Sept. 3, 1940. R. L. IRWINE 2,213,585

FILTER-FORMING MACHINE

Filed Oct. 11, 1939 2 Sheets-Sheet 1

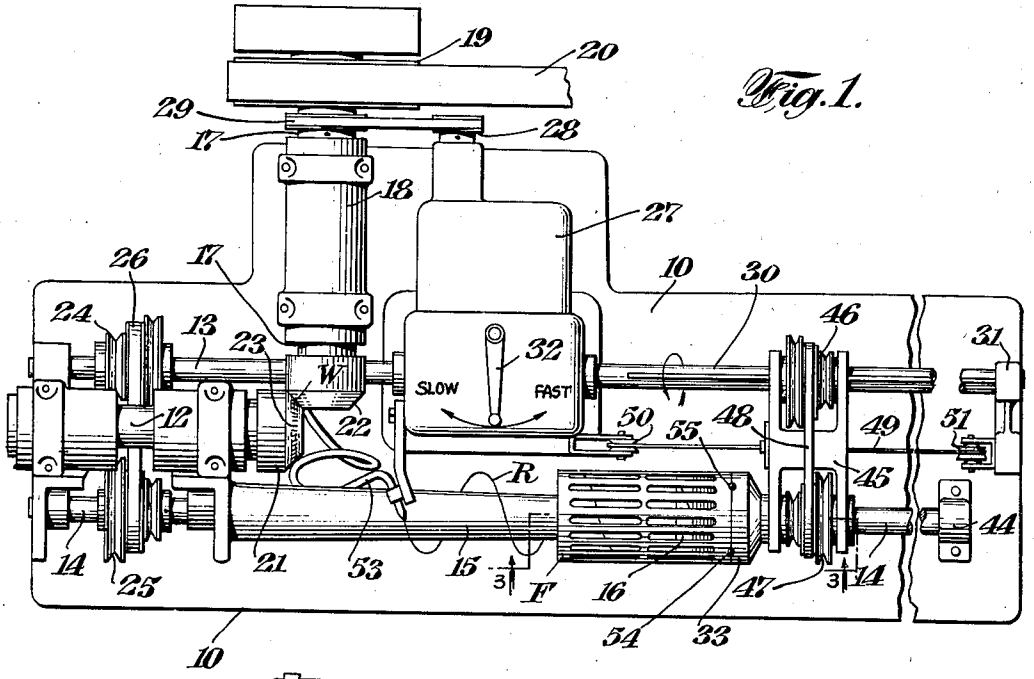


Fig. 1.

