

May 16, 1939.

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2,158,694

METHOD OF AND APPARATUS FOR CLEANING METALLIC SHEETS

Filed Feb. 4, 1936

3 Sheets-Sheet 1

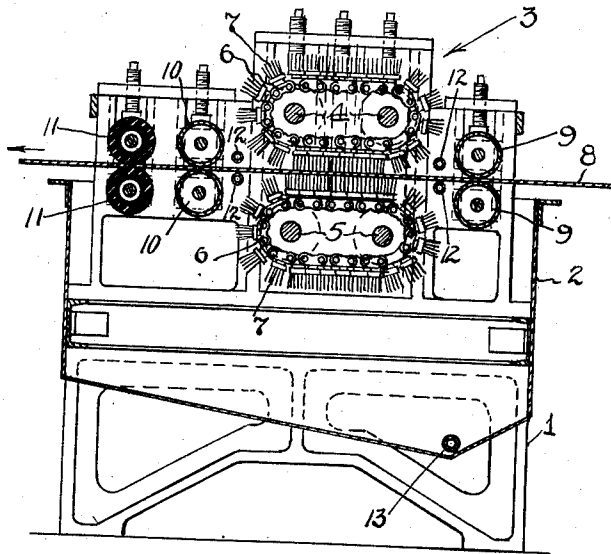


Fig. 1

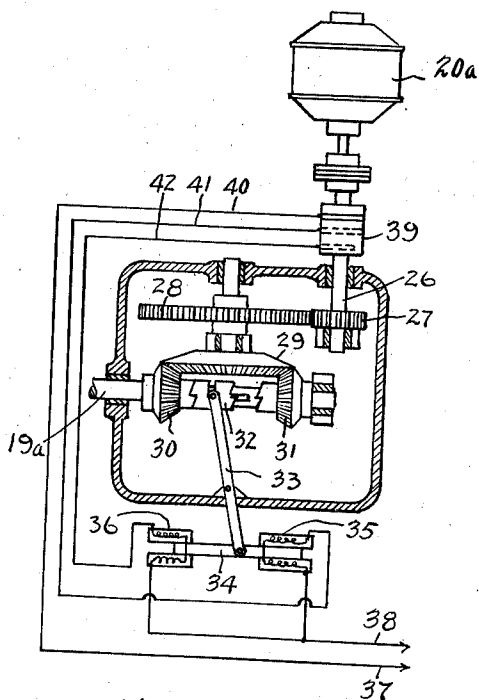


Fig. 5

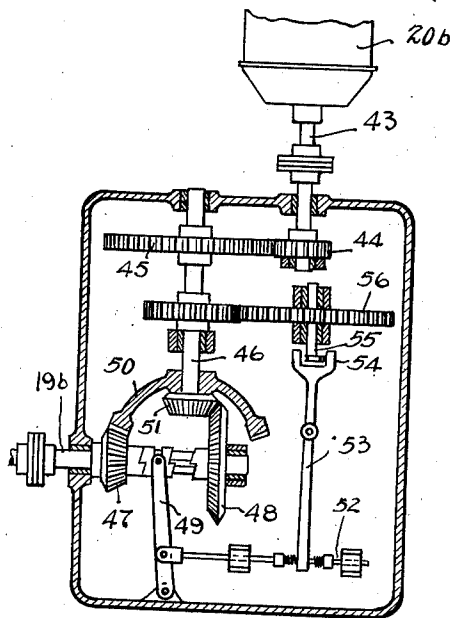


Fig. 6

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3 Sheets-Sheet 2

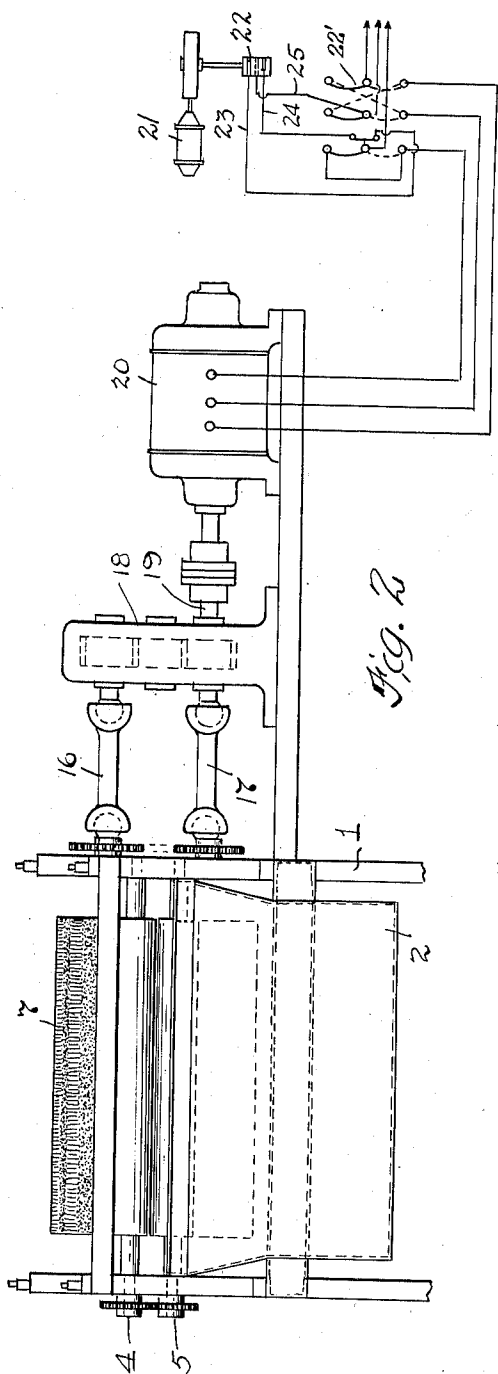


Fig. 2

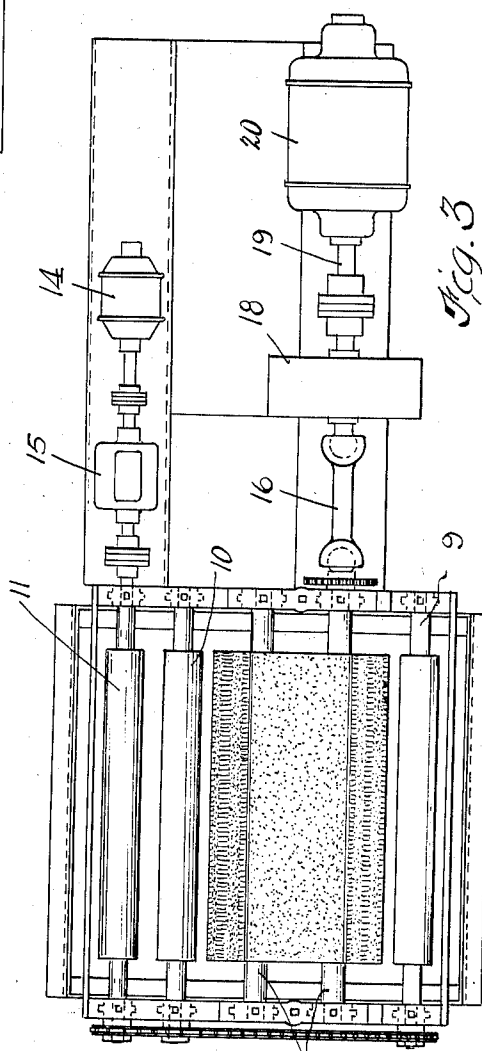


Fig. 3

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3 Sheets-Sheet 3

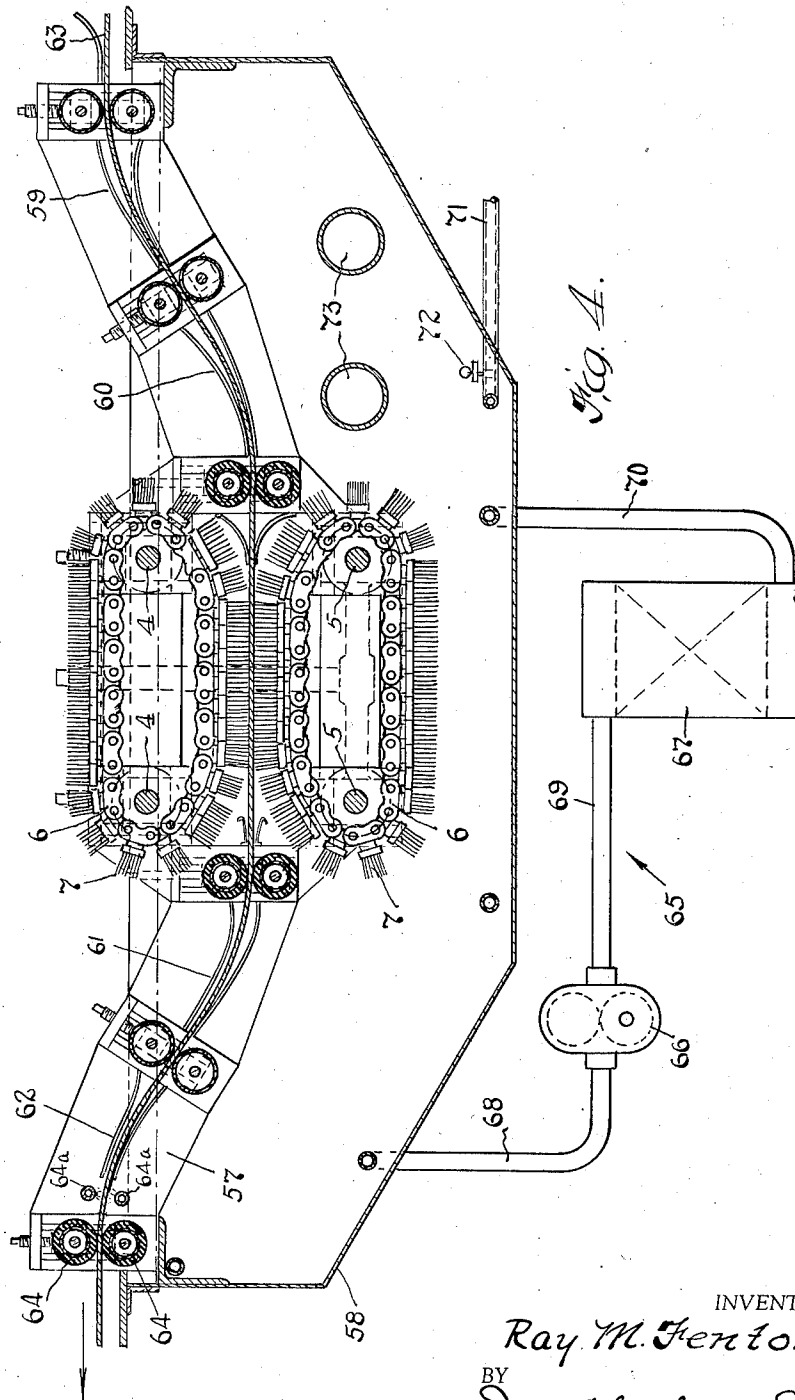


Fig. 4.

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UNITED STATES PATENT OFFICE

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METHOD OF AND APPARATUS FOR CLEANING METALLIC SHEETS

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Application February 4, 1936, Serial No. 62,304

4 Claims. (Cl. 15-77)

This invention relates as indicated to a method of and apparatus for cleaning metallic sheets and more particularly for the purpose of subjecting metallic sheets to a so-called scrubbing action in the presence of a suitable cleaning fluid such as hot water.

It is one of the principal objects of my invention to provide an improved brushing or scrubbing means as well as a novel mode of operation of brushing devices generally whereby the foreign material adhering to metallic sheets may be more efficiently removed.

It is a further object of my invention to provide an improved scrubbing means characterized by the fact that the cleaning station at which the sheet to be cleaned is subjected to a scrubbing action is located within a bath of cleaning fluid instead of supplying the cleaning fluid to the article to be cleaned in the form of sprays.

A further object of my invention is to provide a novel means for supporting and actuating the brushes which engage the sheet so that they may more effectively and more efficiently carry on the scrubbing operation with a minimum of wear to the brushes.

It is a further object of my invention to provide a method of cleaning and scrubbing metallic sheets characterized by a saving of a considerable amount of energy, both with respect to mechanical manipulation of the article and apparatus, as well as the cleaning bath employed.

