Aug. 31, 1965 M. STEIN 3,203,073

TOP ROLL FOR DRAFTING DEVICES ON TEXTILE MACHINES

Filed Sept. 7, 1962 2 Sheets-Sheet 1

Fig. 1.

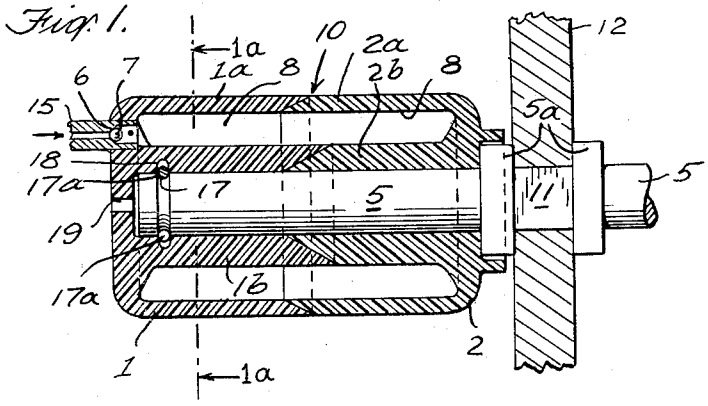
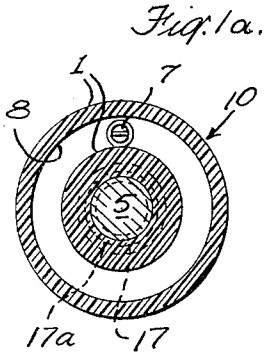


Fig. 1a.



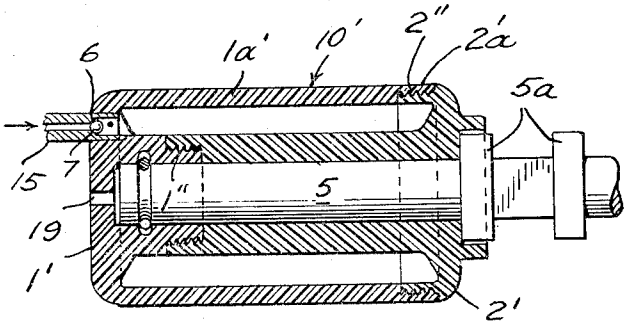


Fig. 2.

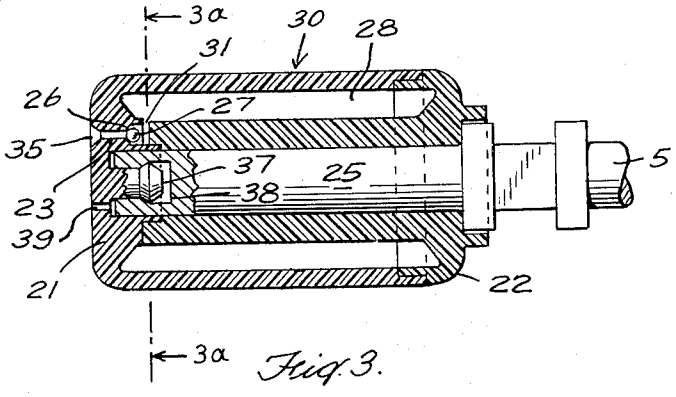


Fig. 3.

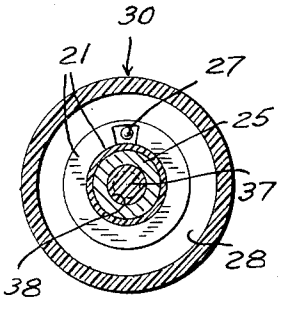


Fig. 3a.

INVENTOR
MARCEL STEIN.
BY
ATTORNEY

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Fig. 4.

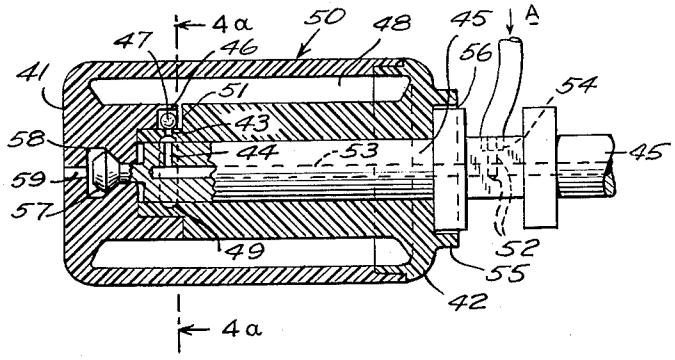


Fig. 4a.

