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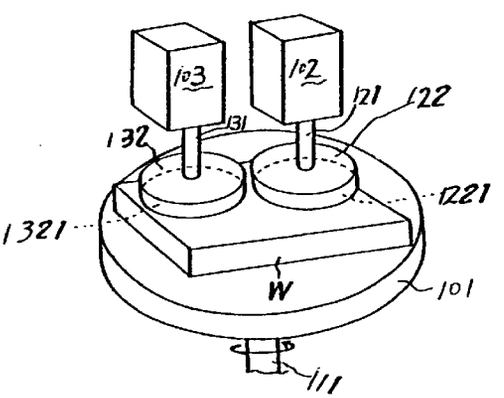
(54) Buffing apparatus and method

(57) A wet type buffing method is practiced such that a final buffing step (G) is conducted in a buffing liquid having alkality and the remaining buffing steps (A,B) are conducted in other buffing liquid having acidity. A work buffing apparatus is constructed such that a disconnection preventive member is disposed at the foremost end of a shaft (510) for a work, the outside of a buffing wheel (520) comes in contact with the disconnection preventive member, a tightening nut (540) is threadably engaged with the buffing wheel (520), and the buffing wheel (520) is tightly fixed to the shaft (510) by displacing the tightening nut (540) along the shaft. In addition, a surface treatment conducting method is practiced such that each surface treatment is conducted after a work is subjected to barrel buffing before or after the surface treatment. Additionally, a work supporting apparatus includes a buffing medium (762) receiving container having a buffing medium received therein and a work supporting arm (792). Further, a buffing medium (762) employable for a buffing apparatus is composed of grain of soft material or small block of the soft material.

Fig. 2



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Description

BACKGROUND OF THE INVENTION

(FIELD OF THE INVENTION)

The present invention relates to a wet type buffing method, a deposition plating method, a work buffing method, a work buffing apparatus, a barrel buffing apparatus, a work surface treating method, a work supporting unit for a barrel buffing apparatus, and a buffing medium. Particularly, with respect to the deposition plating method, the present invention is applicable to a method of conducting deposition plating after a work is subjected to buffing, and moreover, with respect to the work buffing apparatus, the present invention is applicable to a method of mounting a buffing wheel on the work buffing apparatus.

(PRIOR ART)

(FIRST CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

The conventional wet type buffing method is exemplified by a method of improving a buffing efficiency by using an acid buffing agent and a method of smoothly buffing a work by using an alkaline buffing agent.

However, with respect to the conventional buffing method as mentioned above, in the case that a buffing agent having acidity is used like the first-mentioned conventional buffing method, the buffing efficiency can be improved but there appears an inconvenience that it is appreciably difficult to smoothly buff each work. On the other hand, in the case that a buffing agent having alkality is used like the last-mentioned conventional buffing method, each work can smoothly be buffed but an oxide film or the like remaining on the surface of the work can be removed from the work only with much difficulties. As a result, there appears an inconvenience that it is difficult to improve the buffing efficiency with the conventional buffing method.

(SECOND CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

In the case that a deposition plating operation is performed with a work after this work is subjected to buffing, the conventional plating process is practiced in accordance with either one of the hitherto employed methods as mentioned below. In detail, one (1) of the hitherto employed methods is a method of conducting deposition plating after completion of the dry type buffing operation, and other one (2) of the hitherto employed methods is a method of conducting deposition plating after completion of a wet type buffing operation.

However, with respect to the first-mentioned conventional buffing method, since dry type buffing is employed as buffing means, the buffing time can be shortened but the resultant buffed surface of the work exhibits poor surface roughness with a reduced degree of brightness. Consequently, there arises an inconvenience that the thickness of a deposition plated layer should be increased, and moreover, it is practically difficult to improve the operational efficiency of each deposition plating operation performed for the work. In addition, with respect to the last-mentioned conventional buffing method, since wet type buffing is employed as buffing means, a quantity of surface roughness attained by the conventional buffing method on completion of each buffing operation can improvably be elevated. As a result, the thickness of deposition plating can be reduced but the time required for performing each buffing operation is undesirably elongated. For this reason, an inconvenience arises in the same manner as mentioned above such that it is practically difficult to improve the operational efficiency attained by the deposition plating process with each buffed work.

(THIRD CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

Among the conventional work buffing methods, there is a wet type buffing method which is practiced such that a work is subjected to dry buffing with the aid of a buffing wheel, and thereafter, the dry buffed surface of the work is subjected to wet buffing.

However, when the conventional buffing method as mentioned above is employed for the purpose of buffing each work, this work is subjected merely to wet buffing in the presence of an acid detergent liquid. For this reason, there arises an inconvenience that dirty foreign matters are removed from the surface of the work with some difficulty, and moreover, it is practically difficult to remove an oxide film from the surface of the work due to the substantially intense strengthening achieved for the work in the presence of the acid detergent liquid.

(FOURTH CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

With the conventional wet type buffing method, the surface of a work to be buffed is subjected to wet buffing by using a buffing wheel while a buffing liquid is fed between the surface of the work to be buffed and the rotating buffing wheel.

However, when the conventional buffing method as mentioned above is employed, the surface of the work to be buffed is oxidized during each buffing operation, causing an oxide film to be readily formed on the work. As a result, there arises an inconvenience that it is practically difficult to improve a quality of each buffing operation.

(FIFTH CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

With respect to a conventional work buffing apparatus, as shown in Fig. 3, an immovable engaging member 530 is disposed on the inside of a buffing wheel 520 fitted onto a shaft 510, a tightening nut 540 is threadably engaged with the outside of the buffing wheel 520, and the tightening nut 540 is threadably displaced along the shaft 510, causing the buffing wheel 520 to be immovably tightened at the fore end part of the shaft 510. While the foregoing state is maintained, a work (for example, wheel usable for vehicle or the like) W is subjected to buffing by rotation of the buffing wheel 520 about an axis line O of the shaft 510.

However, when the conventional buffing apparatus as mentioned above is employed, since the tightening nut 540 disposed on the shaft 510 of the buffing wheel 520 is displaced along the fore end part of the shaft 510, this fore end part of the shaft 510 is caused to project from the outside surface of the buffing wheel 520 by a distance equal to the thickness of the tightening nut 540 plus the tightening distance. As a result, the projected part of the shaft 510 becomes a kind of obstruction for a buffing operation to be performed with the buffing wheel 520. Consequently, there arises an inconvenience that it is practically difficult to improve the operational efficiency attained by the buffing operation. Especially, in the case that a pair of buffing wheels 520 are arranged on shafts 510 in the opposing relationship relative to each other so as to allow a single kind of work W to be subjected to buffing as shown in Fig. 3, there arises an inconvenience that the fore end parts of the shafts 510 projected from buffing wheels 520 function as a kind of obstruction for preventing the buffing wheels 520 from being displaced, resulting in each buffing operation being performed for the central part of the work W (rotational operation of the work W about an axis line of each shaft 510) with some difficult.

In addition, with the conventional buffing apparatus constructed in the above-described manner, since the buffing wheels 520 are immovably mounted on the shafts 510 with the inside surfaces thereof serving as reference, the positions assumed by the fore end surfaces of the buffing wheels 520 are caused to vary in dependence on the thickness of each buffing wheel 520. As a result, there arises an inconvenience that it is practically difficult to determine the position assumed by each buffing wheel 520 relative to the work W.

(SIXTH CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

With respect to the conventional barrel buffing apparatus, each work is subjected to buffing by allowing a buffing medium to flow in a buffing medium receiving container while the work is received in the buffing medium receiving container.

However, with the conventional barrel buffing apparatus constructed in the above-described manner, since an operational extent attained by the buffing medium is limited within a certain range by the buffing medium, it is required that the buffing medium is replaced with other one in dependence on an object of each buffing operation, i.e., a rough buffing step, an intermediate finish buffing step and a final finish buffing step, and alternatively, it is required that a plurality of barrel buffing apparatuses each including a buffing medium selected in such a manner as to match with a certain object of the conventional barrel buffing apparatus are preparatively arranged. At any rate, there arises an inconvenience that it is practically difficult to improve an operational efficiency of each barrel buffing operation with the conventional barrel buffing apparatus.

(SEVENTH CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

In fact, there is hitherto employed a technique for allowing the surface of a work to be coated with a certain material after completion of each buffing operation.

However, with the foregoing conventional technique, each work is subjected to buffing merely by using operator's hands. Consequently, there arises an inconvenience that an operational extent attained by each buffing operation readily fluctuates, resulting in each coating operation being unavoidably performed with some fluctuation. In addition, since it is required that burrs formed on the work because of a necessity for correctly performing each coating operation are removed from the work, there arises an inconvenience that it is practically difficult to improve the operational efficiency attained by employing the foregoing conventional technique.

(EIGHTH CONVENTIONAL TECHNIQUE AND ITS DRAWBACKS)

With the conventional barrel buffing apparatus, each work is subjected to buffing by allowing a buffing medium to flow in a buffing medium receiving container while the work is dipped in the buffing medium received in the buffing medium receiving container.

However, with the conventional barrel buffing apparatus, since each work is dipped in the barrel buffing medium received in the buffing medium receiving container while it is seized with the aid of a certain seizing instrument, there arises an inconvenience that it is difficult to hold the work in the immovably seized state. In addition, there arises an convenience that it is difficult to attach the work to the seizing instrument and detach the work from the seizing instrument. Especially, in the case of a work having a large mass, the last-mentioned inconvenience appears remarkably.

(OBJECTS OF THE INVENTION)

The present invention has been made in order to eliminate the inconvenience inherent to the first conventional technique as mentioned above. Therefore, a first object of the present invention is to provide a wet type buffing method which assures that an operational efficiency of each wet type buffing operation can be improved via a series of buffing steps, and consequently, each work can smoothly be buffed (hereinafter referred to as "a first invention").

In addition, the present invention has been made in order to eliminate the inconvenience inherent to the second conventional technique as mentioned above. Therefore, a second object of the present invention is to provide a deposition plating method which assures that the thickness of a deposition plated layer can be reduced in excess of the thickness obtained by the conventional deposition plating method, each deposition plating process can quickly be practiced, and consequently, an operational efficiency of each deposition plating operation can be improved for each buffed work in association with the quick execution of the buffing process (hereinafter referred to as "a second invention").

Additionally, the present invention has been made in order to eliminate the inconvenience inherent to the third conventional technique as mentioned above. Therefore, a third object of the present invention is to provide a work buffing method which assures that dirty foreign matters adhering to the surface of a work to be buffed and an oxide film extending over the surface of the work can easily be removed, thereafter, the surface of the work to be buffed is subjected to dry buffing, and subsequently, the surface of the work can be subjected to dry buffing (hereinafter referred to as "a third invention").

Further, the present invention has been made in order to eliminate the inconvenience inherent to the fourth conventional technique as mentioned above. Therefore, a fourth object of the present invention is to provide a wet type buffing method which assures that the surface of a work to be buffed is not oxidized during each buffing operation, resulting in any oxide film being not formed on the surface of the work to be buffed, and consequently, a quality of each buffing operation can be improved in excess of the quality obtainable by performing the conventional buffing operation (hereinafter referred to as "a fourth invention").

Furthermore, the present invention has been made in order to eliminate the inconvenience inherent to the fifth conventional technique as mentioned above. Therefore, a fifth object of the present invention is to provide a work buffing apparatus which assures that any projected part is hardly formed on the outside surface of a buffing wheel in the absence of foreign matters each undesirable for performing a buffing operation, and consequently, an operational efficiency of each buffing operation can easily be improved (hereinafter referred to as "a fifth invention").