Further objects of my invention will appear as the description proceeds.

To the accomplishment of the foregoing and related ends, said invention, then, consists of the means hereinafter fully described and particularly pointed out in the claims; the annexed drawings and the following description setting forth in detail certain means and one mode illustrating, however, but one of the various ways in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a side elevational view partially in section of one form of apparatus constructed in accordance with the principles of my invention; Fig. 2 is an end elevational view of the apparatus illustrated in Fig. 1; Fig. 3 is a plan view of the apparatus illustrated in Figs. 1 and 2; Fig. 4 is a side elevational view partially in section of an improved and in certain respects, the preferred form of apparatus constructed in accordance with the principles of my invention; and Figs. 5 and 6 are plan views partially in section showing alternative forms of the driving means for

the brushes forming a part of the apparatus illustrated in the previous figures.

Referring now more specifically to the drawings and more especially to Figs. 1 to 3, the apparatus illustrated in such figures as representative of one embodiment of my invention consists of a suitable supporting frame generally indicated at 1, which carries a fluid collecting tank 2 and above which there is mounted the scrubbing apparatus generally indicated at 3.

As most clearly illustrated in Figs. 2 and 3, the side members of the frame 1 have journaled therein paired shafts 4 and 5. About each pair of such shafts there are trained endless chains or webs 6 to which there are secured a plurality of outwardly extending brushes 7. The shafts 4 and 5 are so spaced with respect to each other that as the chains or webs 6 are rotated, the brushes 7 carried thereby are successively brought into engagement with the sheet or web 8 to be cleaned.

Likewise journaled in the side members of the frame 1 are paired pinch rollers 9 and 10 adapted to engage the sheet and feed the same through the cleaning station between the brushes 7 of the webs 6. A pair of rubber covered ringer rolls 11 are likewise journaled between the side members of the frame 1 for the purpose of removing the excess cleaning fluid from the web or sheet 8 after the completion of the cleaning operation and before discharge of such web from the machine.

In the modification illustrated in Fig. 1 the spray pipes generally indicated at 12 are positioned on opposite sides of the sheet 8 on opposite sides of the cleaning station to provide a supply of cleaning fluid such as hot water to the sheet during the brushing operation and to wash the sheet free of adhering particles after the scrubbing operation has been completed. A drain conduit generally indicated at 13 carries the waste cleaning fluid from the tank 1 to a suitable point of disposal.

The pinch rolls 9 and 10 and the wringer rolls 11 are preferably intergeared or interconnected by means of sprockets and sprocket chains and driven synchronously by means of a single motor such as 14 which may be connected to the train of gears or sprockets and chains of the rollers 9, 10 and 11 by means of a suitable gear reduction device generally indicated at 15.

One of each of the paired shafts 4 and 5 have respectively secured thereto drive shafts 16 and 17 respectively which are so connected to a gear box 18 that they are driven in opposite direc-

tions at substantially the same speed by unidirectional rotation of the drive shaft 19. The drive shaft 19 may be driven continuously in a single direction by any suitable motor such as 20 in which event, the chains 6 will carry the brushes respectively connected therewith in engagement with the sheet 8 in the same direction relative to the movement of such sheet through the machine. For certain types of operation it may be desirable to have the brushes move in the same direction as the sheet but at a speed different than such sheet and for other types of operation it may be desirable to have the brushes move in a direction counter to the movement of the sheet.

In order to increase the scrubbing effectiveness of the brushes 7, I have provided means whereby they may be reciprocally advanced with respect to the cleaning station, i. e., either in the same direction as the direction of movement of the sheet or counter thereto. In the apparatus illustrated in Fig. 2, such reciprocable movement of the brushes is effected by an alternate energization of the motor 20 so that it will alternately rotate in opposite directions for slightly different intervals of time. In order to accomplish this a constant speed control motor 21 is provided which drives a controller drum 22 with which the leads 23, 24 and 25 are in contact. Said leads 23, 24 and 25 connect with the motor 20 through the conventional magnetic contact control indicated at 22', which reverses the motor 20 periodically. The lead 23 is in contact with the drum 22 at all times; the lead 25 is in electrical communication with the lead 23 during part of the rotation of the drum and the lead 24 is in electrical communication with the lead 23 during the remainder of the revolution. By making different the periods during which the leads 24 and 25 are respectively in electrical communication with the lead 23, the reversals of the motor 20 by the magnetic contact control 22' will vary in time interval and the motor 20 may be driven first in one direction and then the other for different lengths of time causing the brushes 7 to be reciprocally advanced past the cleaning station.

