(No Model.)

W. C. EDWARDS.

STUFF REGULATING APPARATUS FOR PAPER MACHINES.

No. 445,985. Patented Feb. 10, 1891.

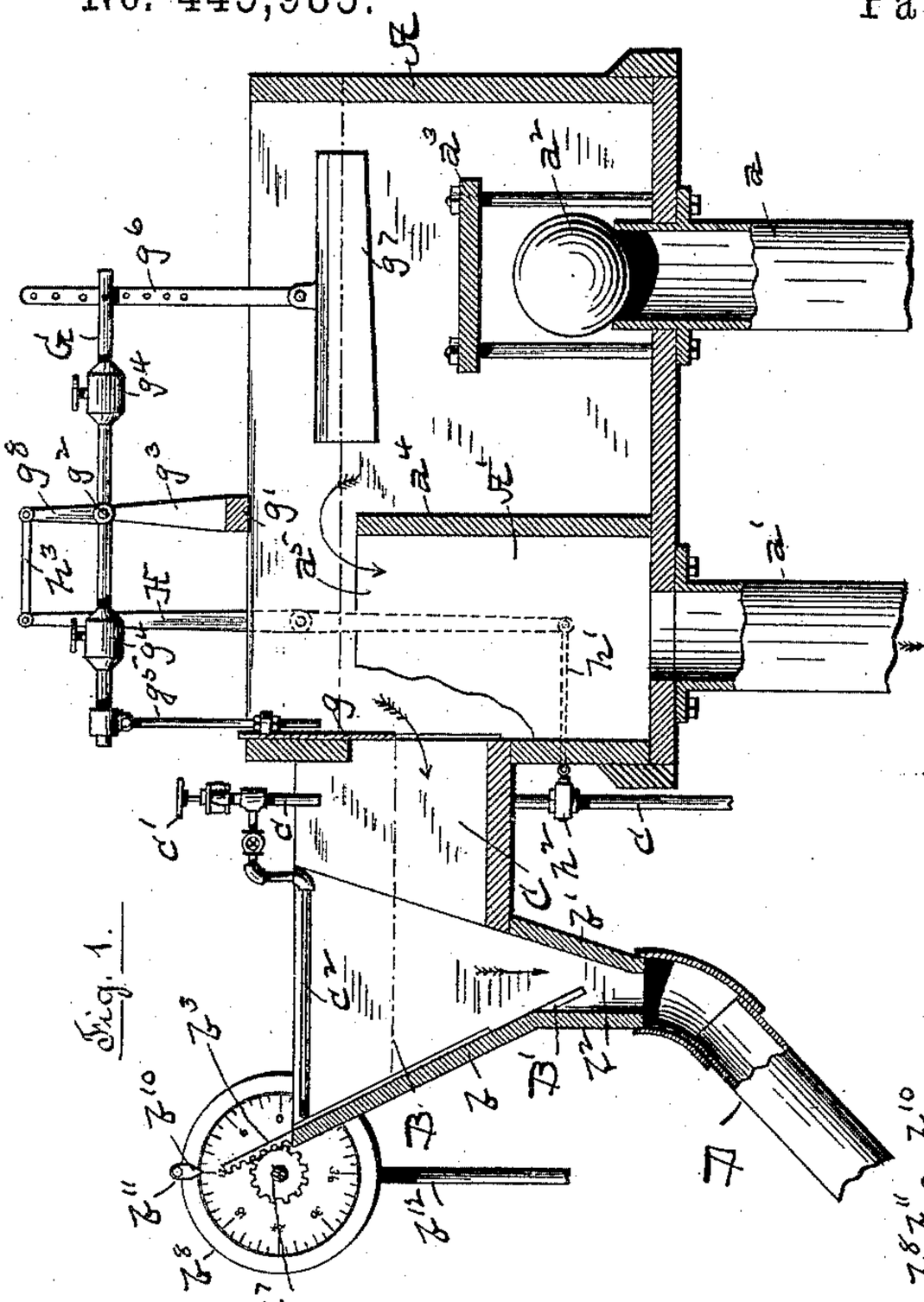

Fig. 1.

