June 27, 1933. W. N. GERE 1,915,779

APPARATUS FOR SPOTTING YARN IN THE MASS

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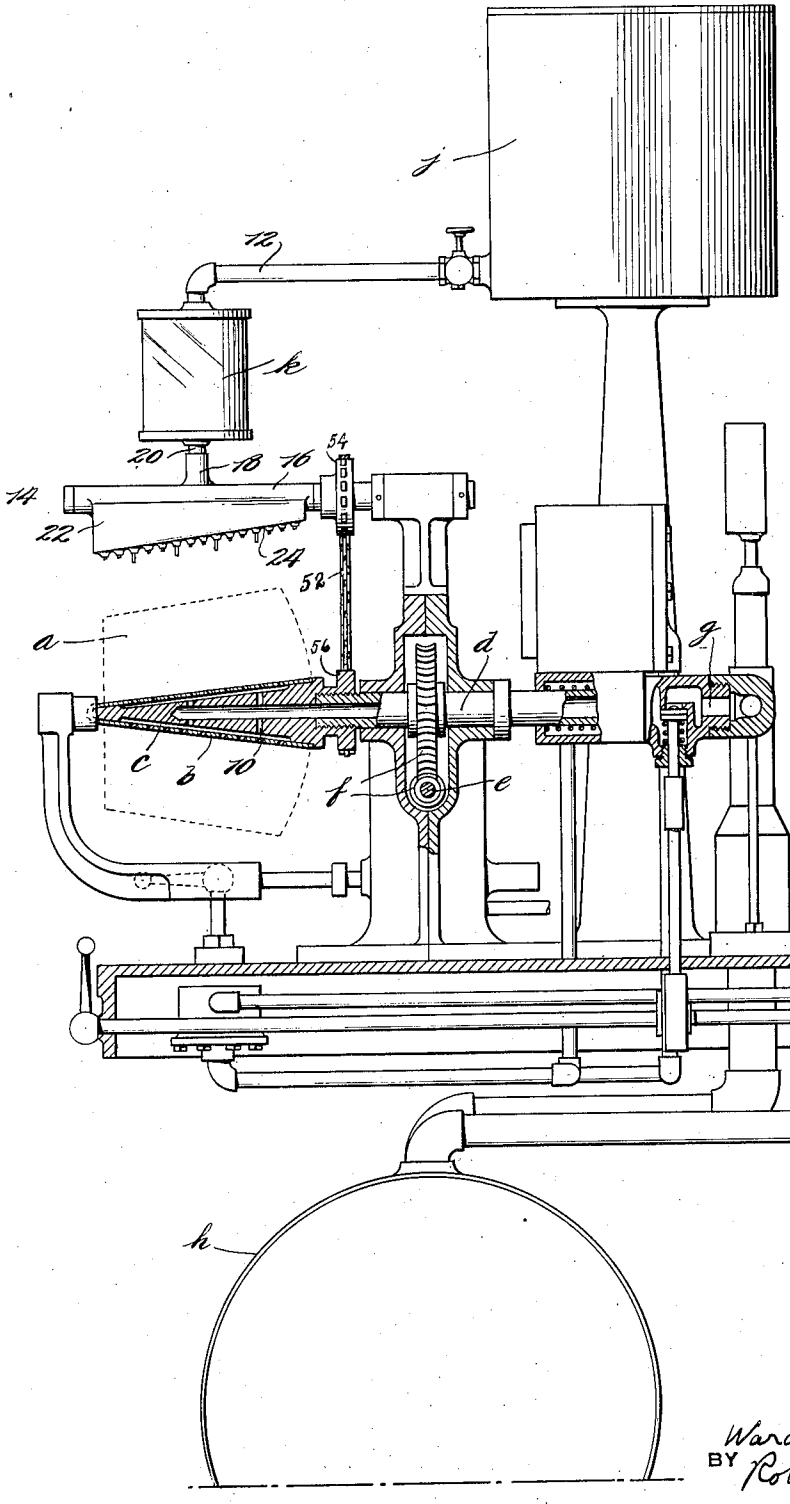



Fig. 1.