Another manner in which the brushes 7 may be reciprocated and advanced past the cleaning station is shown in Fig. 5 in which the driving motor equivalent to motor 20 of Fig. 2 is shown at 20a. The drive shaft 19a in Fig. 5 is similar to the drive shaft 19 of Fig. 2. The drive shaft 19a is driven in opposite directions for different intervals of time by the employment of a control device which may be briefly explained as follows:

The stub shaft 26 has a gear 27 keyed thereto which meshes with a spur gear 28 which is keyed to the same shaft as the bevel gear 29. Bevel pinions 30 and 31 are loosely mounted on the shaft 19a and a sliding clutch member 32 is keyed to the shaft 19a so that upon unidirectional rotation of the shaft 26, engagement by the clutch member 32 with the bevel gear 30 will cause the shaft 19a to be rotated in one direction and when the clutch member 32 is moved into engagement with the bevel gear 31, the shaft 19a will be rotated in the opposite direction. The clutch member 32 is actuated by means of a pivotally supported arm 33 which at its outer end is connected to the armature 34 of solenoids 35 and 36. The solenoids 35 and 36 are connected with the power lines 37 and 38 in the manner shown in Fig. 5 and through the

control drum generally indicated at 39 which is secured to the shaft 26. The leads 40, 41 and 42 are connected to brushes which engage different segments on the control drum 39 so that during a portion of each revolution of the drum 39 the lead 41 will be connected to the lead 40 and during the remainder of the revolution the lead 42 will be connected to lead 40. By so proportioning the segments on the drum 39 with which the leads 41 and 42 are in contact, the shaft 19a may be made to rotate in one direction for a longer period of time than its period of rotation in the opposite direction and accordingly, the same results attained as by the use of the expedient illustrated in Fig. 2.

Still another manner in which the drive shaft for the brushes may be rotated in opposite directions for different intervals of time as illustrated in Fig. 6, wherein the motor 20b corresponds to the motor 20 of Fig. 2 and the drive shaft 19b corresponds to the drive shaft of 19 of Fig. 2. In Fig. 6 the shaft 43 of the motor through gears 44 and 45 drives the shaft 46 in a predetermined direction and preferably at constant speed. The shaft 19b has pinions 47 and 48 loosely mounted thereon and a clutch device 49 generally similar to that shown at 32 in Fig. 5 is employed for alternately connecting the pinions 47 and 48, to the shaft 19b. The pinion 47 is constantly driven by means of the bevel gear 50 and the pinion 48 is constantly driven by means of the bevel pinion 51, the bevel pinions 50 and 51 being keyed to the shaft 46. The differences in diameter of the pinions 47 and 48 will result in their driving the shaft 19b at different speeds during the time they are respectively connected thereto by means of the clutch 49.

The clutch 49 is actuated by means of the arm 52 which is in turn reciprocated by the pivotally supported arm 53, the forked end 54 of which is engaged by the cam member 55 carried by the axle of the gear 56, which being interconnected with the shaft 46, rotates at constant speed.

Constant speed unidirectional rotation of the shaft 43 will, therefore, result in the clutch 49 being alternately moved into engagement with the pinions 47 and 48 for light periods of time. The shaft 19b is, however, rotated for a greater number of revolutions when the clutch 49 is in engagement with the pinion 47 as shown than when such clutch member is in engagement with the pinion 48. Thus the brushes will again be reciprocated past the cleaning station and at the same time progressively moved with respect thereto.

The apparatus illustrated in Fig. 4, insofar as the construction of the brushing apparatus is concerned, is identical with that illustrated in Fig. 1 so that like reference characters will be employed to designate like parts. The principal difference between the construction illustrated in Fig. 4 and that shown in Fig. 1 resides in the fact that the brushing devices are so mounted that the cleaning station is below the normal liquid level indicated at 57 in the tank 58, i. e., instead of spraying the cleaning fluid onto the sheet in the manner illustrated in Fig. 1, the brushes and the sheet at the cleaning station are submerged in a bath of the cleaning fluid.

