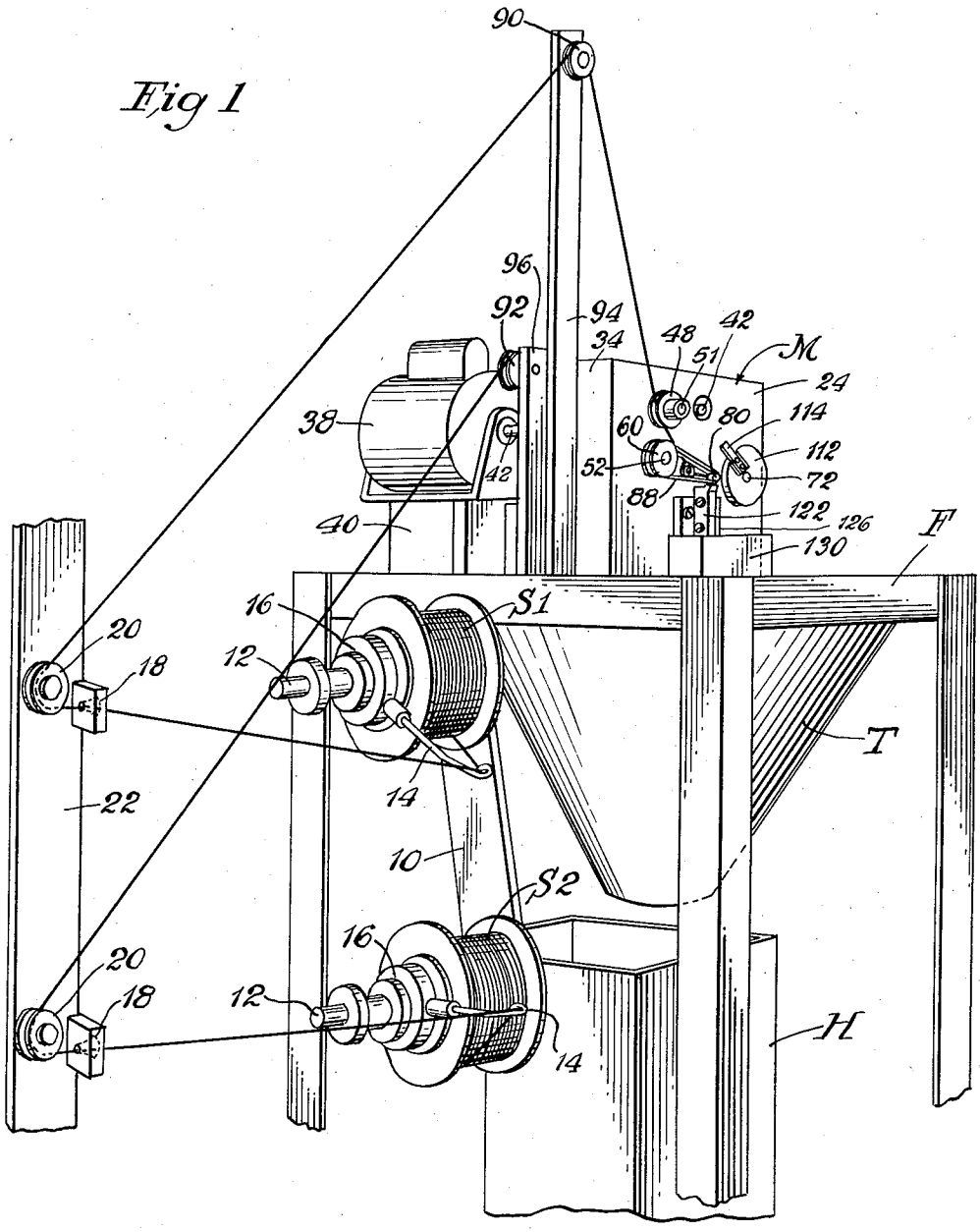
Nov. 25, 1958 W. W. LOWTHER 2,861,621

COIL MAKING MACHINE HAVING A FLEXIBLE BELT FORMER

Filed March 25, 1955 5 Sheets-Sheet 1

Fig 1



