Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 1

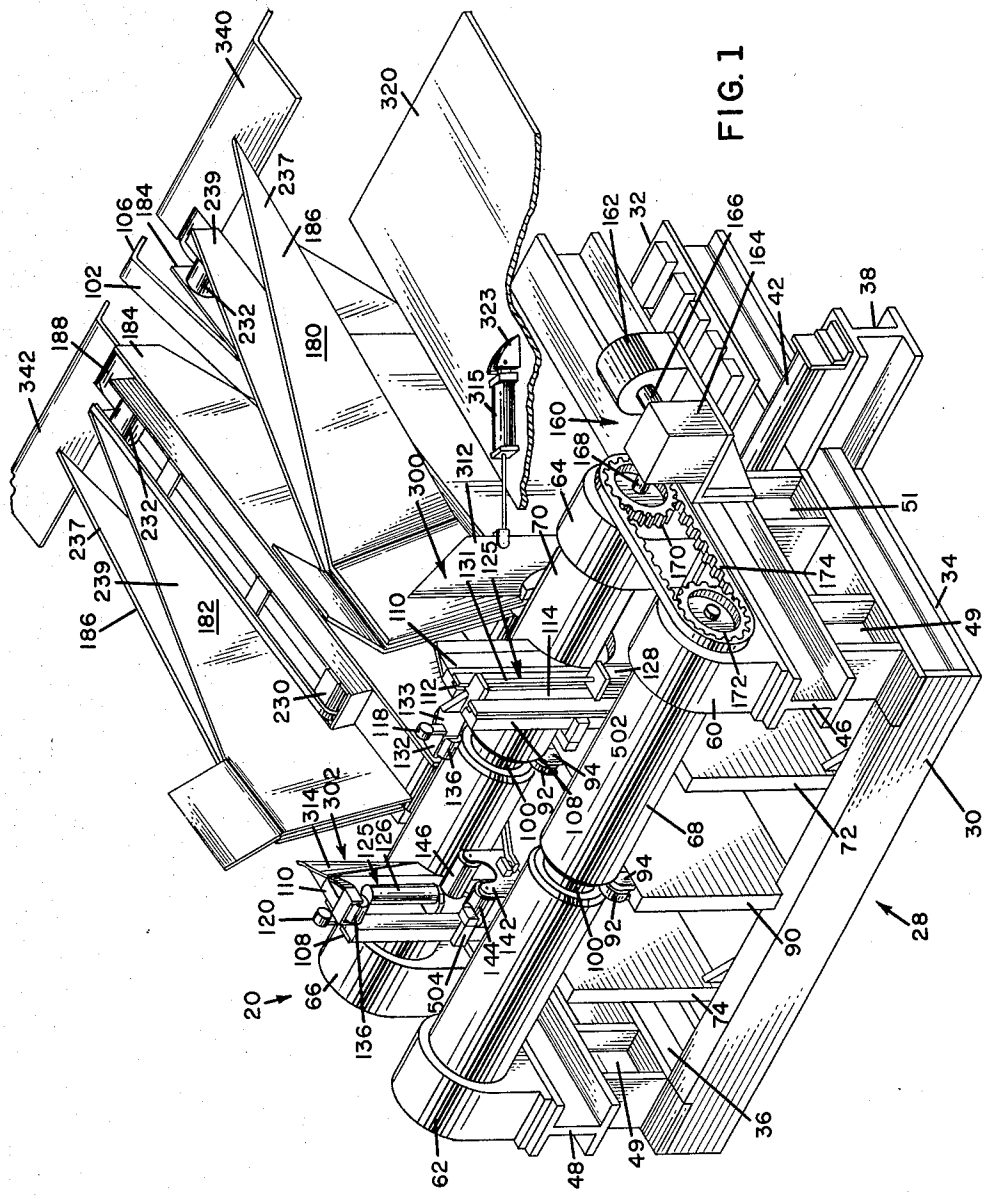


FIG. 1

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON
BY Walter G. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 2

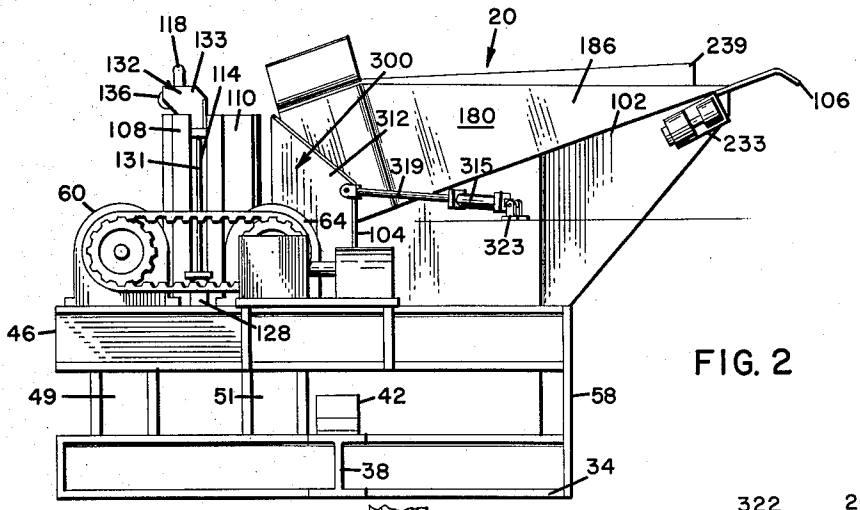


FIG. 2

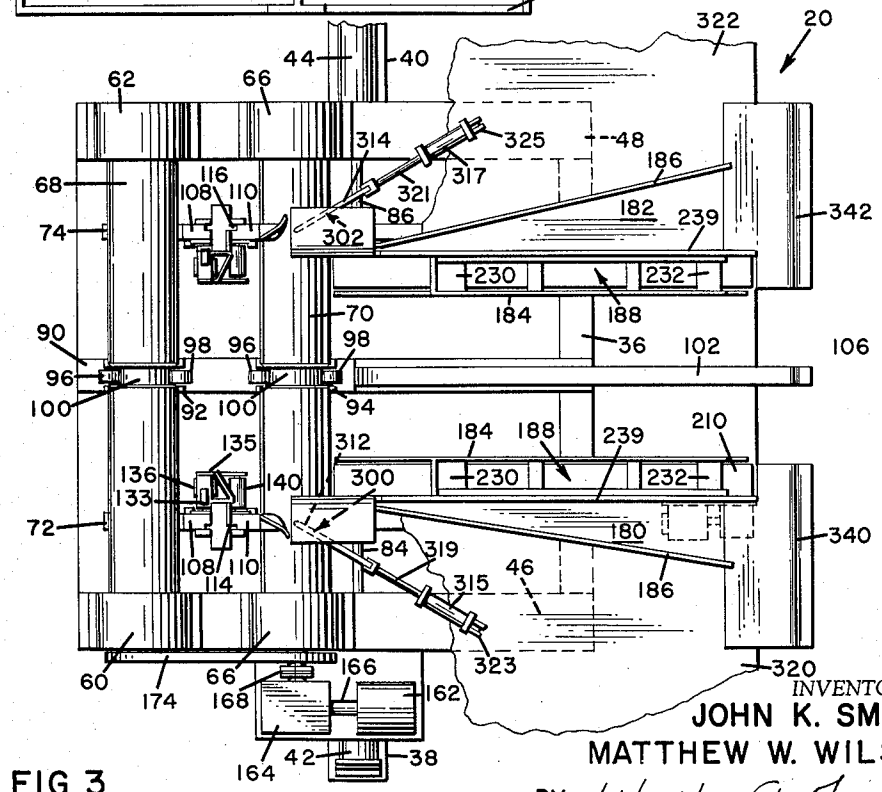


FIG. 3

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON
BY Walter G. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 3