This is accomplished by providing suitable guides such as 59, 60, 61 and 62 on opposite sides of the cleaning station with appropriate pinch rolls associated therewith for the purpose of lead-

ing the sheet or web 63 into the bath and through the cleaning station with wringer rolls 64 adjacent the discharge end of the machine for the purpose of removing excess cleaning fluid from the sheet before the same is discharged.

Connected with the tank 58 is a cleaning fluid circulating and filtering system generally indicated at 65 which consists of a pump 66 and a filter 67, such apparatus being connected to the tank by means of a conduit 68, which carries the cleaning fluid to the pump 66; the conduit 69 which carries the fluid from the pump to the filter and a conduit 70 which carries the filter fluid back to the tank.

Extending into the tank 58 below the normal liquid level therein is a steam pipe 71 which admits varying amounts of steam to the bath under control of a valve 72 in order to maintain the temperature of such bath substantially constant.

In order to augment the heating effect of the steam pipe 71 and in order to supply the principal amount of heat necessary to be continuously supplied to the bath, particularly when the sheets to be cleaned are cold, I provide enlarged closed tubes 73 which extend into the bath from the sides of the tank and into which may be mounted any suitable type of heating device.

In order to insure that the sheet is freed of all foreign matter before passing out through the wringer rolls 64 I may provide spray pipes 64a immediately adjacent the wringer rolls which will project clear water or the like against one or both sides of the sheet to flush the same clean.

From the foregoing description, it will be noted that I have provided a cleaning and scrubbing device for metallic sheets and the like characterized by the fact that a novel arrangement of brushes, as well as their operation, is provided which more effectively and more economically cleans the sheets fed through the apparatus than the prior art devices which have usually consisted of a single rotary brush. Furthermore, the positioning of the cleaning station within a bath of cleaning fluid in contradistinction to the application of the cleaning fluid to the sheet by spray means enables me to carry on the cleaning operation in a more efficient manner and to materially conserve the heat required to elevate the treating fluid to a temperature where the cleaning operation may be carried on most efficiently. The employment of the circulating pump and its associated filter likewise enables me to recirculate the heated bath and thus make it unnecessary to continuously supply a large volume of

cleaning fluid which must be elevated to the desired temperature.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any of the following claims or their equivalent be employed.

I, therefore, particularly point out and distinctly claim as my invention:

1. In apparatus for scrubbing metallic sheets and the like, the combination of means for conveying a sheet to be cleaned past a cleaning station, an endless web trained about spaced axes with one run thereof adjacent said cleaning station, and a plurality of brushes connected to said web and carried thereby into engagement with the sheet to be cleaned, and means for reciprocally advancing said web and brushes past said cleaning station.

2. In apparatus for scrubbing metallic sheets and the like, the combination of a wash tank, means for conveying a sheet to be cleaned past a cleaning station below the normal liquid level in said tank, endless webs trained about paired spaced axes arranged on opposite sides of such sheet with one run of each such webs adjacent the cleaning station, and a plurality of brushes carried by each of said webs and adapted to be moved thereby into and out of engagement with the opposite faces of the sheet, and means for reciprocally advancing said webs and their associated brushes past said cleaning station.

3. In a metallic sheet scrubbing apparatus, in combination, means for feeding a sheet past a cleaning station operative on opposite sides of the sheet to be cleaned and simultaneously holding such sheet against any movement other than such feeding movement, endless chains trained about spaced sprockets with one run of each said chains adjacent said cleaning station on opposite sides thereof, brushes secured to said chains whereby a plurality of such brushes are brought into engagement with each side of the sheet, and means for driving said chains and feeding means, said means for driving the chains being operative to impart a reciprocating advance movement thereto.

4. The method of cleaning metallic sheets which comprises advancing the same past a cleaning station positioned in a bath of cleaning fluid, and at the same time reciprocally advancing a plurality of brushes past such station and in contact with the sheets to be cleaned.

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