Inventor
Wilfred W. Lowther

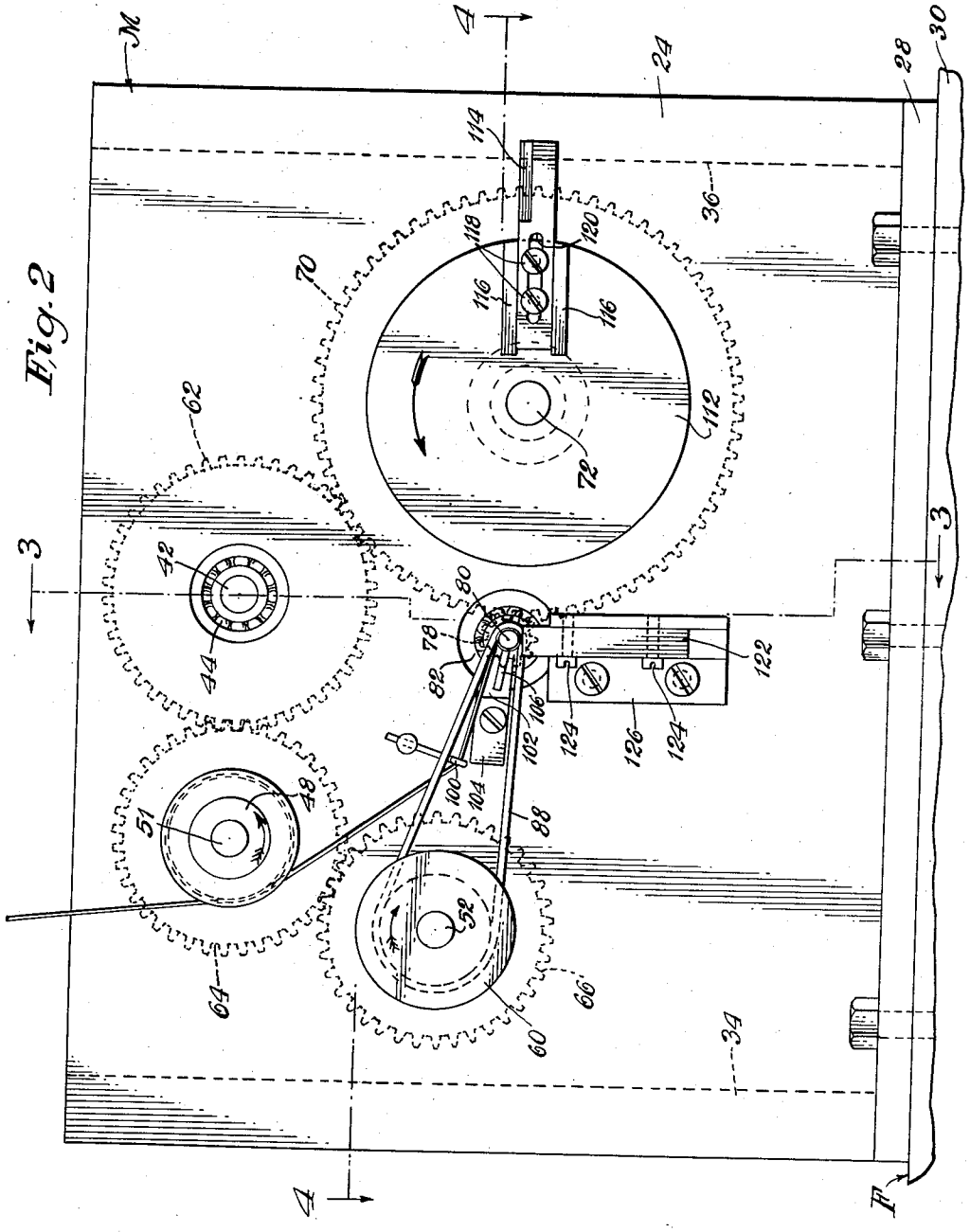
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COIL MAKING MACHINE HAVING A FLEXIBLE BELT FORMER