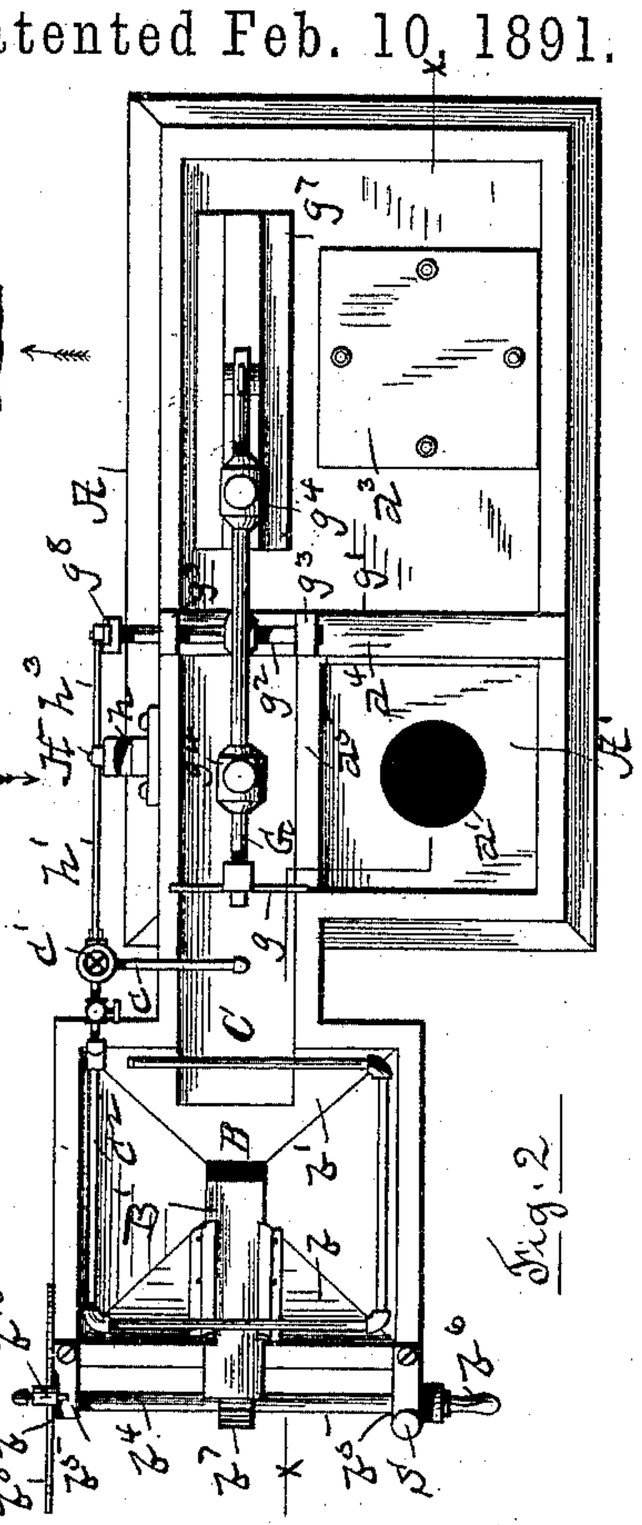

Fig. 2.

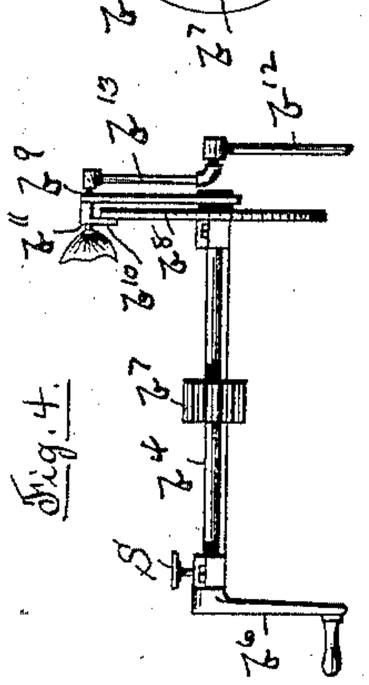

Fig. 4.