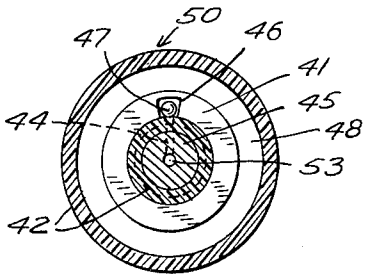


Fig. 5.

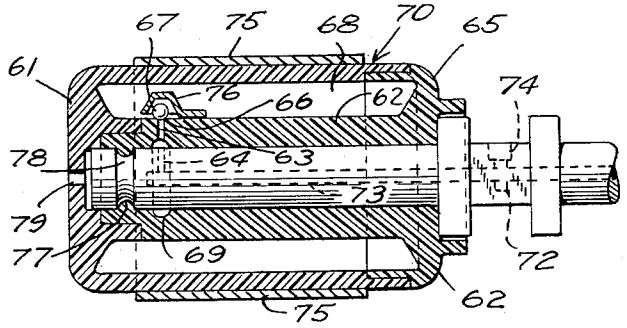
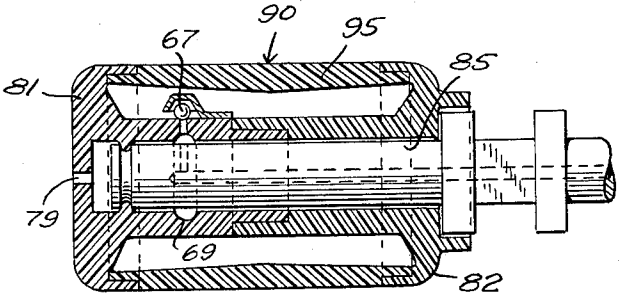


Fig. 6.



INVENTOR
MARCEL STEIN.
BY
ATTORNEY

United States Patent Office 3,203,073 Patented Aug. 31, 1965

3,203,073

TOP ROLL FOR DRAFTING DEVICES ON TEXTILE MACHINES

Marcel Stein, 51 W. 81st St., New York 24, N.Y.

Filed Sept. 7, 1962, Ser. No. 222,231
9 Claims. (Cl. 29—113)

The invention relates to top rolls for drafting devices on textile machines. More specifically, it relates to top rolls having a hollow cylindrical body with a hub and a mantle made of a resilient material, and assembled from parts united with each other so as to form a single member.

Top rolls of this kind are shown in the art. The air cushion enclosed in the hollow space increases the elasticity of the roll mantle.

However, hitherto known top rolls have not been constructed so as to hold air under pressure. It is one of the objects of the present invention to produce a top roll adapted to be pressurized whereby better to perform its purpose.

Conventional top rolls may replace the compact cot but still have the old metal core and hub which have not been changed at all. The metal hub must be supported on its shaft by means of a bearing, or the shaft itself has to be journalled in one or more bearings.

It is the purpose of the invention to eliminate the disadvantages of hitherto known top rolls, for example, barrel-shaped rolls which have been introduced as an improvement over cylindrical top rolls. In known top rolls having barrel shapes, a tubular cot has been compressed in axial direction causing it to bulge. The magnitude of the required compressing force depends on the actual working conditions, like the loading spring force or weight, the yarn quality to be spun, and the like. Therefore, the compressing force and the deformation of the cot has to be changed and checked individually for each cot of a textile machine. This is time consuming and may cause numerous errors.

It is another major object of the present invention to provide means whereby to pressurize the top rolls, individually or simultaneously. As will be fully explained in the specification, this can be performed manually or automaticaly by means adapted to pressurize all top rolls of a frame or textile machine. This, in turn, may be done intermittently or continuously.

By application of the same pressure to all top rolls on a frame, a uniform barrel shape is ensured for all the top rolls. No individual checking and/or altering the roll or cot bulge is needed. If a readjustment should nevertheless be required, this is made simple, inexpensive and not time consuming. By use of the top rolls according to the present invention, uniformly resilient top rolls are created.

