Oct. 25, 1949. T. L. DAVIES 2,485,959

SPINDLE ADAPTER AND BOBBIN

Filed Oct. 18, 1947 3 Sheets-Sheet 1

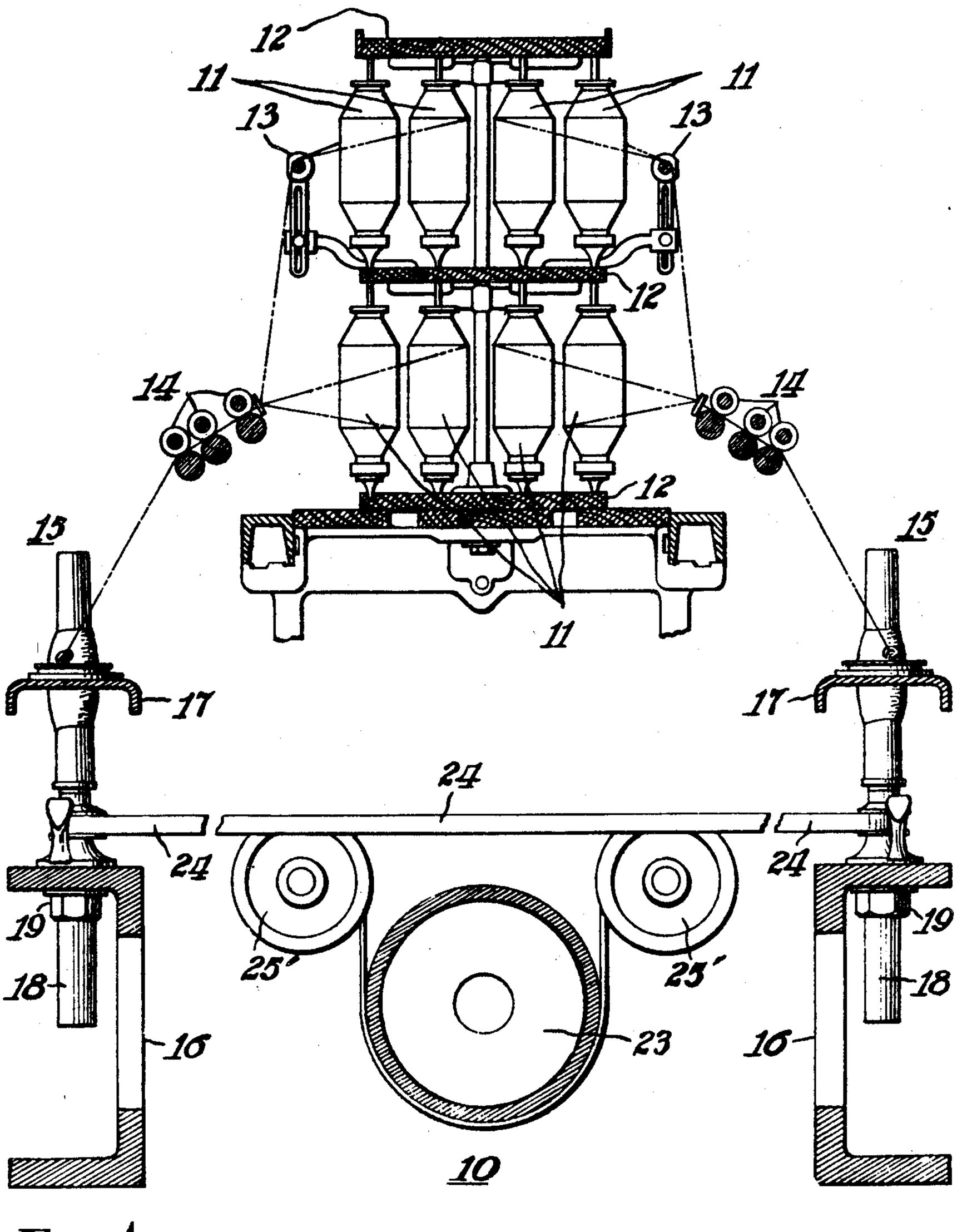


FIG. 1

TREVOR L. DAVIES,
INVENTOR.
Mason, Kolehmainen, Rathburn & Hyes
ATTORNEYS

