Surface Preparation System BIBER (BEAVER)

Thomas Schulz, Rolf H. Manzke

Groh, Prischmann & Schulz
Forschungs-, Entwicklungs- und Vertriebsgesellschaft mbH & Co. KG
Saalmannstraße 7-9, D-13403 Berlin (Germany)

1. Abstract

The Groh, Prischmann & Schulz, Forschungs-, Entwicklungs- und Vertriebsgesellschaft mbH & Co. KG has invented a total new technology for the removal of roughcast, paint, dust, dirt and other coatings on vertical or nearly vertical surfaces. By combining a toolhead, a telescoping device and a vacuum cleaner completed with microelektronics all components of the System BIBER (BEAVER) are mentioned. The main invention is the mounting of the toolhead to the telescope and has been patented.
The result is an outstanding performance (up to 400 m²/h) by lower costs. Dust and dirt is reduced to a minimum.
First step was the outdoor application for roughcast. The removal of paint, dust and dirt by brushes is proven, the indoor application is still waiting for a customer.

2. Application

Millions of square meters of facade await renewal each year. Either the general state of the building demands urgent renovation, or ecologically and economically practical insulation is lacking. A study stated about 75 million square meters of surface in urgent need of restoration in the new German states. Additionally the cleaning and the preparation of technical surfaces, e.g. ships, tanks, has to be done.

Till now many attempts were made to solve the known problems during the removing of thick coatings from vertical surfaces (e.g. roughcast from buildings). All attempts failed to find a efficient mechanised method for this task. Because of the geometry of the buildings (balconies, bay windows and balustrades) and the in reality existing differences to the theoretical plane wall methods with defined cutting deeps don't leed to usefull results. Working devices mounted or guided by scaffolds or rails are needing a lot of pre- and unproductiv work and can not follow the hidden surface in all directions. At least no one can measure the variable thickness of the coating at any point and change the cutting thickness when needed.

The removing of thin coatings like paint, dust and dirt nowadays is mostly done with detergents of different kind and by human force. Often high-pressure is used added by steam or abrasive additions. To save money and space maned plattforms are used. With no idea of the tremendous amount of square meters of flat vertical surfaces each year are

cleanend by hand there will be an anormous field for hazzard to the surroundings und the workers. At least this way isn't very quick.

3. Outline

The BIBER System consists of three components: toolhead, a telescoping manned platform or another lifting unit, and a vacuum cleaner (see figure-1 in the appendix). With this system it is possible to remove up to 100 m²/h roughcast, typical 35 m²/h without no more then half an hour of preparation before starting the work.

The toolhead is the most innovative part of the whole system. The principal application is the removal of roughcast or other old coating by means of a brush. For other areas - the scrubbing or brushing of large surfaces - appropriate applications are being developed. It is the attachment- and drive-housing for rapidly rotating tools, such as mills, brushes and cylinders. A vacuum opening is located behind the drive housing. The vacuum „swallows" the particles loosened from the treated surface, passing them through its hoses to a receptacle. The air is then filtered, and the remaining refuse divided among designated containers.

A telescoping manned platform is the key to the optimal application of the system. In no time the work platform can be replaced by the BIBER System toolhead (see figure-5 and figure-6 in the appendix).
The telescoping lift offers innumerable use, for example wherever and whenever a lack of space (or money) prevents the erection of scaffolding. Small repairs can be carried out, even at tremendous heights.

The vacuum cleaner is also specially designed for the cleaning of large surfaces. Furthermore, it supports the logistics at the construction site by its ability to move large quantities of various building materials.

All components of the BIBER System can be used independently of one another. Backhoes, for example, through the use of an adapter, can assume the guide function for the toolhead. GPS has get patents on all major inventions and has developed a similar system for indoor work.

4. Characteristics and effects

1. Removal, cleaning or preparation can be performed with an accuracy higher than provided by skilled worker; moreover a uniform surface can be expected (see figure-3, figure-4 and figure-5 in the appendix).

2. Conventional manual work is reduced to a minimum, so the worker is relieved from the burden of hard and dusty work in uncomfortable positions.
3. Work efficiency can be improved.
4. Removal, cleaning or preparation of surfaces in an urban area brought complains about noise and dust especially from the residents. The BIBER eliminates these complains.
5. Overall the whole work is done by reduced costs.
6. There is no need of auxiliary power supply for the system BIBER on the construction site.
7. Openings for access to the construction site are 1.45 m width and 2.3 m in height for outdoor-systems and 1 m width and 2 m height for indoor-systems.