According to one of the features of the invention, all parts of the top roll, including the hub and the resilient mantle, are made of synthetic rubber, plastic or similar material. The constituent parts of the mantle may be arranged to fit into each other, to telescope into each other, or to be encapsulated at least partly one in the other. The thus connected parts may be permanently fixed to each other, e.g., by screwing, welding or glueing (cementing) so as to form a unitary top roll member. The top roll is thus made air tight and capable of being pressurized by a suitable medium (for example, air or gas).

For manual, individual pressurization of the top rolls, a check valve may be provided through which the hollow space within the roll may be filled with air or the like. The check valve preferably of the ball type, may have a housing attached to the top roll proper, or have its housing formed inside the hub or side wall of the top roll, as will be explained later.

It is advantageous to make at least the inner surface of the hub from a wear resistant plastic or of synthetic rubber having a low friction coefficient as compared to the shaft material around which the top roll revolves. The hub material may, for example, be tetrafluoroethylene, whereby the top roll may be used without any extra bearing, ensuring undisturbed and maintenance-free rotation around the fixed shaft, without the use of any lubricant.

The invention also includes the use of plastics or synthetic rubber for the mantle in which the formation of electrostatic charges is reduced.

With built-in, automatic means for pressurizing the top rolls, the necessary uniform pressure can be re-established in all connected top rolls simultaneously. This can be done even during the operation of the textile machine, if the inner pressure should fall below a predetermined allowable level.

It is another one of the features of the invention that, in a preferred embodiment, the housing of the check valve can be produced simultaneously with the other top-roll parts, e.g. by molding. The air ducts and inlets of the check valves may also be produced in this manner, eliminating subsequent machining and adjusting steps.

According to another feature of the invention, the means for simultaneously and automatically pressurizing a plurality of top rolls includes an axial duct for the pressurizing medium, which preferably coincides with the axis around which the top roll revolves. The duct is provided in the stationary shaft which supports the top roll and a secondary duct is preferably arranged radially in both the shaft and the top roller itself. A circumferential groove may be provided in either of these members for assuring continuous air delivery to the internal hollow space through the air ducts.

According to a still further feature of the invention, a small current of the pressurizing fluid is allowed to pass between the contiguous bearing surfaces of the top roller and its stationary shaft. Either pressurized intermittently or continuously, the current of said fluid will blow off any fly or dust which may accumulate at or around the junction point of the bearing surfaces. The same small current will positively prevent any such dust from entering the inside of the top roll. The most feared enemy, fly and dust, of textile machines is thus effectively kept away from the top rolls of this invention.

In an alternative embodiment of the invention, an optional cot may be used outside the inflatable top-roll mantel. Such a cot will prevent excessive deformation of the mantle when inflated. This, at the same time, is an economical measure allowing the cots to be replaced from time to time by deflation of the top roll, removal of the old cot and the slipping of a new cot thereover. The life performance of the top rolls is substantially increased by this measure.

Axial motion of the top rolls with respect to their retaining shafts is prevented by button-shaped, annular or other mating portions provided at the outer ends of the rolls and the respective shafts. The top rolls may, at any time, be manually separated from the shafts since the frictional retaining force between the mating portions can be overcome by axial pull.

Other objects, features and many of the attendant advantages of the invention will be readily appreciated as the same become better understood by reference to the following detailed description, when considered with the accompanying drawing, wherein:

FIG. 1 is a sectional illustration of a preferred embodiment of the top roll according to the invention, taken along its shaft axis;

FIG. 1*a* is a cross-sectional illustration of the top roll, taken along line 1*a*—1*a* of FIG. 1;

FIG. 2 is an alternative embodiment of the top roll shown in FIG. 1 wherein screw threads are used for connecting the parts;

FIG. 3 is a section, similar to FIG. 1, of another embodiment of the inventive top roll having a check-valve housing inside the hub;

FIG. 3*a* is a cross section, similar to FIG. 1*a*, taken along line 3*a*—3*a* of FIG. 3;

FIG. 4 is a section of still another top roll, adapted to be pressurized without being removed from its shaft;

FIG. 4*a* is a cross section taken along line 4*a*—4*a* of FIG. 4;

FIG. 5 is a further embodiment of a top roll to be pressurized without removing it from the shaft; and

FIG. 6 is another embodiment of the invention in which the top roll has a mantle the wall thickness of which is increased in the middle.

