# Treatise on Moulding Sand

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# *A TREATISE ON MOULDING SAND*

*By H. S. VROOMAN.*

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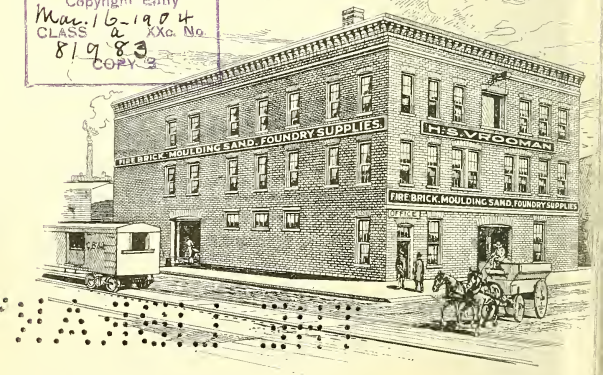


**Shippers of every grade of Moulding Sand for all grades of work.**

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# A TREATISE ON MOULDING SAND

IN the selection of a moulding sand there is no rule that can be laid down for the selection of sand for a particular grade of work, as all foundries differ some in their operation and practice.

A sand that suits one foreman another can not use or would not have. This is not a difference in ability, but in conditions. A sand used in different shops under like conditions will give like results, but under different conditions will not give like results. Every practical man in the foundry business has his ideal in a moulding sand, although he is seldom able to obtain it. We frequently hear certain sands spoken of as being the best sand on earth. Yet, if a visit could be paid to the foundries located in the district that this sand comes from, you would find the usual conditions, i. e., an occasional scab or draw-down, and if the books could be seen, the percentage of loss would be the same as elsewhere. These losses will occur in the best

shops, with the best of moulding sand. The only thing that can be done is to keep them down to a minimum, which can be done with a sand suitable for your work. In ordering sand, allowance must be made for variation, as it is hardly possible you will receive any two shipments that are *exactly* alike. This variation is due to the way sand lays in the pit. Sand deposits, in most cases, are but pockets, being washed in at some time by a flood or overflow, and are usually found in the vicinity of streams or bodies of water. Some deposits contain two and even three grades of sand. These are all mixed together as a whole and shipped, unless the different grades are so separated that they can be mined separately.

Moulding sand is really manufactured at the pit, and it is the ability of the shipper in the manipulation of the sand to put it on the market to suit his customers, and a shipper that understands his business will be able to deliver regularly a good average grade of sand. The time of the year at which sand is dug will make a difference in the quality. A sand digs best

when it is of a temper to work, containing just enough water to mix well and soften up easily. Wet sand will not mix well, as the alumina rolls down and sticks together, neither is sand that is dug dry good, as the alumina is dried up in lumps and can not be broken. If it were possible to dig sand and allow it to weather out over winter and ship it the following season, it would be of much more uniform quality. The expense attached to this method of loading sand would increase the cost too much and the foundries would not want to pay the difference. Not being able to lay down a rule for the selection of a sand for different grades of work, owing to the different conditions under which it is used, the question then arises: What is a good moulding sand? What kind of sand shall be selected and how shall this selection be made? *To begin with, a good moulding sand will resist the pressure of the liquid metal, give free escape to the gases, separate easily from the castings when cool, leaving a clean, smooth surface.* To fill the first requirement, the sand must contain sufficient alumina or

bond to resist the pressure of the liquid metal; this must be kept within reason or it will not permit the free escape of the gases. The amount must be determined by experiment. Railroad work will burn out sand faster than agricultural castings and will require a sand higher in alumina, etc. All sand will burn out or lose its plastic nature at a red heat and to the extent that a sand becomes red-hot from the face of the mould, to that depth will it burn out and become a loss and to that amount must be renewed, and while on that point it might be well to say that a sand heap should have a little new sand every day. The theory held by some that the new sand that is put into the facing sand is enough to keep the heap in good condition is wrong. There is nothing as hard on sand as sea coal. This facing sand is all brought in contact with the melted iron and if it does not burn out from contact with the casting it is burned out from the sea coal taking fire and the passage of gases through the pores left open by burning out of the coal. The renewal of a sand heap is a thing which should