5. Features of the robotization and automation

A key to the successful mechanisation of surface preparation is the use of BIBER System microelectronics and the total new mounting of the toolhead (see figure-3 and figure-5 in the appendix).
All components are using microprocessors for guidance, measurement and adjustment. The data are piped by a common data-bus and are available for each device of the system. In conjunction with the associated application program, the facade is measured, and the volume of surface to be removed is stated. The BIBER System application-software is IBM-compatible. The stored data can be used for further calculations.
The computer enables a gradual manipulation of the telescope arm. This parallel direction guides the machine head in perpendicular lines across the entire pre-measured surface.
At the end the System BIBER is a robot but did not work without an operator because of the demand for an outstanding security-level on a public housing-construction site.

As mentioned all further tries to find a mechanic way to remove coating from vertical surfaces failed.
If a surface is not even in technical terms, very high and has a coating with variable thickness all attemps with fixed devices are useless. So the idea was born by GPS to mount the toolhead hanging fix but free in all three axis of gyro. This leads the reaction forces from the pressure against the surface and the cutting (horizontal and vertical) through the telescope but gives all freedom to follow the surface. By the realized dimensions (see table-1 in the appendix) of the toolhead the system needs less accuracy by the steering than the surface varies. In addition the force on the surface is infinitely variable from 0 up to 1,000 N on the teeth in catch by moveable counterbalances.

With the tooth, a special mixture, the high sofisticated vacuum cleaner, the know-how installed in the toolhead and the microelectronics an outstanding quality of the treated surface is obtainable.

Through intelligent control panel manipulation, the operating of the BIBER System is easy(see figure-2 in the appendix). On a LCD all important data such as distance, angle of inclination are displayed. The data and the signals from the controls load the processor. The results are collision protection and automatic pressure regulation. At least the System is operated by one machinist. It substitutes five up to eight traditional workers. The mounting of the complete BIBER-System can be made by the operator and one handy man.

The BIBER System already offers the foundation for a more thoroughgoing control technology, which will enable the accomplishment of even more complex tasks.

6. Work execution record

The number of units sold by GPS is 4 with working heights of 22 m, 26 m, 30 m and 40 m. The overall amount of prepared surfaces is more than 40,000 m² in 2 years (without times with outside air temperatures below 5° Celsius).

Devices for indoor-surfaces are available but not yet sold.

7. Appendix of tables and pictures

Table-1 Principal Specifications

Components of System	Specification	
Toolhead BIBER FK 500	Dimensions (L*W*H) Weight Force on teeth in catch Work Capability Working Width Rotation Speed	1,400 x 650 x 1,200 mm about 265 kg 0 up to 1,000 N up to 75 m²/h 500 mm up to 2,000 rpm
Vacuum cleaner BIBER SV 250	Dimensions (L*W*H) Max. Headroom Moving Quantity Max. Hose Length	5,600 x 2,300 x 2,350 mm 1,900 mm up to 2 m³ 40 m
Telescoping Manned Platform	Max. Working Height	up to 60 m (depends on type)