In FIGS. 1 and 1*a*, a preferred embodiment of a top roll **10** is shown which has an end portion **1** and an axially shouldered portion **2**, both being made of synthetic rubber, plastic or similar resilient material, and adapted to be interconnected with one another along contacting surfaces, e.g. by cementing. Respective outer sleeve portions **1***a* and **2***a* have tubular thin walls, whereas inner walls **1***b* and **2***b* are made heavier in due consideration of the stresses they have to endure without excessive deformation.

The inner walls **1***b* and **2***b* of the top roll **10** are journaled to rotate around a stationary shaft **5** supported by conventional means, not shown. Textile drafting devices are usually fitted with such shafts, having two shoulder portions **5***a* spaced apart by a substantially central, square-shaped portion **11** mounted in a bracket **12**. The top rolls **10** are attached to the respective outer ends of shaft **5**; throughout the figures, only one top roll has been shown while the opposite roll (on the right-hand sides of the illustrations) have been omitted for the sake of clarity.

In the top roll **10**, a check valve is provided for the pressurizing fluid to be introduced. The valve has a seat **6**, while a ball is shown at **7**. The valve, of conventional structure, is made so as to avoid losing the ball **7**. The respective cylindrical walls **1***a*, **2***a* and **1**, **2** of top roller **10** define therebetween a hollow space **8** capable of being filled with a gaseous or liquid medium adapted to be pressurized, as will be explained hereunder in more detail.

Top roll **10** is prevented from axially moving with respect to shaft **5** by the provision of respective annular grooves or recesses **17**, **18** in shaft **5** and in end portion **1**, with a snap ring or retainer **17***a* interposed in said grooves. It will be understood that other useful means can be used for this purpose, as will be explained hereunder in connection with the alternative embodiments of FIGS. 3 and 3*a*, 4 and 4*a*, as well as 5. With a view to facilitating insertion of shaft **5** into the top roll **10**, portion **1** is preferably provided with an air-release bore **19** at the end opposite the aperture through which the shaft is introduced. Portions **1** and **2** have configurations allowing simple and cheap manufacturing by mass-production methods, e.g. injection molding.

For setting top roll **10** to operation, an axially protruding inlet **15** of the check valve is temporarily connected with an extraneous source of fluid under pressure (not shown). The liquid or gaseous medium, e.g. air, is thus introduced under controlled conditions into the space **8** so that the outer portions **1***a*, **2***a* will slightly bulge outward and provide a resilient support for the yarn to be processed. With this embodiment, the machine would have to be stopped if the top roll **10** should need re-pressurizing.

FIG. 2 shows an alternative top roller **10'** on shaft **5**, having an end portion **1'** and a shouldered portion **2'** with respective sleeve portions **1***a'* and **2***a'* similar to those shown in and described with references to

FIGS. 1, 1*a*. While the interengaging portions of the previous embodiment have substantially centrally arranged abutting surfaces, FIG. 2 is illustrative of a thread connection wherein portion **1'** has an outer thread **1''** and portion **2'** has an outer thread **2''**, both matingly engaged by respective inner threads of the other portion. In other respects, this alternative embodiment is identical to and operates the same way as the first-described, preferred embodiment.

Instead of the above threading, the top-roll portions can be welded or cemented, with or without additional threaded joints by previous softening of the abutting surfaces by a solvent or by means of a thermoplastic procedure known in the art. It will be understood that any combination of the above-mentioned methods and those to be described may be used.

The next embodiment, illustrated in FIGS. 3 and 3*a*, differs from the previous ones in many respects. A seat **26** of a check valve is formed by end portion **21** which, being made of resilient material, provides air-tight closing with valve ball **27**, if under pressure. Air duct **23** and conical air inlet **35** as well as the housing of the check valve can be produced simultaneously when molding end and shouldered portions **21** and **22** of the top roll **30**. They, however, may also be machined, e.g., drilled. Here the air duct **23** is parallel to the axis of shaft **25**.

