

Sept. 19, 1967

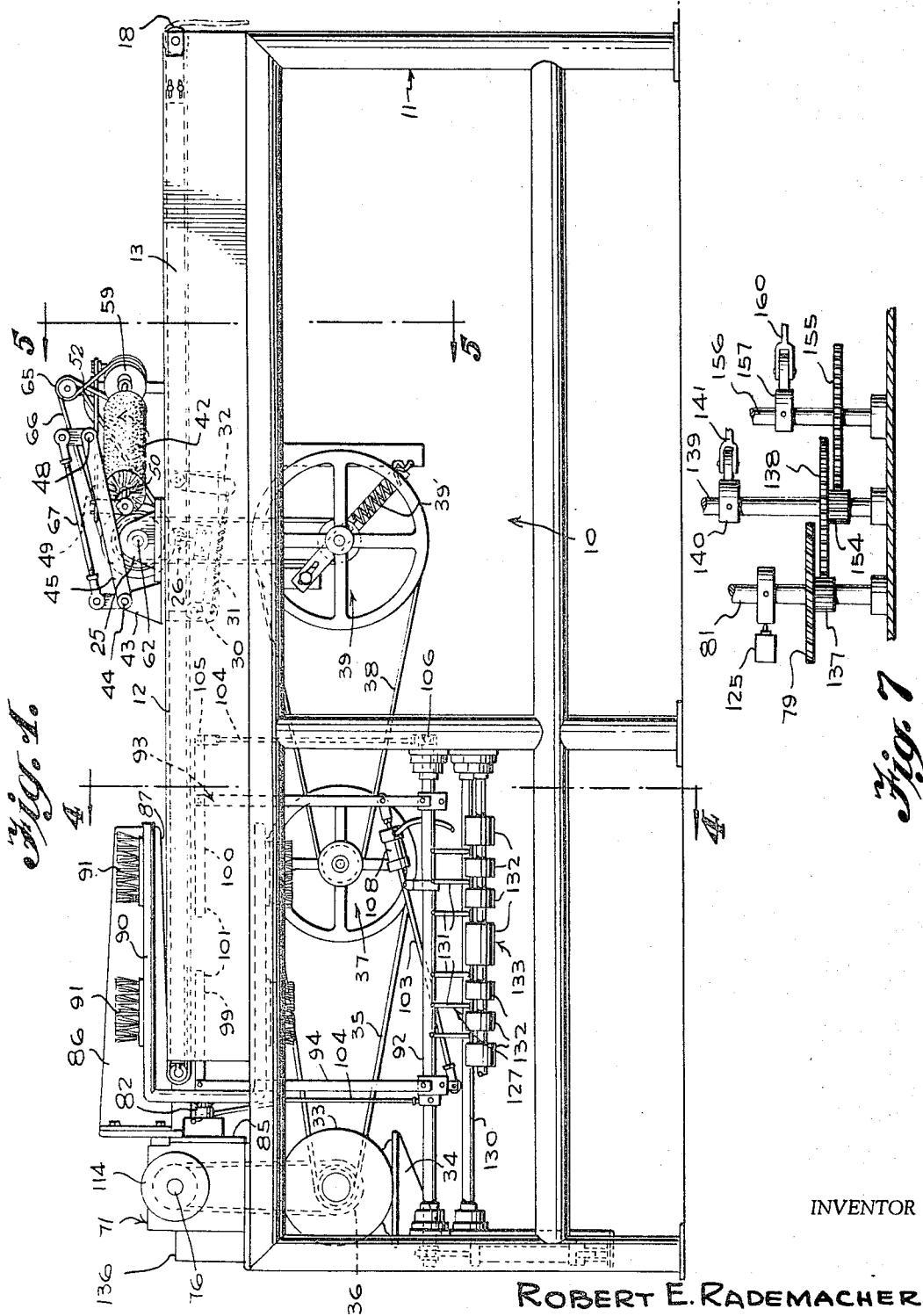
R. E. RADEMACHER

3,342,386

RAG FOLDING MACHINE

Filed April 7, 1964

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Fig. 2.

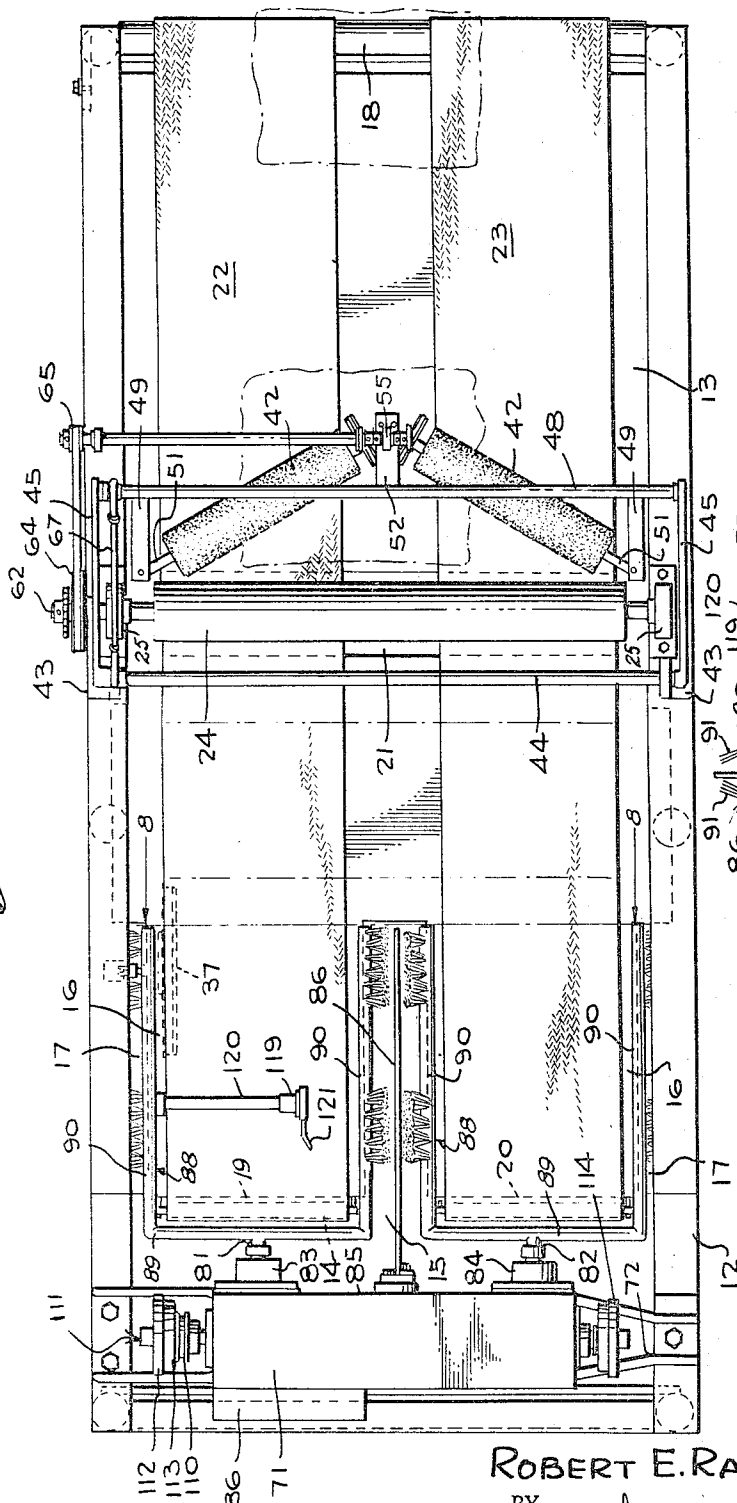
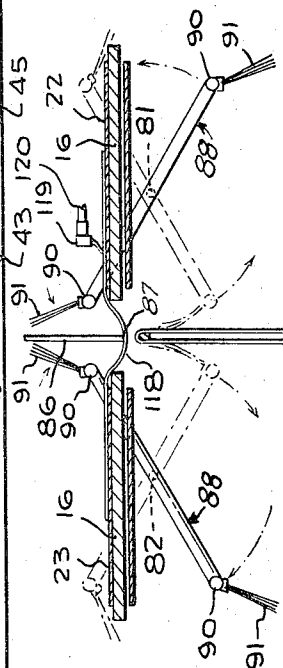


Fig. 3.