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Fig. 2



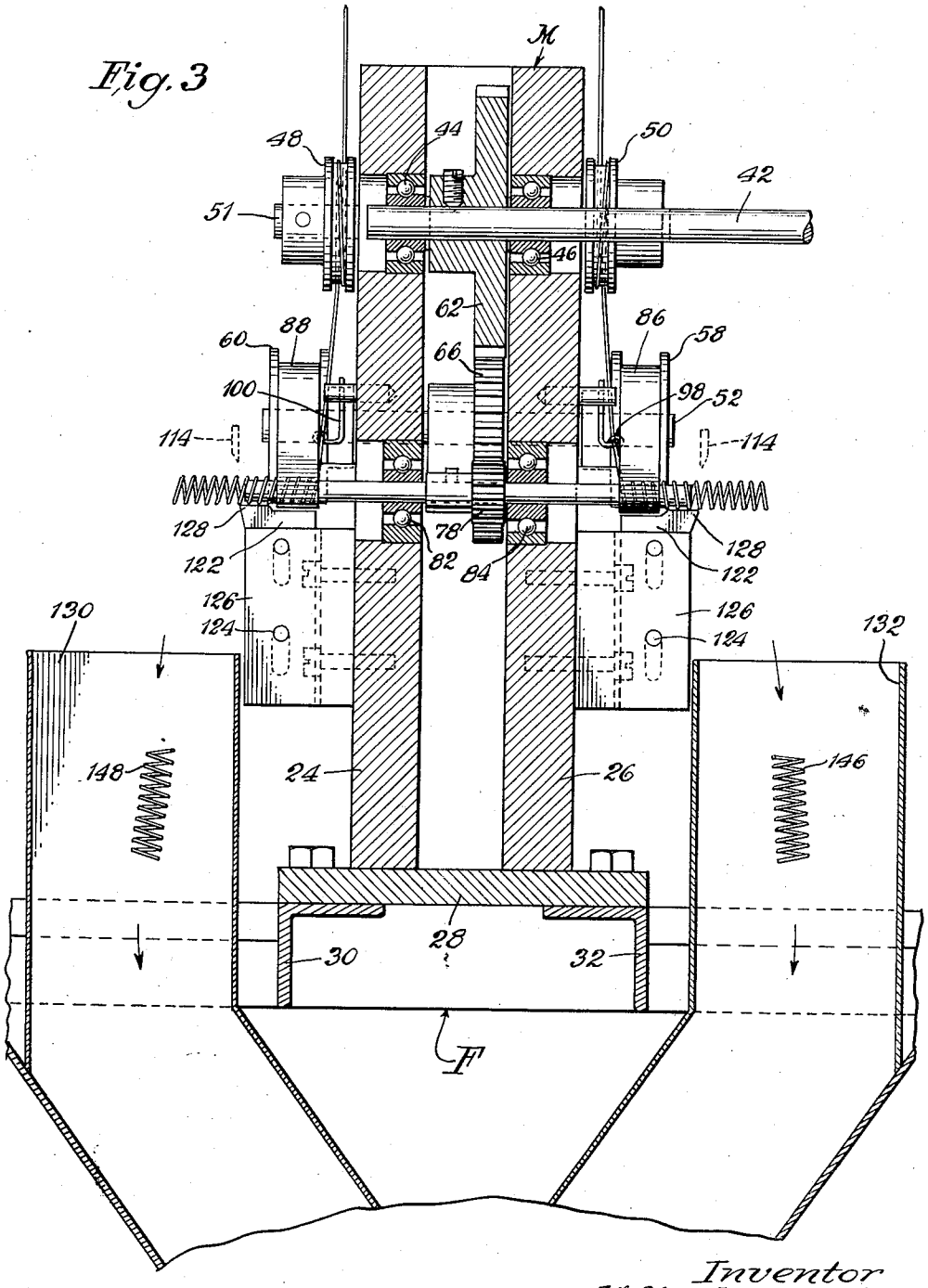
Inventor
Wilfred W. Lowther
by Parker & Carter
Attorneys