Figure-1 Overall View of System BIBER

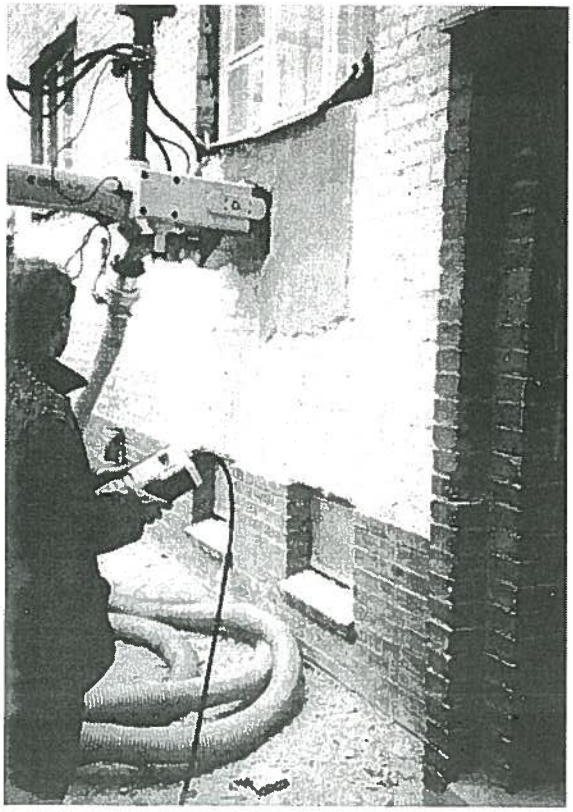

Figure-2 Engine Driver at work

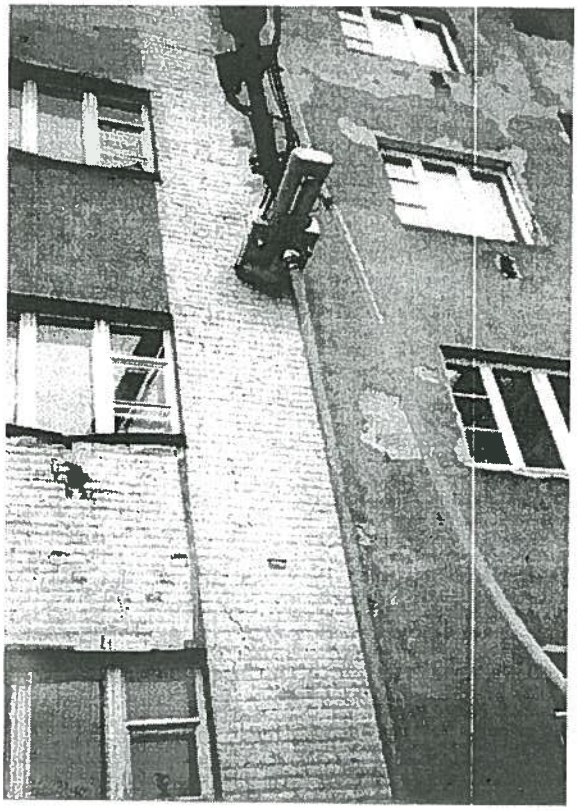

Figure-3 Toolhead BIBER FK 500 at work

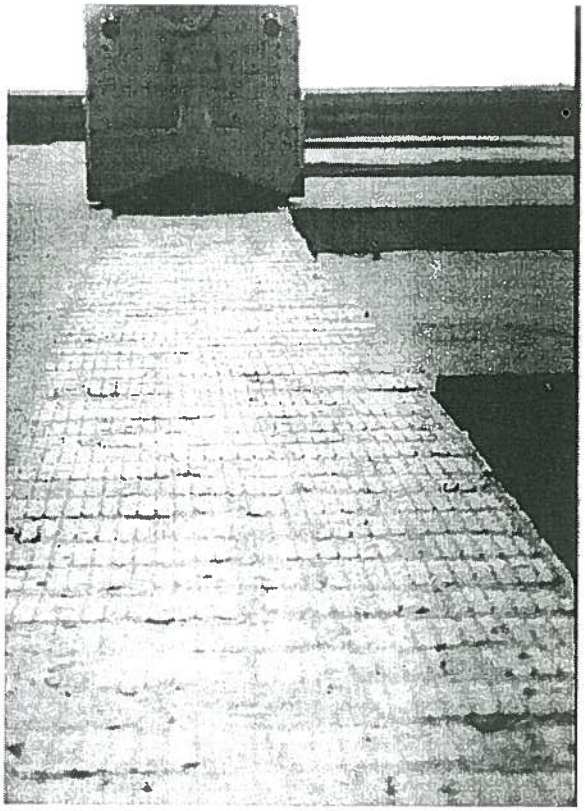

Figure-4 Result (removing roughcast)