be looked after carefully, as many losses that are laid to the sand are the result of *rotten sand heaps.* This renewal should not be left to the men, but should be seen to by the foreman, and the proper amount of new sand put into the heaps every day. The more open a sand is the easier it will separate from the castings. To secure a smooth face use as fine a sand as you can without it burning on to the face of the casting. It is advisable to use as open a sand as you can without it cutting, as an open sand will *carry more water,* which will aid in giving better lifts and clean draws. You can *ram it harder,* which will keep the casting down to weight, and it will *vent easier.* In making a test of a sand a thorough trial should be given, and when failure is met with an analysis of the *causes* as well as the composition should be made and the exact fault located. It may be found under careful scrutiny that a sand you would condemn offhand may be used to advantage when it is thoroughly understood. In making the analyses of sands, three determinations are all that are necessary — (1) alumina, (2)

free silica, (3) loss on ignition. The alumina denotes the strength or wearing qualities, free silica the openness or porosity, the loss upon ignition the water of crystallization and vegetable matter. To this might be added a determination for iron; sand that is very red in color will analyze high in iron. Iron adds a further bond to the sand in addition to the alumina, without closing up the pores. Impurities, such as lime and magnesia, as a rule do not exist in sufficient quantities to do any harm, and can be ignored. After you have decided on about the grade of sand you want to use, you may then have trouble in finding what you want. The next move is for you to buy two or more grades of sand and blend them. This is the only solution of the moulding sand problem and the one way for the foundry men to get good sand and one containing the proper percentage of the different elements. By this method a coarse sand can be made finer by the addition of fine sand, and a fine sand can be made coarse by adding coarse sand, etc. Your percentage of alumina can be increased or decreased at will by

adding open or strong sand in proportions to suit your work. By blending I do not mean to buy two or three grades of sand and put them all in one bin or shed, or put them in different sheds and allow the moulder to dig into them at will. These sands should be bought differing in composition and structure to the extent that they may be used separately on some of your work and when mixed together will give you a sand that you can use generally. The blending process should be done with a mechanical mixer, a machine that every foundry should have. This should not be a machine that will throw the sand out as fast as it is put into it, but a machine that will mix it thoroughly. Care should be taken in mixing and the proper proportions used. Mix by measure and not by weight, as one sand may contain more water than the other and would weigh more. Should your sand go back on you for any reason in the blending process, you have the means at hand by which you can remedy the trouble at once. *You do this in your mixture of iron, why not in sand?* Local sands are not always suitable for

local work, but by the blending process an inferior local sand can be built up by mixing with it a good foreign sand. I have before me the analyses of two sands. No. 2-E, a coarse sand suitable for machinery and general jobbing. The No. 80, a medium grade, suitable for agricultural, malleables and medium-weight castings. We have sold these sands for years and they have given entire satisfaction for this purpose. These two sands come from different States, and as an example of what can be done with them by the blending process, we will mix for example fifty per cent of each. The analyses are as follows:

ANALYSIS NO. 2 SAND, COARSE.

| | Per cent. |
|---|---|
| Loss on ignition | 3.98 |
| Silica | 79.22 |
| Oxide of iron | 5.21 |
| Oxide of aluminum | 9.86 |
| Calcium oxide | .80 |
| Magnesium oxide | .93 |
| Total | 100.00 |

FINENESS NO. 2 SAND.

| | Per cent. |
|---|---|
| 20-mesh | 96.08 |
| 40 " | 72.60 |
| 60 " | 26.77 |
| 80 " | 21.05 |
| 100 " | 15.40 |

The percentage of sand passing through the different mesh sieves:

ANALYSIS NO. 80 SAND, MEDIUM.

| | Per cent. |
|---|---|
| Loss on ignition | 3.36 |
| Silica | 80.57 |
| Oxide of iron | 7.05 |
| Oxide of aluminum | 8.67 |
| Calcium oxide | .35 |
| Magnesium oxide | Trace |
| Total | 100.00 |

FINENESS NO. 80 SAND.

| | Per cent. |
|---|---|
| 20-mesh | 98.87 |
| 40 " | 83.24 |
| 60 " | 67.72 |
| 80 " | 63.16 |
| 100 " | 54.11 |

**BLENDED ANALYSES.**

| | Per cent. |
|---|---|
| Loss on ignition | 3.67 |
| Silica | 79.895 |
| Oxide of iron | 6.13 |
| Oxide of calcium | 9.265 |
| Calcium oxide | .575 |
| Magnesium oxide | .465 |
| | 100.000 |

