Dec. 8, 1959 N. A. ALTMANN ET AL 2,916,216

METHOD AND APPARATUS FOR PREPARING PAPER MAKING STOCK

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Fig. 1.

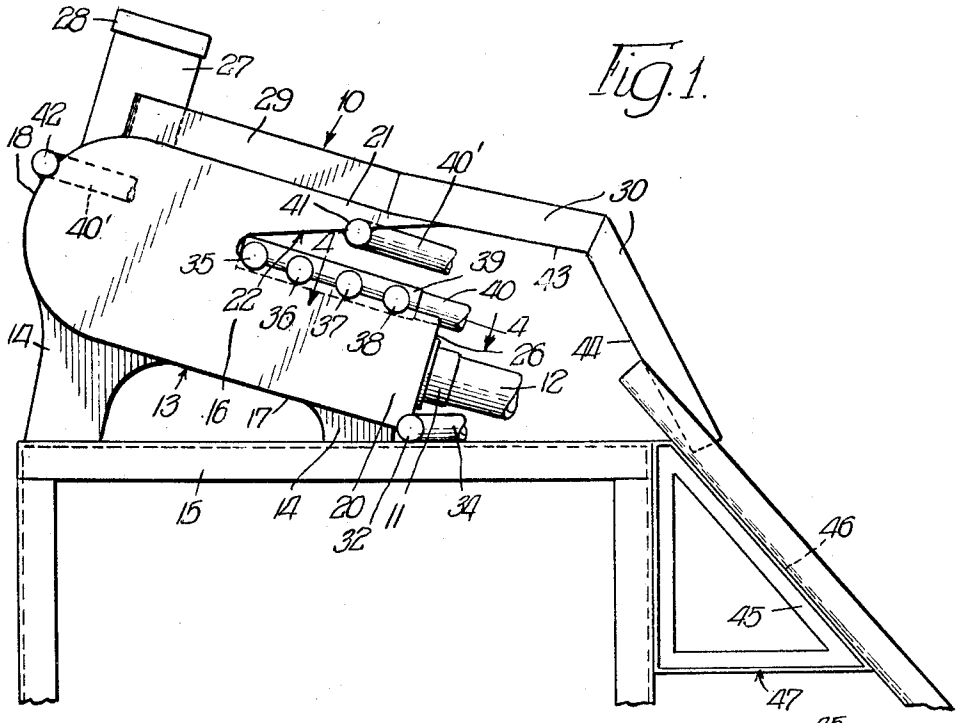
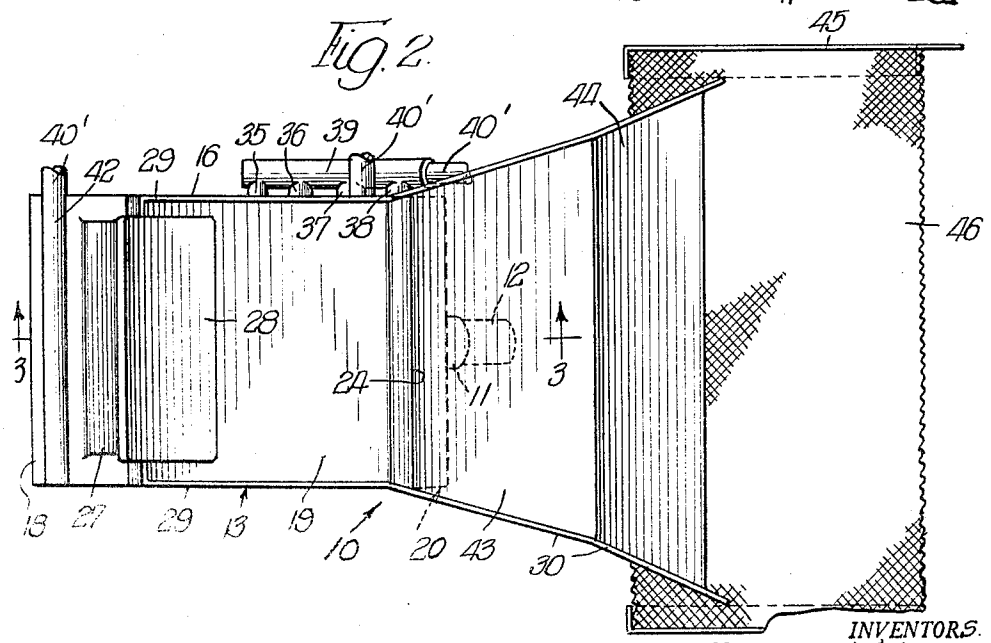


Fig. 2.



