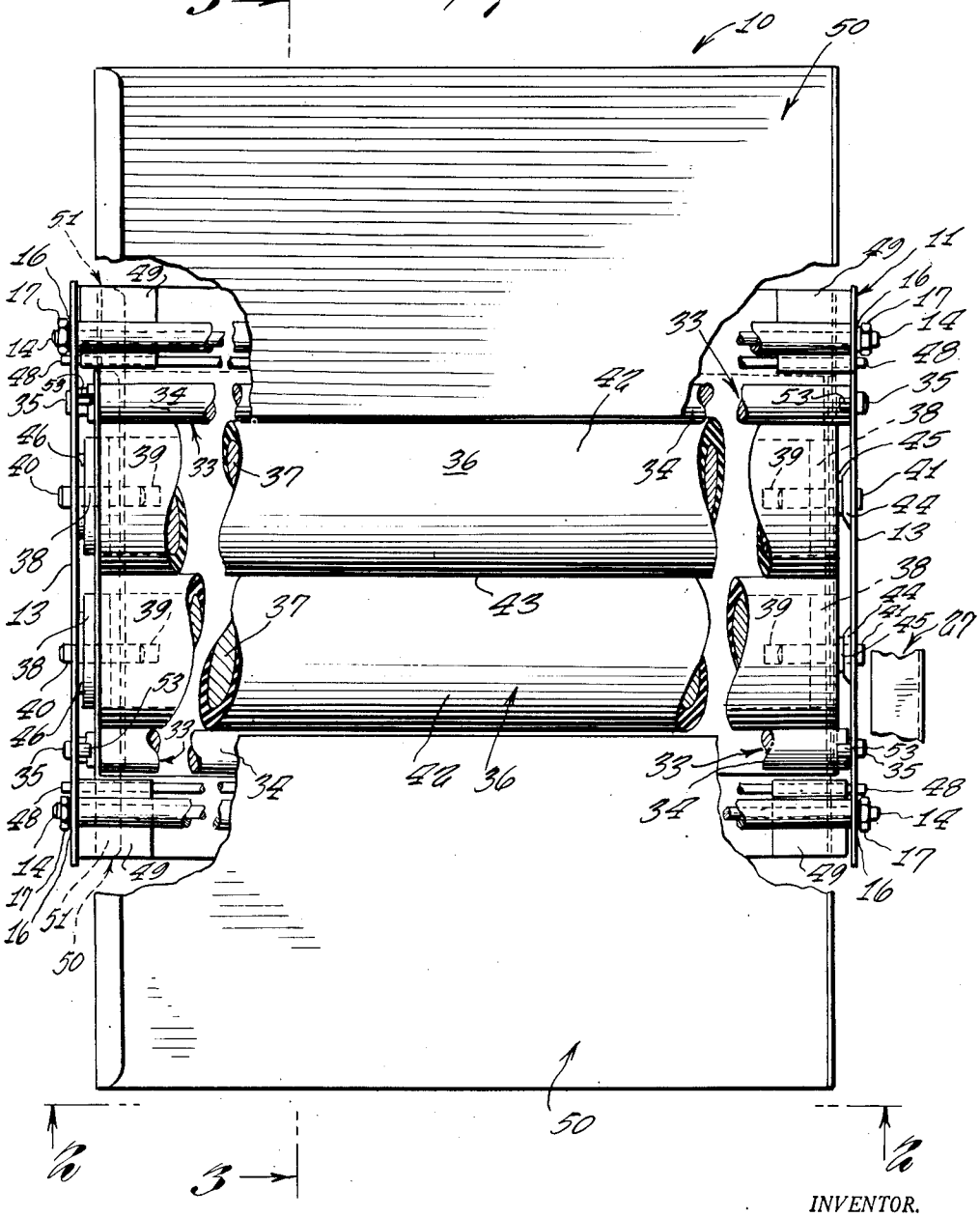
May 21, 1957 F. G. LUDWIG 2,792,768

PROCESSING UNIT

Filed Oct. 5, 1953 3 Sheets-Sheet 1

Fig. 1



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Filed Oct. 5, 1953 3 Sheets-Sheet 2