INVENTOR

ROBERT E. RADEMACHER

BY
Mason, Henwick & Lawrence
ATTORNEYS

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Fig. 5.

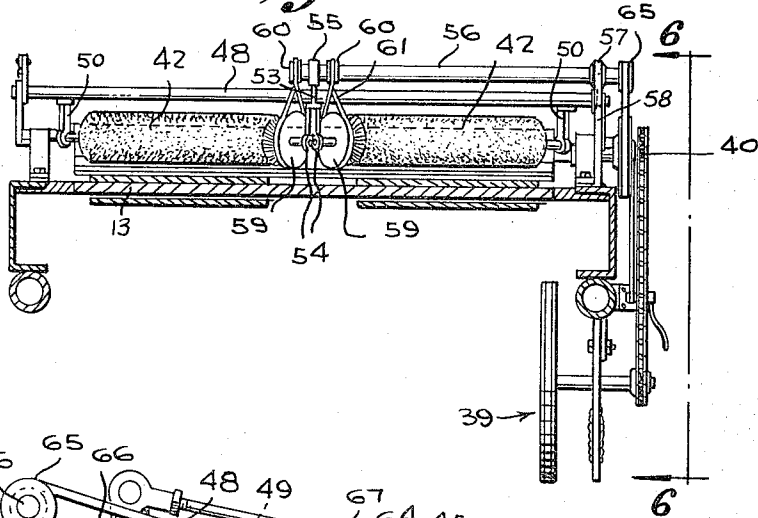
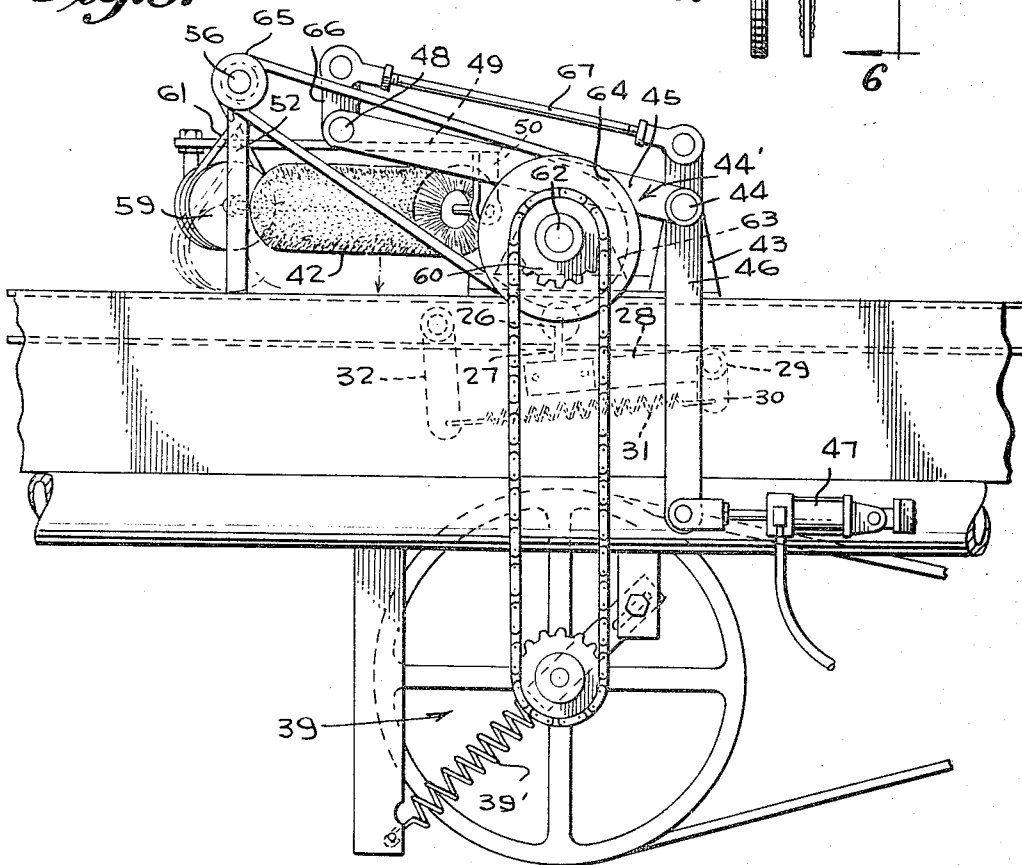


Fig. 6.



INVENTOR

ROBERT E. RADEMACHER

BY

Mason, Henrich & Lawrence
ATTORNEYS

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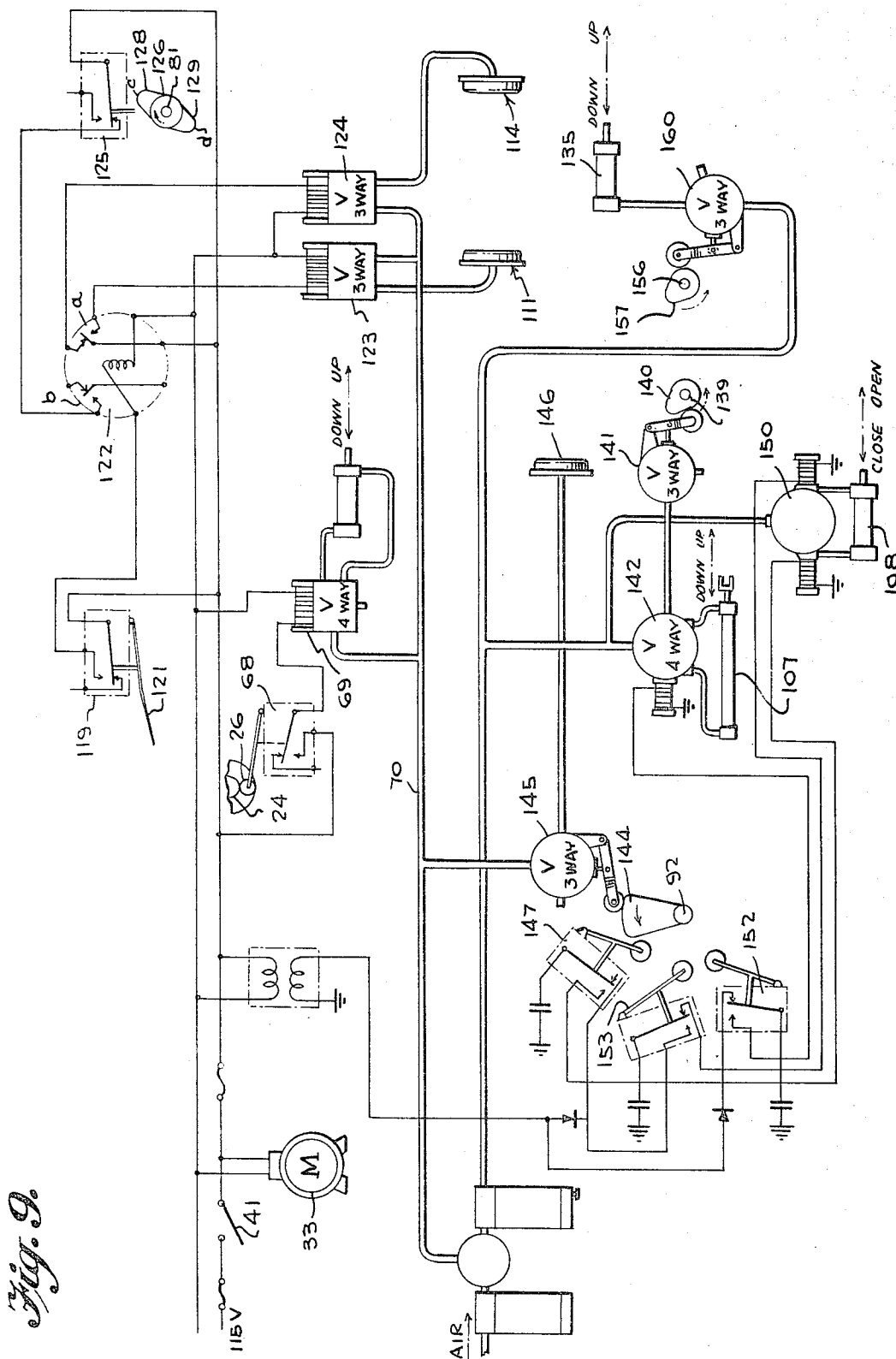
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3,342,386