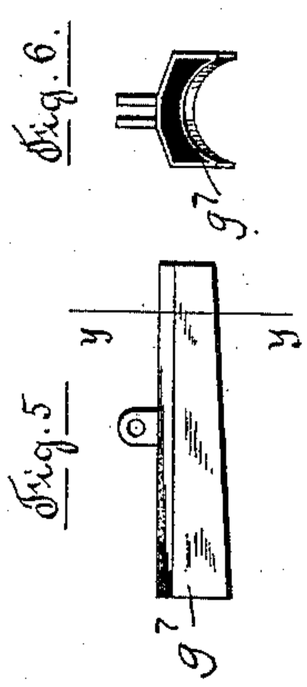

Fig. 6.

Fig. 5.

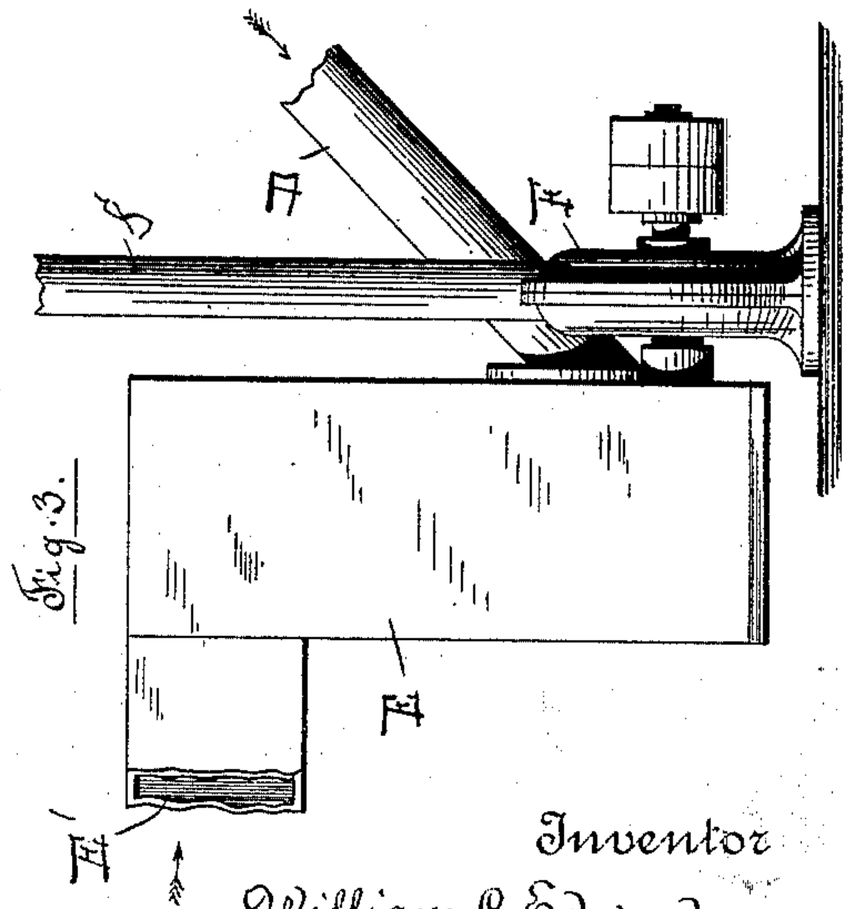

Fig. 3.

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STUFF-REGULATING APPARATUS FOR PAPER-MACHINES.

SPECIFICATION forming part of Letters Patent No. 445,985, dated February 10, 1891.

Application filed November 12, 1889. Serial No. 329,977. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM C. EDWARDS, of Holyoke, in the county of Hampden and State of Massachusetts, have invented a new and useful Improvement in Stuff-Regulating Apparatus for Paper-Machines; of which the following is a specification, reference being had to the accompanying drawings, forming part thereof.

My invention relates to apparatus for regulating the feed of the stuff from which paper is made to the paper-machine, and it has for its object to provide an apparatus for this purpose which, while being simple and inexpensive in construction, will so control the supply of stuff to the machine as to cause the paper made on the machine to be of a uniform weight throughout.