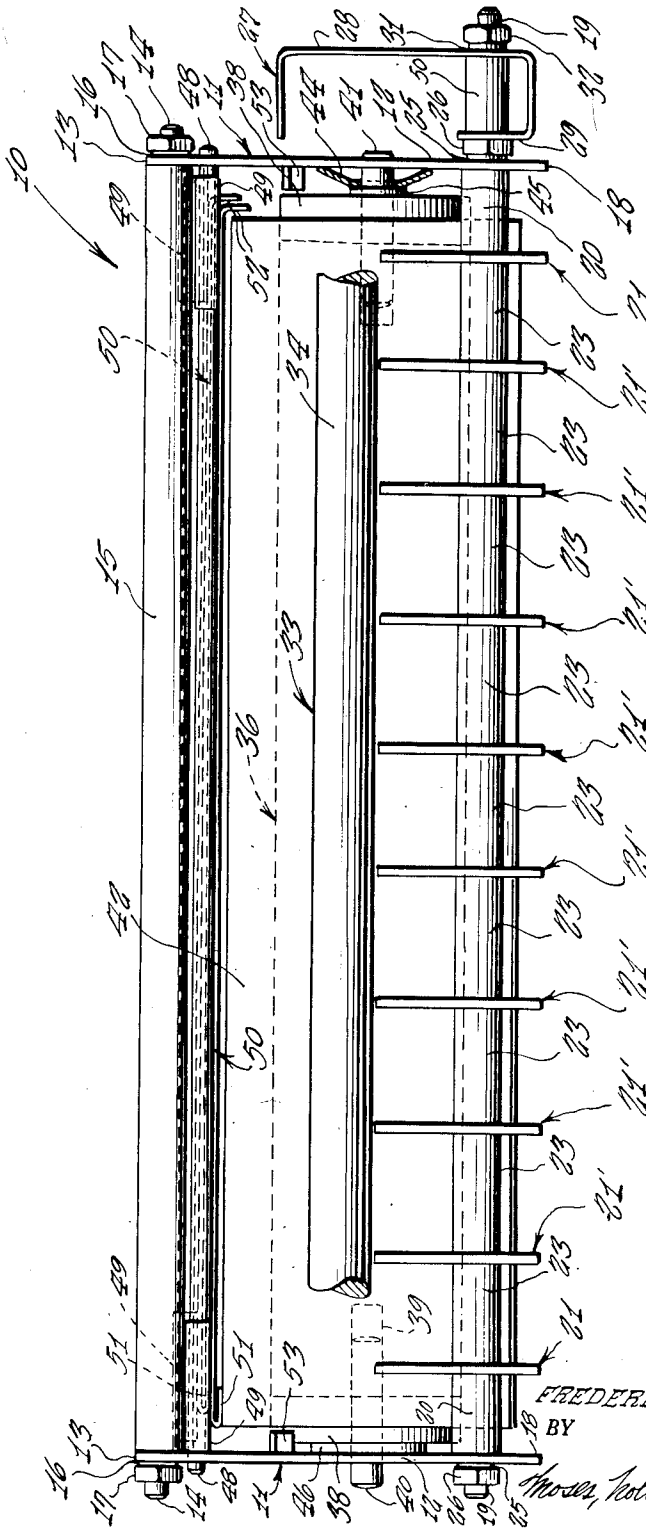


Fig. 2

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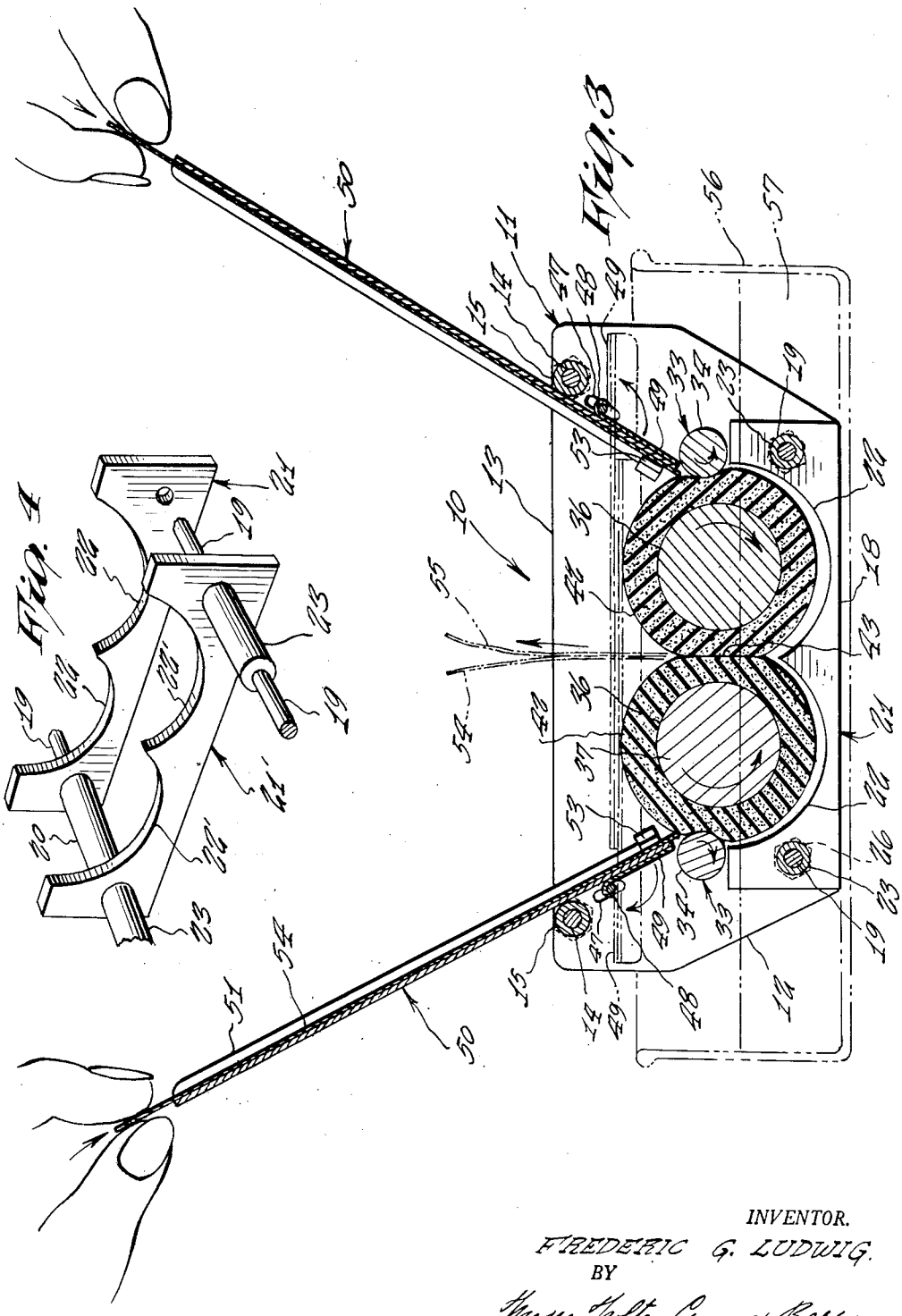


Fig. 3

Fig. 4

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2,792,768

PROCESSING UNIT

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11 Claims. (Cl. 95—89)

This invention relates to processing units of the type employed for immersing and wetting a photosensitive and a non-photosensitive sheet in a processing solution and then pressing them together to effect a transfer of the unexposed areas from the photosensitive sheet to the non-photosensitive sheet.

Such processing units may employ an ordinary photographic developer such as the widely used conventional developer D–72, a photosensitive sheet coated with silver chloride or bromide emulsion and a non-photosensitive sheet coated with a gelatin layer. Some units employ special "fogging" agents and silver halide solvents, but these are not necessary since almost all ordinary photographic developers have these "properties inherently." The purpose of the non-photosensitive sheet is to receive thereon a reverse image from the photosensitive sheet by dissolving unexposed silver salts therefrom. In such processing units, the photosensitive and non-photosensitive sheets are superimposed by the operator and fed into the processing solution along extended guideways which convey the sheets to the pressure rolls where they are squeezed together. Such guideways present several disadvantages.

Due to the design of these guideways, both sheets travel different distances, requiring the starting of one sheet slightly ahead of the other sheet in order to insure proper registration during squeezing. Also, the relatively great length of these guideways prevents the processing of undersized sheets.

Furthermore, since the sheets must be guided through these guideways in a caustic processing solution, the paper bases used must of necessity be quite substantial in order to prevent wilting or crumpling before the sheets reach the pressure rolls. Hence, the disadvantage that thin sheets cannot, therefore, be successfully processed.