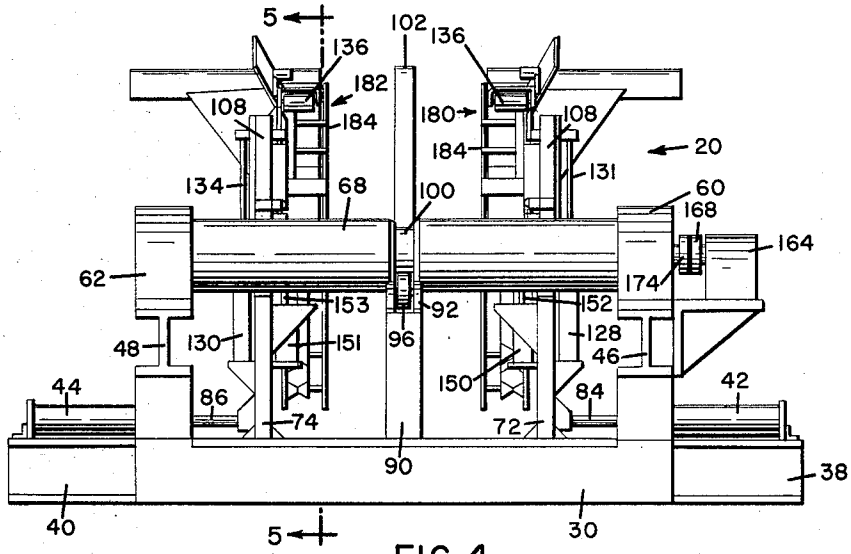


FIG. 4

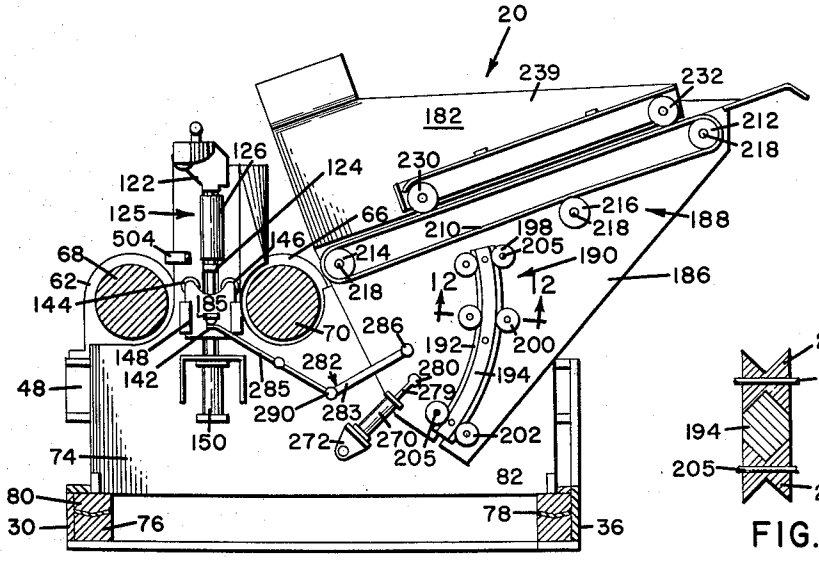


FIG. 5

FIG. 12

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON
BY Walter G. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 4

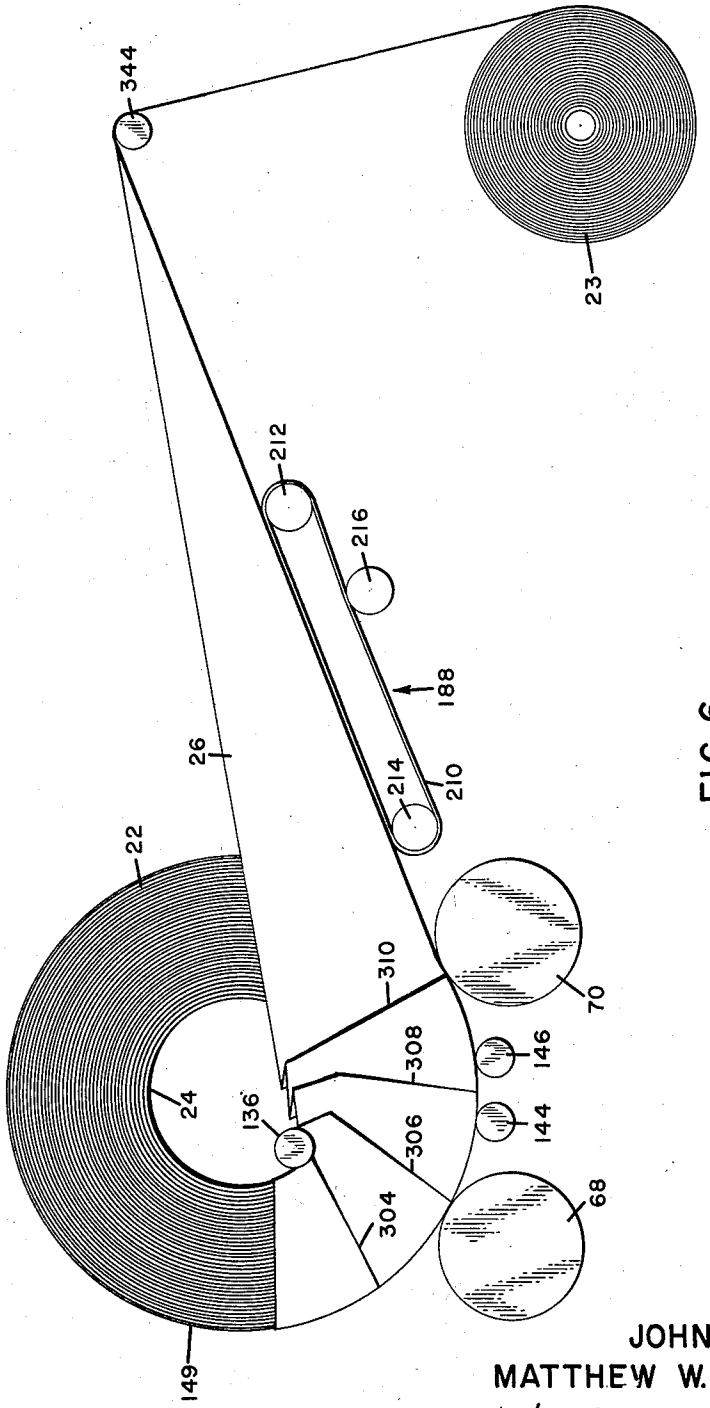


FIG. 6

INVENTORS

JOHN K. SMITH

MATTHEW W. WILSON

BY Walter J. Finch

ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 5

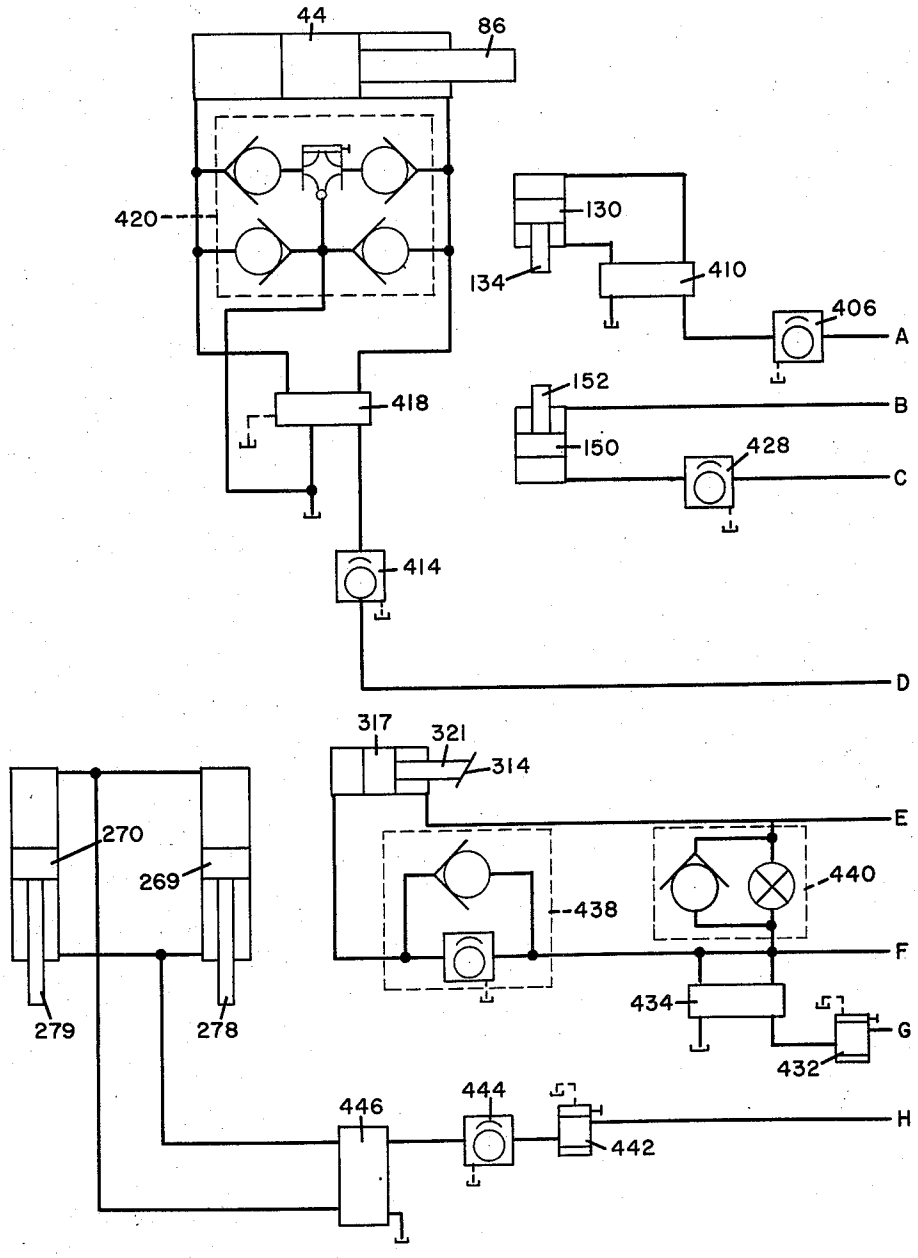


FIG. 7

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON
BY Walter G. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 6