RAG FOLDING MACHINE

Robert E. Rademacher, 7501 Schaaf Drive,
Richmond, Va. 23229

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This invention relates to apparatus for folding substantially similar pieces of textile fabric material, stacking a definite number of the folded pieces in interrelated relation into sheaves, and accumulating a definite number of such sheaves, congruently piled, to form a bundle.

The apparatus is particularly designed and constructed to handle rough-dry laundered pieces of fabric employed as industrial washing or wiping rags, which normally in unused state are smooth and rectangular, but which, through effect of the laundering, have a rough-dry surface and are drawn more or less out of rectangular shape, the restoral of the smooth surface, original shape, and soft, nappy surface texture being a function of the machine.

One of the objects of the invention is to provide a folding, stacking, and bundling machine, as an adjunct to the laundering service of industrial wash or wiping rags, for re-smoothing and re-shaping the rags, folding them once, stacking them one by one in nested relation to form a sheaf containing a definite number of pieces, and depositing a definite number of sheaves in congruently piled relation to form a stack or bundle, so that they may be conveniently, efficiently, and attractively returned to the owner for re-use.

Another object of the invention is the provision of a machine of the type described in which the rags are conveyed, singly, to sequential stations at which the functions of smoothing and re-shaping, folding, stacking, and bundling are performed, the movement of the conveyor means and the function of the mechanism at each station responding to the position of the rag itself, or the absence of a rag, so that there is orderly progression of the pieces through the apparatus, regardless of any irregularity in the timing of the manual feed of the pieces into the machine.

A further object of the invention is the provision, in the apparatus as described, of feed rolls at the anterior station cooperating with the conveyor means for gripping the leading edge of the rag as it reaches them, and a system of driven brushes actuated responsive to the interposition of the leading edge between said rolls, engageable with said rag at a station anterior to said rolls, rotatable in a direction reverse to the travel of said conveyor on axes divergent in the up-stream direction of said conveyor, for tautening the rag in the area between said feed rolls and station, and spreading the rag toward both lateral edges, thereby smoothing and re-shaping it.

Another object of the invention, in apparatus as described, is the provision of correlated folding means, a receiving arm and a stacking platform, the folding means being constructed to transfer flattened rags in one by one sequence from a feed conveyor to the receiving arm, folding them double upon said folding arm and in nested relation forming a sheaf, the receiving arm being constructed and controlled to deposit sheaves, as completed, in congruent superposition upon said platform forming a bundle, the platform being so constructed and controlled as to deliver bundles when completed to a discharge conveyor, and indexing means controlled by the rotation of said folding means for determining the number of folded rags to a sheaf and the number of sheaves to a bundle.

Still another object of the invention is the method of treating rough-dried laundered rags by specialized brush-

ing to eradicate wrinkles, restore the shape, and revive their original soft nappy surface texture.

Other objects of the invention will appear as the following description of a practical embodiment of the inventive concept proceeds.

In the drawings which accompany and form a part of the following specification, and throughout the figures of which the same characters of reference have been employed to designate identical parts,

FIGURE 1 is a view in side elevation of a rag folding machine embodying the principles of the invention;

FIGURE 2 is a top plan view of the machine shown in FIGURE 1;

FIGURE 3 is a view in end elevation of the machine, indicating three positions of the rag receiving arm member;

FIGURE 4 is a section taken along the line 4—4 of FIGURE 1;

FIGURE 5 is a section taken along the line 5—5 of FIGURE 1;

FIGURE 6 is a section taken along the line 6—6 of FIGURE 5;

FIGURE 7 is a section and horizontal plane taken through the compartment 136 of FIGURES 2 and 3 showing in plan view the clock work train and operative connections that index the sheaf accumulating and bundle depositing mechanisms.

FIGURE 8 is a cross section taken along the line 8—8 of FIGURE 2, and

FIGURE 9 is a diagrammatic view of the pneumatic and electrical systems through which the machine is operated, including the essential valves and switches which are purchased items, the structure of which is not the concern of the present invention. The clutches, brake, feeler 121, and the motors, which tie the diagram to the preceding figures, are shown also in the latter.

Referring to the drawings, the rag folding machine 10 comprises an elongated rectangular supporting base 11, as shown, of welded pipe construction, having longitudinal channel bars 12 secured to their opposite sides at the top, with their channeled sides facing inwardly. A planiform table 13, in a horizontal plane, bridges the space between the channel bars, having its side edges extended within the channels, resting upon the lower flanges and being secured. The rearward end 14 of the table terminates some distance forward of the corresponding end of the base 11, the rearward portion being provided with a wide longitudinal slot 15, medially located and extending forwardly. The bifurcations 16 of the table defined by said slot are cut away at their lateral edges sufficiently to form longitudinal openings 17 between the table and channel bars which extend forwardly the length of the slot.

A roll 18 is mounted transversely of the table at its forward end in longitudinally adjustable bearings carried by the respective channel bars. A pair of coaxial rolls 19 and 20 are mounted transversely at the ends of the bifurcations 16. The table, at a point intermediate the closed ends of the slot and the forward end of the table, is formed with a transverse slot 21 extending its full width. A pair of similar conveyor belts 22 and 23 extend longitudinally about the table, each looping about the forward roll 18 and the corresponding one of the coaxial rolls 19 and 20. The adjacent edges of the respective belts are parallel, and at some distance away from the sides of the slot 15.

A flattening roll 24, so called from its effect upon the rough, dry rags, overlies the slot 21 being journaled in bearing brackets 25, mounted on the channel bars 12. This roll is surfaced with rubber or the like, and its periphery, in repose, is substantially tangent to the plane of the table,

so as to be in pressure contact with the upper flights of the belts in their areas that bridge the slot.