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Fig. 3



Inventor
Wilfred W. Lowther

by Parker & Carter
Attorneys

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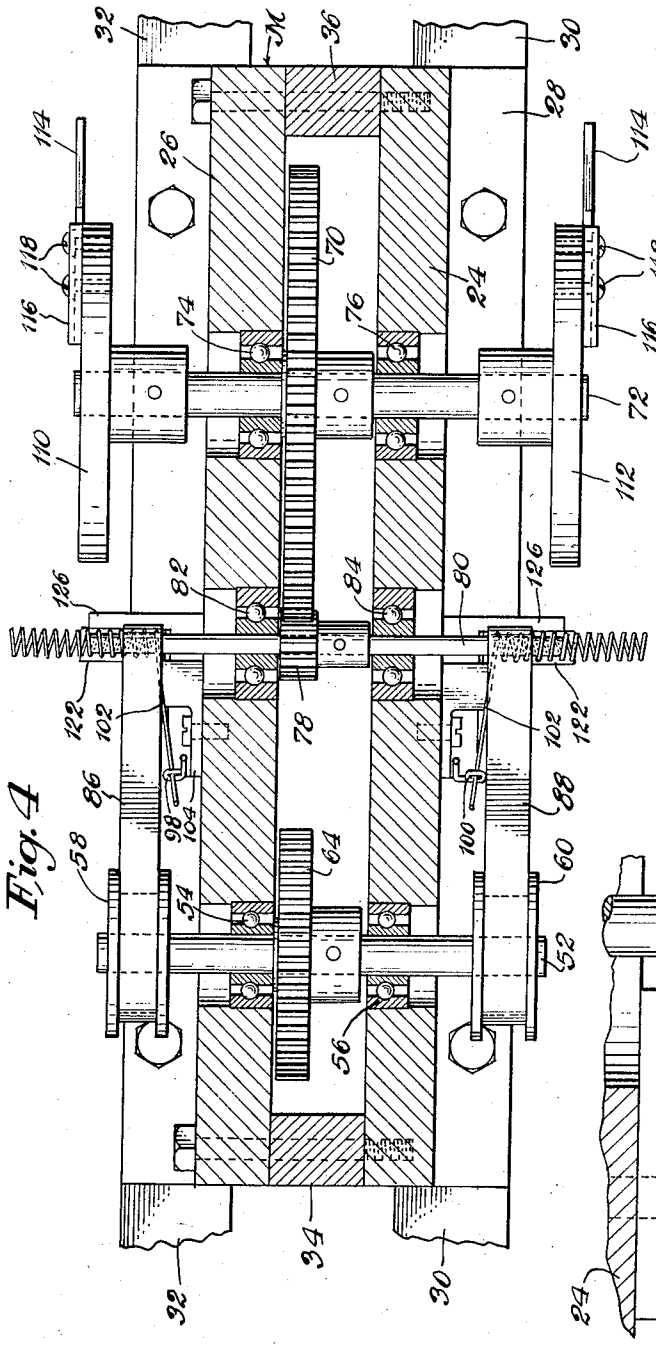