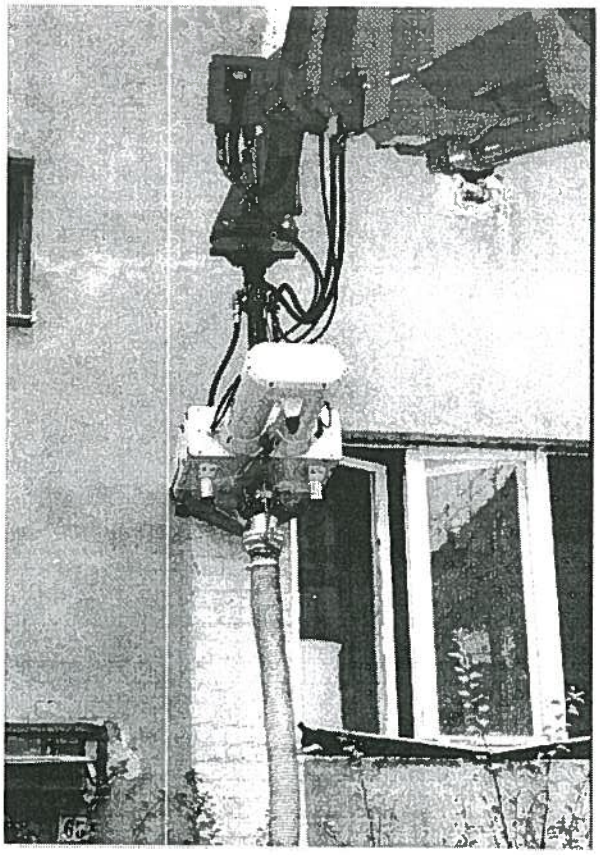

Figure-5 Working on the Edge

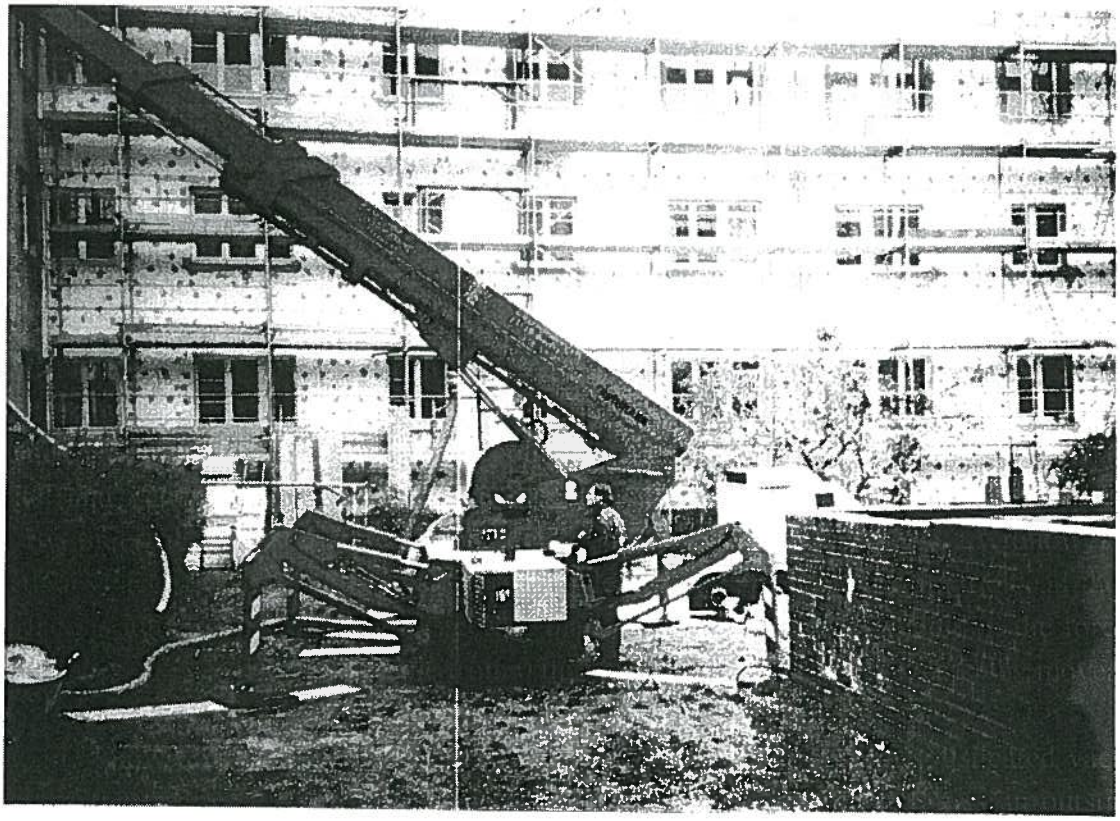

Figure-6 Manned Platform with Engine Driver