This invention relates to an apparatus adapted to revolve a spider-like holder, whereby the articles carried by the spider are automatically discharged from the spider, whenever the spider has revolved around a predetermined angle.

Objects of the present invention are: the provision of a construction which will obtain a more definite securing in place of the spider at various positions where a loading or unloading takes place; to definitely predetermine and time the stops where the spider has to halt in its revolution for loading or unloading, or other operations; the provision of means to revolve shafts or the like for partial turns, and to automatically stop the turning motion at predetermined points and lock the shaft member in that position, and to automatically release the locks when a new turn of the shaft is desired; the provision of a construction which can be operated with very little power but which generates sufficient power to move those heavy spider-like holders, which require much power for acceleration and revolving; the provision of a novel arrangement for use of a hydraulic ram for operating the spider; the provision of a novel arrangement of piping and interposed throttle valves for definitely controlling the flow of a hydraulic operating medium and of the speed of a hydraulic ram; the provision of novel means for automatically throwing a hydraulic pilot valve into its rest position after it has been in working position long enough to achieve its purpose; the provision of means which automatically throw the pilot valve of a hydraulic control system into another position after it has completed one operating cycle, and to lock it in such position; and the provision of means to automatically throw the pilot valve of a hydraulic control system into another position after it has completed one operating cycle, to lock it in such position, and to automatically clear the way for its return movement into the first position.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims, and shown in the drawings, which by way of illustration show what I now consider to be a preferred embodiment of the invention.

In the drawings—

Figure 1 is a transverse sectional view of a paper pipe-forming machine equipped with a spider for supporting and conveying mandrels upon which the paper tubes are formed and provided on one side with hydraulic operated means, upon which the paper tubes are formed and provided on one side with hydraulic operated means, upon which the paper tubes are formed and provided on one side with hydraulic operated means, upon which the paper tubes are formed and provided on one side with hydraulic operated means.

Figure 1a is a detail view of the gage.

Figure 2 is a longitudinal front view of the pipe-forming machine shown in Figure 1.

Figure 3 shows a face view of the spider revolving mechanism.

Figure 4 is a partly sectional and partly side view of part of the spider revolving mechanism, particularly of the mechanism for automatically throwing the pilot valve into its fore position.

Figure 5 is a cross-sectional view through the spider revolving mechanism along the lines indicated by arrows 5—5 on Figure 4 and looking in the direction of these arrows.

Figure 6 is a diagrammatic showing of the pilot valve and piping for controlling the hydraulic ram which supplies the power for revolving the spider.

In Figures 1 and 2, 1 is a tank containing the stock from which paper pipes or tubes are made. This tank is refilled to a certain level from the left, (Figure 1), and the stock flows under and over a plurality of baffles to secure a proper mixing of the stock. 3 is the mold roll which is covered by a sieve. On the inside of this roll, suction is maintained by connecting the air space 4 of the roll with a fan or low pressure chamber. The mold roll 3 is supported at each end by support 5 which is rotatable around pivot 6. The weight of roll 3 and support 5 is counterbalanced by lever 7 and weight 8. This provides sufficient additional force to press the mold roll against the couch roll 8. This couch roll is covered with felt, inside of which a low pressure is maintained which holds the paper-forming material on the roll. Couch roll 9 is supported on stationary bearings 10, and is rotated by means of an electric motor or the like (not shown).

On couch roll 9 rests by its own gravity the pipe-forming mandrel 11, and it is further pressed onto the couch roll by levers 12 and rolls 13, the former being fulcrummed at 14 and weighted by weights 15. An equalizer (not shown) is provided for equally distributing the weights on the two levers 12 arranged at both ends of the forming mandrel 11.