As is well known to persons skilled in the art to which my invention relates, the stuff passes from the beating-engines, in which it is thoroughly disintegrated, to the stuff-chest, which chest is usually of sufficient size to hold the contents of several engines. The stuff in said chest is too thick to be delivered directly to the machine, and it is therefore pumped from the chest into a stuff-box, which is provided with an outlet leading to the machine, and also with an overflow-outlet leading back into the stuff-chest, by which the surplus of stuff pumped into said box is conducted back to said chest. At some point between the stuff-box and the machine water is admitted to the stuff to reduce it to the proper consistency to form paper of the desired thickness and weight. Inasmuch, however, as the stuff comes from the stuff-chest of varying degrees of density, it has hitherto been found to be impossible to so regulate its passage to the machine as to secure a uniform weight to the paper. Various devices, comprising automatic gates, apparatus for weighing the stuff, &c., have been devised with a view to securing this important result, but so far as I am aware all have been failures. I have found by actual test that by admitting water to the stuff at a point between the stuff-box proper and the gate which governs its passage to the machine, by causing the stuff with the water to enter a peculiarly-shaped reservoir, and by governing the escape of the stuff from said reservoir to the machine by means of a gate of peculiar construction, the long-sought-for result of a uniform weight of paper can be attained.

My invention therefore consists in the apparatus embodying these features, hereinafter fully described, and particularly pointed out in the claims.

Referring to the drawings, in which like parts are designated by like letters in the several figures, Figure 1 is a vertical sectional view of the apparatus, taken upon line $x\,x$ of Fig. 2. Fig. 2 is a plan view of the apparatus. Fig. 3 is an elevation of the pump-box and pump. Fig. 4 is a detail view of the crank-shaft by which the regulating-gate is operated. Fig. 5 is a detail view of the float, which automatically controls the gate governing the passage leading from the box proper to the well. Fig. 6 is a cross-section taken upon line $y\,y$ of Fig. 5.

The letter A designates the stuff-box; A′, the overflow-compartment thereof; a, the pipe leading into said box from the stuff-chest, and a' the pipe leading from said overflow-compartment into the stuff-chest, which parts are or may be of the usual construction. The mouth of pipe a within box A is governed by the usual ball-valve a^2 and guard a^3 for said ball, and the walls a^4 a^5 of the compartment A′ stand at a right angle to each other and are of substantially three-fourths the height of the walls of the box, as is customary. At this point, however, the similarity between my apparatus and those heretofore used ceases, since it has been customary to so locate the gate which governs the passage from said box to the machine that the stuff enters the compartment A′ over one of its walls merely—viz., wall a^4—while in my apparatus, as will be presently explained, the stuff enters said compartment over both of said walls.

In the practice of my invention I construct as parts of the stuff-box a reservoir or well B and a conduit C, leading from the box proper to said well. The conduit C leads from the end of the box at which the compartment A′ is located and from the upper portion of said end, so that the bottom of said conduit lies

slightly below the center of the box vertically, while the top thereof is slightly below the plane of the top of the box, as shown in Fig. 1. The sides of said conduit form a continuation of the side a^5 of compartment A′ and the adjacent side of box A, so that, as shown in Fig. 2, a continuous channel or canal is formed extending from a point parallel with wall a^4 of compartment A′ to and into well B, the depth of which channel for a portion of its length is that of box A and for the remainder of its length that of conduit C.

The well B is or may be open at the top, and has its sides converging toward the bottom thereof. Two of the opposite sides of said well—as, for example, the sides b b'—are disposed at such an angle to each other that if continued until they intersect each other the point of intersection would lie slightly to one side of the vertical center of the well, and one of said sides, as b, is deflected a short distance above the bottom thereof into a vertical plane, thus forming the outlet-passage b^2 at the bottom of the well, as shown in Fig. 1. Mounted in ways in said side b is a gate B′, which I will herein call the "primary gate," which is free to move vertically in its ways, and which at its upper end is provided with a rack b^3. In its closed position the lower end of said gate abuts against the side b' of the well, while its edges abut against the two adjacent sides of the latter, which sides are made vertical and parallel at that point to insure the perfect closure of the outlet-passage b^2 by said gate. A crank-shaft b^4 is mounted in bearings b^5 at the upper end of the side b of the well, said shaft having at one end the crank-arm b^6, by which it can be manually rotated, and carrying between its ends the pinion b^7, which meshes with the rack b^3 on said gate. By means of said shaft and pinion, therefore, the primary gate can be raised and lowered at will to govern the escape of the stuff from the well into a pipe D, leading from the bottom of said well to a pump-box E.