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Fig. 3.

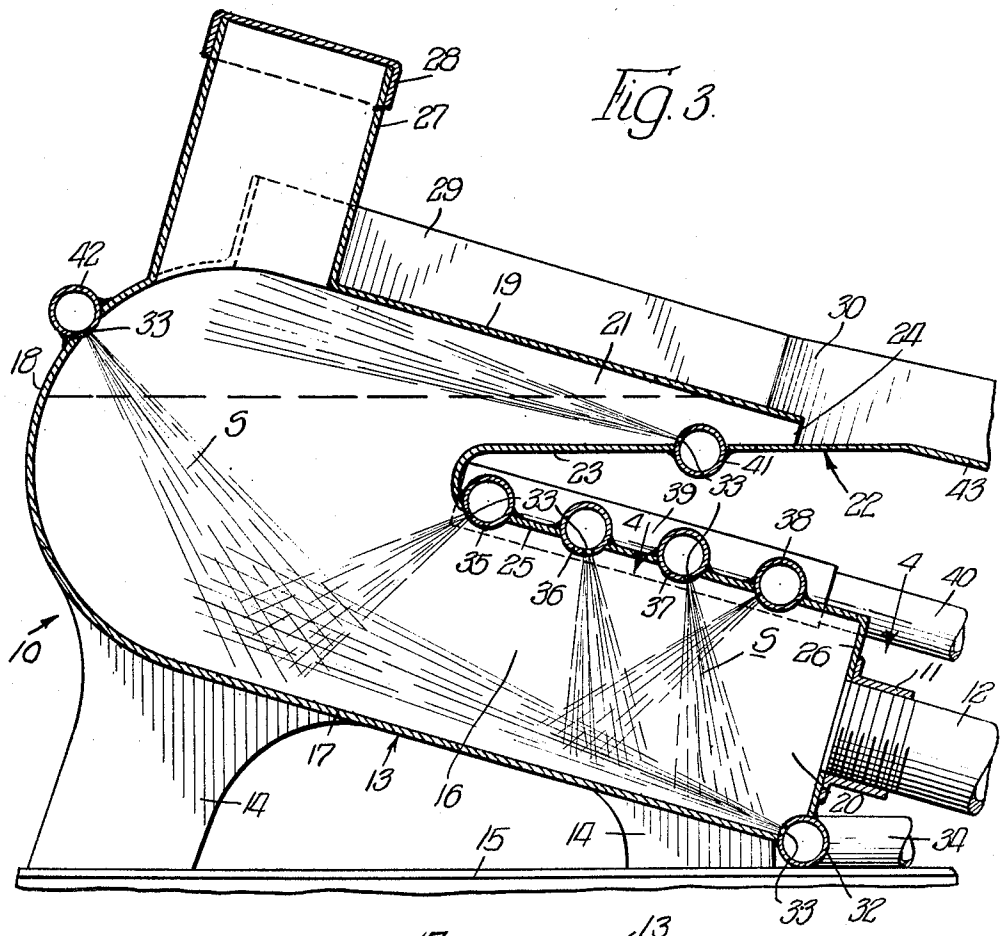
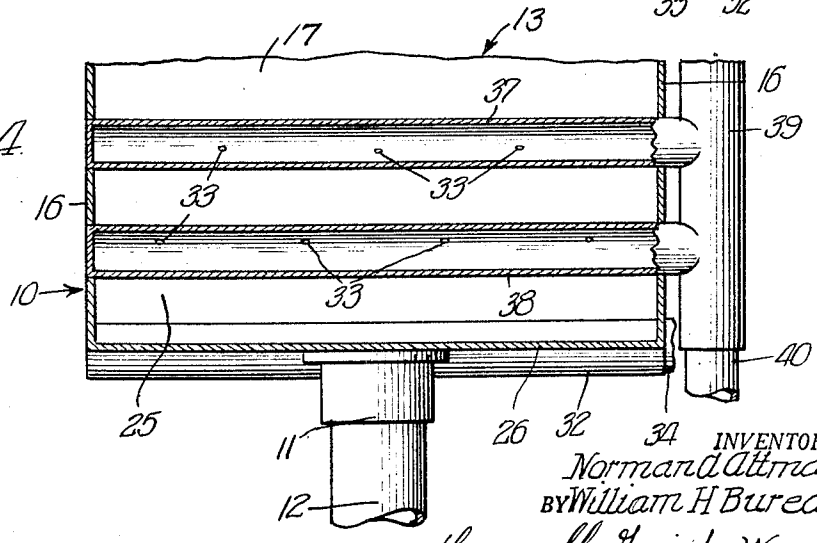