A sensing roll 26 coacts with the flattening roll to detect the presence of a rag between the roll 26 and the belts. The sensing roll has a rigid surface which is preferably of metal. It is journaled in brackets 27, carried by the approximately horizontal arms 28 of bellcrank levers 29, the latter being coaxially pivoted to the opposite channel bars at points displaced longitudinally with respect to the arc of movement of the sensing roll. The other arms 30 of the bellcrank levers normally extend downward and are connected by tensioned springs 31 to lugs 32 fixed to the channel bars at points offset with respect to the roll 26 at the side opposite the bellcranks. The roll 26 lies between the upper and lower flights of the belts and is kept yieldingly pressed upward against the upper flight through the tilting of the bellcranks, the pressure being transmitted through the flattening roll and the rag while passing beneath the roll.

Power for driving the conveyor is derived from a motor 33, mounted on a bracket 34, adjustably secured to one of the members of the base and at one side of the longitudinal median of the base, as shown in FIGURE 3. A belt 35, looped about a clutch controlled pulley 36 on the motor shaft, transmits power to the intermediate speed reducing unit 37, from which the belt 38 transmits it to a second speed reduction unit 39, the power being taken to the flattening roll by a chain and sprocket coupling, including the sprocket 40, fixed to the shaft of the flattening roll. In practice, the speed reduction between motor and sprocket 40 is such as to give the flattening roll a peripheral speed of about ninety feet per minute. The conveyor is driven by frictional pressure between the flattening roll and the upper flights of the belts 22 and 23, engendered by the upward pressure of the sensing roll under the bias of the springs 31.

The switch 41, FIGURE 9, may be manually actuated to close the motor circuit and start the conveyor moving. The laundered rags, rough-dried and perhaps somewhat distorted from their normal rectangular shape, are placed upon the conveyor one at a time by a worker stationed at the anterior end of the table, the leading edge of the rag being spread out transversely with the trailing edge hanging down over the edge of the roll, as shown in FIGURES 1 and 2. The belts carry the rag to the flattening roll, where its leading edge is nipped between the flattening roll and the upper flights of the belts, depressing the latter and lowering the sensing roll 26.

A rag tensioning, smoothing and brushing assembly 42' is associated with and cooperably related to the flattening roll. This comprises a pair of similar driven cylindrical brushes 42, arranged in advance of the flattening roll on axes located in a plane parallel to the plane of the top of the table and symmetrically convergent toward the anterior end of the conveyor. The spread of the angle between the brushes at the ends adjacent the flattening roll is greater than the width of the rag, so that the effect of the brushes reaches to the lateral edges of the rag.

A pair of similar bearing brackets 43 are fixedly mounted in coaxial relation, one on each of the channel bars. A rod 44 is journaled in these bearing brackets extending across the table parallel to the flattening roll. A pair of similar arms 45 are fixed to the rod, one at each end, and in the same phase of angular displacement with respect to the axis of the rod, their free ends terminating above the brushes. On the side of the machine viewed in FIGURE 6 there is another arm 46, extending downwardly, also fixed to the rod 44. Said rod and the three arms fixed thereto form a bellcrank lever 44' having two spaced arms in the same phase and a single actuating arm 46, the latter being connected to the plunger of the pneumatic motor 47 by which the bellcrank lever is rocked.

A shaft 48 extends transversely across the machine having its ends journaled in the free ends of the arms 45.

This shaft has a pair of plates 49 welded thereto, one adjacent each end, being in the same plane and extending rearwardly. These plates carry bearing lugs 50 projecting from their under sides, respectively receiving the rear ends of the shafts 51 of the brushes.

A plate 52 is welded to the shaft 48 on the side opposite the plate 49, in middle position and extending forwardly. This plate carries an upstanding bearing bracket 53, having, at relatively low level, bearings 54 obliquely related, for respectively receiving the forward ends of the brush shafts 51, and at a higher level a bearing 55 receiving one end of the drive shaft 56, the opposite end of which shaft is journaled in a bearing 57 at the top of a post 58 mounted upon the corresponding channel bar 12, the height of which post is such as to locate the drive shaft in a normally level position. The shafts 51 of the brushes are provided with pulleys 59 and the adjacent ends of the drive shaft with corresponding pulleys 60. Belts connect corresponding pulleys 60 and 61, transmitting driving torque to the brushes. The belts are twisted so as to rotate the brushes in a direction contrary to the drive shaft 56 and the flattening roll. Since the amplitude of the rocking movement imparted to the bellcrank lever 44' by the pneumatic motor 47 moves the brushes from the normal raised position shown in FIGURE 6 to a position in which they contact the rag, the bearings at both ends of the drive shaft are spherical to permit universal tilting of the shaft responsive to the rocking of the bellcrank lever.

There is a step-up in the speed of rotation of the brushes provided by a gear reduction unit comprising a lay shaft 62 journaled in a bearing block 63, in which is mounted a relatively large pulley 64, belt-connected to the smaller pulley 65 on the outer end of the drive shaft 56. The lay shaft is driven by a chain and sprocket connection with the gear reduction unit 39, the latter including conventional means 39' for adjusting the tension of the chain by shifting the position of the lower sprocket.

Since the shaft 48 is journaled in the arms 45 of the bellcrank, it has the inherent capability of tilting, and there are a number of factors tending to cause it to tilt; for instance, the weight of the drive shaft 56 upon plate 52. As it is desirable to have the brushes make uniform contact with the rag throughout the area of rag that they overlie, means are provided to prevent tilting of the shaft. These means comprise an extension of the supporting lugs 43 upwardly beyond the rod 44, and the provision of the upwardly disposed links 66, fixedly connected to the shaft 48 at each end of said shaft and extending upwardly.

Turnbuckles 67 are interposed between each link 66 and the corresponding extension of the lug 43. The turnbuckles are of the same length between their pivotal axes as the arms 45, and the distance between the pivotal axes at the ends of the turnbuckles and arms is equal, so that a familiar parallel linkage is thus formed and regardless of the raising and lowering arcuate movement of the arms, the links do not change their attitude, so that, assuming that the brushes in their lower arcs are tangent to a plane parallel to the upper flights of the conveyor belts, the brushes will contact the belts evenly through the length of their mutual engagement.

As soon as the leading edge of the rag has moved beneath the elevated brushes and is nipped between the flattening roll and the underlying conveyor belts, the sensing roll is lowered, actuating the micro-switch 68, FIGURE 9, which energizes the solenoid valve 69, the latter admitting air under pressure from the general pneumatic system 70 to the double acting motor 47, moving the plunger of said motor inward to rock the bellcrank 44' and lower the brushes onto the rag, the brushes stroking the material in a direction which is the resultant of the forward travel of the rag and the inclined rotation paths of the brushes. The opposed directions of rotation of the flattening roller and the brushes causes the rag,

in the upstream area between its line of contact with the flattening roller and the brushes, to become tautened—that is to say, held flat transversely as it moves forward. Due to the convergence of the axes of the brushes and the reverse rotation of the brushes relative to the direction of movement of the rag, the latter is stretched from the middle in both directions to the lateral edges, restoring the rag to its full width and former shape. The effect of the brushing is to soften and raise the nap by breaking the cohesion of the surface fibers resulting from the drying.