The space of the check valve is connected with hollow space **28** of this embodiment by means of a gap **31** provided between the parts **21** and **22**. Top roll **30** is pressurized in a manner similar to that of roll **10**. The external source of pressurized air or the like is connected to the air inlet **35**. It will be understood that both top rolls **10** and **30** may at will be pressurized off their respective shafts **5**, **25** and be applied thereto subsequently, so that the drafting device will idle for a relatively short period of time.

Provision is made in order to prevent axial motion during rotation of the top roll **30** on its shaft **25**. A button-shaped portion **37** is provided at the flat bottom part of portion **21**, pointing toward shaft **25**. The latter, in turn, has a corresponding aperture **38** capable of engagingly receiving portion **37**. When the hub of top roll **30** is pushed over shaft **25**, the button-shaped portion **37** snaps into the aperture **38** owing to its resiliency. It can be removed therefrom only by exerting a certain force in axial direction. This force, however, is far gerater than the axial forces occurring during normal operation; thus the top roll **30** is safely held in position during operation. Slightly off-center portion **21** may again be provided with an air-release bore **39** similar to that shown at **19** in FIG. 1. This facilitates interengagement and separation of top roll **30** with and from, respectively, shaft **25**.

In FIGS. 4 and 4*a*, a top roll **50** is shown wherein the walls of a housing **46** of a check valve are formed by portions **41** and **42**. A valve ball is shown at **47**. An air duct **43** extends in portion **41** in a radial direction, i.e., its axis is perpendicular to that of shaft **45**. A radial duct **44** in shaft **45** is permanently connected with the duct **43** by means of a circumferential groove **49** provided in portion **42**. Whatever the position of duct **43** may be with respect to duct **44**, the air or gas connection will be maintained. A gap **51** between portions **41** and **42** connects the check valve housing with hollow space **48**.

A duct **53** coaxial with the shaft **45** connects duct **44** with a second radial duct **52** machined in the shaft **45**. Duct **52**, traversing the central, square-shaped portion of shaft **45**, has a tapered or screwed connection **54**, only schematically shown in FIG. 4, leading to a pressurized air supply (not shown) denoted by an arrow A. The hollow space **48** of the top roll **50** can be uniformly pressurized through connection **54**. The pressurization may work on both top rolls connected to the same shaft, as has been explained in connection with top roll **10** of FIGS. 1, 1*a*.

The pressurization of the top rolls of one frame can be done by connecting only one duct **52** with the pressure supply, thus pressurizing once only one pair of top rolls which may remain in position on the frame. A group of or all the top rolls can, however, be pressurized on a frame simultaneously, depending on how many of the ducts **52** are connected at any given time to the pressure supply. The top rolls **50**, and those of the following embodiments, can be pressurized even while rotating, that is, no interruption of production is necessary for pressurizing the top rolls. This procedure may be carried out intermittently or continuously; the structures of the top rolls allow both solutions.

In FIGS. 4 and *4a* the shaft **45** is shown with a button-shaped projection **57** and the portion **41** is provided with a corresponding recess **58**. At **59**, an air-passage bore is provided in portion **41**, similar to those previously described.

There is always some play between the shaft **45** and the inner running surface of the top roll **50** through which a small current of air will seep from the groove **49** toward a ring surface **55** of portion **42**, and from the latter, into the ambient through a cylindrical gap **56**, when the tapered connection **54** of duct **52** is connected with the pressurized air supply. This small current of air will blow off any fly or dust accumulation along its path when intermittent pressurization of the top rolls is applied. The same current will not allow any impurity to accumulate along its path if the top roll **50** is permanently pressurized.

In FIG. 5, a top roll **70** is represented in which a seat **66** of a check valve is formed in the hub portion of top-roll portion **62**, while a ball **67** is held near the seat **66** by means of an abutment **76** attached to portion **62**. The resiliency of the abutment **76** allows the insertion of the ball **67** into its position under the abutment.

Sometimes it may be necessary to cover the outer mantle of a top roll **70** with a thin cot **75** of suitable material, as is shown in FIG. 5 in order to prevent excessive deformation of the mantle when inflated. The cot **75** can be pushed over the mantle of portion **61** when the top roll **70** is deflated. Then, when the roll is pressurized, the friction between the cot **75** and the portion **61** will prevent the former from loosening.

Another means for preventing axial motion of the top roll **70** is illustrated, portion **62** being provided with a tapered ring **77** while shaft **65** has an annular groove **78**. When the top roll **70** comes into its position on shaft **65**, ring **77** snaps into groove **78** due to the former's resiliency which prevents axial motion during operation.

