Sand Blast Equipment,

Machinery, Supplies & Accessories

TILGHMAN

1126 SOUTH 11TH STREET.
PHILADELPHIA, PA.

SAND BLAST MACHINERY

30 YEARS AHEAD OF THEM ALL

ESTABLISHED 1869

Comparison Between High and Low Pressure Sand Blast Machines

It is entirely a question of economy. Economy of work comes under two heads. First, the actual economy of the sand blast machine itself, the cost of the compressed air used and sand worn out by the machine. And second, the amount of sand blast power that can be conveniently put into the hands of one man so as to reduce the wage cost of the operation.

One pressure of air is not the most economical for all uses. The grain of sand must deliver a blow of a force properly proportioned to the work that it is expected to do. A given horsepower of compressed air will impart a certain velocity to a given weight of sand per minute and no more. If this velocity is sufficient, then doubling the velocity of the sand will reduce the factor of economy of the machine to 25 per cent. of its former efficiency for these reasons. At double the velocity, each grain of the flying sand will contain four times the energy as the same grain at the lower velocity. The total quantity of sand to which it can impart this velocity, therefore, will be only one-quarter that to which it can impart the lower velocity. As at the lower velocity the sand has sufficient energy to do the work required of it, with greater energy it can do no more and the extra energy imparted to it is only wasted.

This is not all. There are other sources of waste. There is more slip, so to speak, between the sand and the impelling air at higher than at lower velocities. At lower velocities the comparatively lower pressure air imparts more nearly its own velocity to the sand than does the higher pressure air moving at a greater velocity. This can readily be seen by the fact that at the lower pressures, say at about 10 to 16 pounds to the square inch, when the machine is running without sand, when the sand is turned on the pressure will be observed to rise some 25 to 30 per cent., or to 14 to 20 pounds to the square inch. Whereas when the machine is running at about 80 pounds to the square inch, the rise of pressure is scarcely perceptible, not over 2 or 3 per cent., when the sand is turned on. In no other kind of machine would a machine that consumed 97 per cent. of its power load when running empty be put forward as an economical machine. These conclusions were the cause of the low, or rather the moderate, pressure machine being devoloped, and a long course of comparative experiments fully verified them before the machines were put on the market.

These conclusions are true of any type of sand blast machine, but with the flexible hose type of machine they are still more intensified for the following reasons:

In any event, the long flexible hose is a source of loss of power for the plain and obvious reason that every time a grain of sand strikes the soft elastic lining of the hose it loses a very considerable portion of its velocity and drops back into the current at a reduced velocity which must be again imparted to it if it is not to drop and by a repetition of the process finally come to rest and clog up the tube. For this reason the larger the diameter of the hose and the less the velocity of the mixed stream of sand and air passing through it, the less is this loss, for the reason that the larger the hose, the greater the ratio of its cross section to the area of its walls, and therefore the fewer are the impacts of the sand grains passing through it with its walls, and also, owing to the low velocity, the less is the loss at each such impact. As an illustration, our No. 6 machine has a hose 2½ inches internal diameter. Through this hose 180 cubic feet of free air compressed to 14 pounds to the square inch pass per minute. When the sand is turned on, this air carries with it about 35 pounds of sand per minute and the pressure rises in discharging the same amount to about 20 pounds per square inch. This mixed stream is discharged through a ⅝-inch nozzle. In comparison with this we quote from the catalogue of a "high-pressure" machine. A hose ¾ inch in diameter carries an unspecified amount of air at 80 pounds per square inch and discharges it through a nozzle 3/16 inch diameter. The increase of pressure when carrying sand would be practically imperceptible and the amount carried could not possibly be more than 6 or 8 pounds per minute, probably much less. This is forced through a tube of only .09, the area of our hose with, it is easy to see what a loss of velocity and wear on the tube from the fact that the machine will not work at all if the pressure is reduced very much below the specified 80 pounds per square inch. When discharged the sand has not to exceed an efficiency, weight for weight, of more than 1¼ to, at most, 1½ that of an equal weight of sand discharged from our machine, or a net cleaning power of, at most, 1/3 that of our machine at the same cost of air and a greatly increased cost for sand and hose, which the higher pressure wears out much more rapidly, and at a wage cost, if in each case one man handles one hose, of three times that called for by our machine. Including wages, air, sand and hose, this type of machine will cost nearly or quite six times as much per square foot of cleaning ordinary castings, forgings, etc., than our machine.

Another way of looking at the comparative economy of the high pressure and medium pressure machines, which illustrates the inherent waste of the former class, is as follows: The air that it discharged at a considerable velocity from the nozzles of either class of machine is itself of considerable weight—namely, about one-thirteenth of a pound for each cubic foot of free air before compression. Taking the machine discharging 180 cubic feet of free air per minute, this air will weigh about 14 pounds. It is discharged at practically the same velocity as the sand with which it is mixed. The force necessary to give velocity to the air is in itself without effect in sand blasting. Only the force which is imparted to the sand is useful. It is therefore self-evident that a machine which discharges a mixture of 14 pounds of air and 35 pounds of sand per minute transforms somewhat over 70 per cent. to the total force put into it in giving useful velocity to the sand it discharges and wastes only somewhat less than 30 per cent. in incidentally imparting velocity to the air that is discharged along with it. Whereas a machine that discharges the same weight of free air per minute at the higher pressure mixed with only 6 to 8 pounds of sand at a maximum, utilizes only 30 to 35 per cent. of the force in usefully throwing sand and wastes some 65 to 70 per cent. of its force in uselessly throwing air at the same velocity. This is to say nothing of the fact mentioned above that at the higher pressures the sand does not so nearly get the same velocity as the air in which it is mixed and propelled as it does at a lower pressure.

Another wasteful point about some of the high-pressure machines is the fact that they use a very short nozzle. It is evident that the higher the pressure and the greater the velocity sought to be imparted to the sand, the longer should be the nozzle through which the mixture passes, so that the air will have a longer time to act on the sand. The reason that this is not done is that at the higher velocities the wear of the flying sand is so destructive to the nozzles as to be more expensive, and therefore recourse is had to a short nozzle, thereby deliberately sacrificing economy and efficiency of action to secure a longer life to this part of the machine.

One other point in regard to the proportioning of the velocity to the work to be done. One might readily imagine from the above reasoning that a still lower pressure would be still more economical. In general this is so, and for work like the depolishing of glass, where the removal of any of the substance is not desired, but only the roughening of the surface, where the effect will be produced at a very low velocity, it is most economical to use air pressures as low as about one pound to the square inch, the reason being that at that pressure each grain of sand completes the work by striking the surface, and the same surface does not require another blow from another grain of sand. The same with cleaning of castings and forgings. At 10 to 20 pounds to the square inch, depending upon the nature of the sand or scale to be removed, each grain of sand cuts down to the clean metal and the same spot does not require another blow to complete the work. If the blow were weaker, too weak to finish the work at each impact, so that a second and third blow were required to complete it, then the process would be less economical than when it was finished at one blow. But it can readily be seen that even this would not be so wasteful as making each blow several times as hard as is necessary to clean down to the metal each time it is struck, for if this is done a great proportion of the force of the blows would be wasted on the clean metal beneath the sand and scale which you want to get rid of, instead of being practically all expended in removing the sand or scale which it is desired to remove. If necessary to put the comparison in a word, it can best be done by saying that the use of the high-pressure machines for this purpose is much like a proposition to use a heavy, long-stroke pneumatic riveting hammer in place of a light, quick short-stroke hammer for work suitable for the latter.

We shall be pleased to answer any questions that you may desire to ask.

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