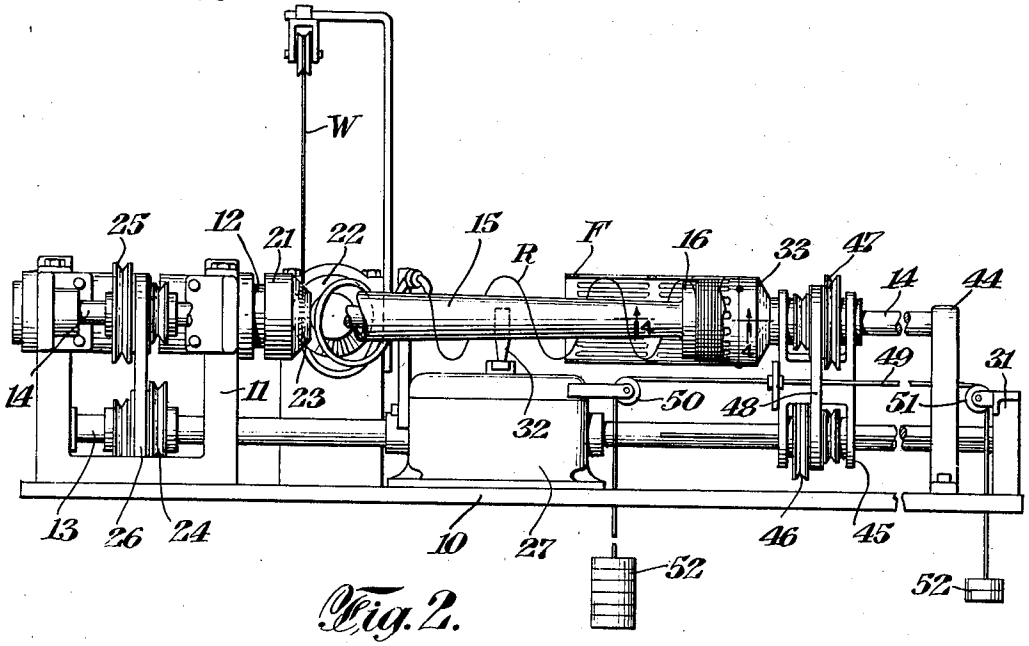


Fig. 2.

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Fig. 3.

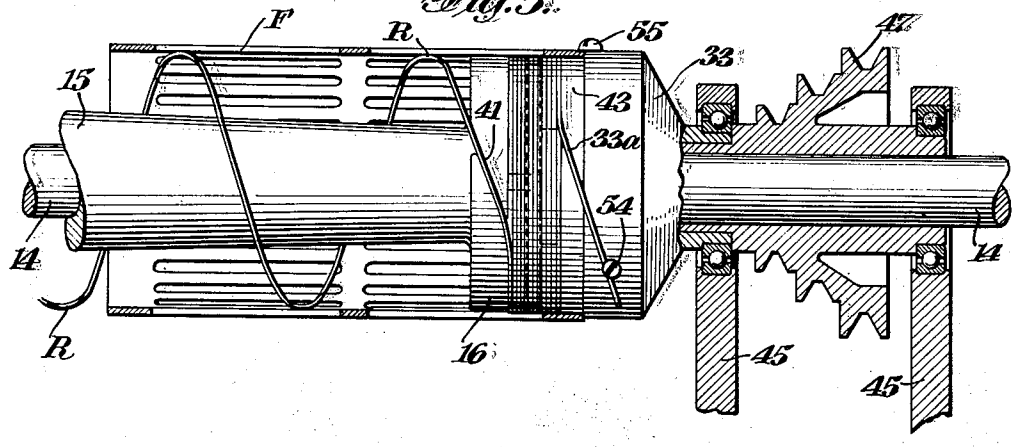


Fig. 4.

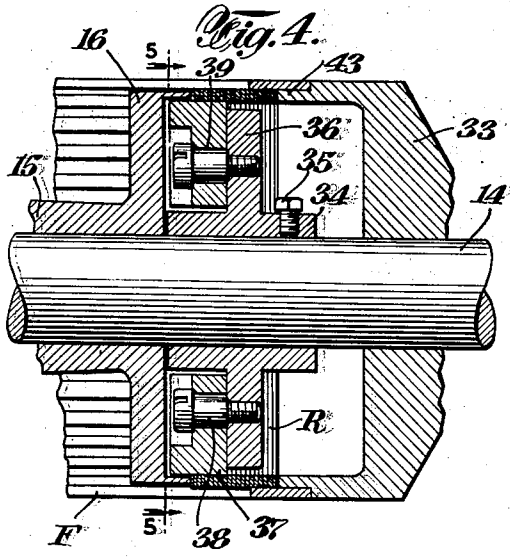


Fig. 5.

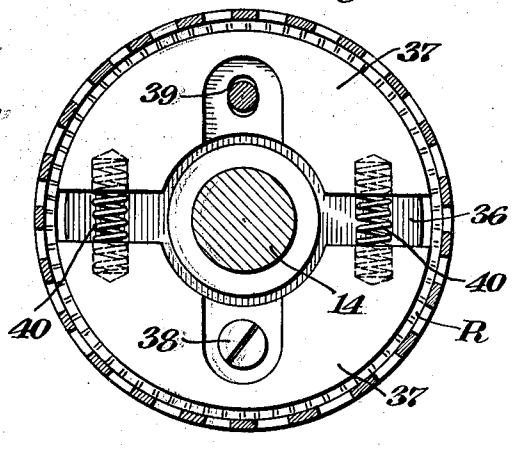
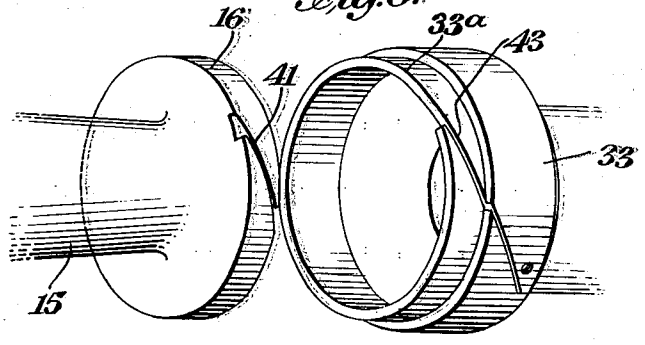