In addition, unless the operator is very skilled in the use of the unit, there is always a tendency to push the sheets quickly through the ways or guides to the pressure rolls, producing the result that the front portions of the sheets are immersed a shorter time than the rear portions and causing a non-uniform image transfer.

It is accordingly a principal object of the present invention to provide an improved processing unit employing a symmetrical feed in which both phoso-sensitive and non-photo-sensitive sheets travel equal distances and arrive at the pressure rolls simultaneously and in proper registration.

It is another object of the present invention to provide a processing unit wherein the immersion time of the sheets is controlled by the speed of the rolls, resulting in a constant immersion time regardless of whether the apparatus is electrically or manually driven. Even when manually operated, the present invention eliminates the necessity of the operator having to match the "shoving in" speed with the rotating speed of the pressure rolls. Thus the present invention requires less skill on the part of the operator.

It is still another object of the present invention to

provide a processing unit of the above type employing a symmetrical chute feed which insures that the sheets will be automatically oriented.

Still another object of the present invention is to provide a processing unit of the above type which may be easily operated manually.

It is still another object of the present invention to provide a processing unit of the above type which is portable.

It is still another object of the present invention to provide a processing unit of the above type which is capable of processing sheets small in area, thus avoiding waste and promoting economical use of the paper supplies as well as the processing solution.

It is still another object of the present invention to provide a processing unit of the above type which may be operated with a minimum of skill.

It is still another object of the present invention to provide a processing unit of the above type which is adapted to process sheets of varying thickness, including extremely thin sheets.

It is still anothed object of the present invention to provide a processing unit of the above type wherein the conventional soft rubber pressure rolls are replaced by cellular resilient or uni-cellular resilient rolls, thus providing an extended area of contact for the processing reaction.

Other objects of the present invention are to provide a processing unit bearing the above objects in mind which is of simple construction, inexpensive to manufacture, has a minimum number of parts, is easy to use and efficient in operation.

For other objects and a better understanding of the invention, reference may be had to the following detailed description taken in connection with the accompanying drawings, in which:

Figure 1 is a top plan view of a processing unit embodying the features of the present invention, shown partly broken away to show the interior construction thereof;

Figure 2 is a side elevational view thereof looking along the line 2—2 of Figure 1, but showing the paper guides in the inoperative position;

Figure 3 is a vertical sectional view taken along the line 3—3 of Figure 1; and

Figure 4 is a perspective view of a pair of bottom guides forming a part of the invention.

Referring now more in detail to the drawing, in which similar reference numerals identify corresponding parts throughout the several views, there is shown a processing unit, referred to collectively as **10**, and including a pair of end plates **11** having downwardly and inwardly sloping side edges **12**, substantially as illustrated.

The end plates **11** at each end of their upper edges **13** are provided with longitudinally aligned openings through which pass a pair of top tie bolts **14**, a pair of top spacers **15** being provided on the bolts **14** intermediate the end plates **11**. The end plates **11** are secured against the opposite ends of the top spacers **15** by means of lock washers **16** and hexagonal nuts **17** provided on each end of each of the top tie bolts **14**.

The end plates **11** at each end of their bottom edges **18** are each provided with a pair of longitudinally aligned openings in which are positioned a pair of bottom tie bolts **19**, the bottom tie bolts **19** being of greater length than the top tie bolts **14** for a purpose which will hereinafter become clear.

An end spacer element **20** sleeves each of the bottom tie bolts **19** near each end, the outer end of the spacer elements **20** abutting the inner faces of the end plates **11** (Fig. 2). A pair of transverse and bottom guides **21** are provided at each side with longitudinally aligned openings receiving therethrough the bottom tie bolts **19**,

(Fig. 3) the outer faces of the bottom guides **21** abutting the inner ends of the spacer elements **20**.

The top edges of the bottom guides **21** are provided with a pair of intersecting, semi-circular cut-outs **22**, as shown in Figure 3.

A plurality of guide spacers **23** sleeve each of the bottom tie bolts **19** intermediate the end bottom guides **21**, alternating with intermediate bottom guides **21**, identical in size and shape with the end bottom guides **21**.

Each of the bottom tie bolts **19** adjacent the outer face of each of the end plates **11** is provided with a lock washer **25** and a hexagonal nut **26**, the ends of the bottom tie bolts **19** extending substantially beyond the hexagonal nuts **26** at one end of the apparatus, as shown in Figure 2.