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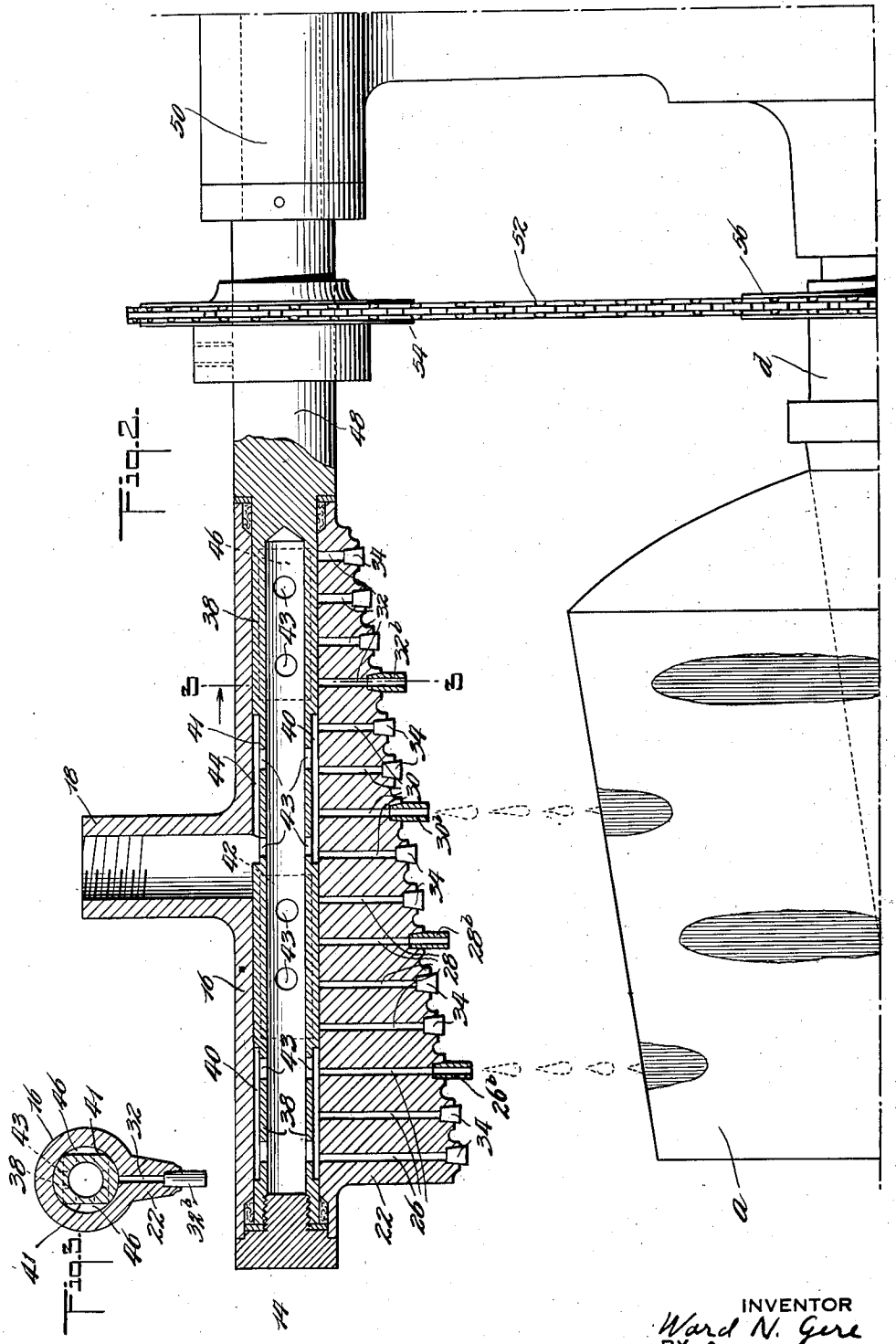



Fig. 2.




Fig. 3.

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# UNITED STATES PATENT OFFICE

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## APPARATUS FOR SPOTTING YARN IN THE MASS

Application filed February 8, 1929. Serial No. 338,386.

This invention relates to apparatus for spotting yarn in the mass, and aims to provide means for coloring various different, and differently distributed, portions of a wound mass of yarn so as to provide for different desired effects in the fabric knitted from the spotted yarn.

In a type of yarn spotting machine now in use, a cone or other wound mass of yarn is supported on a rotating suction core into which air is drawn through the mass, while the dye is applied to the exterior of the mass through one or more nozzles and is drawn inwardly through the mass to its core by the suction. In order that desired portions of the mass may be dyed evenly all the way into the core on such machines, it is necessary that the application of the dye to the surface of the core be continued during several rotations of the mass. It follows that the only portions of the mass which can be colored on such a machine are complete bands or zones extending all the way around the mass of yarn. This is a serious limitation on the effects which can be produced in fabric knitted from the spotted yarn.