Oct. 25, 1949. T. L. DAVIES 2,485,959

SPINDLE ADAPTER AND BOBBIN

Filed Oct. 18, 1947 3 Sheets-Sheet 2

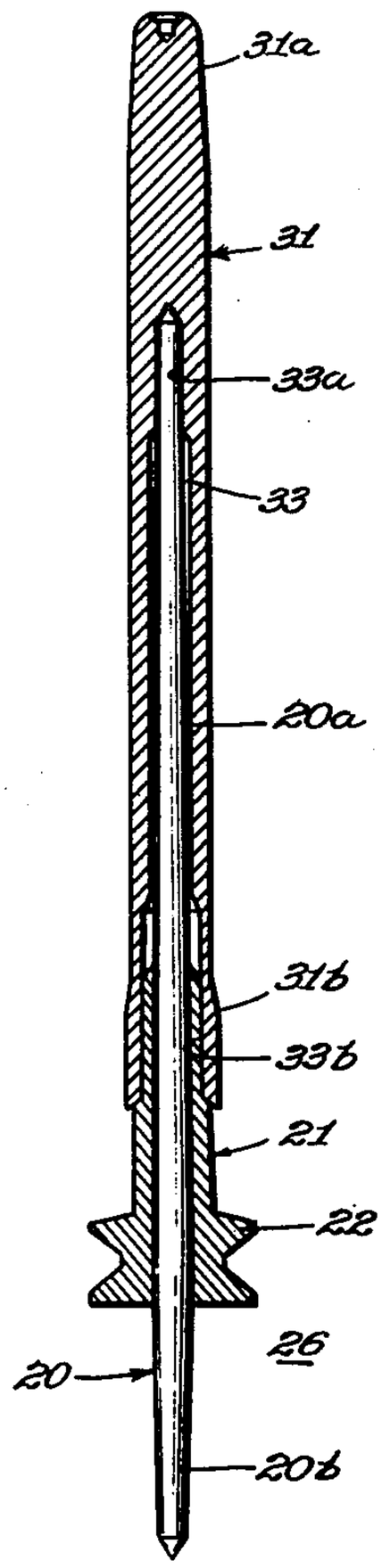


Fig. 2.

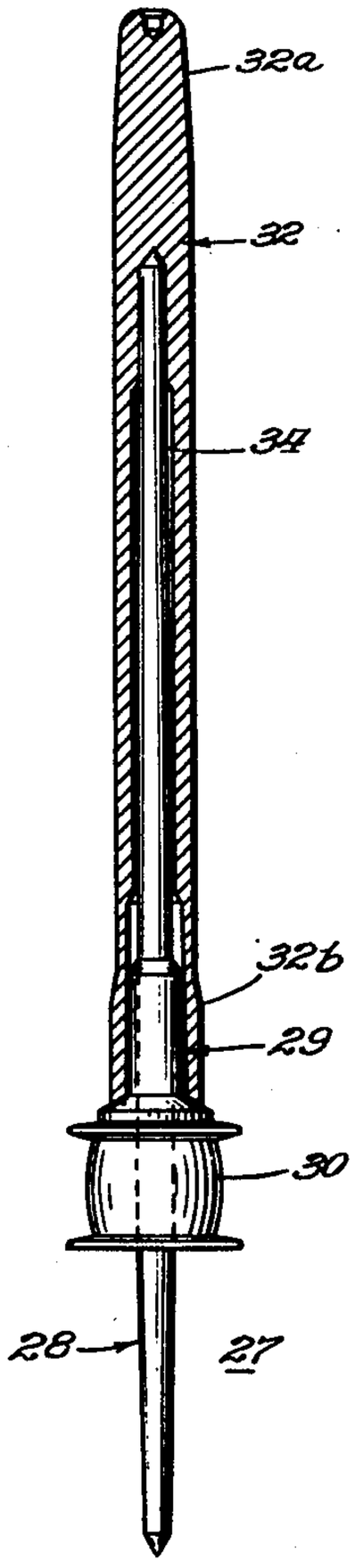


Fig. 3.

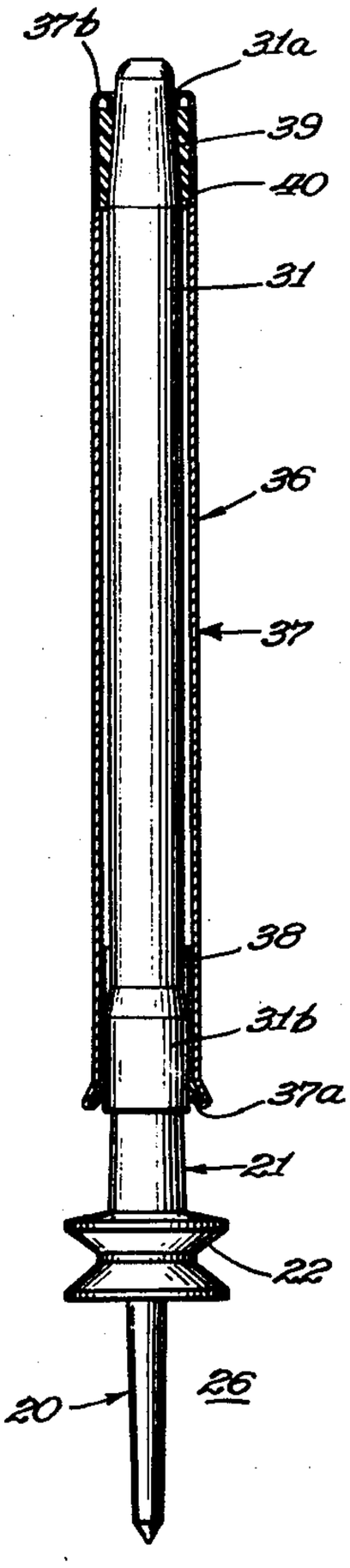


Fig. 4.