In this embodiment, numeral **68** denotes the space between top-roll portions **61**, **62**; the remaining numerals **63**, **64**, **69**, **72**, **73**, **74** and **79** denote top-roll parts already described in the embodiment of FIGS. 4, *4a*, in connection with respective parts **43**, **44**, **49**, **52**, **53**, **54** and **59**.

In FIG. 6, another embodiment of a top roll **90** is represented. This is composed of three portions, i.e. portions **81** and **82** very much similar to portions **1** and **2**, respectively, of the first embodiment, as well as an intermediate cylindrical member **95**. This structure has the advantage that the hub and the sides of the top roll **90** are made of a material having a relatively low friction coefficient, while the cylindrical mantle **95** is made of a resilient material of which the electrostatic chargeability is reduced. It also has a double tapered cross section in order to reduce excessive deformation when pressurized. This particular shape will prevent any untoward, non-uniform bulging of the top roll **90** when set under pressure.

I claim:

1. In a textile apparatus, two interconnected members comprising a fixed shaft and a feed roll journalled on said shaft, said feed roll comprising a pair of end sections composed of plastic material, each of said sections including a cylindrical hub wall having a bore to receive said shaft and a cylindrical outer wall spaced therefrom and integrally joined to said hub wall by an end wall, the hub walls and outer walls of said sections being joined together to form a closed annular chamber within said roll, one of said walls having an air passage therein and carrying a valve means adapted when open to admit a fluid under pressure into said chamber and adapted to be closed in response to fluid pressure in said chamber, said outer cylindrical wall being sufficiently flexible to be bulged outwardly in response to said fluid pressure, one of said end walls extending across and forming an end closure for the bore of said hub wall and having an air release vent therein to permit said roll to be positioned over the end of said shaft, said hub wall and said shaft having cooperating retaining means adapted to releasably secure said roll onto said shaft.

2. The combination set forth in claim **1** in which said valve means includes a seat carried by one of said walls and a valve member movable with respect to said seat and retaining means cooperating with the said seat for holding said valve member in position.

3. The combination set forth in claim **1** in which said air passage and valve means are disposed in one of said end walls.

4. The combination set forth in claim **1** in which said air passage and valve means are disposed in said hub wall and said fixed shaft is provided with an air passage having a port registering with the air passage in said hub wall.

5. The combination set forth in claim **1** in which said air passage and valve means are disposed in said hub wall, the inner surface of said hub wall is provided with an annular recess registering with said air passage and said fixed shaft is provided with an air passage terminating in a radial port registering with said annular recess.

6. The combination set forth in claim **1** in which said retaining means comprises an axial projection carried by one of said members and extending within a corresponding recess in the other of said members, said recess having an annular groove and said axial extension having an annular rib seating in said groove.

7. The combination set forth in claim **1** in which said retaining means comprises annular grooves disposed in said shaft and in said hub wall and a retaining ring disposed in said grooves.

8. In a textile apparatus, a fixed shaft and a feed roll journalled on said shaft, said feed roll comprising a hub having a wall with an inner bearing surface journalled on said shaft, an outer cylindrical wall spaced from said hub wall and a pair of end walls joining said hub wall and said outer wall to form therewith an annular closed chamber in said roll, said roll extending at one end beyond the end of said shaft and carrying an end closure member extending across the end of said shaft to prevent access thereto, said shaft having means securing said roll against axial movement on said shaft and having an axial air passage terminating in a radial passage opening to the bearing surface of said hub at a point between the ends thereof, said bearing surface having a clearance with said shaft such that air under pressure flows from said shaft opening along the bearing surface and is discharged at the end of said roll for preventing contamination of said bearing surface due to deposition of particles from the surrounding atmosphere, said feed roll having an opening communicating between said annular chamber and said axial air passage of said shaft.

9. The combination set forth in claim **8** in which valve means is provided to permit passage of air from said bearing surface into said chamber, said valve means being adapted to be closed in response to air pressure in said chamber whereby said chamber may be maintained under pressure by air supplied through said last passage.

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WALTER A. SCHEEL, *Primary Examiner.*

JOSEPH D. BEIN, *Examiner.*