Moreover, the present invention has been made in order to eliminate the inconvenience inherent to the six conventional technique as mentioned above. Therefore, a sixth object of the present invention is to provide a barrel buffing apparatus which assures that a rough buffing operation can initially be performed with a high intensity of pressure generated by the feeding of a single kind of buffing medium, and thereafter, an intermediate buffing step and a finish buffing step can sequentially be practiced as the intensity of feeding pressure generated by the feeding of the buffing medium is gradually reduced (hereinafter referred to as "a sixth invention").

In addition, the present invention has been made in order to eliminate the inconvenience inherent to the seventh conventional technique as mentioned above. Therefore, a seventh object of the present invention is to provide a work surface treating method which assures that an operational efficiency of each surface treatment can easily be improved (hereinafter referred to as "a seventh invention).

Additionally, the present invention has been made in order to eliminate the inconvenience inherent to the eighth conventional technique as mentioned above. Therefore, an eighth object of the present invention is to provide an apparatus for supporting a work for a barrel buffing apparatus which assures that a work having a large mass can easily be attached thereto and detached therefrom, and an operational efficiency of each barrel buffing operation can be improved (hereinafter referred to as "an eighth invention" and "a ninth invention").

(STRUCTURE OF THE INVENTION AND ADVANTAGEOUS EFFECTS)

According to the first invention of the present invention, the wet type buffing method including a series of wet type buffing steps in the combined state is practiced such that a final buffing step in the plural buffing steps is conducted by using a buffing liquid having alkality, and moreover, other buffing steps before the final buffing step are conducted by using a buffing liquid having acidity.

With this wet type buffing method, a buffing efficiency obtainable by the buffing step before the final buffing step having no influence on a final product can be improved, and moreover, each work can smoothly be buffed during the final buffing step having substantial influence on the final product.

Therefore, when this wet type buffing method is employed, an efficiency of each buffing operation can be improved during a series of buffing steps, and finally, each work can smoothly be subjected to buffing.

According to the second invention of the present invention, the deposition plating method is practiced such that each work is subjected to wet buffing, and thereafter, deposition plating is conducted on the sur-

face of the work to be buffed. Thus, after the work is quickly buffed during the dry type buffing step, a quality of surface roughness of the work is elevated during the wet type buffing step, and thereafter, deposition plating is conducted for the work in accordance with the deposition plating method.

Therefore, when this deposition plating method is employed, a thickness of the deposition plated layer can be reduced in excess of the thickness of the plated layer formed in accordance with the conventional deposition plating method, whereby the deposition plating step can quickly be conducted. As a result, an operational efficiency of each deposition plating operation performed for each buffed work can be improved in association with quick execution of the buffing step.

According to the third invention of the present invention, the work buffing method is practiced such that each work is subjected to dry buffing after a surface of the work to be buffed is subjected to barrel buffing, and thereafter, the work is subjected to wet buffing. Thus, dirty foreign matters adhering to the surface of the work to be buffed and an oxide film extending over the whole surface of the work can easily be removed prior to steps to be conducted subsequent to the dry buffing and the wet buffing.

Therefore, when this work buffing method is employed, the surface of the work to be buffed can be subjected to dry buffing after dirty foreign matters adhering to the surface of the work to be buffed and an oxide film extending over the whole surface of the work are easily removed, and thereafter, the work can be subjected to wet buffing.

Incidentally, when barrel buffing is conducted as a step to be practiced after the dry buffing, wet buffing can be conducted after the oxide film formed when the dry buffing is conducted as well as the buffing refuse adhering to the surface of the work are removed from the work. Consequently, each wet type buffing operation can be performed at a high efficiency, and moreover, concave parts or the like remaining on the surface of the work, for which any buffing operation can not practically be achieved with buffing wheels during the dry buffing step can be subjected to buffing. can be subjected to buffing.

In addition, when barrel buffing is conducted as a step to be practiced after completion of the dry buffing and the wet buffing, each wet buffing operation can be performed after the oxide film formed during the dry buffing step as well as the buffing refuse adhering to the surface of the work are removed from the work, and moreover, concave parts or the like remaining on the surface of the work, for which any buffing operation can not practically be performed with buffing wheels during the dry buffing step, can be subjected to buffing.

According to the fourth invention of the present invention, the wet type buffing method wherein each work is buffed with the aid of buffing wheels while a buffing agent is fed between the buffing surface of each buffing wheel and the surface of the work to be buffed is practiced such that each buffing operation is performed under the vacuum atmosphere or under the nitrogen gas atmosphere. Thus, the surface of the work to be buffed can be held under the vacuum atmosphere or under the nitrogen gas atmosphere during each buffing operation. Therefore, when the wet type buffing method is employed, the surface of the work to be buffed is not oxidized during each buffing operation, resulting in any oxide film being not formed on the surface of the work to be buffed. As a result, a quality of buffing operation can be improved in excess of the quality of buffing operation obtainable by the conventional wet type buffing method.

Incidentally, with this wet type buffing method, when the surface of the work to be buffed is subjected to buffing while nitrogen gas is blown to the surface of the work to be buffed, the nitrogen atmosphere can be formed on the surface of the work to be buffed without any necessity for covering the surface of the work to be buffed with a casing or the like.

Therefore, when this wet type buffing method is employed, any formation of the oxide film on the surface of the work can reliably be prevented by using a simple unit.

According to the fifth invention of the present invention, the work buffing apparatus including a shaft fitted to each buffing wheel so as to allow a work to be buffed while the shaft is rotated about its axis line is constructed such that a disconnection preventive member is disposed at the foremost end of the shaft, the outside of the buffing wheel is brought in contact with the disconnection preventive member, a tightening nut is threadably engaged with the inside of the buffing wheel mounted on the shaft, and the buffing wheel is immovably fixed to the shaft by threadably displacing the tightening nut relative to the shaft. Thus, in contrast with the conventional work buffing apparatus, there does not arise a necessity for disposing the tightening nut on the outside surface of the buffing wheel and maintaining a tightening distance for the tightening nut.

Therefore, when this work buffing apparatus is employed, any protruded part is not formed from the outside surface of the buffing wheel with the result that the presence of any undesirable substance for preventing each buffing operation from being correctly performed is not recognized on the work buffing apparatus. Consequently, an operational efficiency of each buffing operation can be improved. Especially, in the case that a single work is subjected to buffing while a pair of buffing wheels are mounted on the shafts in the opposing relationship relative to each other with the single work maintained therebetween, there does not occur a malfunction that displacement of each buffing wheel is inhibitively hindered due to collision of the foremost ends of the shafts with each other. Thus, the central part of each work can sufficiently be subjected to buffing.

In addition, since the position assumed by each buffing wheel relative to the shaft is definitely deter-

mined on the basis of the outside surface of the buffing wheel, the outside surface of the buffing wheel is caused to positionally vary depending on the thickness of the buffing wheel. As a result, the position assumed by the buffing wheel relative to the work can easily be determined.

In addition, when a diameter enlarged part is formed around the periphery of a shaft hole formed on the outside of the buffing wheel so as to enable the disconnection preventive member to be fully received in the diameter enlarged part of the buffing wheel, the outside surface of the buffing wheel can be caused to coincide with the foremost end of the shaft. As a result, each buffing operation can more easily be performed, and moreover, the position assumed by the buffing wheel relative to the work can more easily be determined.

According to the sixth invention of the present invention, the barrel buffing apparatus is constructed such that this apparatus includes a buffing medium receiving container having a buffing medium received therein and a work adapted to be vibratively displaced, the buffing medium receiving container includes an upper end opening, a buffing medium feeding port is formed at the bottom part of the buffing medium receiving container, the work is located below the buffing medium feeding port, and the buffing medium received in the buffing medium receiving container can continuously be fed to the work while this work is vibratively displaced. Thus, an intensity of feeding pressure acting on the work is gradually reduced, as the buffing medium is increasingly discharged from the buffing medium receiving container.

With such construction, when this barrel buffing apparatus is employed, a rough buffing operation can be performed during the initial period of time when a single kind of buffing medium is fed to the work at a high intensity of feeding pressure, and additionally, a series of steps comprising an intermediate finish buffing step and a final finish buffing step can continuously be practiced as the intensity of feeding pressure of the buffing medium is gradually reduced.

Further, since the buffing medium is caused to naturally fall down, it is easily introduced into hole portions formed on the work. As a result, the hole portions on the work can more adequately be subjected to buffing.

Moreover, since the feeding of the buffing medium to the surface of the work is achieved in dependence on the natural falling-down of the buffing medium, few noisy sound is generated from the barrel buffing apparatus, and moreover, a quantity of consumption of energy can be reduced with the barrel buffing apparatus.

Incidentally, when a guide sleeve is arranged between the feeding port of the buffing medium receiving container and the surface of the work, the feeding of the buffing medium to the work can be achieved without any particular loss.

In addition, when the guide sleeve is vibrated integrally with the work, the feeding of the buffing medium to the work can more smoothly be achieved.

Additionally, when the buffing medium received in the buffing medium receiving container can be compressed by actuating suitable means, an operational extent attained by each buffing operation performed for the work can be changed.

According to the seventh invention of the present invention, the work surface treating method is practiced such that the work is subjected to buffing before surface treatment or after surface treatment, and thereafter, this surface treatment is conducted with the use of a barrel buffing apparatus. Thus, an operational extent attained by each buffing operation can be uniformalized, and moreover, any formation of burrs on the work is not recognized on the surface of the work. Consequently, each surface treatment can easily be achieved as a post-step.

Therefore, when this work surface treatment method is employed, an operational efficiency attained by each surface treatment can easily be improved.

Incidentally, when each barrel buffing operation is performed with the use of a barrel buffing apparatus of the type which is constructed such that this apparatus includes a buffing medium receiving container having a buffing medium received therein and a work adapted to be vibratively displaced, the buffing medium receiving container includes an upper end opening, a buffing medium feeding port is formed on the bottom part of the buffing medium receiving container, the work is located below the buffing medium feeding port, and the buffing medium can continuously be fed to the surface of the work while this work is vibratively displaced, an intensity of feeding pressure acting on the work is gradually reduced as the buffing medium is increasingly discharged from the buffing medium receiving container. Consequently, a rough buffing operation can be performed during the initial period of time when a high intensity of feeding pressure acts on a single kind of buffing medium, and moreover, a series of operational steps comprising an intermediate finish buffing step and a final finish buffing step can continuously be conducted with the barrel buffing apparatus.

In addition, when each barrel buffing operation is performed with the use of a barrel buffing apparatus of the type which is constructed such that this apparatus includes a buffing medium receiving container having a buffing medium received therein and a work supporting arm, the buffing medium receiving container includes an upper end opening, and the fore end part of the work supporting arm can be turned within the range defined by the buffing medium receiving container from the position located substantially directly above the buffing medium receiving container, the work can be attached to the work supporting arm and detached from the same while the fore end part of the work supporting arm is located directly above the upper end opening of the buffing medium receiving container. Therefore, each work having a large mass can be attached to the work

supporting arm and detached from the same.

Additionally, when the work supporting arm is turned in the horizontal direction, the work can easily be located at an adequate position located in the buffing medium receiving container.

Further, when the work supporting arm can forwardly and backwardly be displaced in the axial direction, the work can be displaced to assume a low position when it is attached to the work supporting arm and detached from the same. Thus, attachment of the work to the work supporting arm and detachment of the work from the same can more easily be conducted.

Incidentally, the surface treatment is conducted in the form of, e.g., coating, plating, alumite treatment or the like, and the work is typically exemplified by a wheel usable for a vehicle or the like.

According to the eighth embodiment of the present invention, the apparatus for supporting a work for a barrel buffing apparatus is constructed such that this apparatus includes a buffing medium receiving container having a buffing medium received therein and a work supporting arm, the buffing medium receiving container includes an upper end opening, and the fore end part of the work supporting arm can turnably be displaced within the range defined by the buffing medium receiving container from the position located substantially directly above the upper end opening of the buffing medium receiving container. Thus, since each work can be attached to the work supporting arm and detached from the same while the fore end part of the work supporting arm is located directly above the upper end opening of the buffing medium receiving container, each work having a large mass can easily be attached to the work supporting arm and detached from the same.