Fig. 6.



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FILTER-FORMING MACHINE

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Application October 11, 1939, Serial No. 298,885

26 Claims. (Cl. 140—71)

This invention relates to filter-forming machines.

One type of filter consists of a cylindrical grill-like frame containing a cylindrical filtering unit formed of a metal ribbon helically wound with its edges constituting the inner and outer surface of the cylinder, the turns of the helix being spaced to provide filtering interstices by projections extending from one face of the ribbon. The outer surface of the helix contacts the inner surface of the frame and the liquid to be filtered flows outwardly from the interior of the helix through the interstices.

An object of this invention is a simple and inexpensive machine for winding the metal ribbon into helical form within the frame with the outer surface of the helix in contact with the inner surface of the frame.

In its preferred embodiment, the machine is provided with a rotatable support for the frame and such support is provided with means for holding one end of the metal ribbon. The frame support is also mounted for axial movement and within the frame is arranged a stationary cylindrical block of such diameter that the frame fits it snugly, but rotates freely around it. The block is provided in its periphery with a groove oblique to the block axis and the ribbon passes through such groove into the frame. A rotatable shaft is journalled in the block and to this shaft is fixed a cylindrical guide or wiper of variable diameter, its maximum effective diameter being substantially equal to the interior of the helix to be formed and the wiper being normally held at such diameter by resilient means.

The ribbon is preformed of predetermined curvature and is equipped with spacers by any suitable mechanism such, for example, as conical forming rollers. The formed ribbon is fed on edge through the groove in the stationary block into the space between the wiper and the frame with both rotating in the same direction. The wiper may rotate at a slightly greater peripheral speed than the liner speed of the ribbon and the frame rotates at proper speed to lay the ribbon in turns as fast as the ribbon is delivered. The wiper thus tends to urge the ribbon into contact with the inner surface of the frame. As the helix builds up within the frame, it moves the frame and its support axially of the frame until the right length of helix has been produced at which time the operation of the machine is discontinued and the turns are fixed to the frame in any suitable manner such, for example, as by soldering.

Other objects, novel features and advantages of this invention will become apparent from the following specification and accompanying drawings, wherein:

Fig. 1 is a plan view of a machine embodying the invention;

Fig. 2 is a side elevation partially broken away and partially in section;

Fig. 3 is an enlarged fragmentary section on the line 3—3 of Fig. 1;

Fig. 4 is an enlarged fragmentary section substantially on line 4—4 of Fig. 2;

Fig. 5 is a section on the line 5—5 of Fig. 4, and

Fig. 6 is a perspective view of the block and frame support in substantially the same relation as shown in Fig. 3.

A bed 10 is provided at one end with a frame 11 in which is journalled a shaft 12, a second shaft 13 and a third shaft 14. A bar 15 is supported at one end by the frame 11 and is provided at its other end with a head or block 16, the shaft 14 extending through the bar 15 beyond the head 16 and having a bearing in the head. (Fig. 4). A shaft 17 is journalled in a frame 18 supported by the bed 10 and is provided at one end with a pulley 19 driven through the medium of belt 20 by a source of power, not shown. The shafts 12 and 17 are provided with conical faced rollers 21 and 22, the face of the roller 21 being provided with a series of radial slots 23.