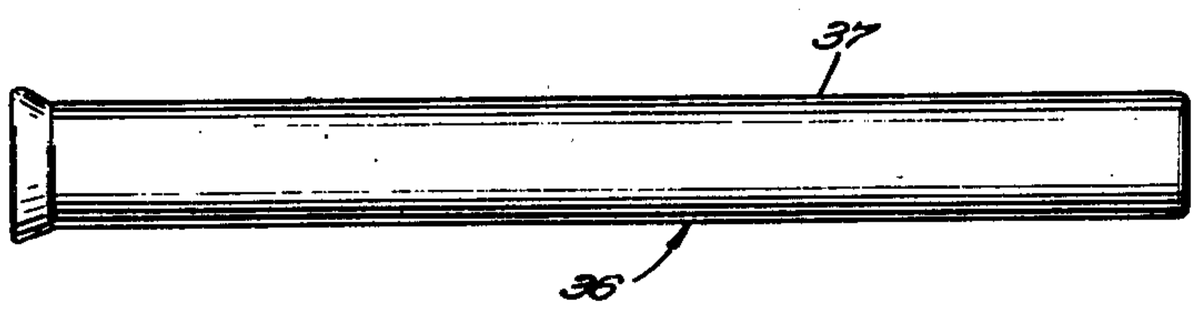


Fig. 5.

INVENTOR.
Trevor L. Davies
BY Mason & Hyss
Attys.

Oct. 25, 1949. T. L. DAVIES 2,485,959

SPINDLE ADAPTER AND BOBBIN

Filed Oct. 18, 1947 3 Sheets-Sheet 3

Fig. 9.

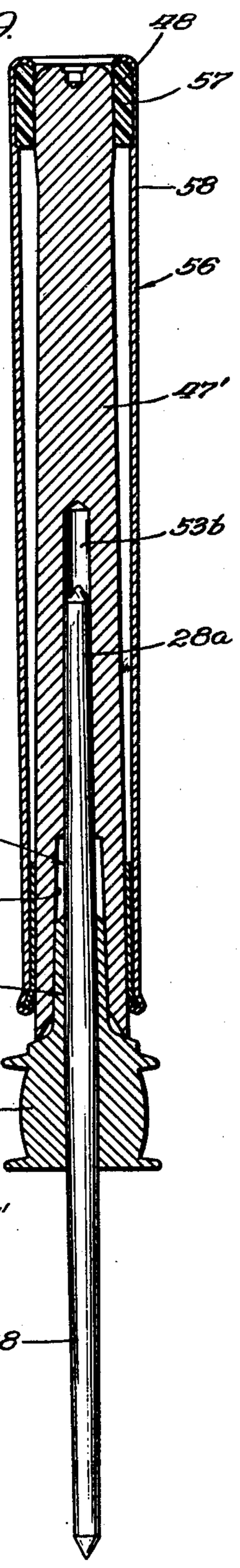
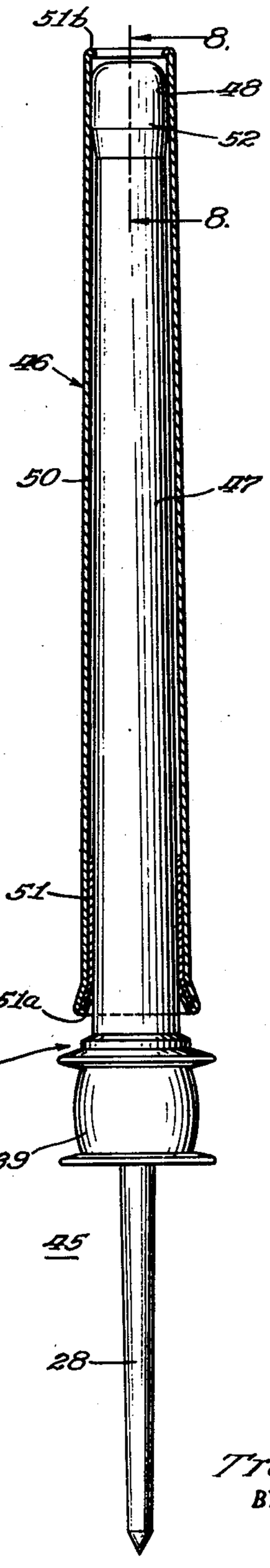


Fig. 7.



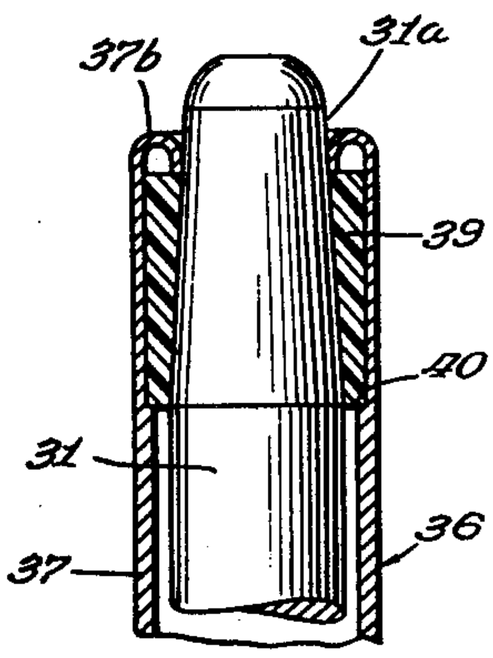


Fig. 6.