Therefore, when this apparatus for supporting a work for a barrel buffing apparatus is employed, an operational efficiency attained by each barrel buffing operation can be improved.

In addition, when the work supporting arm is turnably displaced in the horizontal direction, the work can easily be located at an adequate position in the buffing medium receiving container.

Additionally, when the work supporting arm is forwardly and backwardly displaced in the axial direction, each work can be dislocated to assume a low position when the work is attached to the arm supporting arm and detached from the same. Thus, the work can more easily be attached to the work supporting arm and detached from the same.

Incidentally, when soft material such as sponge, rubber, soft plastic or the like is used for the buffing medium in the form of grain or small block, a finish buffing step can be practiced at a high efficiency. Further, a soft material may be coated on the surface of hard grain or hard small block so as to allow it to be used as a buffing medium.

According to the ninth invention of the present invention, the apparatus for supporting a work for a barrel buffing apparatus is constructed such that this apparatus includes a buffing medium receiving container having a buffing medium received therein and a work supporting arm, the buffing medium receiving container includes an upper end opening, the work supporting arm is arranged at the position tortuously located relative to a rotational shaft, the work supporting arm can turnably be displaced about the rotational shaft within the range of about 180 ° from the buffing medium receiving container, and the fore end part of the work supporting arm assumes a downwardly inclined state in the forward direction when the work supporting arm is located on the buffing medium receiving container side. Thus, when the work supporting arm is turned about the rotational shaft to assume the position located opposite to the buffing medium receiving container side, the work mounted at the fore end part of the work supporting arm can easily be attached to the work supporting arm and detached from the same. In addition, when the work supporting arm is turned about the rotational shaft to assume the position located on the buffing medium receiving container side, the work supporting arm is downwardly inclined in the forward direction, whereby the work is dipped in the buffing medium received in the buffing medium receiving container, causing the work to be subjected to barrel buffing.

Consequently, when the apparatus for supporting a work for a barrel buffing apparatus is employed, each work having a large mass can easily be attached to the work supporting arm and detached from the same. Thus, the operational efficiency attained by the barrel buffing operation can be improved.

In addition, provided that the work supporting arm can forwardly and backwardly be dislocated in the axial direction, each work can be dislocated to assume a low position when it is attached to the work supporting shaft and detached from the same. Thus, the work can more easily be attached to the work supporting shaft and detached from the same.

Additionally, provided that the tortuous angle of the work supporting arm relative to the rotational shaft can be adjusted, the buffing efficiency can be adjusted corresponding to the work, and moreover, the height assumed by the work supporting arm for allowing the work to be attached to the work supporting arm and detached from the same can be adjusted corresponding to an operator.

(BRIEF DESCRIPTION OF THE DRAWINGS)

Fig. 1 is a block diagram showing a series of steps for practicing a wet type buffing method in accordance with a first invention of the present invention.

Fig. 2 is a perspective view showing a wet type buffing apparatus in accordance with the first invention of the present invention.

Fig. 3 is a front sectional view showing a buffing apparatus operable in accordance with a fifth conven-

tional technique.

Fig. 4 is a front sectional view showing a buffing apparatus operable in accordance with a fifth invention of the present invention.

Fig. 5 is a fragmentary sectional view showing the buffing apparatus operable in accordance with the fifth invention of the present invention.

Fig. 6 is a sectional view showing a buffing apparatus operable in accordance with a sixth invention of the present invention.

Fig. 7 is a sectional view showing a barrel buffing apparatus operable in accordance with a first embodiment of a seventh invention of the present invention.

Fig. 8 is a sectional view showing a barrel buffing apparatus operable in accordance with a second embodiment of the seventh invention of the present invention.

Fig. 9 is a sectional view showing a work supporting unit for a barrel buffing apparatus operable in accordance with an eighth invention of the present invention.

Fig. 10 is a perspective view showing a work supporting unit employable for a barrel buffing apparatus operable in accordance with an embodiment of a ninth invention of the present invention.

Fig. 11 is a perspective view showing an attached/detached state assumed by the barrel buffing apparatus shown in Fig. 10.

Fig. 12 is an illustrative view showing a forward/rearward displacing mechanism employable for a work supporting arm arranged on the work supporting unit shown in Fig. 10.

Fig. 13 is an illustrative view showing a rotating mechanism employable for a reversing plate arranged on the work supporting unit shown in Fig. 10.

(DESCRIPTION OF PREFERRED EMBODIMENTS)

Now, the present invention will be described in detail hereinafter with reference to the accompanying drawings which illustrate preferred embodiments thereof.

(EMBODIMENT OF FIRST INVENTION)

Fig. 1 shows an embodiment of a wet type buffing method to be practiced according to the present invention, and this buffing method is practiced by way of a series of wet type buffing steps.

A step A represents a rough buffing step, a step B represents a finish buffing step, and a step C represents a final finish buffing step.

These steps A, B and C will be described below with reference to Fig. 2. In the drawing, reference numeral 101 designates a supporting board, and reference numeral 111 designates a supporting shaft arranged along the axis line of the supporting board. The supporting board 101 is rotated about the supporting shaft 111 with the use of suitable means (not shown) in the direction identified by an arrow mark. Reference character W designates a plate-like work, and this plate-like work is placed on the upper surface of the supporting board 101. In the shown case, the work W serves as a surface to be buffed (hereinafter referred to as a buffing surface).

Next, reference numeral 102 designates a first rotational driving unit, and this first rotational driving unit 102 includes a driving power source such as a motor or the like. Reference numeral 121 designates a rotational shaft, and this rotational shaft 121 is arranged in the rotational driving unit 102 while extending therefrom The rotational shaft 121 is rotated about the axis line by the motor or the like as mentioned above. Reference numeral 122 designates a first buffing wheel, and this first buffing wheel 122 is immovably attached to the foremost end of the rotational shaft 121. The first buffing wheel 122 serves to buff the work W with a buffing surface 1221 coincident with the bottom surface thereof while it is rotated. At this time, buffing liquid is fed between the buffing surface of the rotating buffing wheel 122 and the buffing surface of the work W. In the case that the final finish buffing step C is practiced, the buffing liquid to be used therefor is alkaline. On the contrary, in the case that steps other than the step C, i. e., the rough buffing step A and the finish buffing step B are practiced, the buffing liquid is acid.

In addition, reference numeral 103 designates a second rotational driving unit, and this second rotational driving unit 103 includes a driving power source such as a motor or the like in the same manner as the first rotational driving unit 102. Reference numeral 131 designates a rotational shaft, and this rotational shaft 131 is rotated about the axis line by the power given by the motor or the like. Reference numeral 132 designates a second buffing wheel, and this second buffing wheel 132 is immovably attached to the foremost end of the rotational shaft 131. The second buffing wheel 132 serves to buff the work W with a buffing surface 1321 coincident with the bottom surface thereof. At this time, buffing liquid is fed between the buffing surface of the rotating second buffing wheel 122 and the buffing surface of the work W. Since properties of the buffing liquid employable for the second buffing wheel 122 are same to those of the first buffing wheel 122, repeated description is herein omitted for the purpose of simplification. Incidentally, since the first buffing wheel 122 and the

second buffing wheel 132 are rotated in the opposite direction relative to each other, the buffing surface of the work W is subjected to buffing in the reciprocal direction.

(EMBODIMENT OF SECOND INVENTION)

This second invention will be described below with respect to an embodiment thereof on the assumption that an aluminum wheel is employed as a work.

Firstly, the aluminum wheel is heated in hot water at

a temperature of about 80 °C, and then, it is subjected to dry buffing by employing the ordinary method. Thereafter, the aluminum wheel is subjected to wet buffing while maintaining the working state represented by a temperature of about 30 °C.

After the buffing operation is completed, the aluminum wheel is subjected to deposition plating by employing the ordinal deposition plating method. Any type of deposition plating such as chromium deposition plating, titanium deposition plating or the like may be employed for the aluminum wheel. It should be noted that the thickness of a film formed by the deposition plating generally remains within the range from about 0.1 μm to 0.2 μm. When the deposition plating is used in place of the conventional chromium plating, there does not arise a necessity for carrying out the waste liquid treatment which is unavoidably required when the conventional plating method is used. As a result, an efficiency of the plating operation can be improved.

(EMBODIMENT OF THIRD INVENTION)

For example, an aluminum wheel usable for a vehicle or the like can be noted as a work employable for carrying out this third invention. However, the third invention should not be limited only to the aluminum wheel as a work but all products each usable as a work are involved in the concept of the work in the third invention.

Usually, a wet type buffing method or a dry type buffing method for buffing the buffing surface of a work in the presence of a buffing agent is employed as a buffing method in the third invention. In this case, the number of buffs usable for carrying out the third invention may be limited only to one. Alternatively, a plurality of buffs may be used for carrying out the third invention. Incidentally, a buff wheel can be noted as one example which represents the buff.

To carry out the third embodiment, an ordinary wet type buffing method and an ordinary dry type buffing method can be employed for practicing the wet type buffing method and the dry type buffing method wherein the surface of a work is subjected to buffing in the presence of a buffing agent fed between the buffing surface of the work and the working surface of the buff wheel.

In addition, to carry out the third invention, any type of barrel buffing method such as a fluid barrel buffing method, a vibration barrel buffing method or the like can be used as a barrel buffing method. Additionally, any type of usually used buffing agent such as ceramic grain or the like can be employed as a buffing agent.

Further, the barrel buffing operation performed as a preliminary step for the dry type buffing step can be used as a so-called rough buffing operation.

Furthermore, the barrel buffing operation performed as a preliminary step for the wet type buffing operation exhibits the same operational effect as that of the dry type buffing operation, and therefore, it can be used as a so-called intermediate buffing step.

Moreover, the barrel buffing operation performed as a post-step for the wet type buffing operation exhibits the same operational effect as that of the wet type buffing operation, and therefore, it can be used as a so-called finish buffing step.

(EMBODIMENT OF FOURTH INVENTION)

For example, an aluminum wheel for a vehicle or the like can be noted as a work employable for carrying out a fourth invention. However, the fourth invention should not be limited only to the aluminum wheel but all types of products are involved in the concept of a work.

To carry out the fourth invention, an ordinary wet type buffing method can be used as a wet type buffing method wherein the buffing surface of a work is subjected to buffing in the presence of a buffing agent fed between the buffing surface of the work and the working surface of a buff. In this case, the number of buffs may be limited to one but a plurality of buffs may be used for carrying out the fourth invention. In addition, a usually used buffing liquid can be employed as a buffing liquid.

To assure that the buffing surface of a work is held in the vacuum atmosphere, it is recommendable that, for example, the whole buffing apparatus is covered with a casing or the like, and thereafter, the interior of the casing is evacuated by driving a vacuum pump so as to assume the desired vacuum state. Alternatively, only the buffing surface of a work may be covered with a casing of the type as mentioned above.

In addition, to assure that the buffing surface of a work is held in the nitrogen gas atmosphere, it is sufficient that the interior of the casing is filled with nitrogen gas.

Incidentally, nitrogen gas may be fed to the buffing surface of a work by ejection instead of the concept that the buffing surface of the work is covered with a casing of the aforementioned type of which interior is filled with nitrogen gas.

(EMBODIMENT OF FIFTH INVENTION)

Fig. 4 shows a buffing apparatus constructed in accordance with an embodiment of a fifth invention. In the drawing, reference character W designates a wheel usable for a vehicle or the like, and this wheel W corresponds to a work in the fifth invention. The wheel W usable for a vehicle or the like can be rotated about an axis line O by driving suitable means (not shown).