The shafts 13 and 14 are provided with pulleys 24 and 25 and a belt 26 is provided for transmitting power from one to the other. An infinitely variable transmission 27 has its input shaft 28 driven from the shaft 17 through the medium of a belt 29 passing around pulleys provided on the shafts 17 nad 28. A shaft 30 parallel to the shaft 14 is journalled at one end in the transmission 27 and is journalled at its other end in a bracket 31 supported by the bed 10. The shaft 13 also has one end journalled in the transmission 27. The driving arrangement in the transmission 27 is such that the shaft 13 is rotated at a constant speed while the speed of rotation of the shaft 30 may be increased or decreased by manipulation of the control handle 32.

A cup-shaped head 33 is rotatably supported by the shaft 14 and has a portion of reduced diameter as shown at 33a in Fig. 6. A hub 34 is fixed to the shaft 14 for rotation therewith by a set screw 35 and is provided with a circular flange 36. Two substantially semi-circular

blocks 37 are attached to one face of the flange 36 by bolts 38 passing through elongated recesses 39, thereby permitting limited movement of the blocks 37 toward and away from each other. A pair of expansion springs 40 have their ends seated in recesses in the opposing faces of the blocks 37 and tend to move the blocks apart. In the head 16 is provided a circular recess which partially receives the blocks 37, the surface of the recess serving to limit the movement apart of the blocks 37. (Fig. 4.)

As shown in Fig. 6, the head 16 is provided with an oblique or helical groove 41 and the head 33 is provided with a similar slot 43. The exterior diameters of the head 16 and the portion 33a of the head 33 are the same, so that when they are brought into contact a continuous cylindrical surface results. The end of the shaft 14 extending beyond the head 13 has its end journalled in a bracket 44 supported for movement into and out of journalling position with respect to the shaft 14. A frame 45 journals a set of pulleys 46 slidably keyed to the shaft 30 and a set of pulleys 47 fixed to the head 33 and both rotatable and slideable on the shaft 14. A belt 48 is provided for effecting rotation of one set of pulleys by the other. A cable 49 is attached to the frame 45 and passes over pulleys 50 and 51. Weights 52 are attached to the opposite ends of the cable 49 and the relation between the two weights is such that they tend to oppose movement of the frame 45 to the right.

When operated, the machine above described produces a filter consisting of a cylindrical grill-like frame containing a filtering unit comprising a metal ribbon helix, the turns of which are slidably spaced by transverse projections extending from one face of the ribbon. The ribbon is produced by feeding a metal wire W between the conical faces of the rollers 22 and 23, the roller 22 being positively driven by the shaft 17 and the roller 21 being frictionally driven from the roller 22 through the medium of the wire W. The wire is converted into a flat ribbon of predetermined curvature and transverse projections are produced on one face by the action of the indentations 23. The ribbon R thus formed is conducted through a guide tube 53 which causes it to advance in helical form around the bar 15 to the head 16 where it passes on edge through the slot 41.

In conditioning the machine for the production of a filter, the bracket 44 is disengaged from the end of the shaft 14 and the frame 45, together with the head 33 is moved to the right sufficiently to clear the end of the shaft 14, after which it is swung out of alinement with the shaft 14 about the shaft 30. The frame F which is to constitute a part of the finished filter is then placed over the head 16 and the frame 45 is returned to the position shown in Fig. 1 with the head 33 contacting the head 16. The end of the ribbon R is located in the groove 43 in the head 33 and is locked in place by the set screw 54. Next, the right hand end of the frame F is placed on the reduced portion 33a of the head 33 which it fits snugly and is fixed thereto by bolts 55. With the parts thus arranged, the machine is in condition for operation to produce the desired filter.