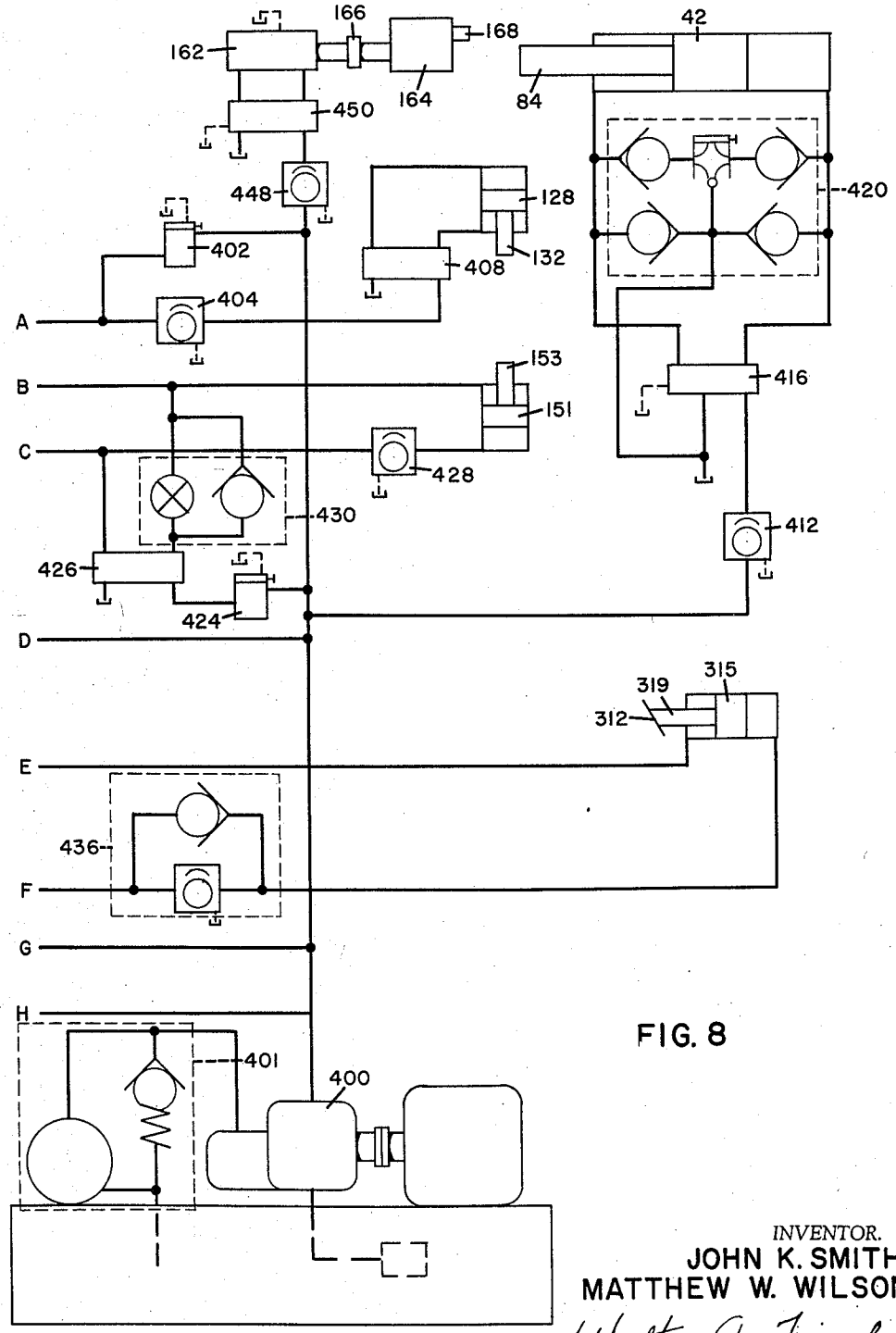


FIG. 8

INVENTOR.
JOHN K. SMITH
MATTHEW W. WILSON
BY Walter J. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 7