Fig. 4

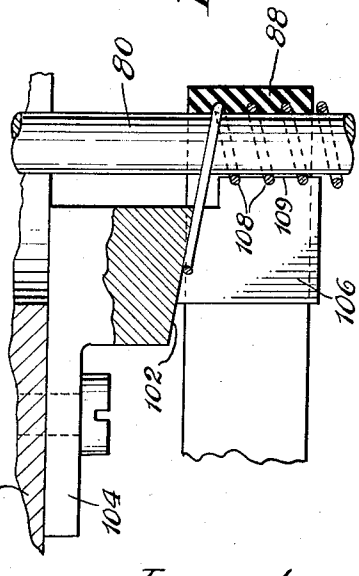


Fig. 5

Inventor
Wilfred W. Lowther

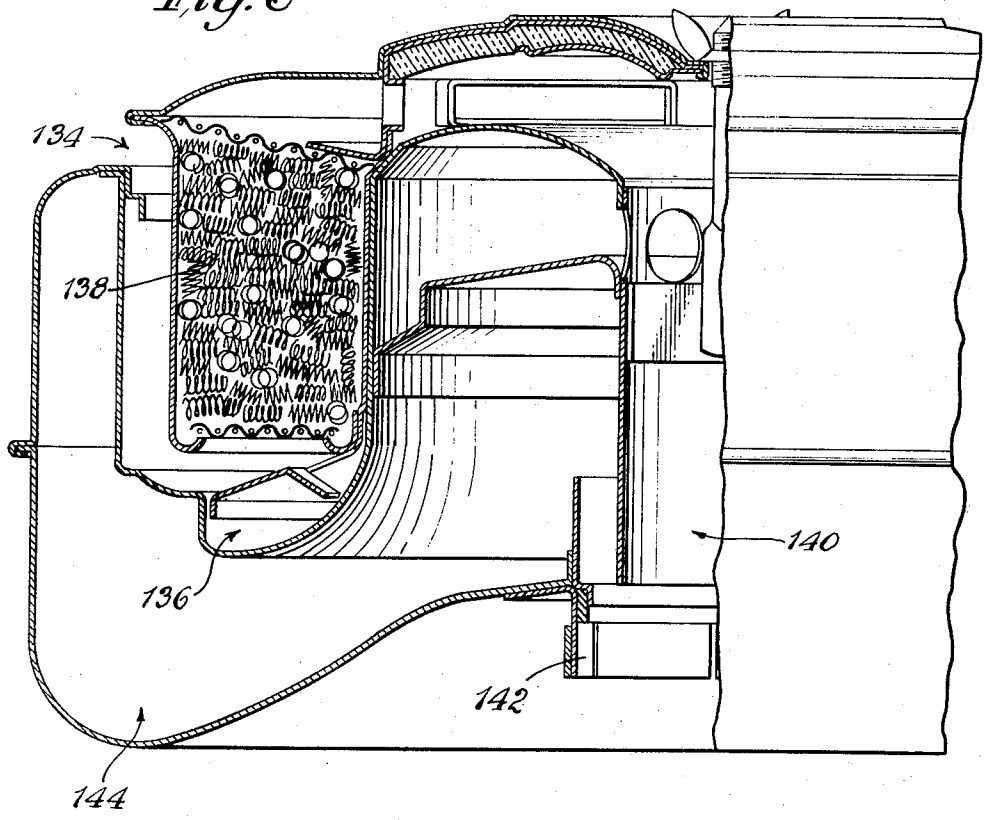
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Attorneys

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COIL MAKING MACHINE HAVING A FLEXIBLE BELT FORMER

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Fig. 6



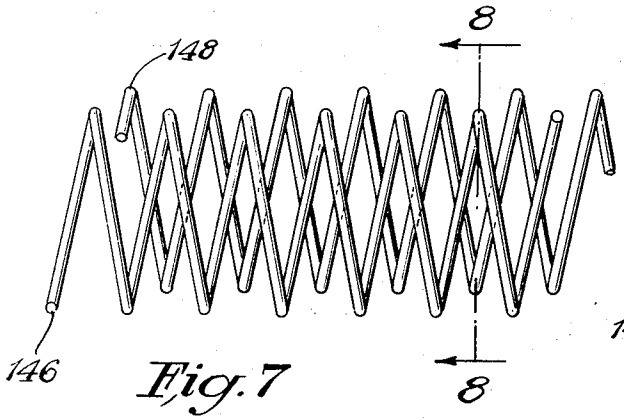


Fig. 7

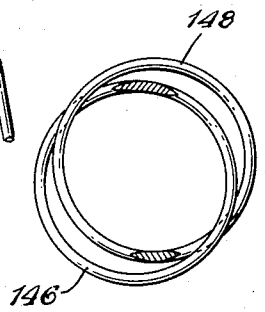


Fig. 8

Inventor
Wilfred W. Lowther

by Parker & Carter
Attorneys

United States Patent Office 2,861,621
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2,861,621

COIL MAKING MACHINE HAVING A FLEXIBLE BELT FORMER

Wilfred W. Lowther, Chicago, Ill., assignor, by mesne assignments, to United Specialties Company of Illinois, Chicago, Ill., a corporation of Delaware

Application March 25, 1955, Serial No. 496,729

5 Claims. (Cl. 153—64)

This invention is in the field of methods and apparatus for making a filter medium such as the type commonly used in air filters of the oil bath type for use on air consuming devices, for example internal combustion engines.