Fig. 4.



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METHOD AND APPARATUS FOR PREPARING PAPER MAKING STOCK

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4 Claims. (Cl. 241—20)

This invention relates to an improved method of preparing paper making stock derived from waste printed papers of various types, digested and cooked native pulp, and the like, and to an improved apparatus for carrying out the method. By practising the improved method the stock is brought readily and rapidly to a very clean condition. Very simple equipment is employed and the use of de-inking and/or de-fibering chemicals, as well as the operation of cooking in such agents, are dispensed with. On the contrary, the method is carried out at a temperature not above, and preferably substantially below, normal room temperature. The stock, for example, waste printed newsprint or magazine paper, is preliminarily disintegrated in a water bath to produce a slurry, and then is subjected to vigorous hydraulic agitation, with resultant further dispersion, or reduction in concentration, of the fibers in the watery slurry. This is followed immediately by mechanical screening, as the result of which impurities, ink particles, particles of coating material, etc., which have been dislodged from the fibers in the disintegrating operation and kept in water suspension during hydraulic agitating and scrubbing, are separated from the fibers by an action analogous to that of washing.

It is an object of the invention to provide a paper preparing method, along with apparatus to realize the same as described above, which is very inexpensively performed by reason of its elimination of the use of chemicals and which offers low initial equipment cost and insignificant cost of maintenance, yet which has a high output rate.

Yet another object is to provide such a method comprising steps of extensive fiber disintegration in water to form a slurry, violent agitation and dispersion of the slurry by the sole action of high velocity water jets, and a final fiber screening operation, in which the intermediate agitating operation has the effect of violently scrubbing the fibers to remove foreign particles not dislodged by the initial disintegration, and of also maintaining those particles in liquid suspension. Thus soiling of the fibers by redeposition of the ink particles and other foreign matter is prevented.

Another object is to provide a method and an apparatus as described, in which agitation of the fiber slurry is accomplished by the action of small high velocity jets of water discharged at intersecting angles into a body of the slurry, accompanied by a continuous discharge of a wide, shallow stream of deconcentrated slurry over a flat inclined screening surface, by which the ink particles and other foreign matter are rapidly screened off, the clean fibers being gravitationally collected after tumbling down the screen, for processing in a conventional paper making machine.

Still more specifically, it is an object of the invention to provide fiber scrubbing and agitating apparatus of the foregoing character which is devoid of moving parts, hence very inexpensive and requiring no maintenance or servicing, the apparatus including a closed agitating and

scrubbing chamber through which preliminarily disintegrated paper fibers in an aqueous bath or slurry are continuously circulated, while being subjected to hydraulic agitation by a multiplicity of high pressure water jets directed from different angles; these jets being primarily responsible for the circulation of the slurry, as well as the violent thorough agitation and reduction thereof to a much more dispersed, less concentrated fiber content; the chamber having a discharge throat or passage of relatively wide, fanned out shape through which the dispersed slurry flows in the form of a shallow stream onto a screening device immediately adjacent the chamber throat.

The foregoing statements are indicative in a general way of the nature of the invention. Other and more specific objects will be apparent to those skilled in the art upon a full understanding of the construction and operation of the method and apparatus.