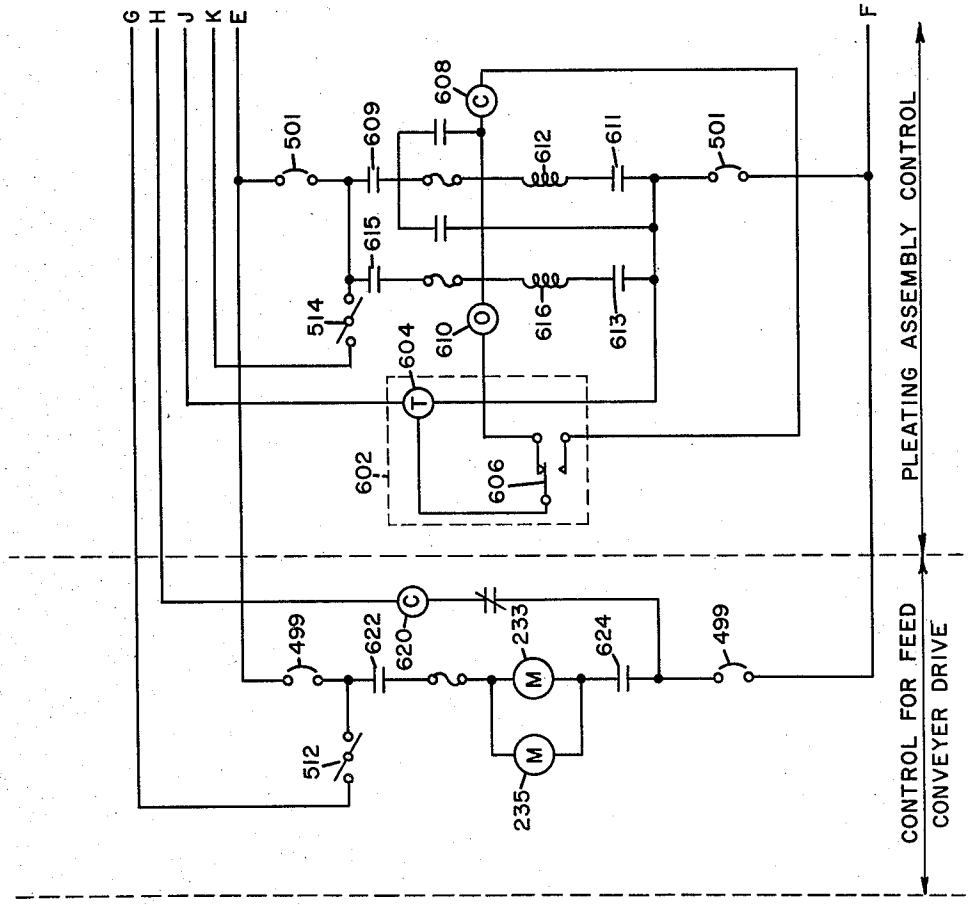


FIG. 9

Inventors

JOHN K. SMITH
MATTHEW W. WILSON

By BY Walter J. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 8

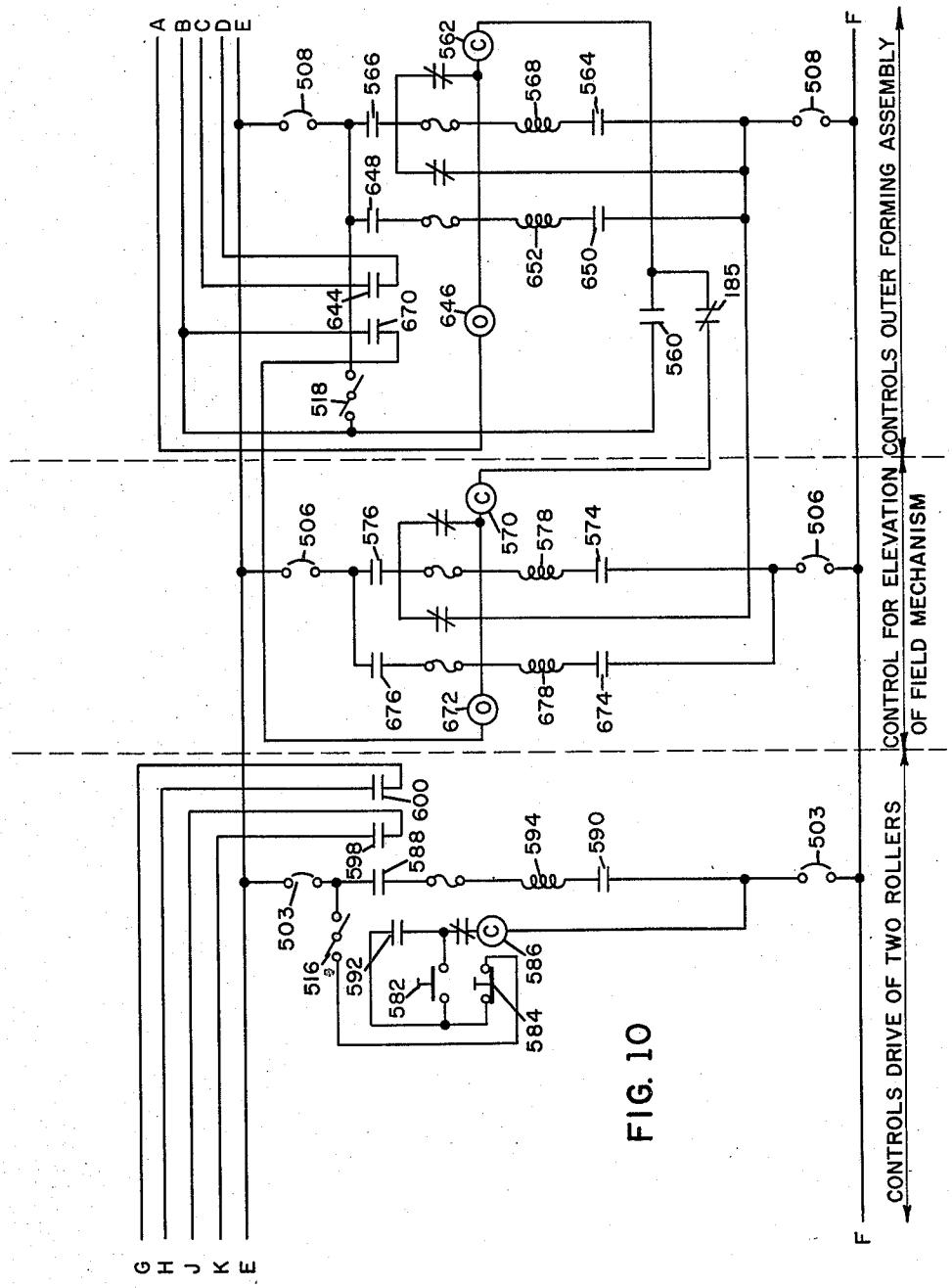


FIG. 10

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON

BY Walter G. Finch
ATTORNEY

Jan. 5, 1960 J. K. SMITH ET AL 2,919,527

WRAPPING AND PACKAGING MACHINE

Filed March 31, 1958 9 Sheets-Sheet 9

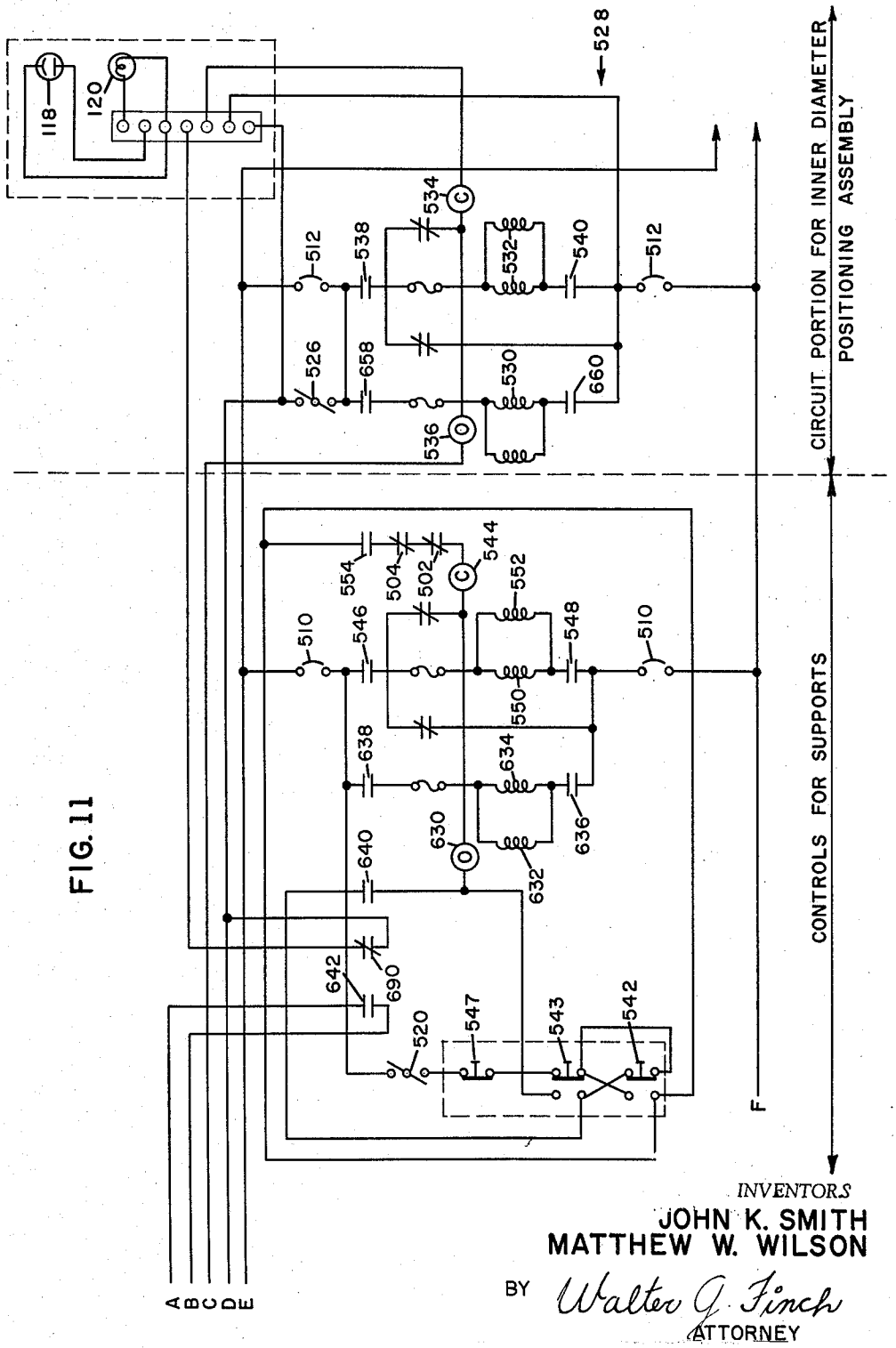


FIG. 11

INVENTORS
JOHN K. SMITH
MATTHEW W. WILSON

BY Walter J. Finch
ATTORNEY

United States Patent Office

2,919,527

Patented Jan. 5, 1960

2,919,527

WRAPPING AND PACKAGING MACHINE

John K. Smith and Matthew W. Wilson, Dundalk, Md.

Application March 31, 1958, Serial No. 724,975

20 Claims. (Cl. 53—66)

This invention relates generally to apparatus for wrapping and packaging of products, and more particularly it pertains to a wrapping and packaging machine for wrapping and packaging products which are substantially cylindrical in shape and which may have an inner diameter.

For example, coils of tin plate, cold rolled sheets, hot rolled sheet steel, aluminum, galvanized steel, titanium, copper, brass and many other metal products, are required to be protected in transportation and storage by a covering material. The covering material may be a paper wrapper, steel wrapper, aluminum wrapper, or any combination of these or equivalent materials.

In the past, coils of the type mentioned above have either been wrapped by hand or by the use of apparatus which is expensive to manufacture and uneconomical to use. Such procedures for wrapping and packaging the coils have been costly and time consuming.

It is an object of this invention to provide a new type of wrapping and packaging machine which can be utilized to neatly wrap and package various sized rolls or coils in sequence with a minimum of operator skill and participation thereof.

Still another object of this invention is to provide a new type of wrapping and packaging machine which can be utilized to apply a wrapper smoothly and accurately to a cylindrical type product and then to form the wrapper to the physical dimensions of the product.

To provide a unique wrapping and packaging machine which can be utilized effectively to reduce the handling of the product to be wrapped and packaged and thus the cost of labor, is another object of the invention.

And another object of this invention is to provide a wrapping and packaging machine for wrapping and packaging articles, the dimensions of which may vary from a few inches in diameter and length to many feet in diameter and length.

And even another object of this invention is to provide a wrapping and packaging machine which will effectively and quickly wrap and package articles which vary in weight from a fraction of a pound to many tons.

To provide a wrapping and packaging machine which will properly wrap and package a product so that it will not be damaged, is still another object of this invention.

To provide a wrapping and packaging machine which will give a better appearance to the packaged article for greater customer acceptance, is also an object of this invention.

To provide a wrapping and packaging machine which will save wrapping and packaging material by reducing waste thereof, is also still another object of this invention.

It is also still another object of this invention to provide an automatically operated wrapping and packaging machine which requires a less skilled operator than required with conventional wrapping and packaging machines.

Another important object of the invention is to provide a wrapping and packaging machine having means for automatically setting the roll width and diameter of the

article or product to be wrapped and packaged by the machine each time a coil or roll is inserted therein, thus obtaining optimum wrapper and package fit despite variations from roll to roll or coil to coil.

To provide a wrapping and packaging machine which is economical to manufacture, efficient and reliable in operational use, and which is easy to install, maintain, and disassemble, are other objects of this invention.

And still another object of this invention is to provide a wrapping and packaging machine for wrapping and packaging an article or articles substantially elongated in shape which has means for automatically determining the physical dimensions of the article and other means for wrapping and packaging the article with material based on the physical dimensions determined.

Still a further object of this invention is to provide a wrapping and packaging machine as aforesaid which additionally has means for simultaneously pleating the edges of the wrapping material so as to conform to the curvature of the elongated shaped article or articles being wrapped or packaged.

To provide a wrapping and packaging machine as indicated above which additionally includes a conveyor system for conveying the wrapping material to the article or articles being wrapped and packaged and adjustable to the external curvature of the article or articles, is still another object of this invention.

And to provide a wrapping and packaging machine which additionally has means for controlling the speed of wrapping and packaging of the article or articles with the wrapping and packaging material, is still another object of the invention.