A tube bracket **27** (Fig. 2) having a vertical outer wall **28** and a vertical inner wall **29** is mounted at each side on the bottom tie bolts **19**, the outer vertical wall **28** and the inner vertical wall **29** at each side thereof having longitudinally aligned openings receiving the tie bolts **19**. A pair of end spacers **30** sleeve each of the tie bolts **19** intermediate the outer wall **28** and the inner wall **29**, a lock washer **31** and hexagonal nut **32** being provided on the end of each of the tie bolts adjacent the outer face of the tube bracket **27**.

A pair of drive roller assemblies **33** are provided across the top edges of the end and intermediate bottom guides **21** and **21'** at each side thereof (Fig. 3), each drive roller assembly **33** including a hard roller **34** extending the length of the device and terminating at each end in drive roller end shafts **35** rotatably mounted in longitudinally aligned openings provided in the end plates **11**.

A pair of roller assemblies **36** are mounted between the end plates **11** above the cut-outs **22** (Fig. 3), each of the roller assemblies **36** including a hard roller **37** provided at each end with a cap **38**, each cap **38** having an opening aligned with a central, inwardly extending cylindrical opening **39** provided at each end of rollers **37** and in which are positioned roller end shafts **40** and **41**. The end shafts **40** and **41** are rotatably mounted in suitable openings provided in the end plates **11**.

A cylindrical, cellular resilient cover **42**, preferably foam rubber or uni-cellular foam rubber, is provided for each of the rollers **37**, this cover fitting within and being freely spaced from the cut-out portions **22** and intersecting the surface of the drive rollers **34** (Fig. 3). It will also be noted that the covers **42** intersect each other on adjacent sides providing a flat rectangular contact area **43**.

A spring washer **44** is provided on each of the roller end shafts **41** adjacent the inner face of one end wall **11**, a spacer washer **45** being provided intermediate the spring washer **44** and cap **38**. Spacer washers **46** are provided on roller end shafts **40** intermediate the inner face of the other end wall **11** and the caps **38**.

The drive roller assemblies **33** and roller assemblies **36** may be driven by suitable electrical or manual means, not shown. Such means are well known to those skilled in the art and will not, therefore, be described in detail. For example, a hand crank, not shown, may be mounted at one end of one drive roller assembly **33**, in which case this roller assembly would rotate against its adjacent roller assembly **36**. Since the sheets to be processed do not entirely cover the roller assemblies **36**, the latter would drive each other and the entire system of rollers would be mutually driven.

The end plates **11** below the top tie bolts **14** are provided with longitudinally aligned, elongated openings **47** within which are positioned the ends of a pair of guide holder rods **48**. Each of the guide holder rods **48** mounts a holder **49** at each end thereof adjacent the inner face of the end plates **11**, the holders **49** being bent around the rod **48** and extending away from the rod in a flat portion adapted to be rotated about the rod **48** in the direction of the arrow of Figure 3.

A pair of paper guides **50** are suitably secured to each pair of holders **49**, as shown in Figure 3, one lateral edge of the paper guides **50** being bent under and back upon itself, as at **51** (Fig. 2), providing a guide within which one lateral edge of the paper will be received. The other lateral edges of the paper guides **50** are bent downwardly at right angles, providing flanges **52**. As shown in Figure 2, the adjacent flanges **52** of each of the guides **50** are displaced somewhat longitudinally relative to each other, permitting the guides to be rotated into a horizontal, inoperative position, with the undersurface of the lowermost portion **51** resting on one end of the covers **42**. The play afforded the guide holder rods **48** by the elongated slots **47** permits the two guides to be rotated into this overlapping position. It will be noted that in this inoperative position, the paper guides **50** provide a convenient covering for the roller assemblies below.

A pair of stops **53** are punched inwardly out of each of the end plates **11**, the stops **53** being bent inwardly at right angles to the end plates **11** and cooperating with the top spacers **15** to limit the upward rotational movement of the paper guides **50**, as shown in Figure 3. Thus, the paper guides **50** may be readily rotated upwardly at their ends remote from the rods **48** to the position of Figure 3, permitting them to feed the photo-sensitive sheet **54** and the non-photo-sensitive sheet **55** downwardly between the drive rollers **34** and the roller assemblies **36**. When feeding the sheets **54** and **55** downwardly, one lateral edge of each sheet will be disposed within a guide **51**, facilitating the alignment of the papers with each other. By this construction, it will be readily seen that the sheets **54** and **55** are both made to travel the same distance and arrive at the pressure rolls simultaneously.