Reference numeral 510 designates a pair of shafts, and these shafts 510 are arranged above the wheel W usable for a vehicle or the like. The shafts 510 are rotated about an axis line by driving suitable driving means (not shown). In addition, the shafts 510 can forwardly or backwardly be displaced in the axial direction or in the direction of width as seen in the drawing, and additionally, they can vibratively be displaced within the

short range. Further, the shafts 510 can turnably be displaced in the horizontal direction or in the vertical direction with their bottom part used as a fulcrum.

In the drawing, reference numeral 511 designates a pair of small diameter portions, and these small diameter portions 511 are formed at the fore end parts of the shafts 510. In addition, reference numeral 512 designates a pair of bolt portions. Tightening nuts 540 are threadably fitted to the bolt portions 512. A function exhibited by the tightening nuts 540 will be described later. Reference numeral 520 designates a pair of buffing wheels, and these buffing wheels 520 are inserted through the small diameter portions 511. The buffing wheels 520 are used as ordinary buffing wheels, and flange portions 522 and 523 are integrally formed at the opposite ends of boss portions 522 so that circular disc-like buffing wheels 524 are clamped between the flange portions 522 and the flange portions 523.

Reference numeral 550 designates a pair of disconnection preventive pins (corresponding to "disconnection preventive members in the fifth invention), and these disconnection preventive pins 550 are fitted through the foremost ends of the small diameter portions 511 formed on the shafts 510. The disconnection preventive pins 550 are used for the purpose of preventing the buffing wheels 520 from being disconnected from the small diameter portions 511 of the shafts 510.

As the tightening nuts 540 are threadably displaced in the direction oriented toward the buffing wheels 520, these buffing wheels 520 are firmly tightened, and moreover, immovably fixed with the aid of the disconnection preventive pins 550.

When the central part of the flange portion 523 is formed in the recessed contour as shown in Fig. 5, the disconnection preventive pin 550 can be received in a recessed part 5231 (corresponding to a "diameter enlarged part" in the fifth invention), whereby the fore end surface (outside surface) of the buffing wheel 520 is caused to coincide with the fore end of the shaft 510. As a result, each buffing operation can more easily be achieved, and moreover, the position assumed by the buffing wheel 520 relative to the wheel W usable for a vehicle can more easily be determined.

Incidentally, the shafts 510 can intermittently be rotated (relative to the rotation of the wheel 520 usable for a vehicle about the axis line O) in the normal direction as well as in the reverse direction.

(EMBODIMENT OF SIXTH INVENTION)

In Fig. 6, reference numeral 610 designates a buffing medium receiving container for a barrel buffing apparatus 64. A buffing medium (aggregate) 620 is received in the buffing medium receiving container 610. Incidentally, any kind of usually used buffing medium such as ceramic grain or the like can be employed for the buffing medium 620.

Reference numeral 611 designates an upper end opening which is formed at the upper end of the buffing medium receiving container 610, and the interior of the buffing medium receiving container 610 is communicated with the atmosphere via the upper end opening 610.

Reference numeral 612 designates a buffing medium feeding port which is formed at the bottom part of the buffing medium receiving container 610. The buffing medium 620 received in the buffing medium receiving container 610 is caused to naturally fall down via the buffing medium feeding port 612. An intensity of pressure generated by the falling buffing medium 620 at this time is gradually reduced as the buffing medium 620 is increasingly removed from the buffing medium receiving container 610.

Reference numeral 630 designates a guide sleeve, and the guide sleeve 630 is fitted to the bottom of the buffing medium receiving container 610 from the outside in such a manner as to enable it to be rotated. In addition, reference numeral 631 designates a trumpet-like sleeve, and this trumpet-like sleeve 631 is arranged at the lower end of the guide sleeve 630 so as to constitute a part of the guide sleeve 630. A function of the guide sleeve 630 will be described later.

Reference character W designates a wheel usable for a vehicle or the like (corresponding to a "work" in the sixth invention), and the wheel W is received in the inside of the trumpet-like sleeve 631 without any substantial gap remaining therebetween. Incidentally, the guide sleeve 630 inclusive of the trumpet-like sleeve 631 is integrally rotated and vibrated when the wheel W usable for a vehicle or the like is rotated.

When the buffing medium 620 is caused to naturally fall down from the grinding medium receiving container 610 while the wheel W usable for a vehicle or the like is vibratively rotated, the buffing medium 620 continuously reaches the surface of the wheel W via the guide sleeve 30 without any substantial gap remaining therebetween. Thereafter, the buffing medium 620 is discharged in the downward direction via a plurality of holes 651 and 652 while the surface of the wheel W is subjected to buffing.

As mentioned above, as the buffing medium 620 is increasingly removed from the buffing medium receiving container 610, the intensity of feeding pressure acting on the wheel W usable for a vehicle or the like is gradually reduced. Thus, the surface of the wheel W can be buffed during the initial time when a high intensity of feeding pressure acts on the surface of the wheel W regardless of a single kind of buffing medium used for each buffing operation. In addition, an intermediate buffing step and a finish buffing step can continuously be practiced for the surface of the wheel W usable for a vehicle or the like, as the intensity of feeding pressure generated by the buffing medium 620 is gradually reduced.

After the buffing medium 620 is completely discharged in the zone located below the wheel W usable

for a vehicle or the like, i.e., after the interior of the buffing medium receiving container 610 becomes empty, the buffing medium 610 is removed again in the buffing medium receiving container 610. Then, the buffing medium 610 can repeatedly be used for continuously practicing a rough buffing step, an intermediate buffing step and a finish buffing step.

(EMBODIMENT OF SEVENTH INVENTION)

Fig. 7 shows a barrel buffing apparatus constructed in accordance with a first embodiment of a seventh invention.

In Fig. 7, reference numeral 710 designates a buffing medium receiving container for a barrel buffing apparatus 74. A buffing medium (aggregate) 720 is received in the buffing medium receiving container 710. Incidentally, any kind of usually used buffing medium such as ceramic grain or the like can be employed for the buffing medium 720.

Reference numeral 711 designates an upper end opening formed at the upper end of the buffing medium receiving container 710, and the interior of the buffing medium receiving container 710 is communicated with the atmosphere via the upper end opening 711.

Reference numeral 712 designates a buffing medium feeding port, and this buffing medium feeding port 712 is formed at the bottom part of the buffing medium receiving container 710. A buffing medium 72 contained in the buffing medium receiving container 710 is caused to naturally fall down via the buffing medium feeding port 712. The intensity of pressure generated by the falling-down of the buffing medium 720 is gradually reduced as the buffing medium 720 is increasingly removed from the buffing medium receiving container 710.

Reference numeral 730 designates a guide sleeve, and this guide sleeve 730 is fitted to the bottom part of the buffing medium receiving container 710 in such a manner as to enable the guide sleeve 730 to be rotated. In addition, reference numeral 731 designates a trumpet-like sleeve, and this trumpet-like sleeve constitutes a part of the guide sleeve 730 arranged at the lower part of the guide sleeve 730. A function of the guide sleeve 730 will be described later.

Reference character W designates an aluminum wheel usable for a vehicle or the like (corresponding to a "work" in the seventh invention). This wheel W can be rotated around an axis line O while it is vibrated. Incidentally, when the wheel W is rotated, the guide sleeve 730 inclusive of the trumpet-like sleeve 731 is vibratively rotated.

When the buffing medium 72 is caused to naturally fall down from the buffing medium receiving container 710 toward the surface of the wheel W while this wheel W is vibratively rotated, the buffing medium 720 continuously reaches the surface of the wheel W via the guide sleeve 730 with any substantial gap between the buffing medium receiving container 710 and the guide sleeve 730. The buffing medium 720 is discharged in the downward direction via a plurality of holes 751 and 752.

Incidentally, as mentioned above, the intensity of feeding pressure generated by the buffing medium 720 to be fed to the wheel W is reduced as the buffing medium 710 is increasingly removed from the buffing medium receiving container 710. Thus, even though a single kind of buffing medium 720 is employed, the surface of the wheel W can be subjected to rough buffing, and moreover, the surface of the wheel W can continuously be subjected to intermediate buffing and finish buffing.

After the discharged buffing medium 720 is completely discharged below the zone located below the wheel W, i.e., after the interior of the buffing medium receiving container 710 become empty, the buffing medium 720 is returned again to the buffing medium receiving container 710 by using suitable means (not shown). Thereafter, the wheel W is continuously subjected again to rough buffing, intermediate buffing and finish buffing. A practical extent attained by each buffing operation can be changed by adding pressurized air or water so as to allow the buffing medium 720 to be compressed by the pressurized air or water.

After the barrel buffing operation is completed, surface treatment such as coating, plating, alumite treatment or the like is conducted for the wheel W. All kind of usually available surface treatment process is employable for carrying out the foregoing surface treatment.

According to the first embodiment of the seventh invention, since the feeding of the buffing medium to the surface of the work is achieved attributable to the natural falling-down of the buffing medium, few noisy sound is generated, and moreover, a quantity of consumption of energy can be minimized.

In addition, according to the first embodiment of the seventh invention, since the guide sleeve is arranged between the feeding port of the buffing medium receiving container and the surface of the work, the feeding of the buffing medium to the work can be achieved without any loss.

Additionally, when the buffing medium received in the buffing medium receiving container can be compressed by using suitable means (not shown), a practical extent attained by each buffing operation performed for the work can be changed.

Fig. 8 shows a barrel buffing apparatus constructed in accordance with a second embodiment of the present invention.

In Fig. 8, reference numeral 78 designates a barrel buffing apparatus, and reference numeral 760 designates a driving section for driving the barrel buffing apparatus 78. Reference numeral 761 designates a cylindrical buffing medium receiving container, and this buffing medium receiving container 761 is mounted on the driving section 760. The buffing medium receiving container 761 can be rotated about an axis line of the

driving section 760 in the circumferential direction by actuating the driving section 760. Reference numeral 762 designates a buffing medium, and this buffing medium is received in the buffing medium receiving container 761. All kind of usually usable buffing medium such as ceramic grain or the like can be employed for the buffing medium 762. Incidentally, the buffing method can be practiced in accordance with a wet type buffing process or a dry type buffing process.

Reference numeral 763 designates an upper end opening which is formed at the upper end of the buffing medium receiving container, and the work W is dipped in the buffing medium 762 via the upper end opening 763.

Next, reference numeral 770 designates a base board which is integrated with the driving section 760, and reference numeral 771 designates a supporting column which upright stands on the base board 770. The supporting column 771 extends in the upward direction to reach the substantially upper end of the buffing medium receiving container 761.

Reference numeral 780 designates an attaching bracket, and this attaching bracket 780 is arranged in such a manner as to swing on the supporting column 771. Specifically, the attaching bracket 780 can swing about a point O along the vertical surface. Reference numeral 790 designates a supporting bed, and this supporting bed 790 is mounted on the attaching bracket 780 via rotating means 781. Thus, the supporting bed 790 can swing along the vertical surface together with the attaching bracket 780, and moreover, the supporting bed 790 can turn or swing about an axis line P by driving the rotating means 781.

Reference numeral 791 designates a supporting member, and this supporting member 791 is arranged on the supporting bed 790 so as to move in the forward/backward direction. In addition, reference numeral 792 designates a supporting arm, and this supporting arm 792 is fitted to the supporting member 791 so as to move in the forward/backward direction relative to the supporting member 791. It should be noted that the forward/backward direction of the supporting arm 792 is coincident with the forward/backward direction of the supporting member 791. Reference character W designates a work (aluminum wheel usable for vehicle), and this work W is mounted on the foremost end of the supporting ram 792 via an air chuck 793, whereby the work W is dipped in the buffing medium 762 received in the buffing medium receiving container 761.

Next, an operation of the buffing apparatus constructed in the above-described manner will be described below.