As the downstream edge of the rag passes from under the flattening roller, the sensing roller 26 rises under the urge of the springs 31, maintaining tractive pressure between the rollers, so that the conveyor belts continue to carry the rag forward toward the portion of the table 13 which is formed with the longitudinal slot 15. The rise of the sensing roller also opens the micro-switch 68, de-energizing the solenoid 69, thereby reversing the direction of movement of the motor 47. The latter rocks the bellcrank 44' in such direction as to elevate the brushes, the plunger of the motor holding the bellcrank and brushes elevated until the next closing of micro-switch 68.

A gear box 71 extends across the base 11 at the forward end of the latter, having brackets 72 at its opposite ends extending from its bottom wall 73 and fixedly supported at their outer ends upon the lower flanges of the channel bars 12. The ends of the gear box are closed by end plates 74 and 75, which afford bearings for a shaft 76 that passes longitudinally through the gear box and beyond at each end and, within the gear box, carries a pair of worm gears 77 and 78 positioned equidistantly from the medial, longitudinal, vertical plane which passes through the table 13 and the slot 15. A pair of gears 79 and 80 of equal diameter lie beneath the worm gears in mesh therewith. Said last named gears are fixedly mounted upon shafts 81 and 82, journaled in bearing bosses 83 and 84 which project from the forward wall 85 of the gear box. The threads on the worm gears are reversely spiralled so that the gears 79 and 80 turn in reverse directions.

A guide plate 86 is fixedly mounted on the wall 85 of the gear box extending substantially the length of the slot 15 and lying in the said medial plane. The lower edge 87 of the guide plate is in general slightly lower than the plane of the conveyor belts on the table at each side of the slot, except at the forward end at which it is slightly curved upwardly sufficiently to override the leading edge of a flat spread rag carried to it by the conveyor from the brushing station.

Outside the gear box the shafts 81 and 82 become the outboard horizontal axes of a correlated pair of similar rotary rag folding members, each consisting of a rectangular U-shaped frame 88, which, as shown, is made of hollow rod stock, including an intermediate diametrical part 89 at one end, to the middle of which one of the shafts is perpendicularly fixed, and a pair of parallel arms 90 extending forwardly from the ends of the diametrical part. The U-shaped frames rotate with their diametrical parts 89 close to the adjacent edges of the bifurcations 16 of the table, and the paths of rotation of the arms 90 encircle said bifurcations and extend through the slot 15 at opposite sides of the guide plate. The relative axial orientation of the frames is such that they rotate reversely in precisely similar phase, the directions of rotation being such that the arms enter the slot 15 from above. The arms are furnished with brushes 91 which have to do with holding rags successively brought beneath the guide plate in bridging relation to the slot 15, and may be identified as *folding arms*.

Referring now particularly to FIGURE 1, which shows a side elevation of the apparatus, and to FIGURE 3, which is a view in end elevation of the machine, one will note the horizontal receiving arm shaft 92, which extends longitudinally below the bifurcated part of the table in a longitudinal direction, being mounted in bearings carried by

rear and intermediate base elements, the shaft being offset to one side of the medial, longitudinal, vertical plane of the table. A rag receiving member 93 is carried by said shaft consisting of a frame composed of end members 94 and 95, extending radially in the same axial plane. These, as shown, are of skeletal construction comprising battens 96 (FIGURES 3 and 4), separated by spacers 97 and being secured to said spacers. The end members are pivoted to clamping blocks 98 at equal distances from their free ends, swingable in an axial plane. The clamping blocks are at some small distance from the ends of the shaft. The two sections 99 and 100 of a divided receiving arm 101 are pivoted at intermediate points in their length respectively to the outer ends of the end members. A tie rod 103 joins the end members at points adjacent their points of pivotal connection with the clamping blocks, but respectively above and below said points. With this hookup, when the tie rod is moved axially in either direction, the end members tilt either toward or away from one another.

In order that the sections 99 and 100 will maintain rectilinear relationship in their mutual approach and retreat, they are prevented from tilting with the end members by the provision of the adjustable rods 104 pivoted to the sections and shaft at points 105 and 106, equidistant from the corresponding pivotal connections of the end members, and of the same effective length between pivotal connections as the end members, thus forming collapsible parallelograms. As seen in FIGURE 3, plunger type pneumatic motor 108 is hingedly mounted upon the shaft 92, the plunger of which is pivotally connected to the end member 95. When the plunger moves inward, it draws the end member 95 and the receiving arm section 100 inward, and simultaneously thrusts the tie rod 103 against the end member 94 at a point below its tilting fulcrum, moving the complementary receiving arm section 99 also inward. Since the motor 108 and tie rod are connected to the end members relatively close to their tilting axes, a small movement of the plunger of the motor produces a range of movement imparted to the sections 99 and 100 at least the width of the rag that the particular machine is adapted to handle.

The first function of the receiving arm is to afford an edge over which the rags are folded dihedrally through the action of the folding arms. To accomplish this purpose the receiving arm is caused to assume the uppermost position shown in FIGURE 3, directly beneath the guide plate 86. The second function is to accumulate and support a sheaf of nested once-folded rags. Still another function is to swing laterally downward, carrying the accumulated sheaf until it is almost in horizontal juxtaposition to an underlying stacking platform 127. In the performance of these functions, the sections of the receiving arm must be in close end to end juxtaposition. The final function is to release the sheaf, letting it deposit gravitationally upon the stacking platform.

In order to enable the receiving arm to perform these functions, the shaft 92 must have a range of oscillatory movement that will swing the rag receiving member 93, including the receiving arm 101 from the upper broken line position of FIGURE 3 to the lower broken line position shown in the same Figure. This range of movement is imparted by the plunger of a pneumatic motor 107 connected to a crank arm 109 on said shaft.

Reverting now to the shaft 76 that drives the folding arms, the latter have to be in precisely the same position with respect to a rag at the folding station, above the slot 15, at the beginning of the folding stroke. This condition could not be fulfilled if the shaft were continuously run, for since the rags are fed to the machine one at a time by hand, their advent at the folding station is not timed, and the folding arms might be in any position with respect to the rag. Consequently, the shaft is normally stationary and its rotation is step by step, its starting and

stopping being controlled by the rag at the folding station.

The shaft 76 is provided with a free pulley 110, FIGURE 3, continuously belt-driven from the electric motor 33. A pneumatic clutch 111 at one end of the shaft has a fixed chambered member 112 connected to the air pressure system, and a complementary movable member 113, forming a wall of the chamber of the fixed member splinably mounted on the end of the shaft and adapted to thrust frictionally against the adjacent face of the pulley to power the shaft. Since the rotation of the shaft must be stopped suddenly to properly position the folding arms, a pneumatic brake 114 is provided at the opposite end of the shaft, the movable element 115 of which thrusts against a shoe 116, anchored against rotation, moving it into sticking frictional engagement with the face of a collar 117 fixed to the shaft.