To provide a wrapping and packaging machine as aforesaid which can be combined with a punch card system or equivalent, such as an IBM machine, for automatically feeding input data into said machine for automatic operation thereof, is still another object of this invention.

These and other objects and advantages of this invention will become readily apparent from the following detailed description and accompanying drawings in which:

Fig. 1 is a perspective view of a wrapping and packaging machine incorporating features of this invention;

Fig. 2 is a side elevation of the wrapping and packaging machine of Fig. 1;

Fig. 3 is a top plan view of the wrapping and packaging machine of Fig. 1;

Fig. 4 is a front elevation of the wrapping and packaging machine of Fig. 1;

Fig. 5 is a cross-section of the wrapping and packaging machine taken along line 5—5 of Fig. 4;

Fig. 6 is a side elevation, partially schematic, illustrating the feeding of the wrapping material in the wrapping and packaging machine;

Fig. 7 is a schematic of the hydraulic system for the wrapping and packaging machine of Fig. 1;

Fig. 8 is a continuation of the schematic of Fig. 7 of the hydraulic system for the wrapping and packaging machine of Fig. 1;

Fig. 9 is a schematic of a portion of the electrical circuitry for the wrapping and packaging machine of Fig. 1;

Fig. 10 is a continuation of the electrical circuitry of Fig. 9;

Fig. 11 is a continuation of the electrical circuitry of Fig. 10; and

Fig. 12 is a detail of the wrapping and packaging machine taken along line 12—12 of Fig. 5.

Referring now to Figs. 1, 2, 3, 4, and 5 of the drawings, there is illustrated generally by reference numeral 20 a packaging machine comprising this invention for wrapping and packaging articles or products, such as a roll or coil 22 with a wrapping material 26 from a roll of ma-

terial 23. It is to be noted that a plurality of small coils (not shown) can be simultaneously wrapped and packaged. In this instance, the smaller coils would be placed end to end, and of identical outside dimensions. One piece of wrapping material 26 could be used to wrap and package the coils simultaneously.

Coil 22 is preferably cylindrical in shape and may be provided with an inner surface 24, as indicated in Fig. 6. It is to be noted that the machine can still be utilized to wrap and package coils or annular shaped articles which do not have an inner diameter. This will be explained subsequently.

Coil 22 can be made of tin plate, cold rolled sheets, hot rolled sheet steel, aluminum, galvanized steel, titanium, copper, brass, and the like, while the wrapping material 26 can be composed of a paper wrapper, steel wrapper, aluminum wrapper or a combination of these materials, as desired. The method and arrangement for wrapping coil or coils 22 will be discussed subsequently.

Referring now again to Figs. 1 to 5, the wrapping and packaging machine 20 is provided with a base 28 composed of front and rear spaced frameworks 30 and 32, respectively, and spaced side frameworks 34 and 36. These frameworks 30 and 32 can be formed of metal plates and angles as desired, while the spaced side frameworks 34 and 36 can be formed of I-beams or equivalent structure, such as H-beams.

I-beams 38 and 40, for supporting hydraulic cylinder arrangements 42 and 44, are positioned transversely to the side I-beams 34 and 36, respectively, as best seen in Figs. 1, 3 and 4.

Two other I-beams 46 and 48 are positioned above and spaced from side frameworks 34 and 36, respectively, as best seen in Figs. 1, 2, 3 and 4, by vertically arranged I-beams 49 and 51 and an end plate 58, located on both sides of the wrapping and packaging machine 20, as best shown in Figs. 1 and 2. The two spaced I-beams 46 and 48 support the end bearing housings 60 and 64, and 62 and 66, respectively, for two rotatable and spaced rollers 68 and 70.

Between and below these rollers 68 and 70 and between the side frameworks 34 and 36, there are positioned two spaced, parallel, and movable vertical support members 72 and 74, which are arranged to ride on a pair of spaced rails 76 and 78, as best seen in Figs. 1 to 5. The spaced rails 76 and 78 each have substantially a V-notch formed in the upper surface thereof for receiving V-shaped elements 80 and 82, respectively, positioned on the bottom surfaces and at substantially the ends of the vertical members 72 and 74. Other types of equivalent rail arrangements can be used, as desired.

The vertical support members 72 and 74 are arranged to be moved laterally along the rails 76 and 78 by means of hydraulic cylinder arrangements 42 and 44 connected thereto by piston rods 84 and 86, respectively, as seen in Figs. 1, 3 and 4. These cylinder arrangements 42 and 44 operate in opposing directions so as to open or close the space between the vertical support members 72 and 74 so as to adjust for the width of the coil 22, as shown in Fig. 6.

A third support member 90, positioned in a fixed position midway of the rollers 68 and 70 and arranged parallel to the two vertical support members 72 and 74, is utilized for supporting the rollers 68 and 70. This support member 90 extends between the rails 76 and 78, as seen in Figs. 1, 3 and 4, and it has a pair of upright U-shaped brackets 92 and 94 mounted on its upper horizontal surface. These brackets 92 and 94 each support a pair of spaced rollers 96 and 98 (front and rear), which engage the notched surface 100 formed in each of the rollers 68 and 70, as seen in Figs. 1, 3 and 4. Vertical support member 90 as well as brackets 92 and 94 can be formed of suitable metal and can be welded together or formed integrally. A fixed metal guide bar 102, having one of its legs 104 secured to support member 90 and its opposite leg 106 secured to the floor or surrounding structure, is utilized to support the center of the wrapping material 26, as best seen in Figs. 1 to 4.

As best seen in Figs. 1, 3, 4 and 5, each support member 72 and 74, which are identical in construction, is provided on its top surface with a pair of spaced vertical uprights 108 and 110, each having on their inner facing surfaces, a longitudinally arranged groove 112 for receiving the edges of a plate member 114 (right side of machine) and plate member 115 (left side of machine). The vertical uprights (each set) 108 and 110 are positioned between the rollers 68 and 70. These rollers 68 and 70, as previously pointed out, support the coil or roll 22 to be wrapped and packaged as shown in Fig. 6.

Plate member 114 has a photo-electric cell 118 mounted thereon and directed in an axial direction with respect to the roll or coil 22. Plate member 116, on the other hand, is provided with a suitable light source 120 for the photo-electric cell 118, as best seen in Fig. 1. Each plate member 114 and 116 has inwardly extending spaced flange elements 122 and 124, as seen in Fig. 5, for mounting a vertical forming assembly 125 consisting of a vertical forming roller 126 as seen in Figs. 1 and 5, for forming pleated material to the edges of the coil or roll 22, as seen schematically in Fig. 6. Plates 114 and 116 are movable in a vertical direction in grooves 112 by hydraulic cylinder arrangements 128 and 130, respectively, which are connected to the plates by their respective piston rods 131 and 134. The hydraulic cylinder arrangements 128 and 130 are supported by the right and left supports 72 and 74, respectively.

The upper end of each plate 114 and 116 is provided with an inner diameter forming assembly 132 for forming the material 26 to the inner diameter or surface 24 of the roll or coil 22 to be wrapped and packaged. Each assembly 132 consists of a plate 133 and a guide bar 135 formed at an angle thereto, with the spaced ends of the plate 133 and guide bar 135 having a roller 136 mounted for rotation to form the edges of the material 26 to the inner diameter or surface 24 of the roll or coil 22.

Each assembly 132 is secured to its corresponding plate 114 or 116 by suitable means such as welding or bolting. Each assembly 132 is positioned between the vertical forming roller 126 and the photo-electric cell 118 or light source 120, although the arrangement of these elements can be changed for various sized rolls or coils 22. For example, it may be desirable in conjunction with small diameter rolls or coils 22 to position the photo-electric cell 118 and light source 120 below the inner diameter forming assemblies 132.

Outer forming assemblies 140 and 142, for guiding the wrapping and packaging material 26 to the curvature of the outside diameter or surface 149, as shown in Fig. 6, of the coil 22, are mounted on the inner faces of vertical support members 72 and 74, as seen in Figs. 3 and 5. Each assembly 140 or 142 consists of two spaced, horizontally mounted rollers 144 and 146, as seen best in Fig. 6, mounted in a housing 148 open at the top thereof, as shown in Fig. 5. Each housing 148, with its rollers 144 and 146, is slidably mounted for vertical movement on the inner faces of vertical support members 72 and 74 by means of suitable guide arrangements attached to the supports 72 and 74. These assemblies 140 and 142 are moved vertically by means of identical hydraulic cylinder arrangements 150 and 151 having their connecting rods 152 and 153, respectively, connected to the assemblies 140 and 142, respectively. This is best illustrated in Figs. 3, 5 and 6.

Referring now to Figs. 1, 2, 3 and 4, there is illustrated a drive assembly 160 for driving the two main rollers 68 and 70. This assembly 160 is mounted in a suitable support 161 integrally attached to the I-beam 46, as

best seen in Figs. 1 and 4. This drive assembly 160 consists of a conventional motor 162 (of either an electrical or hydraulic type) coupled to a speed reducer 164 by means of a suitable coupling arrangement 166. The speed reducer 164, in turn, is coupled directly to the roller 70 by means of a coupling arrangement 168. Roller 70, at its end, is provided with a drive sprocket 170, while roller 68 is likewise provided with a driven sprocket 172 at its corresponding end. A drive chain 174 is positioned on the two sprockets 170 and 172 so that when motor speed reducer 164 drives the roller 70 through the coupling arrangement 168, both rollers 70 and 68 are rotated in a counterclockwise direction to rotate the roll or coil 22 in a clockwise direction which is being wrapped and packaged with the material 26.