As it is of the utmost importance that means for indicating the exact position of the primary gate at all time be provided, and as it is desirable that such indicating means shall be so located as to be readily seen by the machine-tender or other person having charge thereof, I rigidly secure to the bearing b^5, at the end of shaft b^4 opposite to that at which arm b^6 is located, a disk b^8, having graduations upon its inner side, as shown in Fig. 1, and secure to shaft b^4 outside of said disk an arm b^9, having a finger b^{10}, which overlaps the periphery of said disk and terminates in the plane of the graduation-marks on the latter. By so arranging said parts that when the gate is entirely closed finger b^{10} will stand at the point marked O on said disk it is obvious that said finger will at all times indicate the exact position of the gate, as well as the distance traveled by the gate with each movement of shaft b^4. Said indicating means, moreover, are located directly in front of the operator as he changes the position of the gate.

As a means of still further facilitating accurate adjustment of the primary gate, I connect to the outer end of arm b^9 of the crank-shaft a gas-burner b^{11} and connect said burner with the gas-pipe b^{12} by means of a pipe-arm b^{13}, which connects with said pipe by means of the usual swivel-joint, whereby said burner is permitted to move with finger b^{10} about the disk, and the marks on the latter are thus capable of being seen clearly at all times.

A water-supply pipe c communicates with conduit C at a point substantially midway between the well and box A, said pipe containing a hand-valve c', by means of which the passage of water therethrough can be governed, and I prefer to provide said pipe c with a branch pipe c^2, extending around the four sides of well B at the top of the latter, said branch pipe being provided with an independent valve, as shown, and being perforated upon its lower side, whereby jets of water will be directed therefrom against the inner snrface of the sides of said well, for a purpose which will presently appear.

As before stated, pipe D leads from the bottom of well B to a pump-box E, and a pump F forces the stuff from said box to the paper-machine through a pipe f; also, communicating with said pump-box is a conduit E′, leading from the "save all" of the paper-machine—a receptacle for the surplus water which passes to the machine with the stuff, whereby said surplus water is conveyed back into said pump-box, to be again pumped to the machine with the pulp in the usual manner. It will thus be observed that both ends of pipe D are effectually sealed by the commingled water and stuff in well B and pump-box E, respectively, so that air is excluded from said pipe, which fact greatly facilitates a steady and uninterrupted flow of the stuff through said pipe, and such construction forms an important feature of my invention.

The operation of the apparatus as thus far described is as follows: The pump which forces the stuff from the stuff-chest into box A being started, the stuff will rise within said box until it reaches the level of the bottom of conduit C, through which it will pass to well B, primary gate B′ being closed, and will continue to rise until it reaches the level of the top of compartment A′, when the overflow into said compartment and back into the stuff-chest will begin. Valve c' of pipe c being now opened, a constant and uniform supply of water is admitted to and commingled with the thickened stuff in conduit C and well B. The operator then opens the primary valve or gate B′, thereby permitting the stuff to flow through pipe D to pump-box E, whence pump F forces it to the machine. Primary gate B′ is opened more and more until the web of paper made on the machine is of the desired weight, when said gate is locked in

