one side of a stacking bin and in part forming a sheet inlet to the bin, a movable back-up member forming the other side of the bin and movable away from said guide means under the pressure of accumulating sheets within the bin, a rear wall of the bin engageable by the leading edge of a sheet, said rear wall forming a junction with said guide means and a fulcrum for the leading edge of a sheet to be pivoted toward said back-up member, a rotatably driven sheet stacker member positioned within said bin and laterally of said inlet, said stacker member operable to engage the trailing edge of a sheet and pivot the sheet on said fulcrum toward said back-up member, means urging the trailing edge of a sheet away from said guide means toward said stacker member, and a rotatably driven relay stacker member interposed between said guide means and said first-mentioned stacker member, said relay stacker member operable to engage and pivot a sheet about said fulcrum toward said first-mentioned stacker member.

2. A sheet stacking apparatus as defined by claim 1 wherein a lower rail of said guide means adjacent said junction is offset outwardly of the bin.

3. An apparatus for stacking sheets on edge comprising, sheet guide means forming one side of a sheet bin and in part defining a sheet inlet to the bin, a front wall of the bin and terminating in spaced relation to said guide means, a rear wall of the bin forming a junction with said guide means and a fulcrum for the leading edge of a sheet, a stack back-up member forming the other side wall of the bin and movable in broadside relation away from said guide means under the pressure of accumulating sheets within the bin, a first rotatable paddle wheel projecting into said bin at said front wall and rotatable to engage and flick the trailing edge of a sheet toward said back-up member, a second rotatable paddle wheel between the terminus of said bin front wall and said inlet and projecting into the bin, means operable to move the trailing edge of a sheet to the paddles of said second paddle wheel, said second paddle wheel rotatable to flick the trailing edge of a sheet to the paddles of said first paddle wheel, said paddle wheels having their axes of rotation respectively in parallel planes normal to said bin rear wall and with said fulcrum between the planes.

4. A sheet stacking apparatus as defined by claim 3 wherein the respective lineal distances from the axes of said paddle wheels to said fulcrum are equal.

5. A sheet stacking apparatus as defined by claim 4 wherein the linear distances from the axes of the paddle wheels to said rear bin wall are unequal as measured in said parallel planes normal to said bin rear wall.

6. In a sheet stacking apparatus as defined by claim 3

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wherein a buffer member of relatively high frictional coefficient on the inner surface of said front wall is engaged by adjacent sheet edges to oppose regression of the stacked sheets toward said first paddle wheel.

7. A sheet stacking apparatus for stacking sheets on edge comprising a rear wall of a sheet receiving bin, a sheet back-up plate forming one side of the bin and extending normal to said rear wall, a stationary plate forming the other side of the bin and forming in part a sheet inlet adjacent said front wall, said back-up plate biased toward said stationary plate and movable away from the latter under the pressure of accumulating sheets within the bin, said stationary plate extending from said inlet toward said rear wall in converging relationship to said back-up plate and terminating intermediate said front and rear walls, a lower rail extending from the terminus of said stationary plate to and forming a junction with said rear wall, said rail having a medial portion offset outwardly of said stationary plate and away from said back-up plate.

8. A sheet stacking apparatus for stacking sheets on edge comprising a rear wall of a sheet receiving bin, a sheet back-up plate forming one side of the bin and extending normal to said rear wall, a first stationary plate forming the other side of the bin and forming in part a sheet inlet adjacent said front wall, said back-up plate biased toward said first stationary plate and movable away from the latter under the pressure of accumulating sheets within the bin, said first stationary plate extending from said inlet toward said rear wall in converging relationship to said back-up plate and terminating intermediate said front and rear walls, a lower rail extending from the terminus of said first stationary plate to and forming a junction with said rear wall and having a medial portion outwardly offset from said plate, a second plate positioned above and outward of said medial portion in substantially parallel spaced relation to said first plate, and means adjacent said sheet inlet and operable to pivot a sheet about a fulcrum at said junction toward said back-up plate.

9. A sheet stacking apparatus for stacking sheets on edge comprising a rear wall of a sheet receiving bin, a sheet back-up plate forming one side of the bin and extending normal to said rear wall, a stationary plate forming the other side of the bin and forming in part a sheet inlet, said back-up plate biased toward said stationary plate and movable away from the latter under the pres-

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sure of accumulating sheets within the bin, said stationary plate extending from said inlet toward said rear wall in converging relationship to said back-up plate and terminating intermediate said front and rear walls, a lower rail extending from the terminus of said stationary plate to and forming a junction with said rear wall, said rail having a medial portion outwardly offset from said plate, air jet means adjacent said sheet inlet and directed to urge the trailing edge of a sheet toward said back-up plate, and a driven paddle wheel projecting into said bin laterally of said inlet and rotatably driven in a direction to receive the trailing edge of a sheet and flick the trailing edge toward said back-up plate.

10. A sheet stacking apparatus for stacking sheets on edge comprising a rear wall of a sheet receiving bin, a sheet back-up plate forming one side of the bin and extending normal to said rear wall, a stationary plate forming the other side of the bin and forming in part a sheet inlet, said back-up plate biased toward said stationary plate and movable away from the latter under the pressure of accumulating sheets within the bin, said stationary plate extending from said inlet toward said rear wall in converging relationship to said back-up plate and terminating intermediate said front and rear walls, a lower rail extending from the terminus of said stationary plate to and forming a junction with said rear wall, said rail having a medial portion outwardly offset from said plate, air jet means adjacent said sheet inlet and directed to urge the trailing edge of a sheet toward said back-up plate, a driven paddle wheel projecting into said bin laterally of said inlet and rotatably driven in a direction to receive the trailing edge of a sheet and flick the trailing edge toward said back-up plate, and a rotatably driven relay paddle wheel interposed between said stationary plate and said first-mentioned paddle wheel and laterally of said inlet, said relay paddle wheel operable to flick the trailing edge of a sheet toward said first-mentioned paddle wheel.

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