Referring now to Figs. 1 to 5 again, each support member 72 and 74 is provided, on its inner surface, with a feed assembly 180 and 182, respectively, for feeding the wrapping material 26 to the machine 20 so that the coil 22 can be suitably wrapped and packaged. These feed assemblies 180 and 182 are identical except for a linkage assembly 282, shown in Fig. 5, which is connected to feed assembly 182 and having its opposite end arranged to engage a microswitch 185, which will be discussed subsequently. Only the left feed assembly 182, with the linkage 282, will be described in detail now.

Each feed assembly 180 and 182, except for the difference pointed out above, consists of two parallel, spaced metal plates 184 and 186 having positioned therebetween a feed conveyor system 188 for conveying the wrapping material 26 to rollers 68 and 70 of machine 20. These plates 184 and 186 are maintained in spaced, parallel position by the conveyor system 188 and an elevating system 190, to be described below.

Each conveyor system 188 consists of a conveyor belt 210 of rubber or equivalent material located between the plates 184 and 186 and having its upper surface positioned higher than the upper edges of the innermost plate 184 so as to ensure contact with the wrapping paper 26. The innermost plate 184 is of substantially triangular shape, while the outer plate 186 is arranged to extend up and about the inner plate 184, as best seen in Figs. 1 to 5. Guide bar 102 (which is in the center of the machine 20) is positioned in the same plane with the upper surface of the conveyor belt 210. The conveyor system 188 also includes a drive roller 212, a driven roller 214, and an idler roller 216, as seen in Figs. 5 and 6. These rollers 212, 214, and 216, are positioned between the plates 184 and 186 by shafts 218 whose ends are mounted to the plates 184 and 180 for rotation. As shown in Fig. 2, gear ratio electric motors 233 and 235 are secured to the outer plates 186 and are coupled to the drift shafts of the drive rollers 212 to rotate said rollers 212, and rollers 214 and 216.

The outermost plate 186, at its upper and rear portion 237, is offset outwardly at an angle to the main plane of the plate 186 for forming the wrapping and packaging material 26 between it and a plate 239 located in alignment with the outer edge of the conveyor system 188. This plate 239 is secured to plate 186 by suitable means such as bolts and is spaced therefrom so as to receive the wrapping material 26 between plates 186 and 239.

The conveyor system 188 is also provided with a pair of spaced pressure rollers 230 and 232 mounted between a housing 234, whose outer face is secured to the inner surface of plate 239. It is the purpose of these pressure rollers 230 and 232 to exert downward pressure on the wrapping material 26 when the conveyor system 188 feeds the material into the machine 20.

Each outer plate 186 is provided with an arcuate slot 192 for attaching an arcuate guide arm 194 of the elevating system 190 permanently to the supports 72 and 74, as best seen in Fig. 5. This elevating system 190 is also provided with pairs of parallel, spaced rollers 198, 200, and 202, located between the plates 184 and 186. These pairs of rollers 198, 200, and 202 are mounted to the plates 184 and 186 by means of shafts 205 located at their ends. These pairs of rollers 198, 200, and 202 are of substantially the same width as the arcuate guide arm 194, as best seen in Figs. 5 and 12, and are mounted for rotation between the plates 184 and 186 by the shafts 205.

The linkage assembly 282, as previously mentioned, and only one of which is provided, consists of two arms 283 and 285 arranged at an obtuse angle to each other and pivotally mounted by a shaft 286 located between plates 184 and 186, and a second shaft 290 connected to the support member 74.

This linkage assembly 282 controls two hydraulic cylinder arrangements 269 and 270 for the feed assemblies 180 and 182, respectively. Each hydraulic cylinder 269 or 270 has a clevis mounting 272 secured to the inner surfaces of the vertical supports 72 and 74, as best seen in Fig. 5. The connecting rods 278 and 279 for hydraulic cylinder arrangements 269 and 270 are pivotally connected by shafts 280 between the two plates 184 and 186.

When the hydraulic cylinder arrangements 269 and 270 are operated, they cause the arm 283 to pivot about shaft 290 so that its cooperating free arm 285 trips the microswitch 185.

As shown in Figs. 1, 2, 3, and schematically in Fig. 6, pleating assemblies 300 and 302 are provided on each side of the wrapping and packaging machine 20 for pleating the wrapping material 26 in the radial or transverse direction of the coil 22 to form neat and attractive pleats 304, 306, 308, 310, etc., as best seen in Fig. 6. Each pleating assembly 300 or 302 consists of a pleating bar 312 or 314, respectively, having their lower ends (not shown) pivotally connected to supports 72 and 74. These pleating bars 312 and 314 are positioned at an angle to the rollers 68 and 70 so as to gather the excess wrapping material 26 formed as the edges thereof and to form this material to the radius of the roll or coil 22. Each pleating bar 312 or 314 is provided with a hydraulic cylinder arrangement 315 and 317 on side plates 320 and 322, respectively. These side plates 320 and 322 are, in turn, secured to the outer surfaces of the vertical support members 72 and 74, respectively, and move with these members. These hydraulic cylinders 315 and 317 have their connecting rods 319 and 321 pivotally connected to the pleating bars 312 and 314, respectively. These cylinder arrangements 315 and 317 are provided with clevis mountings 323 and 325, respectively, to the side plates 320 and 322.

Guide plates 340 and 342 are integrally attached to the plates 186, at their rear ends, to guide the wrapping material 26 from its roll 23, as shown in Fig. 6, over an entry roller 344. If desirable, the entry roller 344 can be eliminated and the wrapping material 26 from roll 23 be fed from the top of the machine 20. This roll 23 is supported by suitable structure (not shown).

The hydraulic system for operating the wrapping and packaging machine will now be described in connection with Figs. 7 and 8, and Figs. 1 to 5 which show the physical location of the parts of the hydraulic system in relation to the machine.

The inner diameter forming assemblies 132 and the vertical forming assemblies 125, in normal non-operating position, are either at the uppermost position of travel, or lowermost position of travel as determined by the position of the photo-electric cell 118 and light source 120.

When the cutout switch 526, of the electrical system, shown in Figs. 9 to 11, is closed for positioning of the inner diameter forming assemblies 132 and the vertical forming assemblies 125, energy is directed through the photocell 118 and light source 120 to energize the solenoids 532. As the photo-electric beam between the photocell 118 and the light source 120 is interrupted by the radius of roll or coil 22 (radius from the inner diameter 24 to the outer diameter 149), these solenoids 532 posi-

tion the control valves 408 and 410 of the hydraulic cylinder arrangements 128 and 130, respectively.

The flow of oil past the control valves 408 and 410 of hydraulic cylinder arrangements 128 and 130 continues until the photo-electric cell 118 makes a beam through the inner diameter of coil 22. When the beam is completed, the electrical circuit is opened and solenoids 532 are de-energized to allow valves 408 and 410 to resume normal positions. When this occurs, a hydraulic block occurs to hold the inner diameter forming assemblies 132 in position so as to enter the inner diameter 24 of the coil 22. It is to be noted that all valves, except where pointed out, including the valves 408 and 410 are three-way valves. Thus, a solenoid is positioned in each end of the valve, and the valve is spring centered.

The vertical support members 72 and 74 in normal non-operating or open positions are at their extreme open positions, that is, all the way out and adjacent the side frames 46 and 48.

When the control switch 542 is closed, energy is sent through microswitches 502 and 504, which are normally closed switches, to energize the solenoids 550 and 552. Microswitch 502 is mounted on the right pair of spaced vertical uprights 108 and 110, while microswitch 504 is mounted on the left pair of spaced vertical uprights 108 and 110.

The microswitches 502 and 504 are mounted in such a manner that the arm of each switch protrudes inwardly on the inside of vertical supports 72 and 74 so that they will contact the ends of the coil 22 to be wrapped and packaged. These microswitches 502 and 504 each have two poles normally closed and two poles normally open. As the electrical energy passes the normally closed poles, it is directed to the solenoids 550 and 552 to control the valves 416 and 418 of hydraulic cylinder arrangements 42 and 44 for closing the vertical support members 72 and 74 by directing the oil flow in the hydraulic cylinder arrangements 42 and 44.

As the vertical support members 72 and 74 move inwardly, the arms of microswitches 502 and 504 make contact with the ends of coil 22 to open the circuit and de-energize solenoids 550 and 552, allowing the valves 416 and 418 to center, thus holding the vertical support members 72 and 74 in fixed positions with relationship to the width of the coil 22 due to the hydraulic block in the hydraulic cylinder arrangements 42 and 44.

Since each vertical support member 72 or 74 has its own microswitch 502 and 504, respectively, and solenoid control valves 416 and 418, these microswitches and valves work independently of each other on closing of the support members 72 and 74. Thus, if the coil 22 is not centered lengthwise of the rollers 68 and 70, the supports 72 and 74 position in relation to the ends of the coil 22. Clearance between the coil 22 and the vertical support members 72 and 74 is determined by microswitches 502 and 504. These microswitches 502 and 504 are arranged to be adjusted horizontally, that is, they can be moved inwardly or outwardly.