Forming roll or mandrel 11 is supported in its position above the center of couch 9, by radial slots 16 in the disks 17. One disk is arranged on each end of the machine, both fixed to shaft 19, and forming together with said shaft, a roll holding and conveying spider. As 9 revolves, it rotates the mandrel 11 with it and the paper-forming material is wound onto 11. This goes on till the paper layer reaches the desired thickness and touches gage rollers 18, (Figures 1 and 1a), which are rotatable and loosely supported on the spider.
The toothed wheel 31 is loose on the shaft 19. Attached to the toothed wheel 31 is a ratchet wheel 40 which has four notches 41, spaced 90° from each other on the circumference of the ratchet wheel. A pawl 42 is like part 43 which is keyed onto the shaft 19. When the piston 27 is in its lowest position, there is a clearance between the pawl 42 and the notch face 41, and a certain lost motion is available for the upward movement of the rack 28. This lost motion is sufficient to lift the lever 36 upward and to pull a locking pin 44 out of a notch 45. Four of such notches are arranged on the periphery of the disc member 43, equally spaced around the circumference. The locking pin 44 is connected to the lever 36 by means of a pin 46 resting in a slot-like opening 47 on lever 36.

At a further upward motion of the rack 28, the notched face 41 engages with pawl 42 and rotates the disc 43 and with it the shaft 19. At such rotation, the locking pin 44 rides on the circumference of the disc 43. The pawl 42 is forced against the ratchet wheel 40 by means of a spring 48 and a pin-like member 49. As soon as the locking pin 44 is out of engagement with the notch 45, a cam 50 on the rack 23 reaches a pin 51, mounted on the end plate 39. At a further upward movement of the rack 28, the rack wheel which is rotatably mounted on the rack by a pin 52, is pushed towards the left, as shown in Figure 3, against resistance of a spring 53. This causes a disengagement of the rack pawl 33 from the table 35. The lever 36 is now free and the locking pin 44 can drop down into the next notch as soon as a 90° revolution of the locking disc 43 and the shaft 19 is completed.

Attached to the locking disc 43 is a cam ring 54 which has four cams 55 equally spaced around its circumference. As a 90° turn of the shaft 19 is completed, the valve 29 is brought into a position to allow the piston 27 to return to its lowest position so that it is ready for a new action or turning of the shaft whenever required. The throwing of the valve 29, and handle 28, into this position is accomplished automatically. The cam 55 pushes a pin 56 in a guide member 57, mounted on the end plate 39. The pin 56 is forced against the tension of a spring 58 and clutches at its outer end against the handle 28. At the engagement therefore of cam 55 and pin 56, which occurs when the shaft 19 completes a quarter turn, the handle 25 is thrown downward as indicated by the arrow in Figure 3. A slight movement of the pin 56 is sufficient, the handle 28 being completed by means of the spring 60, so mounted that it tends to throw the handle into either end position and to hold it there.

When the handle 25 hangs vertically downward, the valve 29 is in the position shown on flow diagram Figure 6. The cylinder is now connected to the outside air, and the water therein can freely flow away. Pressure water is admitted to the upper side of the piston 27. In this passage, a throttle valve 61 is inserted, by means of which the speed of the downward movement of the piston is changed as is done by means of valve 30 during the upward movement of the piston. A by-pass 62 is arranged around the valve 61, which is equipped with a non-return valve 63. This non-return valve allows a free flow of the operating water only in the direction of the arrow on Figure 6, so that there is no hydraulic resistance against an upward movement of the piston, which is its own resistance. The valve 29 when open remains in a position as far as the work is concerned, to be stopped and then closed.

The toothed wheel 31 is loose on the shaft 19. Attached to the toothed wheel 31 is a ratchet wheel 40 which has four notches 41, spaced 90° from each other on the circumference of the ratchet wheel. A pawl 42 is like part 43 which is keyed onto the shaft 19. When the piston 27 is in its lowest position, there is a clearance between the pawl 42 and the notch face 41, and a certain lost motion is available for the upward movement of the rack 28. This lost motion is sufficient to lift the lever 36 upward and to pull a locking pin 44 out of a notch 45. Four of such notches are arranged on the periphery of the disc member 43, equally spaced around the circumference. The locking pin 44 is connected to the lever 36 by means of a pin 46 resting in a slot-like opening 47 on lever 36.

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power stroke. At the downward movement of the piston, where it has no work to do outside of turning the toothed wheel 31 with the ratchet 40, the valve 30 creates a certain resistance which 5 secures a smooth movement of the piston, the rack, etc.