position. I have shown as one form of means for thus locking said gate a set-screw S, connecting the two halves of one of the bearings b^5 of shaft b^4, whereby the two parts of said bearing can be clamped tightly upon said shaft to prevent movement thereof; but other means for securing the same result can be employed, if desired. The thickened stuff in box A being free to overflow into compartment A′ upon two sides of the latter and the water being admitted to the stuff in conduit C, the water will be prevented by the stuff in the box proper from backing up into the latter, and will be caused to pass into well B and through gate B′ in a uniform stream, and said gate being opened sufficiently to permit the passage of such unvarying stream of water and the requisite quantity of stuff to make the paper of the desired weight it is obvious that the web of paper made on the machine will be of a uniform weight so long as these conditions continue to exist. Again, it will be observed that by making well B of the particular shape shown and by arranging the primary gate in connection therewith, as shown, the pressure exerted by the entire quantity of stuff within the well is constantly directed upon the narrow passage way between the lower end of the gate and the adjacent wall of the well, whereby a steady and uniform flow of the stuff through said passage-way is assured. Moreover, the walls of the well and the gate itself being arranged at an angle to the direction of movement of the stuff through the well, there are no abrupt shoulders or surfaces upon which the stuff can lodge to form into lumps and thus clog the passage-way and interrupt the uniform flow of the stuff. This result is still further enhanced by the jets of water which issue from pipe c^2 at the upper end of each of the four sides of the well, which effectually prevent any lodgment of the particles of stuff upon said sides.

Disk b^8 will preferably have marked thereon the position to be occupied by the finger b^{10} to cause the paper to be of any desired number of pounds to the ream in weight, which marks can be located thereon with accuracy after the machine has once been set in operation.

As before stated, the thickened mass of stuff in box A, by reason of its ability to freely overflow into compartment A′ upon two sides of the latter, will prevent the water entering the conduit through pipe *c* from backing up into said box; but in order to still further assure this result I prefer to locate a gate *g*, which I will herein call the "secondary gate," at the point where conduit C communicates with the box. Said gate is mounted in vertical ways, as shown, and by being raised and lowered governs the size of the passage-way between the box and well B, and when partially opened effectually prevents the water from entering the box proper from the conduit.

As is well known, the periodic impulses given to the body of stuff within the stuff-box by the strokes of the pump which forces the stuff from the stuff-chest into said box have a tendency to interrupt the steady and even flow of the stuff to the machine and to cause an uneven weight in the paper, and in order to counteract this tendency entirely, although it is greatly lessened by the use of conduit C and well B, I prefer to provide means for automatically imparting to the secondary gate *g* a slight downward movement with each upward movement of the body of stuff within the box, and thereby check any increase in the quantity of stuff delivered to the machine which might otherwise be caused. The means herein shown for thus automatically operating said gate are as follows: Upon a bridge-piece *g*′, extending across the top of box A, is supported a rock-shaft g^2, mounted in bearings g^3, projecting upwardly from said bridge-piece, and supported at its center upon said rock-shaft is a lever G, having the weights g^4 adjustably secured thereon upon each side of its fulcrum, whereby said lever can be evenly balanced upon said fulcrum. A rod g^5 is detachably connected at its upper end to said lever by means of a collar embracing the end of the latter, and at its lower end is adjustably connected to gate *g* by means of a thimble on the latter and two set-nuts on the rod, as shown, whereby said gate can be adjusted to different heights on the rod. At its opposite end the lever G is provided with a slot to receive a stem g^6, projecting upwardly from and pivotally secured to a float g^7, said stem being provided with holes to receive a pin extending across the slot in said lever, as shown, to enable the float to be adjusted to different heights relatively to the lever. The float g^7 rests upon the top of the body of stuff within the box, and is preferably made in the form shown in Figs. 5 and 6—that is to say, of a shell forming an inclosed air-chamber having its bottom concaved transversely, and being of a slightly-increasing depth from one end to the other. The float made in this form is not only very buoyant, but is adapted to rest evenly upon the surface of the stuff, and by its concaved bottom to give the stuff an initial movement in the direction of conduit C, and thus facilitate a steady flow of the stuff into and through the latter. With said parts arranged as described every upheaval of the stuff within the box by the strokes of the supply-pump will cause a corresponding upward movement of the float, and through lever G a corresponding downward movement will be given to gate *g*, which gate by slightly contracting the opening between the box and conduit C effectually counteracts the tendency of such upheaval of the stuff to increase the quantity of stuff passing through said opening.