Fineness of blended sands:

| | Per cent. |
|---|---|
| 20-mesh | 97.47 |
| 40 " | 77.92 |
| 60 " | 47.24 |
| 80 " | 42.10 |
| 100 " | 34.75 |

The blending of these two sands is for the purpose of changing their physical structure and not the chemical, as the two sands analyze very nearly alike. But the chemical analyses

of sands can be changed just as readily by the same methods. The usual complaints about sands are that they are either too coarse or too fine, and it is to show how this difficulty can be overcome that these two sands are used. By the process the fine sand is made coarser and the coarse sand the reverse, and you have in the blended sand an intermediate grade, something that is very hard to find in nature. The blended analysis is found by adding together the determination of the same element in both sands and dividing it by two, as the sand is mixed fifty per cent of each. For example, the silica of the No. 2 sand is 79.22 per cent and of the No. 80 it is 80.57 per cent. The sum of the two is 159.79 per cent, divided by 2 leaves 79.89 per cent, the silica of the blended sample.

| | Per cent. |
|---|---|
| Silica of No. 2 Sand..... | 79.22 |
| Silica of No. 80 Sand..... | 80.57 |
| | 2) 159.79 |
| Silica, blended sand..... | 79.89 |

The same is done with the other elements; also use the same method in the determination of the fineness of

the blended sample. In figuring these analyses they have only been carried out two places.

In gauging the fineness of these two sands an average sample is taken of each and passed over five different mesh sieves from a No. 20 mesh up to 100 mesh to the inch. The percentage passing through each sieve is used in the determination for fineness. By adding together the amounts that passed through each different sieve and dividing this by 5, the number of sieves used, it will give you the average per cent that passed through all the sieves, which number you can use to designate the grade of your sand; for example, the total amount of the No. 2-E sand passing through the different-sized sieves is 231.90 per cent, divided by 5 equals 46.38 per cent, the average per cent passing through all the sieves. This will be the average grade of this sand. On the No. 80 sand the total passing through all the sieves is 367.10 per cent, divided by 5 gives 73.42, the average per cent passing all the sieves, which will be the average grade of the No. 80 sand. By taking the difference between these two sands you are able

to tell how much finer one sand is than the other.

No. 2-E Sand.

| | Per cent. |
|---|---|
| 20-mesh | 96.08 |
| 40 " | 72.60 |
| 60 " | 26.77 |
| 80 " | 21.05 |
| 100 " | 15.40 |
| 5) | 231.90 |
| Average fineness No. 2-E Sand... | 46.38 |

No. 80 Sand.

| | Per cent. |
|---|---|
| 20-mesh | 98.87 |
| 40 " | 83.24 |
| 60 " | 67.72 |
| 80 " | 63.16 |
| 100 " | 54.11 |
| 5) | 367.10 |
| Average fineness No. 80 Sand..... | 73.42 |

| | Per cent. |
|---|---|
| No. 80, average fineness..... | 73.42 |
| No. 2-E, average fineness..... | 46.38 |
| Difference ..... | 27.04 |

By the above it will be seen that there was 27.04 per cent more of the No. 80 sand passed through all the sieves than there was of the No. 2-E and is therefore that much finer. By adding up the fineness of the blended sample it will be seen that the average percentage that passed through all the

*Continued on page 16.*

# A CARD

OUR object in sending out this little book is to get you to place your order for moulding sand with us. Our long experience in the business places us in a position to furnish you with *every known grade* of moulding sand. Our sand pits are so located that we are able to reach all points in the Middle and Western States with a minimum freight rate, and we are able to deliver at a *reasonable price* a grade of moulding sand that you can not find locally. We want your business and if you will give us a trial you will be pleased with the results. In addition to the moulding sand, we *manufacture* and carry in stock a complete line of foundry supplies, foundry facings, plumbago and silver lead, fire brick, etc., on which we solicit your business.

Hoping to be able to serve you, I am, Yours truly,

H. S. VROOMAN.

sieves is 59.9 per cent, a grade just between the two sands. It is a hard matter to convey by words the change that has been wrought in these two sands by blending them. They must be seen to be appreciated, and to those interested we will be pleased to send, on application, samples of these sands or any of the sands which we mine. We have a large number of moulding sands suitable for all classes of work and for blending purposes. If you are having trouble with your sand or seeking to improve your castings and will write us, we will be pleased to furnish you with any information we have.

H. S. VROOMAN.