Whenever the operator wants to turn the spider another 90°, he pulls the lever 25 upward by hand until its notch abuts against the pin 56, which has been returned by its spring 58 to normal position with its inner end against the circumference of cam ring 54. The lever is then horizontal, and it is held in this position by the spring 60.

We will now recapitulate one complete cycle of operations.

Operation A.—Operator raises handle 25 to horizontal, which brings four-way valve 29 to the position which allows admittance of pressure water into the lower end of the hydraulic cylinder 26.

Operation B.—Water goes through four-way valve 29, through throttle valve 39, into the bottom of the hydraulic cylinder, and moves piston 27 and rack 28 upward.

Operation C.—Rack pawl 33 engages locking lever lug 35 thereby lifting locking lever 36 and locking pin 44.

Operation D.—As locking pin 44 clears the slot 45 in locking disc 43, ratchet wheel 40 and pawl 42 engage and spider 19, 17 starts to revolve.

Operation E.—As rack 28 continues, tripping cam 50 disengages rack pawl 33 from lug 35, allowing locking pin 44 to ride on circumference of locking disc 45, ready to lock.

Operation F.—As spider 19, 17 nears completion of one-quarter turn, cam plate 54 actuates pin 56, which closes the four-way valve and valve spring 60 then completes one-quarter turn of valve, and again directs water to the top of piston through throttle valve 61. Check valve 63 is closed against flow in this direction. Space below the piston is open to the air, and the piston is returned to lower position bringing back with it the rack 28, its pawl 50, gear 31, and notched wheel 40 to position for the next operation. On power stroke of piston 27, the check valve 63 and by-pass allow free exhaust for water, while on piston return, the throttle valves control the speed of rotation. At the completion of the power stroke, four-way valve 29 is automatically returned to the closed position (closed position meaning that water pressure is acting on upper side of piston).

Although we have shown our invention in this application applied to the operation of a spider for holding the forming rolls of a paper-roll making machine, it is obvious that our apparatus or parts of it may be used for the operation of a wide range of mechanisms where similar problems have to be solved.

We claim:

1. A conveying apparatus for transporting materials, comprising conveying means to carry the materials, power means for actuating the conveying means, locking means for controlling the connection between said power and conveying means to permit free motion of the power means after actuating said conveying means, means for controlling the connection between said power and conveying means to permit free motion of the power means before actuating said conveying means, means operated by said power means during said period of free motion of the power means to disengaging the power means from said unlocking means after a preset period of operation of said power means.

2. A conveying apparatus for transporting materials, having conveying means to carry the materials, power means for actuating the conveying means, locking means for definitely stopping the conveying means, means operated by said power means during said period of free motion of the power means before actuating said conveying means, means operated by said power means during said period of free motion of the power means to permit free motion of the power means before actuating said conveying means, means operated by said power means during said period of free motion of the power means to disengaging the power means from said unlocking means after a preset period of operation of said power means.

3. A conveying apparatus, conveying means, power means for operating said conveying means, power distributing means for controlling the flow of power to said power means, control means cooperating with said conveying means and said distributing means, said control means being connected to said distributing means to automatically reverse the flow of power after a predetermined period of operation of said power means, and means for automatically locking said power distributing means after its operation.

4. A conveying apparatus, conveying means, power means for operating said conveying means, power distributing means for controlling the flow of power to said power means, control means cooperating with said conveying means and said distributing means, said control means being connected to said distributing means to automatically reverse the flow of power after a predetermined period of operation of said power means, yielding means for securing the power distributing means in the desired position after its actuation by the control means for reversing the flow of power, said control means for actuating the distributing means having provisions for permitting the operation of the distributing means against the yielding means as soon as the actuating action of the control means is completed.

In a tube forming machine having forming rolls for forming the tubes, a spider-like conveying apparatus for holding said forming rolls and transporting said rolls in a circular path, a hydraulic ram for revolving said spider, a locking disc fixed upon said spider and having notches spaced around its periphery, an automatic locking member cooperating with said notches for definitely stopping the revolving motion of said spider at predetermined stations and for securely holding the spider at these stations, and means actuated by said ram for disengaging said locking member from said locking disc after a preset period of operation of said spider at predetermined stations and for securely holding the spider at these stations, a ratchet member attached to said locking disc, a shaft supporting said locking disc and said spider, said locking disc and said spider being keyed to said shaft and a ratchet wheel being loosely mounted on said shaft, said ratchet wheel cooperating with a rack extending from said
ram, clearance being provided between said ratchet member and said ratchet wheel to permit free motion of said rack and said ratchet wheel.