When the vertical support members 72 and 74 are positioned, the normally open poles of the microswitches 502 and 504 will close by being actuated by the arms of the aforesaid microswitches 502 and 504. When this occurs, the electrical energy is directed to the solenoid 532 controlling the valves 408 and 410 for applying correct pressure to the rollers of the inner diameter forming assemblies 132 and vertical forming assembly 125 and maintain them in operative position.

Energy is simultaneously sent to the solenoid 568 to control the valve 426 in the hydraulic cylinder arrangements 150 and 151 for the outer forming assemblies 140 and 142, respectively.

Energy is also simultaneously sent to the solenoid 578 to energize it, and position the valve 446 for hydraulic cylinder arrangements 269 and 270. As the arm 285 of the linkage 282 engages the microswitch 185, the microswitch 185 is opened to deenergize the solenoid 578. This allows the valve 446 to center and cause a hydraulic block. When this occurs, the feed assemblies 180 and 182 are held in position in relationship to the outside diameter 149 of the coil 22 as determined by the outer forming assemblies 140 and 142.

In non-operating position, the feed assemblies 180 and 182, the pleating assemblies 300 and 302, and drive assembly 160 will not operate until the switch 547 is closed to simultaneously start. Switch 582 is then closed to simultaneously start motors 233 and 235, respectively, of the feed assemblies 180 and 182, and to actuate a timing device 602 which controls an opening solenoid 612 and a closing solenoid 616. When this occurs, a valve 434 is positioned in relation with these solenoids 612 and 616 to control the hydraulic cylinders 315 and 317 for actuating the pleating assemblies 300 and 302. Energy is also directed to solenoid 594, which positions valve 450 to actuate hydraulic motor 162.

Upon completion of the wrapping and packaging of a coil 22, a stop button 584 is closed to de-energize the timing device 602, the motors 233 and 235 and the solenoid 594, which allows the valve 450 to position in a stop position to stop drive motor 160. Switch 547 also de-energizes the solenoids 612 and 616, allowing the valve 434 to center and thus stopping the pleating assemblies 300 and 302. Button 544 is then pushed to energize the solenoids 530, 632, 634, 652, and 678 to actuate their respective hydraulic cylinder arrangements to move the various assemblies back to normal non-operating positions.

In order to initiate the electrical circuit for the wrapping and packaging machine 20 as illustrated schematically in Figs. 9, 10 and 11, all circuit breakers 499, 501, 503, 506, 508, 510, and 512 in a main panel (not shown) are individually closed. If the machine 20 is to be operated for a long period of time, these circuit breakers 499, 501, 503, 506, 508, 510, and 512 are closed and allowed to remain closed.

Next the cutout switches 514, 516, 518, and 520 are closed individually. These switches are generally located at the operator's stand. The operator then puts the photo-electric system 524 into operation by closing the cutout switch 526.

When the cutout switch 526 is closed, a closing coil 534 is energized, which, in turn, closes main cutouts 538 and 540 to energize a closing solenoid 532. The closing solenoid 532 then operates the hydraulic cylinder arrangements 128 and 130 to raise or lower the inner forming diameter assemblies 132 for positioning to the inner diameter 24 of coil 22. Thus when the light from the light source 120 strikes the photocell 118, the circuit portion 528 for the inner forming diameter assemblies 132 of the coil will be de-energized.

Next, the operator presses a closing button 542, which, in turn, energizes a closing coil 544 to close the main contacts 546 and 548. When this occurs, the solenoids 550 and 552 are energized. These solenoids 550 and 552 then operate the hydraulic cylinder arrangements 42 and 44 to move the supports 72 and 74 inwardly.

Simultaneously, auxiliary contact 553 is closed when closing coil 544 is energized to hold the coil 544 energized. The closed poles of microswitches 502 and 504 are then opened by coming into contact with the ends of coil 22, to deenergize the closing circuit portion for the supports 72 and 74. When microswitches 502 and 504 are opened, switch 560 closes, and closing coil 562 is energized to close the main contacts 564 and 566 to energize the closing solenoid 568 in order to control hydraulic cylinder arrangements 150 and 151 to position the outer forming assemblies 140 and 142, and through the normally closed limit switch 185, energize the operating closed coil 570 to close the main contacts 574 and 576. Upon main contacts 574 and 576's closing, the

solenoid 578 is energized to position the hydraulic cylinder arrangement 269 and 270 of the feed elevating assemblies 180 and 182, respectively.

Next, the portion 285 of arm 282 in the feed elevating system 190 opens the limit switch 135 to deenergize the closing solenoid 578. Then the operator presses the starter button 582 to energize the operating coil 586 which will then close the main contacts 588 and 590, and, at the same time, close the auxiliary closing contact 592 to energize the solenoid 594 and operate the hydraulic motor 162 to rotate the main rollers 68 and 70.

Auxiliary contact 598 will then close, energizing timer circuit or device 602 (which includes the coil 604 and the contacts 606). When timer circuit or device 602 is energized, the contacts 606 will operate closing coil 608 and then open opening coil 610 alternately during operation.

When the closing coil 608 is energized, main contacts 609 and 611 are closed and solenoid 612 is energized to operate cylinders 315 and 317 in a forward direction to operate the pleating assemblies 300 and 302.

When opening coil 610 is energized, contacts 613 and 615 are closed, and solenoid 616 is energized to operate hydraulic cylinder arrangements 315 and 317 in a reverse direction.

Simultaneously, auxiliary contact 600 is closed to energize the closing coil 620 and close main contacts 622 and 624 to energize the two electric motors 233 and 235 to operate the feed conveyor assemblies 180 and 182.

After completion of the operation of packaging the coil 22, the operator will press the stop button 584, thus deenergizing operating coil 586, which, in turn, opens main contacts 588 and 590, and auxiliary contacts 598 and 600. This, in turn, de-energizes timing device 602 and operating coil 620 to stop motors 233 and 235. Also, operating coils 608 and 610 are deenergized to deenergize solenoids 612 and 616 to stop the pleating assemblies 300 and 302 and stop the motor drive 160 for the rollers 68 and 70.

Next, the operator presses the open button 543, which energizes the opening coil 630. This coil 630 opens normally closed auxiliary contact 690 to deenergize the photocell 118 and, at the same time, close main contacts 636 and 638, which energize the solenoids 632 and 634 to move the main supports 72 and 74 outwardly.

When coil 646 is energized, auxiliary contact 670 is closed to energize opening coil 672, and thus close the main contacts 674 and 676. The solenoid 678 is then energized to operate hydraulic cylinder arrangements 269 and 270, and thus lower the feed assemblies 180 and 182.

Simultaneously, when the opening button 543 is pressed, the auxiliary contact 642 is closed to energize coil 646. This coil 646 stays energized and closes main contacts 648 and 650 to energize coil 652 and actuate hydraulic cylinder arrangements 150 and 151 to pull the outer forming assemblies 140 and 142 downwardly.

Auxiliary contact 644 is closed at the same time that contact 642 is closed to energize the opening coil 536 and close main contacts 658 and 660 to energize the solenoids 530 to position the inner diameter forming assemblies 128 and 130.

The operator then presses the stop button 547 and opens cutout switch 526 so as to cut off the power and place the machine for the operation of wrapping and packaging the next coil or roll 22. As the coil 22 is wrapped and packaged, the paper stock is cut off when the proper amount is obtained by a suitable shear (not shown) and runs out through the feed to finish covering the coil 22.

It is to be noted that flow control valves 404, 406, 412, 414, 428, 436, 438, and 448 are all hand operated valves, as shown best in Figs. 7 and 8, each of which individually can be utilized to control the speed of its related hydraulic component. Thus, for example, the flow control valve 448, is utilized to control the flow of hydraulic medium to the directional control valve 450, which, in turn, controls the speed and direction of operation of the hydraulic motor 162 and thus the speed of wrapping of the article or coil 22 with the wrapping material 6.

If desired, at this time standard strapping fasteners can be applied around the outer diameter of the coil 22 by the groove 100 cut into the rollers 68 and 70.

The material for wrapping is chosen for width from the following equation:

$$W=L+OD-ID+2\ Ti$$

Where

W is width of material;
L is length of coil 22;
OD is outer diameter of coil 22;
ID is inner diameter of coil 22; and
Ti is amount of tuck-in desired at the inner diameter 24 of coil 22.

For wrapping, some types of materials or for overseas shipment where extra rugged conditions may be encountered, a metal sheet wrapping stock may be used. Under some circumstances, a wrapper consisting of three pieces may be employed. One sheet is equal to or slightly less in width than the coil 22, and two sheets are pre-formed right angle strips one for each side of the coil 22. In this case, these angle strips are fed to the conveyor belts underneath the flat strip and since they are preformed, they pass readily through the guide plates 239 and 186.

It may be desirable to apply the wrapper in different combinations of metal or paper or in alternate plies. This can be done by feeding from more than one stock roll.

Another form of wrapping material which it may be desired to use is coated with pressure sensitive adhesive. It can be seen that the pleats in this case will better hold their shape.

As pointed out above, a punch system or IBM machine can be electronically coupled to the machine 20 for feeding input data into the machine and for controlling the various switches operated by the operator in order to have a completely automatically operated system.