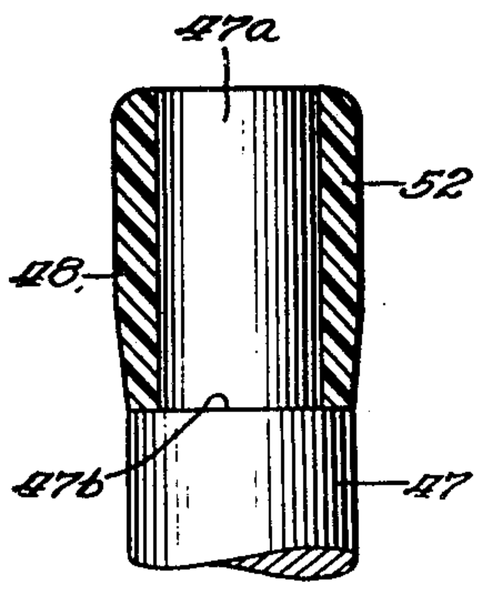


Fig. 8.

INVENTOR.
Trevor L. Davies
BY Mason & Fryss
Attys

Patented Oct. 25, 1949

2,485,959

UNITED STATES PATENT OFFICE

2,485,959

SPINDLE ADAPTER AND BOBBIN

Trevor L. Davies, Clarendon Hills, Ill., assignor to F. L. Regnery Corp., Chicago, Ill., a corporation of Illinois

Application October 18, 1947, Serial No. 780,741

3 Claims. (Cl. 57—130)

1

The present invention relates to spinning machines or frames and more particularly to a spindle adapter and associated bobbin or hollow core for supporting yarn and thread for use in connection with spinning frames used in the textile industry.

Specifically this application is a continuation-in-part of an application for Letters Patent of the United States, Serial No. 700,036 filed September 28, 1946, now abandoned.

In the textile industry spinning machines or frames are employed for spinning yarn such as cotton yarn, for example, into suitable thread which is wound on bobbins. Subsequently, these bobbins are placed on the spooler for the warp yarn and then on to the weaving machines. A single spinning machine or frame in a textile mill may actually have hundreds of spinning spindles associated therewith. The manufacturers of textile machinery have put out a wide variety of spinning frames employing spindles of many different types. The reason for this is that the engineers in the textile machinery manufacturing industry have had numerous occasions to design units with details at variance from standard existing units at the time in question. Some of these special units became standardized with time and it is now common practice for a manufacturer of textile machinery to produce twenty or more standard spinning spindles which vary from each other in numerous details. It will be understood that suitable bobbins of various shapes and sizes are mounted on these spinning spindles, which bobbins subsequently are used in the spooling operations and then on the weaving machines. Perhaps the most common type of bobbin is a wooden device which fits over the spinning spindle. Such wooden bobbins are susceptible to splitting and swelling and furthermore must be designed loosely enough so that they can readily be removed from the spindle when the spinning operation relative thereto has been completed. Very often such wooden bobbins are not properly concentric with the result that about one-third less yarn can be wound thereon than would be the case if the wooden bobbin and associated spinning spindle were accurately concentric. It will be apparent that a substantial saving in labor results in getting more yarn on each bobbin since the changing or doffing of bobbins in the textile industry is done by hand and, consequently, the cost is greatly increased if such changing of bobbins must be done more often. In addition, for each different type of spindle a different type of

2

bobbin must be used. It would be desirable to provide an arrangement whereby all of the many different kinds of standard spinning spindles having various sizes, shapes and designs could be standardized in a simple manner so that a common bobbin or a very few types of bobbins could be employed and which arrangement would permit the maximum amount of yarn to be spun thereon due to maintaining proper concentricity at all times.

Accordingly, it is an object of the present invention to provide spinning spindle adapters by means of which all spinning spindles, regardless of type or make are converted to a relatively few standard spindles completely concentric, whereby in a particular mill a single standard bobbin may be employed with all spinning machines used therein regardless of the various types of spinning spindles originally employed.

It is another object of the present invention to provide a spinning spindle adapter which overcomes the disadvantages existing heretofore in the textile industry as pointed out above.

Still another object of the present invention is to provide an adapter which will convert spinning spindles employed in present textile machinery so that standardized bobbins may be employed therewith.

It is a further object of the present invention to provide a spinning adapter which becomes an integral part of the spindle once it is applied to the spindle whereby all spindles now in operation may be converted so as to accommodate one or at most a few standard types of bobbin.

Still a further object of the present invention is to provide a spinning spindle adapter preferably formed of metal such as aluminum and being provided with a bore designed so that the adapter may be made an integral part of the spindle with which it is associated by means of a press fit at one or more sections of the spindle.

It is another object of the present invention to provide a spinning spindle adapter which when properly assembled to the spinning spindle of a spinning frame greatly reduces the wear on the bolster into which the lower section of the spindle fits.

It is another object of the present invention to provide an improved spinning spindle adapter which is so designed that the bobbin associated therewith is driven from the top rather than the bottom as in prior art devices thereby resulting in a much more concentric motion.

Still another object of the present invention is

the provision of an aluminum bobbin for use with the above-mentioned spindle adapter which may be very accurately formed so as to be foolproof in operation, and insure more satisfactory spinning, is substantially indestructible, is easier to handle in the textile mill, and due to its long life is very economical to use.