A tank **56** (Fig. 3) will be disposed below the unit **10** and contains the processing solution **57** previously referred to.

When employing ordinary foam rubber for covers **42**, a thin latex cover, not shown, sleeves the covers **42** and is tucked in and sealed under the ends of the latter. These latex covers are necessary since ordinary foam rubber is made up of thousands of connectinc cells which tend to swell when immersed in the processing solution, thus changing the pressure between the rollers. Also, these cells will hold and retain exhausted processing solution. In addition, this soaking up action, if not prevented, would make the unit heavier for carrying than would otherwise be the case when the solution had been "emptied" out.

Alternately, uni-cellular foam rubber, which is not quite so resilient as ordinary foam rubber, may be used. In this latter material, there is little tendency to absorb or hold processing solution, eliminating the need for the thin latex covers.

It will also be noted from the above construction that the immersion time of the sheets **54** and **55** is controlled by the speed of the rolls **34**, with the result that this time is constant if the apparatus is electrically or mechanically driven. Even if the rolls **34** are manually operated, the operator is not put in the position of having to match the "shoving in" speed with the rotating speed of the rollers, requiring less skill on the part of the operator.

The symmetrical guides **50** thus described allow the sheets **54** and **55** to be oriented automatically, freezing the hands for manual operation of the rollers **34**.

The symmetrical paper guides **50** also permit undersized papers and portions of sheets **54** and **55** to be fed into the apparatus. It will also be apparent that the sheets **54** and **55** are no longer guided through the elongated ways or guides of previous apparatus in a caustic processing solution. Thus, the paper bases of these sheets no longer require a minimum body to

prevent wilting or crumpling before reaching the pressure rolls, permitting thin sheets to be sucessfully used.

The foam rubber coverings **42** replace the accurately ground soft rubber rolls of conventional apparatus. These coverings **42** are not only less expensive than conventional ground soft rubber rolls, but do not have to be accurately mounted. Hard rubber rolls and even soft non-cellular rubber rolls of necessity must be mounted so that the pressure between them can be adjusted. Furthermore, such rubber rolls afford little more than a "line contact," which requires that they be uniformly driven to avoid "pressure ridges" or uneven transfer areas. Such defects are readily seen in the shadow areas when half tone material, such as a portrait, is processed.

Furthermore, with soft rubber rolls the thickness of the sheets **54** and **55** is greatly limited because slight differences in this thickness greatly effect the pressure applied. This is obviously not the case with the foam rubber covers **42** provided on the roller assemblies **36**.

Ordinary soft rubber rollers cannot be used to form a large rectangular contact area without creating excessive pressure which in turn squeezes out too much processing solution from the rollers and prevents proper transfer. The cellular resilient rollers of the present invention overcome this defect.

It will also be noted that the foam rubber covers **42** when pressure together do not make a "line contact," such as would be the case with two soft rubber rolls, but rather make a flat rectangular contact area **43**. Because of this flat rectangular contact area **43**, the sheets **54** and **55** (Fig. 3) tend to move upward vertically rather than stick to the rolls and follow their rotation. This eliminates the need for guides or scrappers provided in conventional apparatus and designed to prevent the paper from sticking to the rolls. Furthermore, the foam rubber covers **42**, due to their extensive resiliency, receive the sheets **54** and **55** from the basic, and therefore slippery, processing solution **57** simultaneously rather than tending to accept them one at a time, as is often the case when rollers of a harder surface are used. Thus, the resilient rolls **42** allow the processing sheets **54** and **55** to differ substantially in their total thickness without substantially changing the pressure applied to the sheets. These cellular resilient rolls **42** also readily accept both the sheets **54** and **55** even though one sheet were intentionally started ahead of the other. Substantially harder rolls would tend to pull through only one sheet due to the pressure, the angle of acceptance, and the slippery conditions created by the solution **57**. In the present invention, the pressure builds up gradually, eliminating a tendency to reject the sheet which follows the other one.

Furthermore, in the present invention, the extreme resiliency of the pressure rolls **42** allows uniform distribution of the processing solution **57** without requiring the rolls to be very accurately mounted or surfaced. This is due to the broad "contact area" **43** permitted by the extreme resiliency of the rolls **42**. Even the soft rubber rolls which are currently employed have ground surfaces. This feature of the present invention effects an obvious economy as well as increased efficiency in function.