My invention does away with this limitation and makes it possible to color sectors of a mass of yarn extending only part way around the mass. When applied to a yarn spotting machine of the type referred to, my invention may be carried out by controlling the supply of dye to the nozzle by means of a valve which is synchronized with the rotation of the mass of yarn so that it opens and closes at the same predetermined point of each revolution of the mass. A further feature of the invention consists in providing a plurality of nozzles and synchronized valves so arranged that dye is supplied to the nozzles alternately during each revolution of the mass.

In order to provide for further variety in selecting the portions of the mass to be dyed, my invention includes a plurality of nozzles arranged along the whole length of the mass, and permits the selective use of said nozzles by plugging those not required at any particular time. With such nozzles, I associate a common valve which may be used without alteration with any particular ones of the nozzles which are selected for use at a given time.

In order that the invention may be clearly understood, I will describe in detail a specific embodiment applied as an improvement on a known type of suction yarn spotting machine. In this description, I shall refer to the accompanying drawings, in which:

Fig. 1 shows an end elevation, partly in section, of operative parts of a known form of suction yarn-spotting machine with my invention incorporated therein;

Fig. 2 is an enlarged view of the distributor and valve of the machine shown in Fig. 1, showing these parts in longitudinal section and adjacent parts of the machine in elevation; and

Fig. 3 is a transverse section of the distributor and valve taken on the line 3—3 of Fig. 2.

The yarn spotting machine shown in Fig. 1 is designed to spot yarn mass *a* preferably wound in the form of a truncated cone on a conical perforated core *b*. The machine provides a conical rotary hollow mandrel *c* on which such a core may be supported. The mandrel differs from those of the ordinary machines of this character only in that it is provided with passages 10 from its hollow interior to its outer surface along substantially its whole length. It is mounted on one end of a hollow shaft *d* which is rotated from a motor shaft *e* through a worm gear connection *f*. The rear end of the hollow shaft is connected by a valve-controlled passage *g* with a vacuum tank *h* in which sub-atmospheric pressure is maintained by a suction pump not shown in the drawings. The machine thus provides for rotating a cone of yarn and applying suction to its inner surface.

The machine is also provided with a dye reservoir connected by a valve-controlled conduit 12 with an auxiliary reservoir or measuring cup. It has heretofore been customary to provide a direct connection between the measuring cup and a nozzle directed towards the cone of yarn *a*, so that dye is continuously poured on parts of the

outer surface of the cone *a* as the cone rotates. By means of my invention, however, the dye is supplied to the outer surface of the cone from the measuring cup *k* intermittently through a distributor 14 containing a valve synchronized with the rotation of the cone of yarn *a*.

The distributor 14 consists of a hollow cylinder 16 provided on its upper surface with an inlet nipple 18 which is secured on a pipe 20 communicating with the bottom of the measuring cup *k* and holds the distributor in fixed position with its axis parallel to the mandrel *c* and directly above the mandrel. A vertical flange 22 depends from the lower side of the cylinder 16. This flange 22 has an inclined lower edge 24 which is approximately parallel to the upper surface of a cone of yarn *a* mounted on the mandrel *c*. A considerable number of regularly spaced discharge passages arranged in four groups 26, 28, 30, 32 extend vertically through this flange and communicate with the bore of the cylindrical portion 16 of the distributor. These discharge passages have enlarged tapered portions at their lower ends, so that either a plug or a drip pipe may be inserted in each passage as desired. As illustrated, drip pipes or nozzles 26*b*, 28*b*, 30*b* and 32*b* are inserted each in one of the passages 26, 28, 30 and 32 respectively, the remaining passages in each group 26, 28, 30 and 32 being closed by plugs 34, 34. From the shape of the depending flange 22 already described, it follows that drip pipes inserted in any of the discharge passages are all located at the same distance from the upper surface of a cone of yarn on the mandrel *c*, so that the dye dripping from them will wet portions of the outer surface of the cone of the same area. The bores of the nozzles 26*b* to 32*b* are desirably of progressively increasing diameters, so that the nozzle of larger bore delivers onto the larger end of the yarn mass in order that the dye may penetrate to the core at about the same time throughout the length of the cone. Within the bore of the distributor 14 is a rotary valve member 38 which consists essentially of a hollow cylinder having ports 40, 42, 44, 46 which communicate with different groups of the discharge passages 26, 28, 30 and 32 during the rotation of the valve member. In the particular form illustrated, these ports are provided by flats 41, 41 on the outer surface of the valve member 38, each of which is in communication with the interior of the valve member through a radial hole 43. In the form illustrated in Fig. 2, the valve member 38 is provided with four pairs of such ports along its length. The two ports of each pair are diametrically opposite each other, while the ports of adjacent pairs are offset at an angle of 90°. Thus in the position of the valve member 38 shown in Fig. 2, one of the pair of ports 40 is in communication with the group of discharge passages 26, the next pair of ports 42 are closed by the inner surface of the distributor, one of the next pair of ports 44 is in communication with the third group of discharge nozzles 30, and the last pair of ports 46 is closed. It should be noted that the upper port of one of the two pairs 42 and 44 is always in communication with the intake nipple 18, so that a free passage for the dye is always provided between the nipple 18 and the discharge passages which register with any one of the ports.