A primary object of my invention is a device for making or forming a filter medium composed of a plurality of separate spring elements or small coils of wire, which, when packed into a suitable filter housing, form an effective and efficient filter medium usable in an air cleaner, for example, the oil bath type.

Another object is a mechanism of the above type which produces coils at a very rapid rate.

Another object is a method of making filter mediums.

Another object is a device which produces both right and left hand coils at the same time in equal quantities.

Another object is a filter element composed of a filter housing enclosing a plurality of coil wires or coils, the coils having right and left hand helixes with approximately an equal number of each type.

Another object is a device of the above type which makes both right and left coils simultaneously and is adapted at the same time to fill a suitable filter housing.

Another object is a coil forming machine of the above type adapted to form helical coils between a cylindrical mandrel and a distortable or pliable forming or bending element.

Another object is a device for unwinding wire or the like from a spool without rotating the spool.

Another object is a coil forming machine of the above type with means for feeding wire or the like to the coil forming mechanism on a demand basis.

Other objects will appear from time to time in the ensuing specification and drawings in which:

Figure 1 is a perspective view of my new and improved coil forming machine;

Figure 2 is a side view of the coil producing mechanism;

Figure 3 is a sectional view taken along line 3—3 of Figure 2;

Figure 4 is a sectional view taken along line 4—4 of Figure 2;

Figure 5 is a sectional view similar to Figure 4, but on an enlarged scale, showing the coil forming mechanism;

Figure 6 is a partial side view, in section, of a filter element;

Figure 7 is an enlarged view of the coils in the filter element; and

Figure 8 is a sectional view along line 8—8 of Figure 7.

In Figure 1 a frame or housing F suitably supports a coil forming machine M and a suitable funnel or track T guides the coils as they are formed into a filter housing H positioned directly below the open end of the track or funnel. The housing H could be on scales to accurately weigh the coils deposited in the housing and the filter housings can be brought to and removed from the position in Figure 1 by suitable roller tracks or the like, all of which is unimportant to the present invention.

Wire spools S–1 and S–2 are mounted on a suitable side element 10 on the frame by horizontally positioned rods 12 which carry rotary feed arms 14 and locking collars 16 to hold the feed arms and spools in place. The details of the spool structure and the supporting mechanism are not important to the present invention except that the spools are held stationary and the rotary feed arms 14 are allowed to spin. This feeds the wire from the spools to and through eyes 18 and over rollers 20 mounted on a suitable bar or stanchion 22 in spaced relation to the frame F. It should be noted that the eyes 18 are axially aligned with the rods 12 so that the wire from each of the spools can be easily drawn from them in an axial direction without rotating the spools.

The coil forming machine M on the frame includes a pair of side plates 24 and 26 suitably mounted on a flat plate 28 on suitable angle irons 30 and 32 extending across the frame to provide a housing. In Figure 4, I have shown end elements 34 and 36 held by suitable bolts or the like to close the ends liquid tight and add stability to the housing so that an oil tight gear box is formed, oil or a suitable lubricant being provided up to the level of the lowest gear. The top can also be closed and provided with a suitable breather cap. An electric motor 38 or the like in Figure 1 is mounted on a suitable stand 40 adjacent the housing and has an output or drive shaft 42 which extends through the housing and is carried by suitable ball bearings 44 and 46 or the like in Figure 3. Slip pulleys 48 and 50 are carried on a second shaft 51 on each side of the housing. A third shaft 52 is mounted in the housing on suitable ball bearings 54 and 56 or the like and carries belt pulleys 58 and 60. These pulleys are driven by the motor shaft through a driving gear 62 on the motor shaft and driven gears 64 and 66 on the second and third shafts. The driving gear 62 on the shaft 42 engages a driven gear 70 on a fourth shaft 72 supported by suitable ball bearings 74 and 76 in the housing. The gear 70 meshes with a small pinion 78 carried by a mandrel 80 which is supported by suitable ball bearings 82 and 84 in the housing and projecting from each side as shown in Figure 4.