Inasmuch as it may be desirable in some instances to automatically control the supply

of water in accordance with the consistency of the stuff pumped into the stuff-box, I have herein shown means for securing such result, the same consisting of a lever II, pivoted at its center upon a hub *h* upon the side of box A, said lever at its lower end being connected to the stem *h'* of a valve h^2 in the water-supply pipe *c*, and at its upper end being connected by a link h^3 to an arm g^8, rigidly secured to rock-shaft g^2. The connection between valve-stem *h'* and said lever II will be such that when the stuff is of a normal consistency valve h^2 will be opened sufficiently to permit the proper quantity of water to pass through pipe *c* into conduit C, and it will be obvious that when the stuff increases in density or becomes thicker it will cause an upward movement to float g^7, which movement of said float will, through lever G, rock-shaft g^2, arm g^8, link h^3, and lever H, still further open valve h^2 and admit an additional quantity of water to the stuff, and that when the stuff decreases in density or becomes thinner the float will be depressed, and will through the same means partially close valve h^2, thus diminishing the quantity of water supplied. Said means are thus adapted to automatically regulate the water-supply according to the varying consistency of the stuff; but under all ordinary conditions of the stuff the apparatus constructed and operating as hereinbefore described will secure a steady and uniform flow of the stuff to the machine without the use of said automatic feature.

I desire to call particular attention to the point relatively to the stuff-box proper at which the water is admitted to the stuff, to the peculiar shape of well B, and to the angle at which the primary gate is set relatively to the direction of movement of the stuff through the passage at the bottom of the well, since to these features of construction is largely due the fact that by the use of the apparatus described I am able to secure a uniform weight to the paper made on the machine.

The apparatus herein described is composed of few parts and is not liable to get out of working order, as would be the case with a more complicated construction.

It is obvious that modifications in the details of construction can be made without departing from the spirit of my invention.

Having thus fully described my invention, what I claim, and desire to secure by Letters Patent, is—

1. In a stuff-regulating apparatus for paper-machines, the combination, with the stuff-box having the usual inlet and overflow-outlet for the stuff, of a well having converging sides and having at the bottom thereof an outlet-passage and a gate for closing said passage, a conduit leading from said box to said well, and a water-supply pipe leading into said conduit, substantially as and for the purpose set forth.

2. In a stuff-regulating apparatus for paper-machines, the combination, with the stuff-box having at one end thereof an overflow-compartment, two of the sides of which are exposed to the passage of the stuff thereover, of a well the sides of which converge toward an outlet-passage at the bottom thereof, a gate movable in ways upon one of the sides of said well for closing said passage at the bottom of the latter, and a conduit leading from the end of said box at which said overflow-compartment is located into said well, arranged and operating substantially as and for the purpose described.

3. In a stuff-regulating apparatus for paper-machines, the combination, with the stuff-box having the usual stuff-inlet opening and having in one corner thereof an overflow-compartment, of a well the sides of which taper toward the bottom thereof and two of the opposite sides of which stand at such an angle to each other that the vertical plane of their intersecting point will lie at one side of the center of said well, a gate movable in a plane parallel with one of said oppositely-located sides of the well for governing the outlet-passage from the latter, and a conduit leading from said box to said well, said conduit communicating with the box at a point above the bottom of the latter and between said overflow-compartment and the adjacent side of said box, arranged and operating substantially as set forth.

4. In a stuff-regulating apparatus for paper-machines, the combination, with the stuff-box, of a well located between said box and the paper-machine, said well having its sides tapering toward the bottom thereof, a gate mounted in ways upon one of the sides of said well for closing the outlet-passage from the latter, a rack and pinion for operating said gate, an indicator operatively connected to said rack and pinion for indicating the movement thereof, a conduit connecting said well with said stuff-box, and a water-supply pipe communicating with said conduit, arranged and operating substantially as described.

5. In a stuff-regulating apparatus for paper-machines, the combination, with the stuff-box, of a well the sides of which taper toward the bottom thereof, where they terminate in an outlet-passage from said well, a primary gate movable in a plane parallel with one of the sides of said well for closing said outlet-passage, a conduit leading from said stuff-box to said well, and a secondary gate for closing the entrance to said conduit, substantially as and for the purpose described.