The operation of the apparatus from the time the rag moves away from the brushing station to and including the involvement of the means for controlling the step by step rotation of the shaft 76 will now be described. The rag, flat upon the moving conveyor belts, passes under the upturned forward portion of the edge of the guide plate 86 and is slightly depressed into the slot 15, through contact with the portion of said edge to the rear of said forward portion, being formed into a longitudinal valley 118, about said edge, as shown in FIGURE 8, whereby its frictional contact with said edge is increased reducing any tendency for it to slip sidewise. A micro-switch 119 overlies the table at the folding station, mounted upon a bar 120, supported by the base of the machine, the switch having a feeler 121 that normally wipes against the underlying belt of the conveyor. When the feeler is against the belt, the micro-switch is open. When the leading edge of the rag encounters the feeler, the latter is raised, closing the micro-switch 119. This, as shown in FIGURE 9, operates the double relay 122, closing the relay switch *a* to energize the solenoid of the pneumatic valve 123, which opens actuating the clutch 111, and simultaneously closing the relay switch *b*, de-energizing the solenoid of the pneumatic valve 124, releasing the brake 114. As the result of this double action, the shaft 76 is set rotating. There is inherently a lag between the closing of the micro-switch and the activation of the shaft, for which compensation is made by having the micro-switch placed sufficiently forward of the final position of the leading edge of the rag at the folding station to let the rag reach said final position before it is contacted by the folding arms.

Before the shaft 76 starts to rotate, the upper folding arms 90 of the pairs of diametrically opposed arms are poised in similar positions above the rag and over the slot 15. The brushes 91 are at the trailing side and their filaments are quite long. In the prototype machine they are about five inches long. Upon rotation the folding arms sweep down at the opposite sides of the guide plate 86, striking the rag and whisking its free lateral portions through the slot 15, so as to deposit the rag in depending position astride the underlying sectional receiving arm 101, the sections of which are at the time in close relation. The filaments or bristles of the brushes, at the start, are warped back against the guide plate, through lack of room, so as to assume a small angle to the guide plate, but as they pass through the slot into the divergent arcs of the travel paths of the folding arms, they progressively present their bristle ends to the free portions of the folded rag, causing the nap to become loose and fluffy. The pressing of the sides of the bristles against the plies of the fold adjacent the receiving arm sharply defines the fold line and assists in shaping the sheaf by closely seating each successive folded rag in close nested relationship to the one that precedes it.

It is obvious that when the rag is snatched through the slot by the folding arms, it will be pulled laterally from under the feeler of the micro-switch 119, letting the feeler drop to the level of the belt, opening the micro-

switch, thereby releasing clutch 111 and applying the brake, stopping the shaft 76. Now, this stopping means is just a fortuitous incident, not provided by intent, and cannot be relied upon, for it responds to human irregularity.

For instance, if the worker at the front of the conveyor carelessly places a rag across the belts badly centered, one lateral portion of the rag will be greater than half and the other less. The moment at which the lateral edge would pull out from under the feeler would not be constant, but vary with the extent of error in placing each rag, so that there would be no certainty in the constancy of the starting position of the folding arms. If similar errors in placing the rag were made with several consecutive rags, the effect would be cumulative, which might throw the starting position of the arms so far away from starting position that the arms might fail to draw the rag through the slot.

A positive stopping means has therefore been provided, operated independently of the feeler, for precisely stopping the folding arms at the optimum point. It is noted that the folding arms of a pair are diametrically opposed, as when one arm of each pair starts to move ragward, the other arms of said pairs simultaneously move upward, to stop at the same points vacated by the preceding arms. In other words, each time the shaft 76 is actuated, it moves through an arc of 180°. The positive stopping means comprises an additional micro-switch 125 connected in multiple with the switch 124 to the relay 122, and being actuated to disengage the clutch and set the brake when closed by contact of its movable element by either swell of the double cam 126. The latter is mounted on the shaft 82 of one of the pairs of folding arms within the gear box 71. The opposite swells 128 and 129 of the cam are symmetrical with respect to a radical line *c-d* that leads the angular displacement of the diametrical plane that embraces the corresponding pair of folding arms by about 15°. This lead compensates for the time lag between closing of the switch and the simultaneous release of the clutch and setting of the brake.

It has been suggested in the course of describing the rag receiving member 93 that one of its functions is to remain a sufficient length of time beneath the guide plate 86 to accumulate a definite number of rags into the form of a sheaf and to deliver this sheaf to a stacking platform 127. This platform, as best shown in FIGURES 1 and 4, consists of a shaft 130 between a rear and an intermediate member of the base 11, journaled in bearings in said members. FIGURE 4 shows that the shaft 130 is in the same vertical axial plane as the shaft receiving member, so that the latter can swing parallel to the platform.

The platform consists of a plurality of spaced tines 131 lying in a common plane, so positioned that they can interdigitate, in the course of swing of the platform, with the upper flights of a plurality of parallel belts 132, which also lie in a common plane and constitute a discharge conveyor 133 for taking stacks or bundles of folded rags away from the machine. The shaft 130 of the platform has a crank arm 134 fixed thereto and connected to the plunger of a pneumatic motor 135 which swings the platform, subject to controls as will appear, from an upper to a lower limit, indicated respectively in full and broken lines in FIGURE 3.

The operation of the rag folding machine as described contemplates building up a sheaf of ten folded rags on the receiving arm, the transfer of each sheaf as completed, from the receiving arm to the stacking platform and building up on the latter a stack or bundle consisting of five superposed sheaves; then the bundle of fifty pieces being deposited by the stacking platform upon the discharge conveyor.

A compartment 136 is positioned at the rear of the gear box 74, into which the shaft 81 of the worm gear 79 extends. This compartment, as best shown in FIGURE 7, houses a clockwork gear train of two units serially related.

The first unit consists of the small gear 137 mounted on the shaft 81 and a large gear 138 in mesh therewith, these gears having a five to one ratio. Since the folding arms make two passes through the slot 15 for each revolution of the shaft 81, the gear will count or index ten passes of the folding arms for each complete revolution.

The shaft 139 of the gear 138 is provided with a cam 140. When the gear 138 has completed one revolution and the folding arms are starting another pass responsive to the arrival of a succeeding rag at the folding station, the cam 140 rotates, contacting a poppet valve 141 which is in pneumatic communication with the solenoid controlled air pressure valve 142, the latter serving both ends of the piston motor 107. Opening the poppet valve causes it to bleed the chamber at one side of the motor piston and causes pressure on the opposite side to draw the piston rod inward, moving the rag receiving member on its downward stroke at a rate sufficiently slow to allow complete release movement of the receiving arm mechanism during the down stroke.

A cam 144 is mounted upon the shaft 92 of the receiving arm member 93, and about the cam are clustered a group of servo-devices in serial arcuate arrangement having actuating elements in the path of rotation of said cam. The first of these to be encountered by said cam at the beginning of the downstroke of the member 93 is a poppet bleed valve 145 similar to the valve 141, intercalated in the general pneumatic system, in one position supplying air pressure to a clutch 146, and in another position cutting off the supply and bleeding air from the clutch, releasing the latter. In FIGURES 3 and 4 the clutch is shown in operative relation to the free pulley on the shaft of the electric motor 33.

At the start of the downward movement of the receiving arm member 93, the cam 144 engages the operating arm of the poppet valve 145 to open the clutch to atmosphere, releasing the clutch from the pulley 36 to stop the conveyor belts 22 and 23 long enough to permit the receiving arm member to lower, release the sheaf and rise again to its normal rag receiving position before the next rag arriving at the folding station causes the folding arms to be actuated. When the receiving arm member has moved about half way on its down stroke, the cam 144 engages the operating arm of the next of the arcuately grouped servo-devices, the micro-switch 147, closing the latter and activating that solenoid of the valve 150 that supplies air to the end of the motor 108 that forces the plunger inward. This causes the sections 99 and 100 of the receiving arm 101 to pull out from the ten folded pieces. As has been described, the sections are so connected that they pull out rectilinearly, their motion being parallel to the fold line of the sheaf. As the receiving arm continues downward, the cam 144 closes the micro-switch 153, which activates that solenoid of valve 150 that reverses the pressure on the plunger of motor 108 to initiate the closing movement of the arm sections 99 and 100, the sheaf having been deposited. This closing movement necessarily takes place before the receiving arm reaches the bottom of its stroke to allow for the progressive build-up in the thickness of the bundle. In this position the free end of the sheaf is in supported contact either with the platform or previously laid sheaves, so that some of the weight is taken off the receiving arm sections, facilitating the release of the sheaves.