Belts 86 and 88 of a suitable material for example, rubber, leather, or the like, are looped around each of the pulleys 58 and 60 and pass around the projecting ends of the mandrel. The gear ratios and diameters of the pulleys and mandrel are such that the belts ride smoothly without slip around the pulleys and mandrel. Suitable belt tighteners could be used, if desired, such as a spring biased pivoted wheel.

The incoming wires from the spools S–1 and S–2 are led over suitable rollers 90 and 92 on upright posts 94 and 96 or the like and are looped around the slip pulleys 48 and 50 once or more as shown in Figure 3 and are fed in through suitable eye guides 98 and 100 on each side of the housing. Each guide is suitably mounted by a pin or the like and is positioned between the throws of the belt. Thus the wire is brought in between the throws of the belt and is fed forward from this eye guide as shown in Figure 2. The wire is deflected at an angle by a surface guide surface 102 on a guide element 104, as shown in Figure 5, suitably attached by a screw or the like between the throws of the belt as shown in Figure 2 to the side of the housing, the angle of deflection being obtuse to the mandrel in the direction of movement of the coil. The wire is turned or formed around the rotating mandrel by the belt into a helix by a guide extension 106 which has a plurality of longitudinally spaced guiding slots 108 along its forward edge 109. As will be clear from Figures 2 and 5 the forward edge 109 of the guide is positioned almost in contact with the mandrel so that as the wire is bent around the mandrel in a helix form,

the spaced slots feed the wire coil outwardly so that it will project beyond the end of the mandrel as shown in Figure 4.

The fourth shaft 72 carries cutter disks 110 and 112 on each end, each disk having a knife blade 114 adjustably mounted to extend in a radial direction by suitable guides 116 and screws 118 or the like extending through a slot 120 in the blade. These blades are adapted to pass or cross the end of the mandrel as the disks are rotated as shown by the dotted lines in Figure 3, and a stationary blade 122 is adjustably mounted by suitable screws 124 on a bracket 126 on the side of the housing. As shown in profile in Figure 3, each stationary blade projects slightly at 128 to cooperate effectively with the moving blade 114.

Tubes 130 and 132 open on each side of the housing directly below the coil forming and cutting station to receive the coils as shown in Figure 3. The tubes joined together in a Y-type connection or empty directly into the funnel T so that the coils, as they are formed, will be directed into the housing H of the cleaner.

The use, operation and function of my invention are as follows.

This machine takes wire from two conventional spools and forms it into helical coils which, as they are formed, are cut periodically into a predetermined length and deposited into a suitable filter housing. The wire runs in diameter between .007 to .015 inch, by way of example, and can be easily bent or formed by the flexible belt. The machine has a rapidly rotating arbor or mandrel with a belt looped around it. The arbor or mandrel projects from each side of the housing, and two wires are led by suitable guides to each side between the belts and mandrels. The belts perform the function of bending or forming the wires around the mandrel into a coil. The slots 108 in the guide 106 cause the wire to feed outwardly in a helix and the knives 114 on the rotating disks periodically cut off the coil to form small individual or separate coils.

It should be noted that the coils formed on each side will have different helices, one having a left hand helix and the other having a right hand helix. Two such coils are formed at the same time, one of each type, so that theoretically, in a given interval of time, the machine will produce an equal number of right and left hand coils. The belts are in tension around the mandrels and pulleys and are sufficiently sturdy to form the wire around the mandrel. Furthermore the belts and mandrels serve to feed the wire, and the slip pulleys 48 and 50 perform a capstan function of drawing the wires from the spools as long as tension is placed on the wires between the slip pulleys and the mandrels by their frictional drive. If any slack develops in the wires between the mandrels and slip pulleys, the slip pulleys 48 and 50 will merely spin or slip inside of their loop of wire. When the wire is again tensioned by the mandrel and belt, the slip pulleys will take up the heavy duty of drawing the wire from the spools.

To start the unit, the wires should be threaded through the eyes and around the rollers and slip pulleys and through the eye guides 98 and 100. The belt should be removed and the wires wound around the mandrel and spaced by the notches 108 in the guide 106, the belts should be replaced and the machine is ready for operation. As the wire is coiled by the belts and mandrels, it is fed outwardly beyond the end of the mandrels by the notches 108 in the guide 106 and is periodically severed by the rotating knives 114.