A single embodiment of the invention is presented herein for purpose of illustration. It will be appreciated that the invention may be incorporated in other modified forms coming equally within the scope of the appended claims.

In the drawings:

Fig. 1 is a fragmentary view in side elevation illustrating an improved apparatus for performing the operations involved in the improved method;

Fig. 2 is a fragmentary top plan view of the apparatus;

Fig. 3 is a somewhat enlarged, fragmentary view in vertical central section through the apparatus, being taken along a line corresponding generally to line 3—3 of Fig. 2; and

Fig. 4 is a fragmentary view in cross section along the line 4—4 of Figs. 1 and 3.

Present day paper making stock, derived to a great extent from waste papers of different types, is ordinarily prepared by mechanically disintegrating the waste paper, and cooking the same at elevated temperatures in a chemical de-inking and/or defibering bath for the purpose of loosening and dissolving inks, pigments, coating materials, etc. from the waste paper fibers. These reclaiming operations are expensive, due to the costly chemicals and time and labor involved. Furthermore, the native pulp fibers are substantially darkened by cooking, hence requiring bleaching. Extensive washing of the fibers is always necessary, in any event, in order to free them from the chemical agents in which they have been treated. All this greatly increases the cost of the reclaiming operations necessary to prepare the fibers for paper making.

The invention provides an improved method and apparatus whereby cooking in chemical agents at elevated temperatures and repeated washings, bleaching, etc., are eliminated. The waste paper fibers are readied for the paper making process by three simple successive operations. The method and apparatus are also suited to the treatment of digested and cooked native pulp, as well as reclaimed stock.

Referring to drawings, the reference numeral 10 generally designates an improved fiber scrubbing, agitating and dispersing unit according to the invention. This is supplied with liquid pulp or waste paper slurry through a forward intake fitting 11 to which a pipe 12 is connected. Unit 10 comprises an enclosed, generally U-shaped metal housing 13 which may be supported by appropriate legs 14 on an elevated platform 15 of any suitable type. Housing 13 has vertical side walls 16, a rearwardly and upwardly inclined bottom wall or floor 17, and a semicircular rear wall 18 merging at its bottom and top with the floor and with a forwardly and downwardly inclined top housing wall 19.

Lower intake and upper discharge legs 20, 21, re-

spectively, for the U-housing **13** are defined by the housing walls and by a forward V-shaped plate member, generally designated **22**. A forwardly and upwardly inclined upper surface **23** of this plate converges with respect to the top housing wall **19** of the housing, defining a forwardly narrowing discharge throat **24** of uniform horizontal width. The lower surface **25** of V-member **22** parallels floor **17** of the housing. Member **22** is coextensive in width with the housing, and is sealed at its opposite ends to the side walls **16** of the latter to define a U-shaped housing structure. Intake fitting **11** is applied to a rectangular wall **26** which otherwise seals the intake leg **21** at the forward intake end of the housing.

It may be found desirable to provide an inspection opening to the interior chamber of the housing; in the illustrated embodiment such opening is provided by an upstanding rectangular chimney member **27**, which extends upwardly from a rather large, like shaped aperture at the junction of the rear and top walls **18**, **19** of the housing. A removable closure member **28** may be applied to the chimney, if desired.

In order to laterally confine the stream of relatively thin watery slurry issuing from the discharge throat **24** of the housing, we provide vertical side fences or walls **29** extending forwardly and downwardly at either side of and above the housing. This wall is well flared out laterally at **30** (Fig. 2) to enable sidewise spread of the stream which issues through discharge throat **24**.

The body of liquid slurry in housing **13** is agitated with great turbulence as the same traverses the housing from intake fitting **11** to discharge throat **24**. This agitation is performed solely by hydraulic action. As illustrated best in Fig. 3 of the drawings, housing **13** is provided with a number of transversely extending horizontal jetting tubes which emit high velocity water jets S to the housing chamber. One of these, designated **32**, is applied to a full length opening at the junction of forward wall **26** and floor **17**, being in liquid tight relation to the housing. Tube **32** is perforated to provide a plurality of small radial jet orifices **33**, these being aligned in longitudinally spaced relation along the tube. Water is supplied through a supply line **34** to one end of tube **32** under a relatively high pressure.