As the receiving arm member reaches the downward limit of its stroke, the cam 144 depresses the operating element of the micro-switch 152, which activates the air valve 142, causing the plunger of the motor 107, FIGURE 3, to thrust out, starting the receiving arm member on its upward stroke. When the receiving arm member has risen about 15°, the cam 144 closes the micro-switch 153, tripping the valve 148 to reverse the plunger of motor 107, starting the receiving line on its upward stroke. It will be observed in FIGURE 3 that the bottom wall of the gear

box 71 is indented to provide radial clearance between the gear box and said sections, if the latter should by chance be projecting on the side adjacent the gear box.

Now, returning to the compartment 136 and referring to the second unit of the clockwork gear train housed therein, this comprises small and large gears, respectively 154 and 155, said gears being in mesh and having a one-to-five ratio, the small gear being mounted upon the shaft 139 of the large gear 138 of the first unit already described. Therefore, the large gear 155 makes one complete revolution for each revolution of the gear 138. The gear 155 functions to count or index the five times that the receiving arm member deposits a sheaf of ten pieces upon the stacking platform 127. The shaft 156, upon which the gear 155 is mounted, carries a cam 157 which is so angularly set on the shaft as to make contact with the poppet valve to open the latter, thereby bleeding air from one end of the cylinder of the motor 135. This causes the plunger of the motor to lower the platform to the level at which its times sink below the level of the conveyor belts 132, the bundle of fifty pieces, consisting of five superposed sheaves of ten rags each being thus transferred from the platform to the conveyor, to be discharged by the latter from the machine. The duration of the downward travel of the platform is determined by the design and position of the cam and the length of time it is in contact with the operating element of the poppet valve. The platform will raise when the cam 157 in the course of its continuous rotation passes out of contact with said operating element.

In addition to the description of the brushing operations taking place at the brushing station and at the folding station, as hereinbefore set forth, it may be stated, particularly with respect to the brushing of the rags incident to the folding operation, that the brush action gives a much tighter pack of the nested rags forming the sheaves, it gives a second chance to remove wrinkles from the material, and it causes a static charge of electricity to be built up on the surfaces of the material through their stroking by the brushes, the filaments of which are of non-conducting material, causing loose ends of threads to cling against the rag to which they belong.

While I have in the above description disclosed a practical embodiment of the invention, it will be understood by those skilled in the art, and others, that the specific details of construction and arrangement of parts as illustrated and described are by way of example and not to be construed as limiting the scope of the invention.

I claim:

1. Rag folding machine comprising parallel laterally spaced, synchronously driven conveyor flights in a common level plane, the upstream ends of said flights being a feeding station for rags manually placed spread, one at a time, across said flights in bridging relation to the space between them, a receiving arm at a distance from said feeding station, its position establishing a folding station, said arm being parallel to said flights, midway between them and at a slightly lower level, cooperating folding arms mounted to revolve in cylindrical paths of revolution of equal radius, axially parallel to said receiving arm and similarly positioned at opposite sides of said receiving arm so that the adjacent arcs of said paths of revolution pass through the space between said flights, said folding arms being oppositely revoluble and synchronized to maintain the same phase of angular displacement, the direction of revolution being such that the folding arms descend in said adjacent arcs, said arms when at rest being above and equidistant from the plane of said flights, drive means for intermittently and synchronously revolving said arms in opposite directions, said drive means being activated responsive to the advent of a spread rag at said folding station, whereby the opposite portions of said rag are dragged through said space by said arms at opposite sides of said receiving arm, folding the rag thereupon.

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2. Rag folding machine as claimed in claim 1, said drive means comprising a drive shaft, a motor clutch connected to said shaft, a brake on said shaft for absorbing the impetus of the motor, folding arm shafts supporting the folding arms, and a gear set for each folding arm shaft between each and said drive shaft, one including a reverse gear, the means for starting said drive shaft comprising a micro-switch having a feeler at the folding station engageable with a rag, responsive to the thickness of the rag to close the switch, simultaneously clutching the motor to the drive shaft and releasing the brake through circuitry controlled by said micro-switch.

3. Rag folding machine as claimed in claim 1, said drive means comprising a drive shaft, a motor clutch connected to said shaft, a brake on said shaft for absorbing the impetus of the motor, folding arm shafts supporting the folding arms, a gear set for each folding arm shaft between each arm shaft and the drive shaft, one including a reverse gear, a cam in the line of torque transmission between said drive shaft and folding arm shaft, and circuitry including a switch positioned to be closed by said cam, for simultaneously effecting the release of the clutch connection and the application of the brake, said cam being so angularly oriented as to effect the stopping of the drive shaft when the folding arms are in their normal position of repose.

4. Rag folding machine as claimed in claim 1, said drive means comprising a drive shaft, a motor clutch connected to said shaft, a brake on said shaft for absorbing the impetus of the motor, folding arm shafts supporting the folding arms, a gear set for each folding arm shaft between each arm shaft and the drive shaft, one including a reverse gear, a cam in the line of torque transmission between said drive shaft and folding arm shaft, and circuitry including a switch positioned to be closed by said cam, for simultaneously effecting the release of the clutch connection and the application of the brake, there being two pairs of folding arms in intersecting diametrical planes, the corresponding arms of each pair cooperating to fold the rag, said cam being formed with similar switch engaging portions 180° displaced.

5. Rag folding machine comprising parallel, laterally spaced, synchronously driven conveyor flights in a common level plane, a table beneath said flights in supporting relation thereto, the upstream ends of said flights being a feeding station for rags manually placed spread, one at a time, across said flights in bridging relation to the space between them, the table between downstream portions of said flights being bifurcated by a longitudinal slot registering with the space between said flights, a receiving arm normally positioned in the medial longitudinal vertical plane of said slot, its position establishing a folding station, said arm being at a slightly lower level than said flights, cooperating similar folding arm units at opposite sides of said receiving arm, each comprising a shaft and folding arms supported by said shaft at equal radial distances therefrom and parallel thereto, said units being so positioned that the adjacent arcs of the paths of revolution of said folding arms pass through said slot, means for intermittently rotating the folding arm shafts in such direction that the folding arms descend in said adjacent arcs, corresponding arms of said units being in the same phase of angular displacement whereby they descend in side by side relation, means activated by a spread rag upon its advent at the folding station for starting the revolution of said folding arms from a repose position above the plane of said flights whereby the opposite portions of said rag are dragged through said slot by said descending folding arms at opposite sides of said receiving arm, thus folding the rag upon said receiving arm.

6. Rag folding machine as claimed in claim 5, including a cam rotatable with a folding arm shaft and

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means actuated by said cam for effecting the stopping of said folding arms at the end of 180 degrees travel.