An important feature of the invention is the equal number of right and left hand helical coils produced by this machine. If all of the coils have the same helix, they will have more of a nesting tendency. When packed in a filter housing, the turns or convolution of one coil will easily mesh with one or more adjacent coils. Thus a more solid mass of filtering medium results which fails

to produce an efficient filtering function. By having a filter medium with approximately an equal number of right and left hand helix coils, the coils will have less of a tendency to intertwine and closely mesh with one another, and the filtering efficiency of the medium will be greatly improved.

In Figure 6 I have shown, partly in section, a filter housing such as in Dreznes Patent No. 2,690,233. Generally this cleaner has an annular air inlet 134, an oil sump 136, a filter medium 138 and a clean air outlet 140 adapted to be attached to a carburetor by a suitable connection 142. A silencer chamber 144 surrounds the filter medium on both sides and extends below it as disclosed in the Dreznes patent.

The filter medium 138 is encased in a conventional housing and is composed of a plurality of closely packed helical coils.

In Figure 7, two such coils 146 and 148 have been shown, one having a left hand helix and the other a right hand helix. These two coils will not tend to closely nest and when tightly compressed together, will nevertheless present a substantial amount of free wire surface.

In Figures 7 and 8 the two coils have been shown in slightly spaced relation and it should be understood that in use they will be more tightly compressed so that one turn will closely approach another. But the adjacent or corresponding turns of two such coils will not contact each other throughout their length due to their left and right hand helices.

The coils deposited in each filter housing can be measured by scales or by a revolution counter, appropriately graduated, on the driving mechanism.

By this invention, I can drive the machine at speeds to produce 2100 R. P. M. on the knives which will produce approximately 4200 coils per minute which is a production capacity far and above any coil forming machine known before this time.

It should be understood that the above figures are merely given as an example, and the invention of course is not restricted to that rate of speed.

In the appended claims, I have used the term wire and it should be understood that this does not necessarily imply a metallic wire. For example the wire could be formed from plastic although in most cases the coils formed by this machine will be metal. The term coil should also be given an interpretation to include either metal, plastic or any suitable material. In the specification and claims I have also used the terms coil and strand and the same interpretation should be given to them.

While I have shown and described the preferred form of my invention, it should be understood that many changes may be made in the size, shape, number and disposition of parts without departing from the spirit of my invention. For example the projecting ends of the mandrel could have different diameters so that the coils formed on one side would have a different diameter from those formed on the other, furthermore more than one cutter could be used on one side; for example, two, so that twice as many coils would be produced by one side but they would be half as long. Furthermore, the guide on each side could have different pitches. I, therefore, wish my description and drawings to be taken as in a broad sense illustrative or diagrammatic, rather than as limiting me to my precise showing.

I claim:

1. In a machine for forming thin wire into a helical coil, a base, a mandrel mounted on and projecting from the base, a flexible tension belt of a resilient material having the general characteristics of rubber, said belt being looped partially around the mandrel and extending from it, the belt having an inner generally smooth continuous surface in engagement with the mandrel, power means for driving the belt, and means for guiding the wire be-

tween the mandrel and belt at an obtuse angle to the axis of the mandrel to form the wire into a helical coil on the mandrel.

2. The structure of claim 1 further characterized in that the mandrel is rotatably mounted.

3. The structure of claim 1 further characterized by and including a guide plate between the throws of the belt having a guide surface opposed to the mandrel, said guide surface having wire guiding notches to receive the turns of the wire and spaced longitudinally with respect to the mandrel.

4. The structure of claim 1 further characterized in that the last mentioned means includes a guide element between the throws of the belt and having a guide surface for engaging the wire and disposed at an obtuse angle to the mandrel.

5. The structure of claim 1 in which the power means for driving the belt includes a pulley around which the belt is looped, the diameter of the pulley being substantially larger than the diameter of the mandrel so that the throws of the belt are disposed at an acute angle to each other.

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