However, one of each pair of ports 40, 42, 44 and 46 may be omitted, if desired, care being taken to arrange apertures 43 so that the interior of the rotary valve is always in communication with the bore in nipple 18.

The valve member 38 is fixed on one end of a shaft 48 journalled in the frame of the machine at 50 and driven from the mandrel shaft *d* by a chain 52 passing over two sprockets 54 and 56 of the same size on shafts 48 and *d* respectively. It follows that the valve member 38 makes one rotation for each rotation of the mandrel *c*.

In the operation of the machine which has been described, the dye is dripped from the pipes 26*b* and 30*b* during a quarter of the revolution of the yarn cone. It is then dripped through the pipes 28*b* and 32*b* through the next quarter of the revolution, and again through the pipes 26*b* and 30*b* for the next quarter of the revolution and so on. The dye is thus applied to the outer surface of the yarn mass *a* in four broken bands, and is sucked directly inward from the areas to which it is applied to the core of the cone by the suction which is applied within the mandrel *c*. On each revolution of the cone of yarn *a*, each nozzle applies dye to the same areas as those to which it has applied dye during the previous revolution, so that the operation may be continued for a sufficient length of time to draw the dye completely into the core *b* without dropping dye on any portions of the surface of the yarn *a* other than those to which dye was applied during the first revolution of the yarn. This result is attained by synchronizing the valve member 38 with the revolution of the cone *a*, so that each valve port 40, 42, 44 or 46 is open during the same portion of each successive revolution of the cone. Such synchronization, of course, does not require that the valve member make one revolution for each revolution of the mandrel, as in the form shown. If, for instance, one of each pair of ports 40, 42, 44 and 46 is omitted and the valve makes one revolution to one of the cone, each nozzle would make only one spot on the cone, but if the valve should make two turns to one of the cone, each nozzle would make two spots on the cone as in the

arrangement illustrated, whereas three turns of the valve to one of the cone would produce three spots per nozzle on the cone and so on. The axial length of the spot is controlled by the size of the nozzle.

It is apparent that by re-arranging the position of the plugs and drip pipes in each of the groups 26, 28, 30 and 32 of discharge passages, by leaving open a number of passages in each group, or, if desired, by plugging up those of one or more groups and leaving open such as may be desired in the other groups, a great variety of different parts of the cone may be dyed without in any way changing the valve structure. Furthermore, it is apparent that the invention permits still greater variety in the positioning of dyed portions since it is by no means limited to using a valve whose ports are open during just 90° of the revolution of the cone, but may be carried out by applying dye to any arc of the cone less than a complete circle.

It results from the operations heretofore described that the dyed portions of a given mass of yarn are spaced apart not only at the surface of the mass, but throughout its extent, and also that a given dyed portion of a mass of yarn extends only a fraction of the extent of the mass in any direction.

What I claim is:

1. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a nozzle for applying dye to the surface of the mass, and valve means controlling the flow of dye through the nozzle and synchronized with the rotation of the mass.

2. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a nozzle for applying dye to the surface of the mass, valve means controlling the flow of dye through the nozzle and synchronized with the rotation of the mass, said rotary support being hollow, and means for passing gas through the mass of yarn toward said hollow support.

3. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a nozzle for applying dye to the surface of the mass, and valve means controlling the flow of dye through the nozzle and synchronized with the rotation of the mass, said nozzle means and valve means being arranged to supply dye to the surface of the mass alternately at points spaced along the mass.

4. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a nozzle for applying dye to the surface of the mass, and a rotary valve controlling the flow of dye through the nozzle and synchronized with the rotation of the mass.

5. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a plurality of nozzles for applying dye to the surface of the mass and arranged above said support, a reservoir for dye, connections supplying dye to said nozzles from said reservoir, and rotary valves in said connections driven from said support.

6. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a plurality of nozzles for applying dye to the surface of the mass and arranged above said support, a reservoir for dye, connections supplying dye to said nozzles from said reservoir, rotary valves in said connections driven from said support, and said rotary valves supplying the nozzles alternately.

7. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, nozzles for applying dye to the surface of the mass, valve means controlling the flow of dye through the nozzles, said rotary support being hollow, and means for passing gas from the surface of the mass of yarn toward said hollow support, said nozzles and said valve means being arranged to supply the dye alternately at points spaced along the mass.

8. Apparatus for spot-dyeing a mass of yarn, comprising a rotary support for the mass of yarn, a plurality of nozzles arranged in line above the mass of yarn for applying dye to the surface of the mass, and a rotating valve supplying and cutting off dye to said nozzles alternately.

9. Apparatus for spot-dyeing a mass of yarn, comprising a support for the mass of yarn, a plurality of nozzles spaced above the mass of yarn for applying dye thereto, a source of dye for said nozzles, and a hollow rotary valve intermediate said nozzles and said source of dye and arranged to connect said nozzles to said source alternately.

10. Apparatus for spot-dyeing a mass of yarn, comprising a support for the mass of yarn, a plurality of nozzles above and spaced along the mass of yarn for applying dye thereto, a source of dye for said nozzles, and a hollow rotary valve structure intermediate said nozzles and said source of dye and arranged to connect said nozzles to said source alternately, said valve structure comprising a casing having a bore therein and having passages connecting said bore with said nozzles, a hollow valve member mounted and turning in said bore to connect said passages and to disconnect them from said bore, said hollow valve member having its outer face flattened to form ports between itself and said casing and having apertures connecting its interior with said ports, the outer face of said member intermediate said ports acting to close said passages at given intervals during the rotation of the valve member.

11. The apparatus as set forth in claim 10

and in which the ports on one portion of the hollow valve member are angularly displaced as compared to the ports on another portion of the hollow valve member.

12. A dye-applying mechanism, comprising a valve casing having a plurality of discharge passages, valve means having sections opening certain of said discharge passages alternately as compared to others, each of said valve sections controlling a plurality of passages, said passages being obstructed except one for each valve section.

13. A dye-applying mechanism, comprising a valve casing having aligned discharge passages and a valve member mounted to turn said casing member and casing being so constructed and arranged that said member opens some of said passages and closes others when in one position and closes the passages first opened and opens those first closed when turned through a material angle from said position.

14. Apparatus for spot-dyeing yarn including means adapted to discharge liquid on a mass of yarn, and a rotary valve controlling the flow of dye to said means and having a flattened portion acting as a port.

15. Apparatus for spot-dyeing yarn including means adapted to discharge dye on a mass of yarn, and a rotary valve controlling the flow of dye to said means and having a plurality of flattened portions arranged longitudinally of the valve and acting as ports, said valve having one flattened portion displaced angularly with respect to the one adjacent thereto.

16. A dye-applying mechanism, comprising a valve casing having aligned discharge passages and a valve member mounted to turn in said casing, said member acting to open said passages, the valve member intermediate said flattened portions acting to close said passages.

17. Apparatus for spot-dyeing a mass of yarn, having a rotary support for a yarn mass, discharge passages arranged to discharge on a mass of yarn on said support, and valve means controlling the flow of dye through said ports, said means opening a given discharge passage at a given point in successive revolutions of said yarn support, and maintaining the passage open for less than a complete revolution of the support.

18. Apparatus for spot-dyeing a mass of yarn, comprising means for rotating the yarn mass, means operated in synchronism with the revolution of the mass to apply dye to a sector of the outer surface of the mass extending part way around the mass, and means for causing the dye so applied to penetrate into the mass to color the portion of the mass between the area of application and the core of the mass.

In testimony whereof I have hereunto set my hand.

WARD N. GERE.