Firstly, as shown by phantom lines (one-dot chain lines), the supporting arm 792 is mounted such that the foremost end of the supporting arm 792 is located directly above the supporting arm 792, and thereafter, this supporting arm 792 is retracted in the downward direction. While the foregoing state is maintained, the work W usable for a vehicle or the like is mounted on the foremost end of the supporting arm 792 by actuating the air chuck 793 so that the work W is fixedly mounted on the supporting arm 792 with the aid of the air chuck 793. Thereafter, as shown by phantom lines (two-dot chain lines), the supporting arm 792 is caused to extend in the upward direction. Subsequently, as shown by solid lines, the supporting arm 792 is caused to swing about the point O together with the supporting bed 790 along the vertical surface so that the wheel W is dipped in the buffing medium 762 which is held in the flowing state. Incidentally, while the work W is dipped in the buffing medium 762, the supporting arm 792 can fragmentarily be displaced with the swinging state maintained. After completion of the buffing operation, the supporting arm 792 is caused to swing about the point O in the opposite direction together with the supporting member 791 and the supporting bed 790 along the vertical surface, the supporting arm 792 is held to assume the upright state with the foremost end thereof located directly above the supporting member 791 as shown by phantom lines (two-dot chain lines), and thereafter, the supporting arm 792 is displaced in the downward direction to assume the state as shown by phantom lines (one-dot chain lines). While the foregoing state is maintained, the wheel W is disconnected from the foremost end of the supporting arm 792. Subsequently, the aforementioned operational steps are repeated.

Incidentally, when soft material such as sponge, rubber, soft plastic or the like is used in the form of grain or small block as a buffing material usable for the buffing apparatus 78, each finish buffing operation can be performed at a high efficiency. Incidentally, soft material may be coated on the surface of each hard grain or hard small block so as to allow it to be used as this kind of buffing medium.

After completion of the barrel buffing operation, surface treatment such as coating, plating, alumite treatment is carried out for the work W. All kind of normally employable surface treatment is involved in the concept of surface treatment as mentioned above.

The work W usable for practicing the first embodiment and the second embodiment of the seventh invention may be a work which is preliminarily subjected to surface treatment, and alternatively, it may be a work which is not subjected to any kind of surface treatment.

(EMBODIMENT OF EIGHTH INVENTION)

Fig. 9 shows a work supporting unit employable for a barrel buffing apparatus constructed in accordance with an embodiment of an eighth invention.

In Fig. 9, reference numeral 8B designates a barrel buffing apparatus, and reference numeral 860 designates a driving section for driving the barrel buffing apparatus 8B. Reference numeral 861 designates a cylindrical buffing medium receiving container, and this buffing medium receiving container 861 is mounted on

the driving section 860. The buffing medium receiving container 861 can be rotated about an axis line of the driving section 860 in the circumferential direction by actuating the driving section 860. Reference numeral 862 designates a buffing medium, and this buffing medium 862 is received in the buffing medium receiving container 861. All kind of usually available buffing medium such as ceramic grain or the like can be employed for the buffing medium 862. In addition, a wet type buffing process may be employed for the buffing method, and alternatively, a dry type buffing process may be employed for the buffing method.

Reference numeral 863 designates an upper end opening which is formed at the upper end of the buffing medium receiving container, and a work (aluminum wheel usable for vehicle or the like) W to be described later is dipped in the buffing medium 862 via the upper end opening 811.

Next, reference numeral 870 designates a base board which is integrated with the driving section 860, and reference numeral 871 designates a supporting column which upright stands on the base board 870. The supporting column 870 is caused to extend in the upward direction to reach the substantially upper end of the buffing medium receiving container 861.

Reference numeral 880 designates an attaching bracket, and this attaching bracket 880 is arranged so as to swing on the supporting column 871. Specifically, the attaching bracket 880 can swing about a point O along the vertical surface. Reference numeral 890 designates a supporting bed, and this supporting bed 890 is mounted on the attaching bracket 880 via rotating means 881. With this construction, the supporting bed 890 can swing along the vertical surface together with the attaching bracket 880, and moreover, it can turn or swing about an axis line P by driving the rotating means 881.

Reference numeral 891 designates a supporting member, and this supporting member 891 is arranged on the supporting bed 890 in such a manner as to enable it to move in the forward/backward direction. In addition, reference numeral 892 designates a supporting arm, and this supporting arm 892 is fitted into the supporting member 891 in such a manner as to enable it to move in the forward/backward direction. Reference character W designates a work (aluminum wheel usable for vehicle or the like), and this work W is attached to the foremost end of the supporting arm 892 via an air chuck 893 so as to allow it to be dipped in the buffing medium 862 received in the buffing medium receiving container 861.

An operation of the buffing apparatus constructed in the aforementioned manner will be described below.

Firstly, as shown by phantom lines (one-dot chain lines), the supporting arm 892 is mounted to assume the position where its upper end is located directly above the supporting member 891, and thereafter, it is retracted in the downward direction. While the foregoing state is maintained, the wheel W is fixedly mounted on the upper end of the supporting arm 892 with the aid of the air chuck 893. Thereafter, as shown by phantom lines (two-dot chain lines), the supporting arm 892 is caused to extend in the upward direction. Then, as shown by solid lines, the supporting arm 892 is caused to swing about a point O together with the supporting member 892 and the supporting bed 890 along the vertical surface, whereby the wheel W is dipped in the buffing medium 852 which is held in the flowing state in the buffing medium receiving container 861. Incidentally, while the wheel W is dipped in the buffing medium 862, the supporting arm 892 can fragmentally be displaced in the vibrative state. After completion of the buffing operation, the supporting arm 892 is caused to swing about the point O in the opposite direction together with the supporting bed 890 along the vertical surface, and then, as shown by phantom lines (two-dot chain lines), the supporting arm 892 is held so as to assume the position where the foremost end of the supporting arm 892 is located directly above the supporting member 891. Thereafter, the supporting arm 892 is retracted in the downward direction to assume the state as represented by phantom lines (one-dot chain lines). While the foregoing state is maintained, the wheel W is disconnected from the foremost end of the supporting arm 892. Subsequently, the aforementioned operational steps are repeated.

Incidentally, when soft material such as sponge, rubber, soft plastic or the like is used as a buffing medium employable for the buffing apparatus 8B, each finish buffing operation can be achieved at a high efficiency. Incidentally, soft material may be coated on the surface of each hard grain or hard small block so as to allow the coated hard grain or the coated hard small block to be used as a buffing medium of the aforementioned type.

After completion of the barrel buffing operation, surface treatment such as coating, plating, alumite treatment or the like is conducted. All kind of normally available material is employable for achieving the surface treatment.

(EMBODIMENT OF NINTH INVENTION)

Fig. 10 is a perspective view showing a work supporting unit employable for a barrel buffing apparatus constructed in accordance with an embodiment of a ninth invention wherein a work is held in the buffing state, Fig. 11 is a perspective view showing the attached/detached state of the work in the barrel buffing apparatus, Fig. 12 is an illustrative view showing a forward/backward displacing mechanism for a work supporting arm in the work supporting unit, and Fig. 13 is an illustrative view showing a rotating mechanism for a reversing plate in the work supporting unit.

In Fig. 10 and Fig. 11, reference numeral 9B designates a barrel buffing apparatus, and reference numeral

910 designates a base board for the barrel buffing apparatus 9B. Reference numeral 920 designates a buffing medium receiving container, and this buffing medium receiving container 920 is mounted on the base board 910. The buffing medium receiving container 920 is designed to exhibit a cylindrical configuration so that it can be rotated about an axis line thereof in the circumferential direction by actuating suitable driving means (not shown). Reference numeral 921 designates a buffing medium, and this buffing medium 921 is received in the buffing medium receiving container 920. All kind of normally available material such as ceramic grain or the like can be used. Incidentally, a wet type buffing process may be used for practicing a buffing method, and alternatively, a dry buffing process may be used for practicing the buffing method.

Reference numeral 922 designates an upper end opening which is formed at the upper end of the buffing medium receiving container 920, and a work (aluminum wheel usable for vehicle or the like) W to be described later is dipped in the buffing medium 921 via the upper end opening 922.

Next, reference numeral 911 designates a supporting frame, and this supporting frame 911 upright stands on the base board 910. The supporting frame 911 is caused to extend in the upward direction to reach the substantially upper end of the buffing medium receiving container 920.

Reference numeral 930 designates a reversing plate, and this reversing plate 930 is turnably mounted on the supporting frame 911 via a rotational shaft 931. This reversing plate 930 can be turned within the range of about 180 ° on the basis of rotation of the rotational shaft 931 (i.e. within the range defined by the state shown in Fig. 10 and the state shown in Fig. 11). In addition, as shown in Fig. 13, a first driving motor 932 is mounted on the supporting frame 911. While the rotational force of the motor 932 is reduced in the decelerated state, the foregoing rotational force is transmitted from a pulley 933 of the first driving motor 932 to a pulley 935 of the rotational shaft 931 via a V belt 934, whereby the reversing plate 930 can reciprocably be turned within the range of about 180 °.

Reference numeral 940 designates a supporting bed, and this supporting bed 940 is fixed to the reversing plate 930 via a pair of brackets 941. This supporting plate 940 is mounted on the supporting frame 911 in the forwardly inclined state (it is assumed that the fore end side of a work supporting arm 960 to be described later is represented as a forward direction). It should be noted that the inclination ang le of the supporting bed 940 can be adjusted. of the supporting bed 940 so as to move in the forward/backward direction along, the inclined surface of the supporting plate 940. This slide plate 950 can be displaced relative to the supporting bed 940 in the forward/backward direction by actuating a bolt/nut mechanism 95. Incidentally, reference numeral 9511 designates a bolt portion in the bolt/nut mechanism 95 arranged on the rear surface of the supporting bed 940, and reference numeral 9512 designates a pair of nut portions arranged on the slide plate 950. When a second driving motor 952 is driven, causing the bolt portion 9511 to be rotated, the nut portions 9511, i.e., the slide plate 950 are displaced in the forward/backward direction by way of threadable engagement of the bolt portion 9511 with the nut portions 9512.

Referring to Fig. 10 and Fig. 11 again, reference numeral 96 designates a work supporting arm, and as shown in Fig. 12, this work supporting arm 960 is caused to project from the slide plate 950. A work (aluminum wheel usable for vehicle or the like) W is detachably attached to the foremost end of the work supporting arm 960 with the aid of an air chuck (not shown) so that the work W is dipped in the buffing medium 821 received in the buffing medium receiving container 920. In addition, a third driving motor 961 is mounted on the slide plate 950. The work supporting arm 960 can be rotated about an axis line thereof by transmitting the rotational force of the third driving motor 961 to the work supporting arm 960 in the decelerated state. Incidentally, the work supporting arm 960 can intermittently be rotated in the normal direction as well as in the reverse direction.

An operation of the buffing apparatus will be described below.

Firstly, as shown in Fig. 11, the reversing plate 930 is arranged outside of the buffing medium receiving container 920 by driving the first driving motor 932, causing the rotational shaft 931 to be rotated (refer to the state as represented by phantom lines in Fig. 13). At this time, the fore end part of the work supporting arm 960 assumes an upwardly inclined state. While this state is maintained, an operator places the work W on the foremost end of the supporting arm 960 so as to allow it to be fixed to the supporting arm 960.

Thereafter, the reversing plate 30 is located inside of the buffing medium receiving container 920 by driving the first driving motor 932, causing the rotational shaft 931 to be rotated, whereby the wheel W is dipped in the buffing medium 921 held in the buffing medium receiving container 920 in the flowing state. Incidentally, while the wheel W is held in the buffing medium 921 in the dipped state, the work supporting arm 960 can fragmentarily be displaced in the vibrative state. After completion of the buffing operation, the reversing plate 930 is located outside of the buffing medium receiving container 920 by driving the first driving motor 932, causing the rotational shaft 931 to be rotated. At this time, the fore end part of the work supporting arm 960 assumes an upwardly inclined state. While this state is maintained, the operator disconnects the wheel W from the work supporting arm 960, and thereafter, he places a next work on the work supporting shaft 960 so as to allow the next work to be fixed to the work supporting arm 960.