As previously described, rotation of the roller 22 by the shaft 17 produces metal ribbon of predetermined curvature which is fed through the slot 41. The head 33 is rotated from the shaft 30 through the medium of the pulleys 46 and 47 and belt 48, the speed of rotation of the head being variable by operation of the handle 32. Rotation of the head 33 and continued feed of the ribbon R builds up the helical structure within the frame F and due to the fact that the head 16 is stationary, such building up of the helix causes movement to the right of the head 33 and attached frame F, together with the frame 45 and the parts associated therewith, such motion being opposed by the weights 52. At the same time, the shaft 14 together with the wiper consisting of the blocks 37 is caused to rotate in the same direction as the head 33 preferably at a somewhat higher linear speed than the feed rate of the ribbon R. The outer surface of the wiper engages the inner surface of the ribbon and forces it outwardly against the inner surface of the cage F and also urges the ribbon in the direction of rotation of the head 33. The diameter of the recess in the head 16 is such that the recess wall is substantially the same thickness as the width of the ribbon R. Consequently, the maximum effective diameter of the wiper is less than the interior diameter of the frame F by the width of the ribbon R. The wiper, therefore, tends to lay the ribbon with its outer edge snugly contacting the inner surface of the frame F and is yieldable to compensate for any variation in the width of the ribbon. By operation of the handle 32, the rotational speed of the head 33 is controllable to insure that the ribbon R is wound up in the frame at the same rate that it is delivered by the forming rolls 22 and 23.

Rotation of the head 13 is continued until the frame F has been sufficiently filled with the ribbon helix after which operation of the machine is discontinued and both ends of the helix are fixed to the frame by soldering or other equivalent procedure and the ribbon, of course, is cut. Also, the ribbon is disconnected from the head 33 by loosening the set screw 54 and the bolts 55 are loosened to permit disengagement of the head 33 from the frame F. Next, the bracket 44 is disengaged from the shaft 14 and the frame 45 is manipulated to move the head 33 out of alinement with the head 16 thereby permitting removal of the finished filter.

It is, of course, understood that various modifications may be made in the apparatus above described without departing in any way from the spirit of the invention as defined in the appended claims.

I claim:

1. A device for forming a filter from metal ribbon having definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block, a shaft journalled in said block, a head slidably and rotatably mounted on said shaft and being adapted to support a cylindrical frame for rotation about said block and movement axially thereof, means for rotating said shaft and said head, and means for guiding the ribbon into edge contact with the inner surface of said frame between said block and head.

2. A device according to claim 1 in which means are provided for feeding said ribbon through said guiding means.

3. A device for forming a filter from metal ribbon having definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block, a shaft journalled in said block, a head slidably and rotatably mounted on said shaft and being adapted to support a cylindrical frame for rotation about said

block and movement axially thereof, a cylindrical member fixed to said shaft between said head and said block, means for rotating said shaft and said head, and means for guiding the ribbon into edge contact with the inner surface of said frame between said block and said head.

4. A device according to claim 3 in which means are provided for feeding said ribbon through said guiding means.

5. Apparatus according to claim 1 characterized by co-directional rotation of said shaft and said head.

6. Apparatus according to claim 3 characterized by co-directional rotation of said shaft and head.

7. A device according to claim 3 in which said cylindrical member is of variable size and is provided with resilient means tending to oppose decrease of its size.

8. A device for forming a filter from metal ribbon having a definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block, a shaft journalled in said block, a head slidably and rotatably mounted on said shaft and being adapted to support a cylindrical frame for rotation about said block and movement axially thereof, a two-section substantially cylindrical member fixed to said shaft between said block and said head, the sections of said member being supported for movement toward and away from each other with resilient means tending to move said sections apart, means limiting the extent of movement apart of said sections, means for rotating said shaft and said head, and means for guiding the ribbon into edge contact with the inner surface of said frame between said block and said head.

9. A device for forming a filter from metal ribbon having definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block having a cylindrical recess, a shaft journalled in said block concentric of said recess, a head slidably and rotatably mounted on said shaft and being adapted to support a cylindrical frame for rotation about said block and movement axially thereof, a two-section substantially cylindrical member fixed to said shaft and having one end extending into said recess, the sections of said member being supported for movement toward and away from each other with resilient means tending to move said sections into contact with the wall of said recess, means for rotating said shaft in said head, and means for guiding the ribbon into edge contact with the inner surface of said frame between said block and head.