The complete operation of the machine 20 will now be explained. When the machine is in the neutral position, the supports 72 and 74 are at their outermost position. No preadjustment of the machine 20 is necessary or required because of the size of the coil 22 to be packaged.

The coil 22 to be packaged is now placed on the rotating rollers 68 and 70 of the machine 20. Centering of coil 22 to be packaged in relationship to the center of the rotating rollers 68 and 70 is not necessary. In addition, the method or procedure of placing the coil 22 on the rotating rollers 68 and 70 is optional, that is, the coil 22 can be placed on the rollers 68 and 70 by crane, conveyor, tractor or the like.

The operator of the machine 20 now depresses switch button 542, which energizes solenoid 532 to position the hydraulic valve to control the movement of the hydraulic cylinder arrangements 150 and 151 to move the inner diameter forming assemblies 132 to the center of the coil 22. When the light beam is made between the light source 120 and the photoelectric cell 118 through the inner surface 24 of the coil 22, the photo-electric cell 118 causes the closing solenoid 532 to deenergize and allow the control valve 426 to hold the forming assemblies 132 in a fixed position to enter the inner surface 24 of the coil 22.

The operator of the machine 20 now depresses control switch 543, which, in turn, energizes the solenoids 550 and 552 which control the valves 416 and 418. These valves 416 and 418 are then positioned to allow oil flow to the hydraulic cylinder arrangements 42 and 44. These hydraulic cylinder arrangements 42 and 44 then operate to move the supports 72 and 74 laterally in a closing movement.

The microswitches 502 and 504 are positioned in the supports 72 and 74 in such a manner so that their operating arms project inwardly as they come into contact with the coil 22 to be packaged. These microswitches 502 and 504 break the flow of current which, in turn, allows solenoids 550 and 552 to deenergize. This then causes the control valves 416 and 418 and hydraulic cylinder arrangements 42 and 44 to hold the supports 72 and 74 in position.

Microswitches 502 and 504 have now energized the circuit, that is, solenoid 532 which controls the flow of oil to the control valves 408 and 410 to apply correct pressure to the inner forming assemblies 132.

Simultaneously, energy is sent to solenoid 568 which controls valve 426 in the hydraulic cylinder arrangements 150 and 151 to position the outer forming assemblies 140 and 142 to the outer diameter of the coil.

Energy is also simultaneously sent to the solenoid 578 to energize it and position the valve 446 for hydraulic cylinder arrangements 269 and 270. These arrangements 269 and 270, in turn, position the feed assemblies 180 and 182 relative to the outside diameter of the coil 22 to be packaged, which is determined by the outer forming assemblies 140 and 142 and which is controlled by microswitch 185 through the linkage 282. The machine 20 is now in alignment to package coil 22 in respect to the physical dimensions sensed therefor.

The operator now closes the control switch 547, which energizes solenoid 594 to position the control valve 450 to supply pressure to the hydraulic motor 162 to rotate the rollers 68 and 70 by means of speed reducer 164 and the chain drive 174. Simultaneously, energy is sent to the timing device 602, which, in turn, sends energy to the solenoids 612 and 616 alternately to actuate control valve 434 so that hydraulic pressure can be directed to alternate ends of the hydraulic cylinder arrangements 315 and 317 to actuate the pleating assemblies or bars 312 and 314. Energy is also sent to the speed reduction motors 233 and 235 to drive the feed assemblies 180 and 182.

It is to be noted that the width of the paper needed to package the coil 22 is determined by the distance between the outside edge of plate 340 to the outside edge of plate 342, which, in turn, is determined by the dimensions of the articles to be packaged.

When packaging of the coil 22 is completed, the operator opens switch 547, which returns all of the assemblies to a neutral position. The packaged article is then removed from the machine 20 and the next coil 22 is inserted in the machine.

Obviously many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A wrapping and packaging machine for wrapping and packaging articles of substantially elongated shape and having inner and outer surfaces, comprising, structure defining a base, means including a pair of spaced rollers mounted on said base for receiving an article to be wrapped and packaged, automatically operated means for sensing the inner diameter of said article, automatically operated means including adjustable members for sensing the width of said article to be packaged as well as the outer diameter of said article, and means for wrapping and packaging said articles based on the sensed inner and outer diameters and width of said article.

2. A machine for wrapping and packaging articles of substantially elongated shape and having inner and outer surfaces, comprising, means including a plurality of spaced rollers for receiving an article to be wrapped and packaged, automatically operated means for sensing the width as well as the inner and outer diameters of said article, and means for wrapping and packaging said article based on the sensed inner and outer diameters and width of said article.

3. A machine for wrapping and packaging articles of substantially elongated shape and having internal as well as external dimensions, comprising means for receiving said article to be wrapped and packaged, means for automatically sensing the internal as well as the external dimensions of the article to be wrapped and packaged, and other means for wrapping and packing said article based on the sensed internal as well as external dimensions.

4. A machine for wrapping and packaging an article of substantially elongated shape and having external as well as internal dimensions, comprising, means for receiving and supporting said article for rotation during wrapping and packaging thereof, means for automatically sensing the internal and external dimensions of said article to be wrapped, and other means for wrapping and packaging said article based on said sensed internal and external dimensions thereof.

5. A machine for wrapping and packaging an article of substantially elongated shape and having external as well as internal dimensions, comprising, means for automatically sensing the external and internal dimensions of said article, and other means for wrapping and packaging said article based on its sensed external and internal dimensions.

6. A machine for wrapping and packaging an article of substantially elongated shape and having external and internal dimensions, comprising, means for automatically sensing the external and internal dimensions of said article to be wrapped and packaged, means for wrapping and packaging said article with a wrapping material based on its sensed external and internal dimensions, and means for pleating the edges of said wrapping material so as to conform to the curvature of said elongated shaped article.

7. A machine for wrapping and packaging an article of substantially elongated shape and having external as well as internal dimensions, comprising, means for automatically sensing the physical dimensions of said article to be wrapped and packaged, means for wrapping the external surface as well as a portion of the internal surface of said article with a wrapping material based on the sensed physical dimensions of said article, and means for simultaneously pleating the edges of said wrapping material so as to conform to the curvature of said elongated shaped article.

8. An arrangement as recited in claim 7, wherein said means for automatically sensing the physical dimensions of said article comprise a photocell and a plurality of microswitches.

9. An arrangement as recited in claim 7, wherein the means for automatically sensing the physical dimensions of said article are electrohydraulically operated.

10. An arrangement as recited in claim 8, and additionally means including a conveyor feed system for conveying and feeding said wrapping material to the article to be packaged and adjustable to the external curvature of said article.

11. A machine for wrapping and packaging an article of substantially elongated shape and having external and internal dimensions, comprising, means for automatically sensing the physical dimensions of said article to be wrapped and packaged, means for wrapping the external surface as well as a portion of the internal surface of said article with a wrapping material based on the physical dimensions sensed for said article, means for simultaneously pleating the edges of said wrapping material so as to conform to the external curvature of said article, and means including a conveyor feed system for conveying and feeding said wrapping material to the article to be wrapped and packaged and adjustable to the external curvature of said article.

12. An arrangement as recited in claim 11, wherein said means for automatically sensing the physical dimensions of the article to be wrapped and packaged com-

prise a photoelectric cell arrangement for sensing the internal dimensions of said article and a plurality of adjustable spaced members having rollers mounted thereon to sense the external dimensions thereof.

13. An arrangement as recited in claim 11, and means for controlling the speed for wrapping said article with said wrapping material.

14. An arrangement as recited in claim 11, and means for discontinuing the wrapping of said article as desired.

15. A machine for wrapping and packaging an article of substantially elongated shape and having at least the external dimensions of width and outer diameter and at least an internal dimension of inner diameter, comprising, means for automatically sensing said outer and inner diameters of said article as well as said width thereof, and other means for wrapping and packaging said article with wrapping material based on the sensed outer and inner diameters of said article and said width thereof.

16. An arrangement as recited in claim 14, wherein said means including a conveyor system for conveying said wrapping material to the article to be wrapped and packaged is automatically adjustable to the external curvature of said article.

17. An arrangement as recited in claim 16, and means for controlling the speed for wrapping said article with said wrapping material.

18. An automatic machine for wrapping and packaging an article having external and internal dimensions, comprising, means for automatically sensing the external and internal dimensions of said article to be wrapped, and other means for automatically wrapping and packaging said article with material based on its sensed external and internal dimensions.

19. An automatic machine as recited in claim 18, and additionally means for simultaneously pleating the edges of said material so as to conform to the curvature of said article being wrapped and packaged.

20. An automatic machine as recited in claim 19, and means for automatically conveying said material to said article being wrapped and packaged, with said conveying means being adjustable to the external curvature of said article.

References Cited in the file of this patent

UNITED STATES PATENTS

1,702,276	Shaffer	Feb. 19, 1929
1,764,081	Jones	June 17, 1930
2,638,725	Hurter	May 19, 1953
2,639,567	Murdoch et al.	May 26, 1953
2,746,224	Wollett	May 22, 1956
2,803,935	Gibson	Aug. 27, 1957
2,831,304	Michaud	Apr. 22, 1958