Incidentally, when soft material such as sponge,

rubber, soft plastic or the like is used in the buffing apparatus 9B as a buffing medium, each finish buffing operation can be achieved at a high efficiency. Further, soft material may be coated on the surface of each hard grain or each hard small block. The coated hard grain or the coated hard small block can be used as a buffing medium of the aforementioned type.

After the barrel buffing operation is completed, surface treatment such as coating, plating, alumite treatment or the like is carried out for the work, All kind of usually available surface treatment is involved in the concept of surface treatment.

While the present invention has been described above with respect to preferred embodiments of first invention to eighth invention thereof, it should be noted that the present invention should not be limited only to these preferred embodiments but various change or modification may be made without departure from the scope of the present invention as defined by the appended claims.

Claims

1. A method of practicing a wet type buffing process by way of a series of wet type buffing steps, wherein a final buffing step in said plurality of buffing steps is practiced in a buffing liquid having alkality, and buffing steps to be practiced before said final buffing step are practiced in another buffing liquid having acidity.

2. A method of conducting deposition plating, wherein a work is subjected to wet buffing after said work is subjected to dry buffing, and thereafter, said deposition plating is conducted for a surface of said work to be buffed.

3. A method of buffing a work, wherein said work is subjected to dry buffing after a surface of said work to be buffed is subjected to barrel buffing, and thereafter, said work is subjected to wet buffing.

4. A method of buffing a work, wherein said work is subjected to dry buffing after a surface of said work to be buffed is subjected to barrel buffing, thereafter, said work is subjected to barrel buffing, and subsequently, said work is subjected to wet buffing.

5. A method of buffing a work, wherein said work is subjected to dry buffing after a surface of said work is subjected to barrel buffing, thereafter, said work is subjected to barrel buffing, subsequently, said work is subjected to wet buffing, and finally, said work is subjected to barrel buffing.

6. A method of practicing a wet type buffing process by allowing a work to be subjected to buffing with the aid of a buffing wheel while a buffing liquid is fed between the buffing surface of the rotating buffing wheel and a surface of said work to be buffed, wherein said work is buffed in the vacuum atmosphere or in the nitrogen gas atmosphere during said wet type buffing process.

7. A method of practicing a wet type buffing process by allowing a work to be subjected to buffing with the aid of a buffing wheel while a buffing liquid is fed between the buffing surface of said buffing wheel and a surface of said work to be buffed, wherein said surface of said work to be buffed is subjected to buffing while nitrogen gas is fed to said surface of said work to be buffed.

8. An apparatus for buffing a work while a shaft is fitted to a buffing wheel, and then, said shaft is rotated about an axis line of said shaft, wherein a disconnection preventive member is disposed at the foremost end of said shaft, the outside of said buffing wheel is brought in contact with said disconnection preventive member, a tightening nut is threadably engaged with the inside of said buffing wheel, and said buffing wheel is tightly fixed to said shaft by threadably displacing said nut along said shaft.

9. The apparatus for buffing a work as claimed in claim 8, wherein a diameter enlarged part is formed around the periphery of a shaft hole on the outside of said buffing wheel so as to enable said disconnection preventive member to be received in said diameter enlarged part.

10. An apparatus for buffing a work in a barrel, wherein said apparatus includes a buffing medium receiving container having a buffing medium received therein and a work adapted to be vibrated, said buffing medium receiving container includes an upper end opening, a buffing medium feeding port is formed at the bottom of said upper end opening, said work is located below said buffing medium feeding port, and said buffing medium can continuously be fed to the surface of said work while said work is vibrated.

11. The apparatus for buffing a work in a barrel as claimed in claim 10, wherein a guide sleeve is arranged between said buffing medium feeding port of said buffing medium receiving container and the surface of said work.

12. The apparatus for buffing a work in a barrel as claimed in claim 11, wherein said guide sleeve is vibrated integrally with said work.

13. The apparatus for buffing a work in a barrel as claimed in claim 11 or claim 12, wherein said buffing medium received in said buffing medium receiv-

ing container can be compressed by using suitable means.

14. A method of conducting surface treatment, wherein said surface treatment is conducted after a work is subjected to barrel buffing before said surface treatment or after said surface treatment.

15. The method of conducting surface treatment as claimed in claim 14, wherein barrel buffing is conducted with the use of a barrel buffing apparatus including a buffing medium receiving container having a buffing medium received therein and a work adapted to be vibrated, said buffing medium receiving container includes an upper end opening, a buffing medium feeding port is formed at the bottom of said buffing medium receiving container, said work is located below said buffing medium feeding port, and said buffing medium received in said buffing medium receiving container can continuously be fed to the surface of said work while said work is vibrated.

16. The method of conducting surface treatment as claimed in claim 14, wherein barrel buffing is conducted with the use of a barrel buffing apparatus including a buffing medium receiving container having a buffing medium received therein and a work supporting arm, said buffing medium receiving container includes an upper end opening, and the upper end part of said work supporting arm can vibratively be displaced from the position located substantially directly above said upper end opening along the vertical surface within the range defined by said buffing medium receiving container.

17. The method of conducting surface treatment as claimed in claim 16, wherein said work supporting arm can turnably be displaced in the horizontal direction.

18. The method of conducting surface treatment as claimed in claim 16 or claim 17, wherein said work supporting arm can forwardly and backwardly be displaced in the axial direction.

19. The method of conducting surface treatment as claimed in any one of claim 14 to claim 18, wherein said surface treatment is coating.

20. The method of conducting surface treatment as claimed in any one of claim 14 to claim 18, wherein said surface treatment is plating.

21. The method of conducting surface treatment as claimed in any one of claim 14 to claim 18, wherein said surface treatment is alumite treatment.

22. The method of conducting surface treatment as claimed in any one of claim 14 to claim 21, wherein said work is a wheel usable for a vehicle or the like.

23. An apparatus for supporting a work for a barrel buffing apparatus, wherein said apparatus includes a buffing medium receiving container having a buffing medium received therein and a work supporting arm, said buffing medium receiving container includes an upper end opening, and said work supporting arm can turnably be displaced from the position located substantially directly above said upper end opening within the range defined by said buffing medium receiving container along the vertical surface.

24. The apparatus for supporting a work for a barrel buffing apparatus as claimed in claim 23, wherein said work supporting arm can turnably be displaced in the horizontal direction.

25. The apparatus for supporting a work for a barrel buffing apparatus as claimed in claim 23 or claim 24, wherein said work supporting arm can forwardly and backwardly be displaced in the axial direction.

26. A buffing medium usable for a buffing apparatus, wherein said buffing medium is composed of grain of soft material or small block of said soft material.

27. An apparatus for supporting a work for a barrel buffing apparatus, wherein said apparatus includes a buffing medium receiving container having a buffing medium received therein and a work supporting arm, said buffing medium receiving container includes an upper end opening, said work supporting arm is arranged at the position tortuously located relative to a rotational shaft, said work supporting arm can turnably be displaced about said rotational shaft within the range of about 180 ° from said buffing medium receiving container, and the fore end part of said work supporting arm assumes a downwardly inclined state in the forward direction when said work supporting arm is located on the buffing medium receiving container side.

28. The apparatus for supporting a work for a barrel buffing apparatus as claimed in claim 27, wherein said work supporting arm can forwardly and backwardly be displaced in the axial direction.

29. The apparatus for supporting a work for a barrel buffing apparatus as claimed in claim 27 or claim 28, wherein a tortuous angle of said work supporting arm relative to said rotational shaft can be adjusted.

Fig. 1

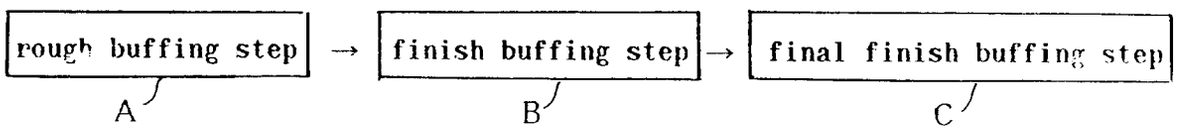
rough buffing step
finish buffing step
final finish buffing step
A
B
C