A still further object of the present invention is an improved drive between the bobbins and spindles or spindle adapters of spinning machines.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of novelty which characterize this invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the present invention, reference may be had to the accompanying drawings in which:

Fig. 1 is a somewhat schematic diagram of a spinning frame provided with spinning spindles employing the adapters and bobbins of the present invention;

Fig. 2 is an enlarged view of one of the spinning spindles of Fig. 1 showing in sectional view the adapter of the present invention mounted thereon as well as a sectional view of a portion of the spindle;

Fig. 3 is a view similar to Fig. 2, with the adapter only in section, showing a different spinning spindle construction with the adapter of the present invention for converting the spinning spindle to the identical exterior configuration as that of the arrangement shown in Fig. 2;

Fig. 4 is a view of the spinning spindle and adapter of the present invention shown in Fig. 2 of the drawings with a bobbin embodying another feature of the present invention applied thereto and shown in section;

Fig. 5 is a view of the bobbin which may be employed with all spinning frames employing the spinning spindle adapters of Figs. 2, 3 and 4 of the drawings regardless of the spinning spindles associated therewith;

Fig. 6 is an enlarged view of a portion of Fig. 4.

Fig. 7 is a view illustrating still another modification of the adapter and bobbin of the present invention;

Fig. 8 is an enlarged partial sectional view of a portion of the adapter of Fig. 7 taken on line 8—8 of Fig. 7; and

Fig. 9 is a sectional view of a spinning spindle having associated therewith modifications of both the adapter and bobbin of the present invention, both shown in section.

Referring now to Fig. 1 of the drawings, there is illustrated in schematic form a spinning frame generally indicated at 10 which may be of any conventional type. It will be understood that the particular construction of the spinning frame 10 forms no part of the present invention and is included in the drawings merely to aid in understanding the invention. As illustrated, the spinning frame 10 includes a double two-story creel arrangement for accommodating the roving bobbins generally indicated at 11. As is common practice, the creel boards 12 are vertically adjustable to accommodate any length of roving bobbins 11. The textile fiber from the roving bobbins passes over the roving rods 13 and through the drafting rolls 14. The threads leaving the drafting rolls are wound on bobbins associated with the spinning spindle units generally indicated at 15. As

illustrated in the drawings, the spinning frame 10 is a double frame with two rows of spinning spindles which are supported on a pair of spindle rails 16, one positioned at either side of the machine and extending longitudinally along the length of the machine. The spinning spindles and associated bobbins extend through a ring rail 17, also extending horizontally along the length of the machine and provided with suitable spaced openings through which the various spinning spindles and associated bobbins extend. Each spinning spindle unit 15 includes a spindle base 18 which extends down through an opening in the top flange of the spindle rail 16 and is fastened thereto by suitable means indicated at 19. This spindle base 18 includes a bolster into which the lower end of the spinning spindle extends.

By referring to Fig. 2 of the drawings, the detailed construction of a representative spinning spindle may readily be understood. Each spinning spindle includes two separate parts comprising a generally slender, cylindrical blade 20 preferably formed of a suitable deformation resisting material, and a whorl 21 which includes a pulley portion 22. The blade 20 and whorl 21 are assembled in the manner shown in Fig. 2 of the drawings and a force fit maintains them in this relationship. The portion 20*b* of the blade 20 extending below the pulley 22 is adapted to extend into the base 18 which is suitably provided with a bolster, not shown, for accurately mounting the spinning spindle for high speed rotation with very accurate concentricity. The portion of the blade 20 extending above the whorl 21 is characterized by the reference numeral 20*a*.

For the purpose of driving various parts of the spinning mechanism, spinning frames are usually provided with a rotating cylinder 23 extending longitudinally of the spinning frame and rotated by any suitable means such as a suitable prime mover of some sort associated therewith. The plurality of spindle units 15 mounted along the spindle rails 16 on either side of the spinning frame are driven from the rotating cylinder 23 by means of a conventional tape drive. Preferably this tape drive for each four spindles comprises a belt member 24 which passes around the pulleys 22 of two adjacent spindles on one side of the spinning frame then into frictional engagement with the cylinder 23 and around the pulleys 22 of two adjacent spinning spindles on the other side of the spinning frame 10. With this arrangement, all of the spinning spindles associated with a spinning frame are driven at a constant speed regardless of the tape length. Suitable tension and guide means schematically indicated at 25' may be provided to insure constant tape tension and maintain the pressure on the pulley portions 22 of the whorls 21 substantially constant.

As was pointed out above, the present invention is not concerned with the entire spinning frame 10 illustrated in Fig 1 of the drawings, but is specifically concerned with an adapter to be used with a spinning spindle associated therewith of the type shown in Figs. 2, 3 and 4 of the drawings. The spinning spindle unit comprising the blade 20 the whorl 21 and an adapter associated therewith has been designated by the reference numeral 26 in Fig. 2 of the drawings. In order better to understand the present invention, reference may be had to Fig. 3 of the drawings in which there is illustrated a spinning spindle unit generally indicated at 27 which includes a blade 28 and a whorl 29, including a pulley portion 30. The pulley portion 30 has a configuration for re-

ceiving a flat type belt or tape as contrasted with the V-shaped pulley portion 22 of Fig. 2 of the drawings.