Similar jetting tubes **35**, **36**, **37**, **38** all beneath the normal level of the slurry in the chamber, are fitted into appropriate apertures in the upper wall **25** of the V-member **22** defining housing intake leg **21**, these tubes being likewise provided with radial jetting orifices **33** like those of the tube **32**, and similarly spaced longitudinally of the respective tubes. Tubes **35**, **36**, **37**, **38** are fed from a manifold pipe **39** which is in turn supplied with water at a pressure mentioned later by a feed line **40**.

A still further submerged jetting tube **41** is fitted in the upper wall **23** of housing V-member **22**, being provided with series of jetting orifices **33**, as in the case of the other jetting tubes. If desired, still further jetting tubes identical to those described may be applied to the housing; an example is the tube **42** on the arcuate rear housing wall **18** referred to above. Supply lines **40'** service the jetting tubes **41**, **42**, it being understood that jetting occurs at all tubes under uniform pressure. Suitable provisions not necessary to describe connect the various pressure lines **34**, **40** and **40'** with a source of water at relatively high pressure, say 50–300 p.s.i.

The arrangement of the various sets of jet orifices **33** is such as to produce maximum turbulence for effective internal agitation of the slurry introduced into housing **13** through supply pipe **12**. As illustrated in Fig. 4 of the drawings, the jetting orifices **33** of adjacent, successive jetting tubes are preferably arranged in a longitudinally staggered relationship. The number thereof in any given tube is capable of some variation,

however, we find that the approximate arrangement shown in Fig. 4 is effective.

The angular disposition of the orifices, in respect to the direction of the water jets S emitted therefrom, is of considerable importance in accomplishing the desired turbulence. As shown in Fig. 3 of the drawings, jets S issuing from tubes **36** and **37** intersect those from tube **38** at an acute angle, while the jet from forward bottom tube **32** intersects all three sets of these, flowing rearwardly and at a slight upward angle, with reference to the entry flow of slurry from supply pipe **12**. The jets from tube **35** generally parallel those from tube **38**, being in obtuse intersecting relation to the jets of tube **32**, while the tube **42** has its orifices **33** arranged to direct downward and forward jets S in intersecting relation to those out of tubes **32** and **35**.

The arrangement of radial orifices **33** in the throat jetting tube **41** is important. They are disposed so that a rearward stream S issues in direct opposition to the path of flow of slurry forwardly to discharge throat **24**. This insures a final vigorous agitation of the now considerably dispersed and thinned slurry as it issues from the housing, keeping ink particles and other particles of foreign matter in liquid suspension until the flow passes onto a forward continuation **43** of the surface **23**.

In issuing forth onto floor extension **43**, the relatively shallow stream spreads out, though laterally confined by the members **29**, **30**, and gravitates down an acute angled ramp **44**, which is in superposed, longitudinally overlapping relation to a screening device **45** (Figs. 1 and 2 of the drawings). Device **45** includes a fine wire screen **46** (70–80 mesh) which is suitably supported by appropriate framework **47**, for example upon the platform **15** which mounts scrubbing and agitation unit **10**.

Screening device **45** may consist of but a single screen, or it may be in the form of a plurality of screens arranged in cascaded relation, in a manner well known to the art. The scrubbed fibers tumbling thereover are collected at the bottom of unit **45**, particles of foreign matter and ink particles being water carried through the interstices of the screen. The collected fibers are generally sufficiently washed after a single run through unit **10** to be charged directly to a paper making machine for the production of a very bright sheet; however, a second run may be made if desired. It will thus be appreciated that the method of the invention is exceedingly economically performed, there being no chemical or cooking cost involved and the apparatus required for the performance thereof involving the ultimate in simplicity and ease of operation.

In practising the improved method, waste paper is preliminarily disintegrated and pulped in a suitable apparatus well known to the art, such as a conventional beater or a refiner of any one of various types. This is done, without chemical treatment, in a water bath or carrier preferably substantially below room temperature, i.e. at 50°–70° F. As described in our copending application Serial No. 263,965, filed December 28, 1951, now abandoned, we have found that disintegration at relatively low temperatures, as compared with known cooking treatments, promotes shattering of ink and other particles in the mechanical grinding operation, and also increases the surface tension of the water.