Fig. 2

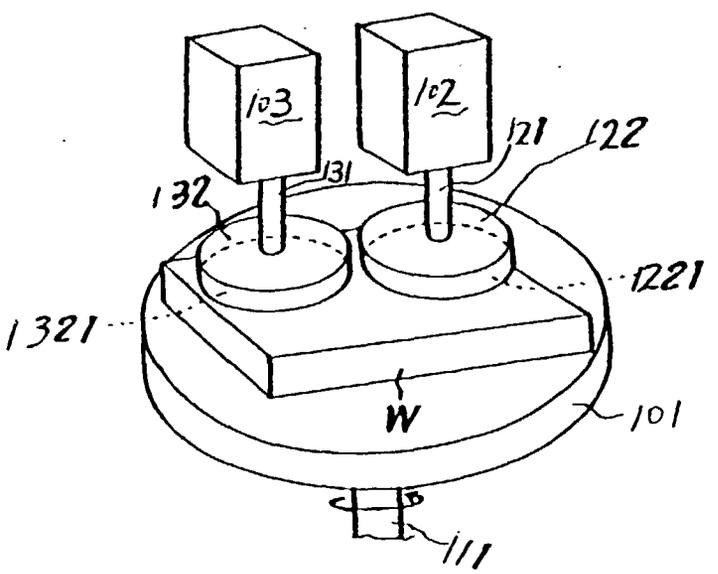

Fig. 3

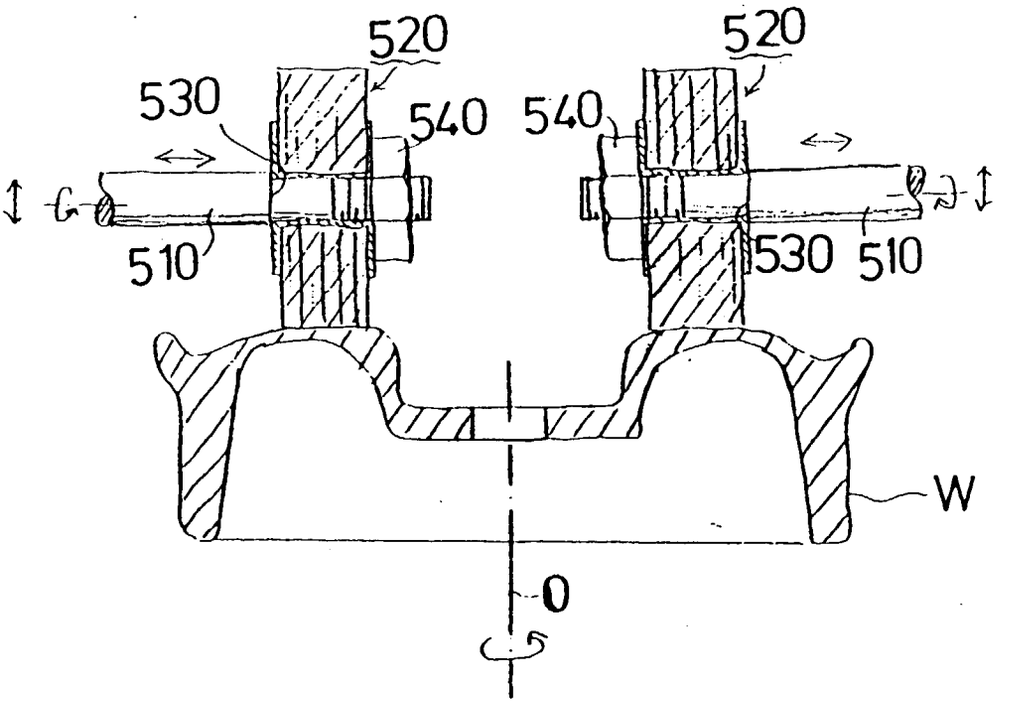

Fig. 4

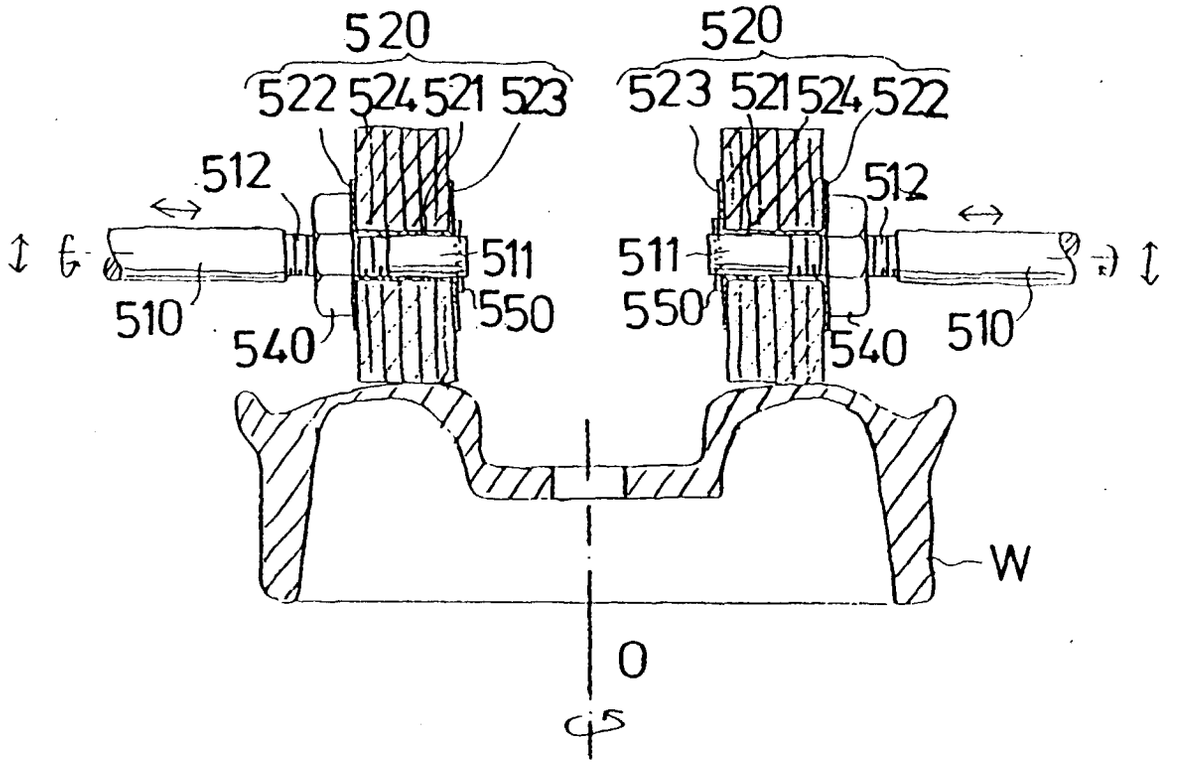
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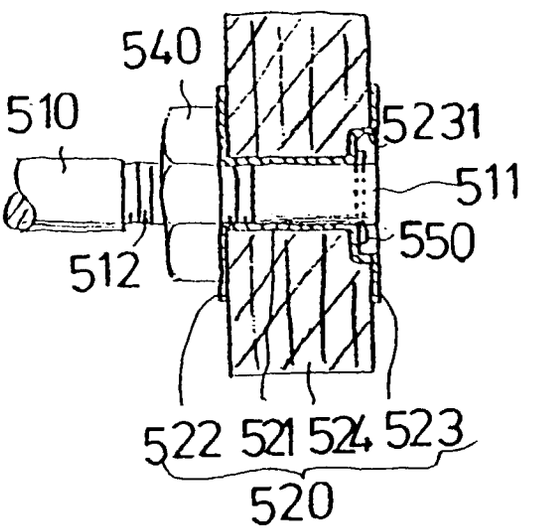
Fig. 5



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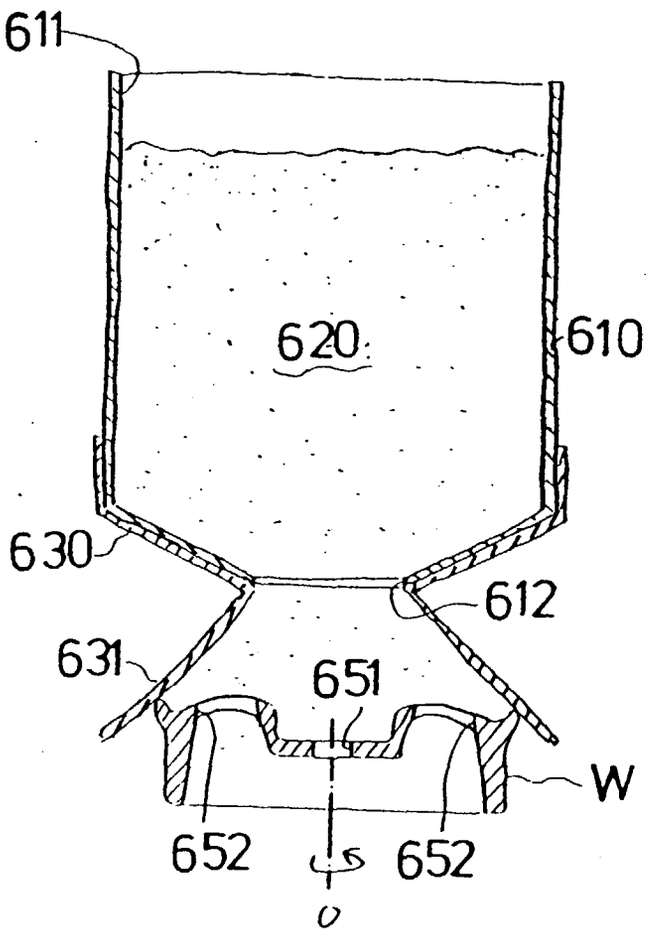

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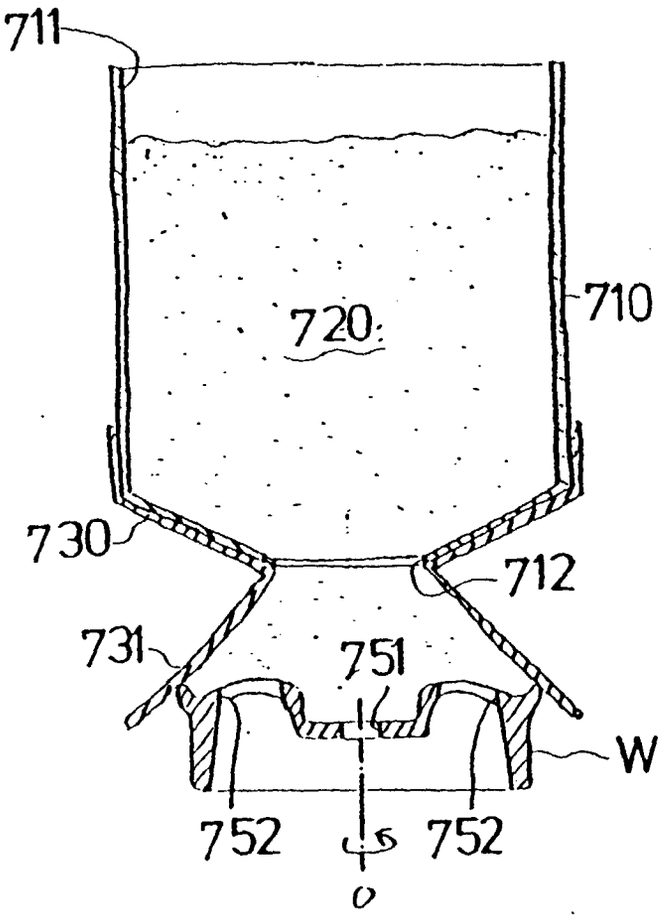

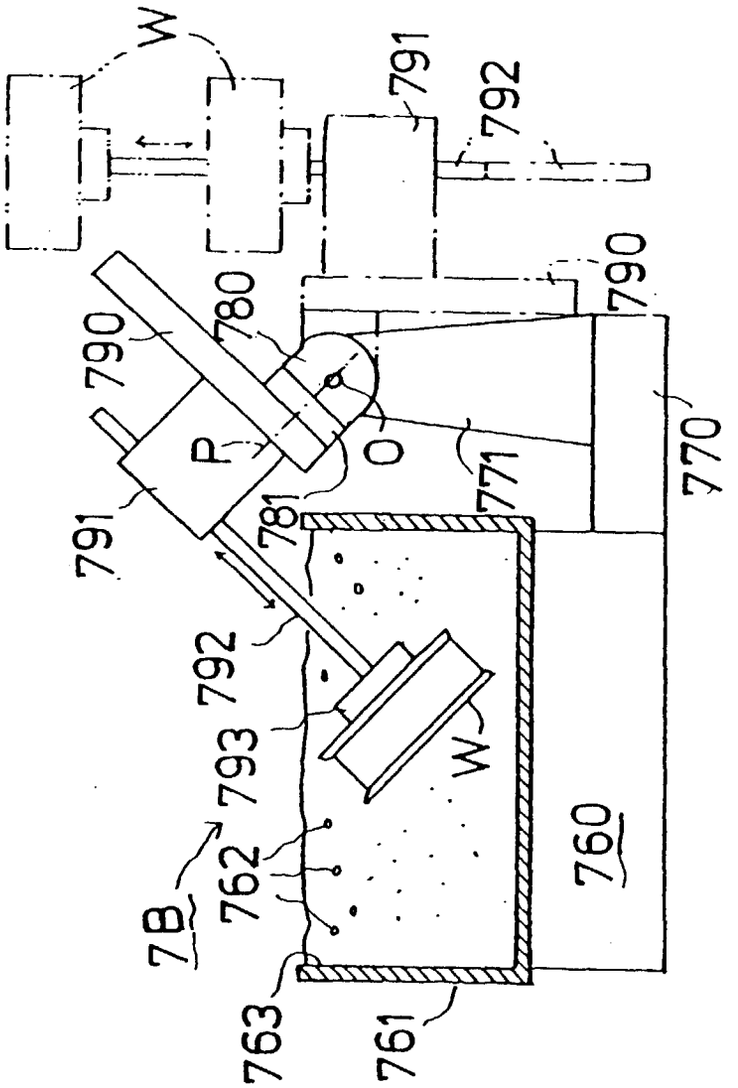
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Fig. 8