7. In a tube forming machine having forming rolls for forming the tubes, a spider-like conveying apparatus for holding said forming rolls and transporting said rolls in a circular path, having a hydraulic ram for revolving said spider, a locking disc having notches spaced around its periphery, a lock member cooperating with said notches for definitely stopping the revolving motion of said spider at predetermined stations and for securely holding the spider at these stations, a ratchet member attached to said locking disc, a shaft supporting said locking disc and said spider, said locking disc and said spider being keyed to said shaft and a ratchet wheel being loosely mounted on said shaft, said ratchet wheel cooperating with a rack extending from said ratchet member and said ratchet wheel to permit free motion of said rack and said ratchet wheel, a locking lever operating said locking member, a pawl connected to said rack, to lift the locking lever and the locking member whenever the ram moves for turning said spider, and a pin cooperating with said rack pawl for disengaging the rack pawl from said locking lever to free the locking lever from the rack pawl after a predetermined travel of the ram.

8. In a tube forming machine having forming rolls for forming the tubes, a spider-like conveying apparatus for holding said forming rolls and transporting said rolls in a circular path, having a hydraulic ram for revolving said spider, a locking disc having notches spaced around its periphery, a locking member cooperating with said notches for definitely stopping the revolving motion of said spider at predetermined stations and for securely holding the spider at these stations, a ratchet member attached to said locking disc, a shaft supporting said locking disc and said spider, said locking disc and said spider being keyed to said shaft and a ratchet wheel being loosely mounted on said shaft, said ratchet wheel cooperating with a rack extending from said ratchet member and said ratchet wheel to permit free motion of said rack and said ratchet wheel, a locking lever operating said locking member, a pawl connected to said rack, to lift the locking lever and the locking member whenever the ram moves for turning said spider, and a pin cooperating with said rack pawl for disengaging the rack pawl from said locking lever to free the locking lever from the rack pawl after a predetermined travel of the ram, and a four-way valve for controlling the flow of water to said hydraulic ram, a handle for operating said valve, a cam on said handle, a piston pin cooperating with said cam, a cam ring connected to said locking disc, cams equally spaced around the periphery of said ring, said last-mentioned cams cooperating with said piston pin to operate said ram, a valve setting cam cooperating with said piston pin with said cam on said handle.

9. In a machine of the character described, the combination of a roll-carrying spider, a hydraulic ram for operating the spider, a valve for controlling the flow of water to said hydraulic ram, a valve setting cam cooperating with said spider, and means actuated by the ram to release the spider from said locking means.

10. In a machine of the character described, the combination of a roll-carrying spider, a hydraulic ram, a rack operated thereby, a gear operated by said rack and having pawl and ratchet connection with said spider, hand controlled means for controlling the operation of said ram, spider locking means controlled by said ram, and means actuated by said spider to return said hand controlled means to normal position.

11. In a machine of the character described, the combination of a roll-carrying spider, a hydraulic ram, means actuated by said ram for rotating said spider, a hand-operated valve controlling said ram, means normally holding said spider against motion, means actuated by the initial movement of said ram to disengage said locking means and release said spider, said locking means being retained in disengaged position during the movement of said spider, and means actuated by said spider for restoring said hand operated valve to its normal position.

12. In a machine of the character described, the combination of a roll-carrying spider, a hydraulic ram, means actuated by said ram for rotating said spider, means controlling said ram, locking means normally holding said spider against motion, means actuated by the initial movement of said ram to disengage said locking means and release said spider, and means retaining said locking means in disengaged position during the movement of said spider, said spider-locking means including a locking lever, and said means actuated by the initial movement of said ram including a member for lifting said locking lever to release said spider, and means for disengaging said lever-locking member.

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