The resultant watery slurry is transferred directly, as by pumping through supply pipe **12**, to the inner chamber of housing **13**. Here it is violently agitated by high velocity jets submerged in the slurry in the manner described above, while at the same time being considerably thinned or dispersed by the added water of the jets. The fiber slurry proceeds, under such agitation, around the U-turn of the housing chamber and approaches discharge throat **24**. Here it is given a final violent agitation by the jets S from tube **41**. Issuance of the liquid from the housing is followed by screening and separation of foreign matter, as described above.

The temperature of the water used in jetting is preferably relatively low, certainly not in excess of room temperature. In short, the water may be at a temperature falling within the same range as that used in the preliminary disintegrating operation, since it is contemplated that the source of this water shall be the same as any other water used in the paper making operation, for example, a river or a water main.

The amount of water required in operation of the apparatus is not excessive and the output rate of the apparatus is high, being controlled largely by the hydraulic pressure in the jetting tubes, the number of tubes, the number of tube orifices, etc. As stated, the pressure may range from 50 lbs. per square inch to 300 lbs. per square inch, however, as far as we are able to ascertain, these values do not appear to be critical, other than in respect to the output rate of the unit. Quite obviously, if the pressure falls below a minimum necessary to keep foreign matter, ink particles, etc. in suspension, they will tend to redeposit upon the fibers, with resultant loss of operational effectiveness.

We claim:

1. Apparatus for dispersing the fibers in a slurry of wastepaper pulp and stripping ink particles from the fibers, which comprises, a generally U-shaped chamber, a slurry inlet adjacent the outer end of one of the legs of said chamber, a narrow outlet opening extending across the outer end of the other leg, and wash water distributing means located in opposite walls of said chamber having spaced jet openings on the interior of said chamber whereby as a slurry of wastepaper pulp is flowed in a U-shaped path through said chamber it may be subjected to high velocity jets of wash water introduced therein under pressure from said jet openings.

2. Apparatus for dispersing the fibers in a slurry of wastepaper pulp and stripping ink particles from the fibers which comprises, a generally U-shaped chamber having parallel side walls and adapted to be supported with one leg overlying the other, a slurry inlet adjacent the outer end of the lower leg of said chamber, a narrow outlet opening extending across the outer end of the upper leg, and wash water distributors extending across the inner and outer U-shaped walls of said chamber having spaced jet openings communicating with the interior of said chamber whereby as a slurry of wastepaper pulp is flowed in a U-shaped path through said chambers it may be subjected to high velocity submerged jets of wash water introduced thereinto under pressure from said jet openings.

3. Apparatus for dispersing the fibers in a slurry of wastepaper pulp and stripping ink particles from the fibers so as to condition the slurry for separation of the ink particles from the fibers, comprising, a U-shaped chamber having vertical and parallel side walls, means for supporting said chamber on its side with one leg overlying the other, the lower leg being substantially deeper in cross section than the upper leg and having a slurry inlet located adjacent its outer extremity, the outer end of said upper leg terminating in a narrow outlet opening extending across the width of the chamber, an apron joined to the bottom lip of said outlet opening for receiving slurry discharged therefrom, and wash water distributors extending across the inner and outer U-shaped walls of said chamber having spaced jet openings communicating with the interior of said chamber whereby as a slurry of wastepaper pulp is flowed in a U-shaped path through said chambers it may be subjected to high velocity submerged jets of wash water introduced thereinto under pressure from said jet openings.

4. The method of processing a slurry of wastepaper pulp which has been subjected to a disintegrating action to defiber the wastepaper and dislodge ink and other particles from the fibers, comprising, subjecting an enclosed stream of said slurry of relatively deep cross section to the action of a plurality of high velocity submerged jets of wash water so as to intensely agitate the slurry and disperse the fibers and said particles in the water vehicle while lowering the consistency to a thin watery slurry, and immediately discharging the thin watery slurry onto a screen and draining the water and suspending particles from the fibers so as to leave them in a clean condition.

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