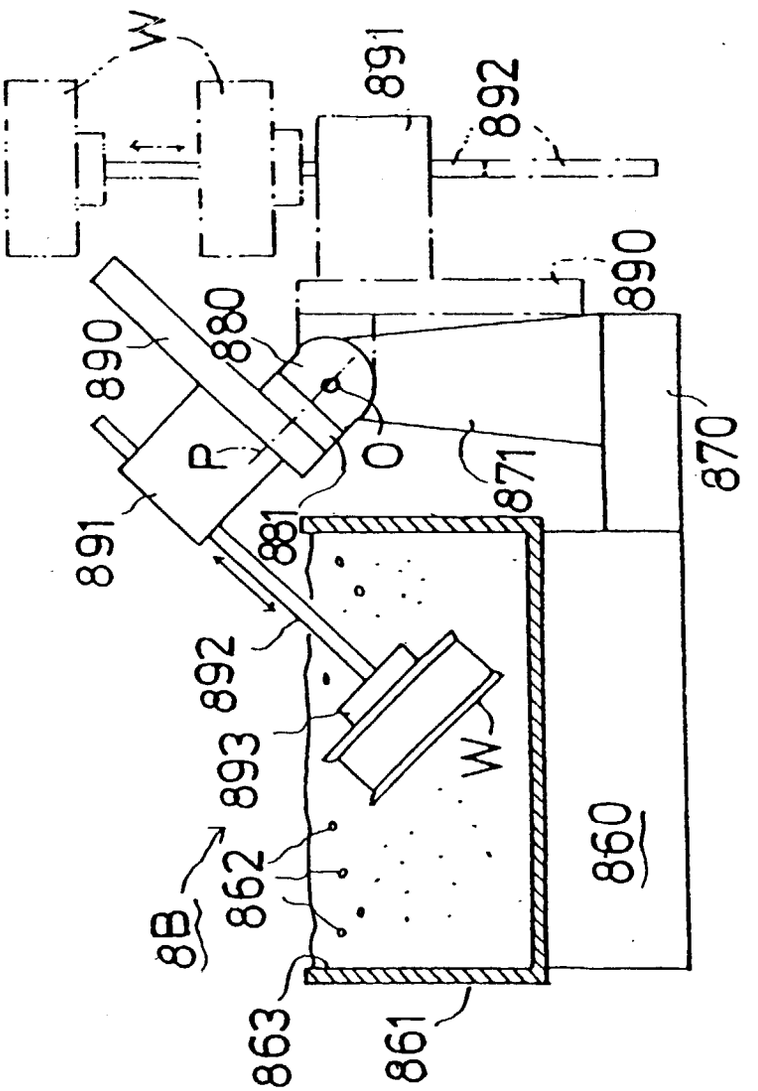
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Fig. 9

Fig. 10

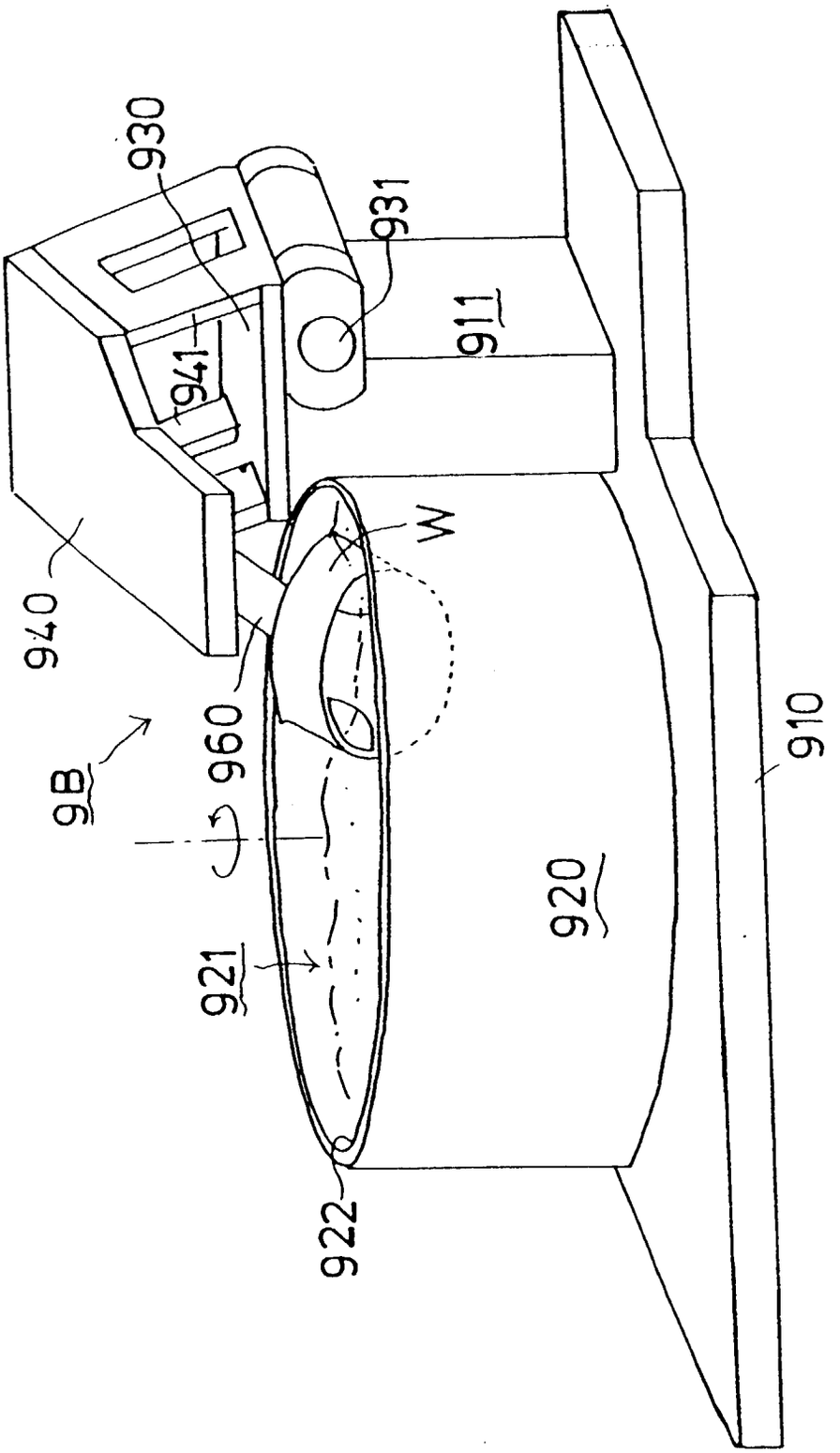

Fig. 11

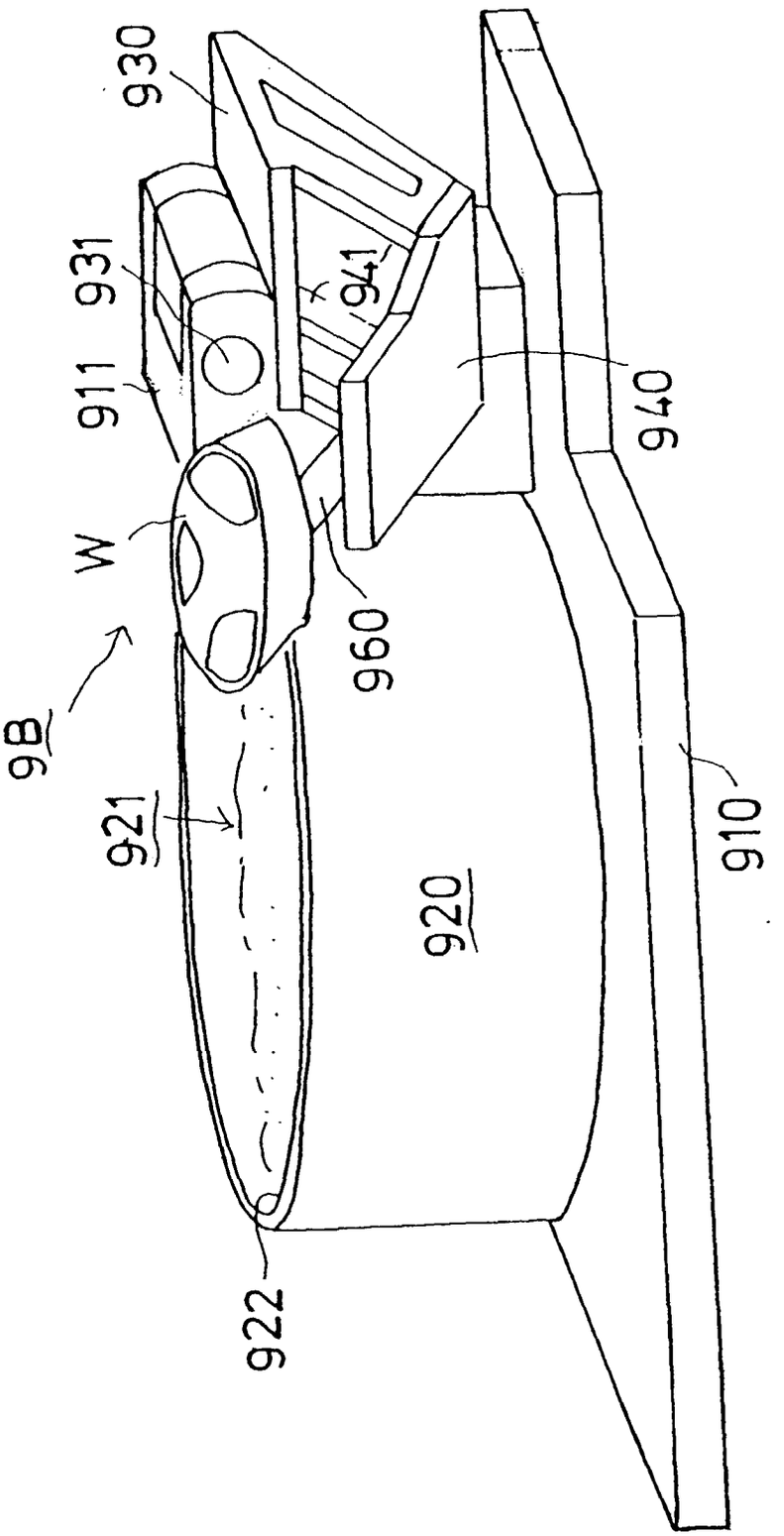

Fig. 12

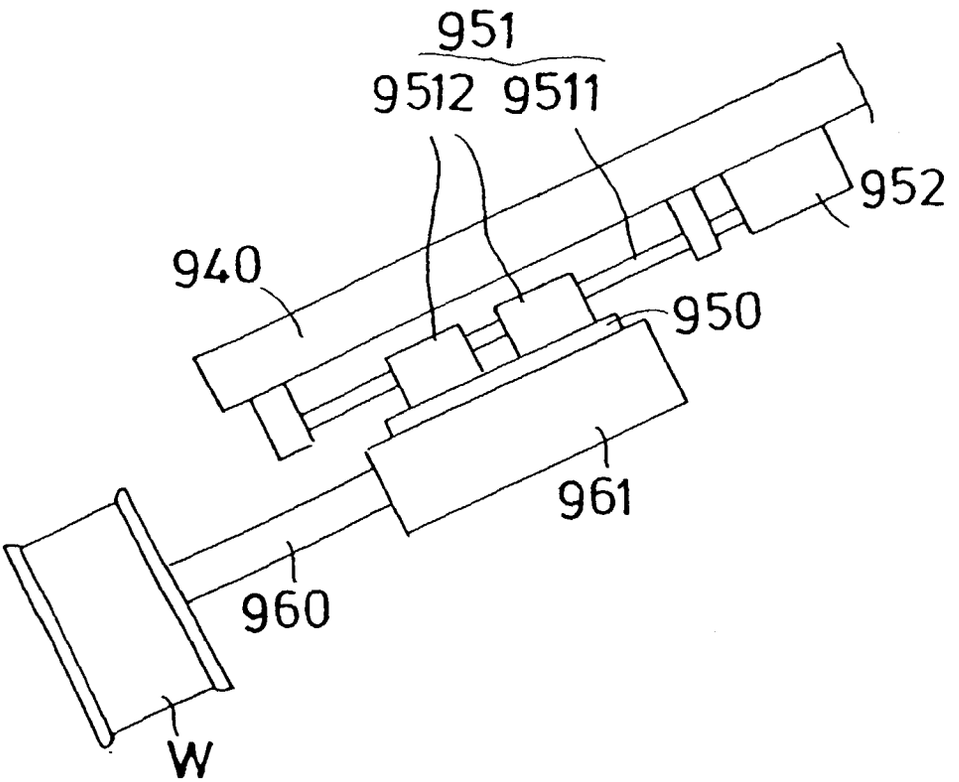

Fig. 13