7. Rag folding machine including a conveyor upon which spread rags are placed to be taken to a folding station, a receiving arm normally at said folding station, folding arms positioned to engage the portions of the spread rag at opposite sides of the receiving arm and stroke them downward into a position of approach thus folding the rag upon the receiving arm, a stacking platform having a lower position than said folding station, a receiving arm shaft, radial members movable with said shaft supporting said receiving arm, the latter being swingable from its position at the folding station to a position adjacent said platform, said receiving arm being divided into sections mutually movable rectilinearly from positions of substantially end to end abutment to positions apart a sufficient distance to release a rag to said platform, indexing means operative to hold said receiving arm at said folding station until a definite number of rags have been folded in nested relation upon said receiving arm, forming a sheaf, said indexing means being operable to effect the downward swing of said receiving arm upon the accumulation of a sheaf of rags on said arm.

8. Rag folding machine as claimed in claim 7, said radial members being pivoted at points adjacent said shaft to rock in an axial plane of said shaft, said sections of the receiving arm being pivoted to said radial members, means for maintaining said sections in rectilinear alignment despite arcuate movement of said radial members in said axial plane, means for rocking said radial members together or apart, and means controlled through said indexing means for stopping the conveyor and folding arms and simultaneously swinging said receiving arm from rag folding to sheaf depositing positions.

9. Rag folding machine as claimed in claim 7, said radial members being pivoted at points adjacent said shaft to rock in an axial plane of said shaft, said sections of the receiving arm being pivoted to said radial members, means for maintaining said sections in rectilinear alignment despite arcuate movement of said members in said axial plane, means for rocking said radial members together or apart, and means controlled through said indexing means for stopping the conveyor and folding arms and simultaneously swinging said receiving arm from rag folding to sheaf depositing positions, a cam driven by said receiving arm shaft and which is in operative proximity to switches, engaged thereby successively to activate circuits that effect the starting of the apart and approach movements of said receiving arm at intermediate points respectively in the down and up strokes of its range of travel, and maintain the sections fully apart at the bottom of said range.

10. Rag folding machine including a conveyor upon which spread rags are placed to be taken to a folding station, a receiving arm normally at said folding station, folding arms positioned to engage the portions of the spread rag at opposite sides of the receiving arm and stroke them downward into a position of approach, thus folding the rag upon the receiving arm, a stacking platform having a lower position than said folding station, a receiving arm shaft, radial members movable with said shaft supporting said receiving arm, the latter being swingable from its position at the folding station to a position adjacent said platform, said rag receiving arm being divided into sections mutually movable rectilinearly from positions of substantially end to end abutment to positions apart a sufficient distance to release a rag to said platform, the latter comprising a shaft, and a plurality of spaced parallel bars extending radially from said shaft at one side thereof in a common plane, a plurality of spaced parallel conveyor belts together constituting a discharge conveyor, with which belts said bars interdigitate for transferring a stack of rags from said platform to said discharge conveyor, said platform being swingable from a sheaf receiving position adjacent said receiving arm

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when the latter is at the bottom of its range of travel, to a discharge position in which the bars are below the belts, indexing means operative to hold said receiving arm at said folding station until a definite number of rags have been folded in nested relation upon said receiving arm, forming a sheaf, said indexing means being also operative to hold said platform in its sheaf receiving position until a definite number of sheaves have been deposited thereupon to constitute a stack.

11. Rag folding machine comprising parallel, laterally spaced belts having their upper flights in a common level plane forming a conveyor, the upstream ends of said flights being a feeding station for rags manually placed spread, one at a time, across said flights in bridging relation to the space between them, a receiving arm at a distance from said feeding station, its position establishing a folding station, said arm being parallel to said flights, midway between them and at a slightly lower level, a table beneath said flights in supporting relation thereto, said table being formed with a longitudinal slot in its downstream portion registering with the space between said flights and being at least coextensive in length with said receiving arm, a guide plate extending forward from a fixed part of the machine in the medial vertical plane of said receiving arm, having its lower edge slightly below the plane of said flights, and extending upwardly therefrom, cooperating folding arms mounted to revolve oppositely and in paths of revolution that intersect said slot on opposite sides of said medial longitudinal plane and are axially parallel thereto, the folding arms in the adjacent arcs of said path moving downwardly, said arms including brushes positioned to sweep progressively first against the guide plate at opposite sides, then against the opposite portions of a spread rag bridging said slot and bearing against the lower edge of said guide plate dragging said portions downward through said slot into positions of approach, thus folding the rag upon the receiving arm, the pressure of the lower edge of said guide plate stabilizing the approximately centralized position of the rag preventing its being pulled down further on one side than the other by unequal friction of the brushes.

12. Rag folding machine comprising parallel laterally spaced belts having their upper flights in a common level plane, together forming a conveyor, the upstream end of which constitutes a feeding station for rough-dried laundered rags placed spread, one at a time, across said flights in bridging relation to the lateral space between said flights, a table between said flights in supporting relation thereto, bifurcated in its downstream portion by a longitudinal slot registering with said lateral space, a receiving arm positioned below said slot longitudinally thereof and parallel to the plane of said flights, the position of said receiving arm establishing a rag folding station, a transverse driven roller normally bearing upon the upper faces of said flights at a point intermediate said stations, and a complementary roller spring-pressed upward against the lower faces of said flights, the pressure thus engendered enabling the driven roller to drive the conveyor, a brush assembly above said conveyor, adjacent said driven roller on the upstream side comprising a pair of driven rotary brushes symmetrically convergent

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in a direction toward the feeding station, the transverse dimension between the convergent ends of said brushes being at least as great as the transverse dimension of the outer edges of said conveyor, said brush assembly being mounted for vertical reciprocation, being normally elevated with respect to said conveyor in repose position, folding arms mounted to revolve downward in adjacent arcs at opposite sides of said receiving arm, the axes of revolution being located to position the arcs so that they progressively diverge from a point above the plane of a spread rag at the folding station to a point below the receiving arm, said folding arms including brushes having bristles as the elements that contact the rag, the length of the bristles being such that as the spread rag is dragged down through the slot at both sides of the receiving arm by the brushes, the bristles are diverted back while traversing the narrow spaces between arcs of revolution and rag, so that their sides stroke the parts of the rag adjacent the receiving arm making a close fold, and are progressively released as the spaces enlarge, presenting their ends to engagement with the downfolded lower portions of the rag, fluffing the nap.

13. In a rag folding machine, a belt conveyor, the upstream end of which constitutes a feeding station for rough-dried laundered rags placed spread, one at a time, transversely of said conveyor, approximately longitudinally centered, a table in supporting relation to the upper flight of said conveyor, a transverse driven roller normally bearing upon upper face of said upper flight at a point downstream from said feeding station, a complementary roller spring-pressed upwardly against the under face of said upper flight, the pressure thus engendered enabling the driven roller to drive the conveyor, a brush assembly above said conveyor adjacent said driven roller on the upstream side, comprising a pair of driven rotary brushes symmetrically convergent in a direction toward the feeding station, the transverse dimension between the convergent ends of said brushes being at least as great as the transverse dimension of the outer edges of said conveyor, said brush assembly being mounted for vertical reciprocation, being normally elevated with respect to the conveyor in repose position, said brushes rotating in a contra direction to the travel of the conveyor, means for lowering the brush assembly to bring the brushes into engagement with a rag moving with the conveyor including a sensing roller and an activating element, said sensing roller being depressible into operative contact with said activating element responsive to the nipping of the leading edge of the rag, assuring that the rag will be nipped before it is contacted by said brushes.

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JORDAN FRANKLIN, *Primary Examiner*.

G. V. LARKIN, *Assistant Examiner*.