Hereinafter the reference numerals 26 and 27 are employed to characterize both the spinning spindles without the adapters as well as the unit including the adapters. A comparison of Fig. 2 and Fig. 3 of the drawings indicates that the blade 28 of the spinning spindle 27 differs considerably from the blade 20 of the spinning spindle 26. There is also a considerable difference in the whorls 21 and 29 associated with the respective blades 20 and 28. Prior to the present invention, it was necessary to have two distinct bobbins for spinning spindles 26 and 27 due to their entirely different configuration. When it is considered that the spinning spindles 26 and 27 are representative of two types of spinning spindles out of twenty or more standard spinning spindles, it will be appreciated that a very large number of different kinds of standard bobbins were required to go with the various kinds of spinning spindles. It should be understood, therefore, that Figs. 2 and 3 represent only two of the large number of different standard spinning spindles available on the market. In order to simplify the drawings, it was felt that two different types of representative spinning spindles would be sufficient to bring out this aspect of the present invention.

In order that all spinning needles now in use may be converted to a standard type of spinning spindle with which a standard form of bobbin may be used, there is provided in accordance with the present invention a spinning spindle adapter generally indicated at 31 in Fig. 2 of the drawings and 32 in Fig. 3 of the drawings. The spinning spindle adapters 31 and 32 and any additional adapters which would be provided for other forms of standard spindles, have identical configurations and dimensions as far as the exterior thereof is concerned as will become apparent from an examination of Figs. 2 and 3 of the drawings. As illustrated in Figs. 2 and 3 of the drawings, the exterior of the spindle 31 is provided with a somewhat tapered portion 31*a* at the upper end thereof and a somewhat enlarged portion 31*b* at the lower end thereof. Similarly the adapter 32 is provided with a tapered portion 32*a* at the upper end thereof and an enlarged portion 32*b* at the lower end thereof. As was pointed out above, the dimensions of the portions 32*a* and 32*b* are identical with the portions 31*a* and 31*b* as far as the outside configuration thereof is concerned. The same is true of the portions of the spinning spindle adapters 31 and 32 between the end portions designated by the corresponding reference numerals marked with appropriate subscripts *a* and *b* respectively. The diameters and lengths of the bores provided in the spinning spindle adapters such as 31 and 32 vary as will be apparent in accordance with the spindles with which they are to be associated. As indicated, the spinning spindle adapter 31 has a bore 33 therein which is considerably shorter than a bore 34 provided in the spinning spindle adapter 32. In any event, with reference to the spinning spindle adapter 31, for example, the bore 33 is provided with an enlarged portion 33*b* adjacent the end thereof into which the spinning spindle 26 is adapted to be inserted and a portion 33*a* adjacent the closed end of the adapter. When the spinning spindle adapter 31 of Fig. 2 of the drawings is applied to the spinning spindle

26 comprising the blade 20 and whorl 21, a press fit is made at the upper end between the bore 33*a* and the upper portion 20*a* of the blade 20. In addition a press fit is made at the lower end with the bore 33*b* engaging the whorl 21 of the spinning spindle 26. By means of these press fits the spinning spindle adapter 31 of Fig. 2 of the drawings in effect becomes integral with the spinning spindle to provide a standard spinning spindle unit 26 which will accommodate a standard bobbin. An important feature of the present invention is that the adapter 31 is intimately fastened by a press fit to each of the two separate parts 20 and 21 of the spinning spindle, which two separate parts as was mentioned above are also united by a press fit. Consequently the adapter 31 effectively locks the blade 20 and whorl 21 together and there is provided an effectively integral spinning spindle unit 26 which may be made accurately concentric in every respect to permit high speed rotation with a minimum of vibration and the like. Where the term "press fit" is employed in this application and the claims thereof it should be understood to include any effectively integral junction whether it is obtained by an actual pressing of the parts together or whether the spindle is shrunk as by chilling or the adapter is expanded as by cooling or both during the assembly operation. Similarly the spinning spindle adapter 32 of Fig. 3 of the drawings when fastened to the spinning spindle 27 by means of a press fit not only effectively becomes an integral unit therewith but moreover effectively locks the blade 28 and the whorl 29 together. It will be apparent therefore that the two different spinning spindles shown in Figs. 2 and 3 of the drawings which heretofore required different bobbins have been converted to identical units as far as the bobbin to be associated therewith is concerned. This may be true of all spinning spindles with which the spinning spindle adapter of the present invention is associated. Actually the adapters 31 and 32 are of a type referred to for accommodating parallel-sided bobbins as will become apparent from the following description. There are also what are generally referred to as "tapered" bobbins and in Fig. 7 of the drawings there is illustrated an adapter for receiving a so-called "tapered" bobbin.

In accordance with the present invention, the spinning spindle adapters such as 31 and 32 may be formed of any suitable material, but preferably are formed of aluminum. By employing such aluminum spinning spindle adapters, a textile factory may convert its spinning frames which up to now were of the type employing spindles of considerably different standard constructions, to a standard construction employing standard bobbins. With this arrangement, the spinning spindles are converted to those having very accurate concentricity whereby much larger quantities of yarn may be applied thereto to reduce the manufacturing expense, as was brought out earlier in this application.