6. The combination, with stuff-box A, having overflow-compartment A', of well B, having tapering sides and outlet-passage b^2 at the bottom thereof, gate B' for closing said passage, conduit C, connecting said stuff-box with said well, water-supply pipe *c*, communicating with said conduit, and branch pipe c^2, communicating with said well at or near the top thereof, substantially as described.

7. The combination, with well B, having its sides tapering toward the bottom thereof and

having an outlet-passage at said bottom, of gate B′, mounted in ways upon one of the sides of said well and carrying at its upper end the rack b^3, shaft b^4, mounted in bearings on said well and carrying pinion B^7, which meshes with said rack, said shaft having at one end thereof crank-arm b^6 and at its opposite end arm b^9, carrying finger b^{10}, and graduated disk b^8, secured to one of the bearings of said shaft in position to have its periphery overlapped by said finger b^{10}, arranged and operating substantially as set forth.

8. The combination, with well B, gate B′, carrying rack b^3, shaft b^4, carrying pinion b^7 and indicating arm and finger b^9 b^{10}, and graduated disk b^8, of gas-pipe b^{12}, having branch pipe b^{13} connected thereto by means of a swivel-joint and in the plane of the axis of said shaft b^4, said branch pipe at its outer end being connected to the outer end of arm b^9 and carrying burner b^{11}, arranged and operating substantially as described, whereby said burner will be caused to follow the movements of said indicating-finger.

9. The combination, with stuff-box A, conduit C, and well B, having tapering sides, as described, of pump-box E, having conduit E′ communicating therewith at or near the top thereof, pump F, and pipe D, leading from said well at the bottom of the latter into said pump-box at or near the bottom of the same, substantially as set forth, whereby both ends of said pipe will be sealed by the stuff in said well and pump-box, respectively.

10. The combination, with stuff-box A, well B, having primary gate B′, and conduit C, leading from said box to said well, of secondary gate g, mounted in vertical ways and governing the entrance to said conduit, lever G, mounted upon a horizontal axis and being adjustably connected at one end to said secondary gate, float g^7, constructed to rest upon the surface of the stuff within said box, said float having stem g^6, and means for adjustably connecting said stem to the opposite end of said lever, substantially as and for the purpose described.

11. The combination, with stuff-box A, having gate g at one end thereof and having bridge-piece g' extending across the top thereof, of bearings g^3, supported upon said bridge-piece, shaft g^2, journaled in said bearings, lever G, mounted at its center upon said shaft and having weights g^4 adjustably mounted thereon, rod g^5, detachably secured to said lever at one end of the latter and at its opposite end being adjustably connected to said gate g, float g^7, consisting of a hollow shell and having the bottom thereof concaved, as described, and stem g^6, pivotally secured to said float at one end and at its opposite end to said lever G, substantially as and for the purpose described.

12. The combination, with stuff-box A and conduit C, leading therefrom at one end thereof, water-supply pipe c, having valve h^2 therein, said pipe communicating with said conduit, shaft g^2, having arm g^8, lever G, and float g^7, connected to said lever, substantially as described, of lever H, pivoted upon said box and being connected at its lower end to the stem of said valve h^2, and link h^3, connecting the upper end of said lever to said arm g^8 of shaft g^2, substantially as and for the purpose set forth.

13. The combination, with stuff-box A, having inlet-pipe a communicating therewith, and having at one end thereof overflow-compartment A′, with pipe a', leading from the latter, of well B, having its sides tapering toward the bottom thereof, and having gate B′ mounted in ways upon one of said sides, pump-box E, pipe D, leading from the bottom of said well to and into said pump-box, and conduit C, leading from said stuff-box at the end of the latter at which said compartment A′ is located into said well, arranged and operating substantially as described.

14. The combination, with stuff-box A, of well B, having the sides $b\,b'$ thereof disposed at such an angle to each other that if continued said sides would intersect each other at one side of the vertical center of said well, and having said side b deflected near the bottom thereof to a vertical plane, whereby outlet-passage b^2 is formed, gate B′, mounted in ways upon said side b, and movable in a plane parallel with the upper portion of the latter, and conduit C, connecting said well with said stuff-box, arranged and operating substantially as and for the purpose described.

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