10. Apparatus according to claim 8 characterized by co-directional rotation of said shaft and said head.

11. Apparatus according to claim 9 characterized by co-directional rotation of said shaft and said head.

12. A device of the character described comprising a cylindrical block having a groove in its surface oblique to its axis, means for converting wire into flat ribbon of definite curvature about an axis perpendicular to its wide faces with spacers on one face and feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member fixed to said shaft adjacent said block and being of less diameter than said block by the width of said ribbon, means for supporting a cylindrical frame for rotation about said block in contact therewith and for movement axially of the block, and means for rotating said frame-supporting means and said shaft.

13. A device of the character described comprising a cylindrical block having a groove in its surface oblique to its axis and having a recess in one face, means for converting wire into flat ribbon of definite curvature about an axis perpendicular to its wide faces with spacers on one face and feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member fixed to said shaft and fitting into said recess, the interior diameter of said recess and the outer diameter of said member being of less diameter than the diameter of said block by the width of said ribbon, means for supporting a cylindrical frame for rotation about said block in contact therewith and for movement axially of said block, and means for rotating said frame supporting means and said shaft.

14. A device according to claim 13 in which said cylindrical member is of variable diameter and resilient means are provided for maintaining the outer surface thereof in contact with the inner surface of said recess.

15. A device of the character described comprising a cylindrical block having a groove in its surface oblique to its axis, means for converting wire into flat ribbon of definite curvature about an axis perpendicular to its wide faces with spacers on one face and feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member of less diameter than said block by the ribbon width fixed to said shaft, a head slidable and rotatably mounted on said shaft, and means for rotating said shaft and said head.

16. Apparatus according to claim 15 in which said cylindrical member is of variable diameter and means including resilient members are provided for normally maintaining the diameter of said member less than the diameter of said block by the width of said ribbon.

17. A device of the character described comprising a cylindrical block having a groove in its surface oblique to its axis and having a cylindrical recess in one end, means for converting wire into flat ribbon of definite curvature about an axis perpendicular to its wide faces with spacers on one face and feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member fixed to said shaft and extending into said recess, the diameter of said member and the interior diameter of said recess being less than the diameter of said block by the width of said ribbon, a head slidable on and rotatably mounted on said shaft, and means for rotating said head and said shaft.

18. A device according to claim 17 in which said cylindrical member is of variable diameter and is provided with resilient means tending to increase its diameter.

19. Apparatus according to claim 12 characterized by rotation of the frame-supporting means and the shaft in the same direction.

20. Apparatus according to claim 15 characterized by co-directional rotation of said shaft and said head.

21. A device of the character described comprising a cylindrical block having a groove in its surface oblique to its axis, means for converting wire into flat ribbon of definite curvature about an axis perpendicular to its wide faces with spacers on one face and feeding said ribbon on edge through said groove, a shaft journalled in

said block, a cylindrical member of less diameter than said block fixed to said shaft, a head slidably and rotatably mounted on said shaft, and means for rotating said shaft and said head.

22. Apparatus according to claim 21 characterized by co-directional rotation of said shaft and said head.

23. A device for forming a filter from metal ribbon having definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block having a groove in its surface oblique to its axis, means for feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member of less diameter than said block by the ribbon width fixed to said shaft, a head slidably and rotatably mounted on said shaft and being adapted to support a cylindrical frame for rotation about said block in contact therewith and for movement axially of said block, and means for rotating said shaft and said head.

24. A device according to claim 23 in which said member is of variable diameter and means including resilient elements are provided for normally maintaining the diameter of said member less than the diameter of said block by the width of said ribbon.

25. A device for forming a filter from metal ribbon having definite curvature with respect to an axis perpendicular to its wide faces, said device comprising a cylindrical block having a groove in its surface oblique to its axis and having a cylindrical recess in one end, means for feeding said ribbon on edge through said groove, a shaft journalled in said block, a cylindrical member fixed to said shaft and extending into said recess, the diameter of said member and the interior diameter of said recess being less than the diameter of said block by the width of said ribbon, a head slidable on and rotatably mounted on said shaft, said head being adapted to support a cylindrical frame for rotation about said block in contact therewith and for movement axially of said block, and means for rotating said head and said shaft.

26. A device according to claim 25 in which said cylindrical member is of variable diameter and is provided with resilient means tending to oppose decrease of its diameter.

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