Although any suitable bobbin may be associated with the spinning spindles as converted by means of the adapters 31 and 32, there is illustrated in Figs. 4 and 5 of the drawings a bobbin 36 embodying another aspect of the present invention. Heretofore it has been common practice to employ paper, fiber or wood bobbins all of which have relatively short lives and all of which are adversely affected by factors such as temperature, humidity and the like. In accord-

ance with the present invention there is provided a substantially indestructible bobbin which is unaffected by conditions such as humidity and the like and which is especially adaptable for use with adaptors such as 31 and 32. In some applications it is desirable to wet the yarn while still on the bobbin for a better weaving operation. Obviously in such an application wood and particularly paper and fiber bobbins are quite unsatisfactory whereas the bobbin of the present invention is ideally suited. As illustrated in Fig. 4 of the drawings the bobbin is applied to the spindle adapter unit 26 of Fig. 2 of the drawings and the corresponding parts are designated by the same reference numerals. The bobbin 36 is of course equally applicable to the spindle adapter unit 27 shown in Fig. 3 of the drawings since they are identical as far as their outside configurations are concerned. In accordance with the present invention the bobbin 36 is adapted to be supported substantially entirely by the upper tapered portion 31*a* of the adapter 31 while in accordance with the present invention providing a very small clearance at the lower end with respect to the portion 31*b* of the adapter 31. With this arrangement, unlike bobbins and spinning spindles used heretofore, the bobbin is driven from the top rather than the bottom. This results in a much more concentric motion.

As illustrated the bobbin 36 preferably is a so-called "parallel-sided" or "straight" bobbin formed of a tube of hardened aluminum generally designated as 37. For the purpose of reinforcing the lower end of the bobbin there is provided a metal reinforcing sleeve or other suitable insert 38 having a diameter slightly larger than the portion 31*b* of the adapter 31 to provide the clearance referred to above. As illustrated the sleeve 38 is held in position by rolling over the bottom edge of the tube 37 as indicated at 37*a*, and if desired flaring the lower end to aid in placing the bobbin on the adapter. In order to eliminate the metal to metal driving contact between the adapter 31 and the bobbin 36 there is provided at the upper end of the tubular member 37, a bushing 39 having an inner configuration so as to engage the tapered portion 31*a* of the adapter 31. This bushing may be formed of a moldable insulating material or plastic such as polystyrene or the like in which case it could be molded into position. The bushing 39 may also be molded from a canvas-impregnated material such as Bakelite or the like before insertion into the upper end of the tube 37. To properly position bushing 39 within the tube 37 the upper end of the tube 37 is counter-bored to define a shoulder or ledge 40 for engaging the lower end of the bushing 39. The upper end of the tubular member 37 is rolled over as indicated at 37*b* firmly to lock the bushing 39 in position. The plastic insert effectively provides a "cushion" drive. The bobbin 36, as illustrated, fits over the adapter 31 to within approximately one-eighth inch from the bottom of the adapter 31.

In view of the detailed description included above, operation of the spinning spindle adapter and improved bobbin therefor of the present invention will be understood by those skilled in the art and no further discussion thereof is included herewith. It will furthermore be understood that with the present invention it is no longer necessary for a textile manufacturer to stock 15 or 20 different types of bobbins which might be employed with various ones of the spinning frames in the textile mill. Instead, all of the spinning frames can be converted so as to employ a standard bobbin identical for all machines. In addition, the disadvantages of the wooden, paper, fiber or other bobbin are dispensed with which disadvantages comprise splitting, swelling, lack of concentricity and the like, and the additional advantage is obtained of being able to wind about one-third more yarn on the bobbin associated with the spindle than on prior art arrangements.

It will furthermore be understood that with the present invention bent spindles may effectively be straightened merely by applying the adapter of the present invention thereto. In such a case the adapter prior to finally forming the exterior surface thereof is applied to the spinning spindle in the manner described above, and the exterior of the adapter is then formed so as to be accurately concentric with the spindle.

It has been common practice in the spinning industry to employ to a considerable extent the so-called "tapered" bobbins and in Figs. 7 and 8 of the drawings there is illustrated a spinning spindle unit 45 having associated therewith a tapered bobbin 46. The spindle is illustrated as being identical with the spindle of Fig. 3 of the drawings and the corresponding parts are designated by the same reference numerals. It should be understood however that any other type of spindle might equally well have been illustrated and could equally well be converted to accommodate a standard "tapered" bobbin such as 46.

The adapter in Fig. 7 is indicated by the reference numeral 47 and comprises the necessary internal bore commensurate with the spindle with which it is to be united as an integral unit. As illustrated the adapter 47 is tapered from end to end with the exception of a slight enlargement 48 at the upper end thereof to provide the driving surface for the "tapered" bobbin 46 which may be substantially identical with the bobbin 36 described above except for the substitution of a tapered tube 50 for the "straight" or "parallel-sided" tube 37. A sleeve 51 similar to the sleeve 38 is employed at the lower end of the bobbin 46. The lower end of the tapered tube 51 is provided with a rolled edge 51*a* which may also be flared as indicated. The upper end of the tapered tube 51 may be provided with the rolled edge 51*b* for holding a plastic bushing or insert in position in the same manner as the rolled edge 37*b* in Fig. 4 of the drawings to provide the desired top drive which avoids metal to metal contact.