Finally, with the use of the resilient rolls **42**, the apparatus may be operated manually with uniform transfer results. The processing solution **57** is squeezed out gradually due to the gradually built up pressure in the broad "contact area" **43**. Hence, the transfer is substantially uniform even though the rolls **42** are not operated at constant speed, which would be the case in manual operation. Substantially harder rolls would create uneven squeezing of the solution **57**, producing uneven results unless mechanically driven.

While various changes may be made in the detail construction, it shall be understood that such changes shall

be within the spirit and scope of the present invention, as defined by the appended claims.

What is claimed is:

1. A processing unit comprising pressure roller means including a pair of juxtaposed, substantially parallel pressure rollers adapted to squeeze a pair of paper sheets upwardly therebetween, drive roller means including a drive roller alongside and in contact with each of said pressure rollers whereby to drive said pressure rollers, means for rotating said drive rollers, means for supplying processing solution to said pressure rollers, and a pair of symmetrical planar paper guides at each side of said pressure rollers extending upwardly therefrom and adapted to feed the paper downwardly into the nip formed between said pressure rollers and said drive rollers.

2. A processing unit according to claim 1, said pressure roller means including a cover of cellular resilient material for each of said pressure rollers, said covers being squeezed together on adjacent sides whereby to provide a planar contact area.

3. A processing unit according to claim 2, said cellular resilient material comprising foam rubber.

4. A processing unit according to claim 1 including bottom guide means below said pressure rollers adapted to conduct the sheets downwardly on each side between each of said drive rollers and pressure rollers around the bottom of said pressure rollers and upwardly between said pressure rollers.

5. A processing unit according to claim 1, each of said paper guides being rotatably mounted above said drive roller means and adapted to be rotated downwardly into a substantially horizontal position in overlapping relation to each other whereby to provide a cover for said pressure roller means.

6. A processing unit according to claim 5, said paper guides along one set of corresponding lateral edges having doubled up guide portions adapted to slidably receive and guide a lateral edge of the paper sheets, the other set of corresponding lateral edges of said guides having laterally bent flange portions adapted to about the other lateral edge of the paper sheets.

7. A processing unit comprising a pair of end plates, spacer means interconnecting said end plates, a pair of substantially parallel pressure rollers rotatably mounted between said end plates, a cellular resilient covering for each of said pressure rollers, said covers being squeezed together on adjacent sides whereby to provide a planar contact surface, a drive roller in resilient contact with each of said covers on the side of said rollers remote from said planar contact area, means for driving each of said drive rollers in opposite directions, means for supplying processing solution to said covers, said spacer means including bottom guide means below said covers, a pair of planar paper guides each adapted to slidably receive a paper sheet on the upper surface thereof, and means for rotatably mounting said paper guides on the undersurface thereof between said end plates, said paper guides when rotated to the operative position being adapted to feed a pair of sheets downwardly between each of said covers and the adjacent drive roller.

8. A processing unit according to claim 7, said bottom guide means comprising a plurality of substantially transverse, longitudinally spaced plates below said covers, each of said plates on the upper edge thereof having a pair of intersecting, substantially semi-circular cut-out portions extending around the peripheries of said covers in freely spaced relation and adapted to guide the paper sheets around the bottoms of said covers.

9. A processing unit according to claim 7, said means for mounting said guides comprising each of said end plates near the upper corners thereof having a pair of elongated longitudinally aligned openings, a guide holder rod in each pair of said longitudinally aligned openings, and a holder secured to each of said guide rods at each

end adjacent the inner faces of said end plates, said paper guides being secured to said holders.

10. A processing unit according to claim 9, said spacer means including a pair of top spacers intermediate said end plates, said guides abutting said spacers when in the raised operative position on one side of said guide holder rods, and stops on the inner faces of said end plates above said covers abutting the other face of said guides on the other side of said guide holder rods when in the operative position, said guides being adapted to be rotated about said rods away from said spacers and stops into a substantially horizontal, overlapping position whereby to provide a cover for said rolls.

11. A processing unit according to claim 10, one set of corresponding lateral edges of said guides having channel portions adapted to slidably receive and guide one lateral edge of the paper sheets, the other set of corresponding lateral edges of said guides having laterally bent flanges adapted to abut the other lateral edges of the papers.

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