In Figs. 7 and 8 of the drawings, however, there is illustrated a modified so-called "plastic" bobbin drive in that the plastic bushing is made as an integral part of the adapter 47 rather than as an integral part of the bobbin 46. In this modified arrangement the upper end of the adapter 47 is cut away to define a portion of reduced cross section 47*a* and a shoulder or ledge 47*b*. A plastic sleeve 52 preferably formed of Bakelite or the like is positioned on the ledge 47*b* in concentric relationship with the portion 47*a* and integrally united as by a press fit or the like to provide the driving surface 48 mentioned above. It should be understood however that the driving surface 48 could be a metal surface as indicated in Fig. 9 of the drawings in which case the plastic bushing would be made a part of the bobbin as in Fig. 4 of the drawings.

In Fig. 9 of the drawings there is illustrated a spinning spindle 45' identical with the one shown in Fig. 7 of the drawings except that the adapter is not provided with the plastic sleeve 52. Both

the adapter **47'** and the whorl **29** of the spindle are shown in section. It may be noted that the upper portion **28***a* of the blade **28** is relatively short as contrasted with Fig. 2 of the drawings. Preferably the blade is cut off to a short desired length as illustrated. The adapter **47'** is provided with a bore **53** having an enlarged bore portion **53***a* near the lower end having a configuration to provide a press or shrink fit with the whorl **29** and an upper bore portion **53***b* having the desired configuration to provide a press or shink fit with the short upper portion **28***a* of the blade **28**. With this arrangement two spaced portions of the adapter **47'** tightly embrace cooperating portions on the spindle **45'** and specifically a portion of the blade and a portion of the whorl so as effectively to lock the blade and whorl together as a unit in the manner described in connection with Fig. 2 of the drawings.

In the construction of Fig. 9 of the drawings the spindle is preferably straightened, the blade cut off and the blade and whorl modified to be concentric, if not already so, preparatory to assembly with the adapter. The adapter is also constructed so that its internal bore and external surface are truly concentric. These two parts are then assembled by a press fit or the like to produce an integral truly concentric structure.

In Fig. 9 of the drawings there is illustrated a modified bobbin **56** of the so called "straight" type which may be employed on a tapered adapter **47'**. The plastic insert **57** at the upper end thereof has a configuration to produce the desired drive with the surface **48** while still permitting the diameter of the upper end of the tube **58** to equal that of the lower end. Such a bobbin would enable more yarn to be wound thereon and would provide a better angle of yarn pull throughout the traverse.

While there have been shown and described particular embodiments of the present invention, it is to be understood that the arrangements disclosed are merely illustrative of the invention. It will, of course, be apparent to those skilled in the art that changes and modifications may be made without departing from the present invention, and it is also aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. An adapter for use with a spinning spindle of the type having a blade and a whorl united by a press fit or the like, comprising a metal member having a predetermined external configuration for accommodating a standard bobbin, and means defining a bore in said adapter of such shape as tightly to embrace two spaced portions of said spinning spindle, one of said spaced portions comprising a tapered portion of said blade and the other of said spaced portions comprising a tapered extension of said whorl, said adapter effectively becoming an integral part of said spindle upon press fitting of the tightly embracing portions of said spindle and said adapter, whereby said blade and whorl of said spindle are effectively locked together by said adapter.

2. A spinning spindle comprising a relatively slender circular blade having a first tapered surface portion, an elongated member having a predetermined external configuration for accommodating a bobbin, means defining a tapered internal bore in said member for receiving therein in frictional engagement as by a press fit or the like said first tapered surface portion to form an effectively integral unit, means defining on said member an accurately formed second tapered cylindrical surface of larger diameter than said first tapered surface portion, and a whorl having a tapered cylindrical surface portion frictionally interrelated with said second tapered cylindrical surface.

3. A spinning spindle comprising a relatively slender circular blade having a first external surface portion, an elongated member having a predetermined external configuration for accommodating a bobbin, means defining an internal bore in said member for receiving therein in frictional engagement as by a press fit or the like said first surface portion to form an effectively integral unit, means defining on said member an accurately formed second cylindrical surface comprising an enlargement of said internal bore spaced in the direction of the longitudinal axis of said member from said first surface portion, and a whorl having a cylindrical surface portion frictionally interrelated with said second cylindrical surface, said cylindrical surface portion of said whorl being shorter in the direction of said longitudinal axis than the corresponding length of said second cylindrical surface whereby to afford an annular chamber in said member surrounding said blade immediately above said whorl.

TREVOR L. DAVIES.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
505,507	Buttrick	Sept. 26, 1893
515,035	Wrigley	Feb. 20, 1894
602,183	Sutcliffe	Apr. 12, 1898
680,019	Brown	Aug. 6, 1901
1,614,648	Buffington	Jan. 18, 1927
2,320,965	Cetchett et al.	June 1, 1943
2,417,485	Gleitz et al.	Mar. 18, 1947
2,463,484	Gelpke	Mar. 1, 1949

FOREIGN PATENTS

Number	Country	Date
620	Great Britain	Nov. 4, 1909
23,874	Great Britain	Oct. 7, 1893
23,988	Switzerland	May 30, 1901
522,622	Great Britain	June 21, 1940
552,842	France	Jan. 30, 1923
565,382	France	Nov. 6, 1923
458,746	Germany	Apr. 20, 1928
498,786	Germany	May 27, 1930