

МИНИСТЕРСТВО ОБЩЕГО И ПРОФЕССИОНАЛЬНОГО ОБРАЗОВАНИЯ
РОССИЙСКОЙ ФЕДЕРАЦИИ

САМАРСКИЙ ГОСУДАРСТВЕННЫЙ АЭРОКОСМИЧЕСКИЙ
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МЕТАЛЛУРГИЯ

Учебные задания
по английскому языку

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Составлены в соответствии с требованиями программы по английскому языку для неязыковых специальностей вузов и содержат упражнения для закрепления каждой грамматической темы.

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LESSON 1

I. Запомните следующие слова.

1. Furnace - печь
blast furnace - доменная печь, домна
2. to reduce - восстанавливать
reduction - восстановление
3. to bring about - создавать, вызывать
4. to throw out of line - выводить из соосности
5. desulphurisation - обессеривание, выделение серы
6. furnace top - колошник
top gas - колошниковый газ
7. flue dust - пыль, уносимая в дымоход при плавке руд
8. stove - печь, воздушонагреватель для домны
9. tuyere [ˈtʃwaɪə] - фурма
10. impurity - примесь
11. crucible - тигель, металлоприемник доменной печи
12. pig-iron - доменный чугун, чугун в чушках
13. hoisting - подъем
14. to line - облицовывать, футеровать
15. hearth [ˈhɑːθ] - горн, под (печи)
16. bosh - заплечики (у домны), распар
17. stack - шахта печи
18. slag - шлак, окалина
19. to charge - загружать

II. Дайте значения следующих интернациональных слов:

reaction, temperature, container, material, practically, form, metal, method, construction, designed, proportion, monoxide, ton, apparatus, modern, vertically, distance.

III. Переведите следующие предложения.

1. The advantages of the blast furnace lie in the reduction (recovery) of all the iron from the ore.
2. The construction of the blast furnace is changed greatly due to the changing industrial conditions.
3. Heated air from stoves is blown in near the bottom through openings called tuyeres.
4. The process is continuous except for periodical removal of the impurities in the form of slag and of the metal through large openings in the crucible of the furnace.

5. The modern blast furnace is divided vertically for convenience into three main parts.
6. No generalization can be given as to size and depth; they will vary with the conditions of soil (sand, clay or rock) on which the furnace is built.

IV. Переведите следующие слова и выражения.

At the same time; except for; in the present-day practice; besides; cross section; for convenience; in view of; of great importance; in proper proportions.

V. Переведите производные слова.

to reduce - reduction; to contain - container;
to recover - recovery; to deliver - delivery;
cheap - cheapness; high - height; deep - depth;
strong - strength; to continue - continuous;
to remove - removal; to produce - production;
to introduce - introduction; to found - foundation - founder.

VI. Выберите из колонки "Б" синонимы к данным словам.

A	B
1. high	1. old
2. charge	2. low
3. modern	3. weak
4. strong	4. discharge
5. cheap	5. bottom
6. top	6. expensive

VII. Прочитайте и переведите текст.

The Blast Furnace

Part I

The reduction of the iron ores is brought about by a reaction¹ with carbon from the fuel used to smelt them, at the high temperature made to prevail in the container of the material - the furnace. The advantages of the blast furnace lie in the recovery of practically all the iron from the ore, the delivery of both iron and slag in the liquid form and the desulphurization of the metal, and in the cheapness of the method.

Construction of the Blast Furnace

General. - The changing industrial conditions have brought about radical changes in the construction of the modern blast furnace. A blast furnace is now designed so that a mixture of ore, fuel, and flux in proper proportions can be charged through a specially constructed opening in the top of a cylindrical furnace and top-gas and flue dust withdrawn for recovery, treatment and use. At the same time heated air from the stoves which obtain their heat from the combustion of this top gas, is blown in near the bottom through opening called tuyeres, forming carbon monoxide, which passes up through the openings in the charge to reduce the iron ore. The process is a continuous one except for periodic removal of the impurities, in the form of slag, and of the metal, through large openings in the crucible of the furnace.

In present-day practice the production of a ton of pig-iron involves the use of about 2 tons of iron ore, 1 ton of fuel, 4 tons of air, and 0,35 ton of flux and produces, besides 1 ton of pig-iron, 6 tons of gas, 0,6 ton of slag, and 75 to 375 pounds of flue dust.

While the central equipment in a blast-furnace plant is the furnace with its auxiliary apparatus for hoisting the materials to the top and handling the slag and molten metal, a considerable investment, and much space must be provided for auxiliary apparatus.

The modern 1000-ton blast furnace is circular in cross section, 90-100 feet high and lined with fire brick, held in a close-fitting steel shell which is divided vertically for convenience into three main parts. The bottom, cylindrical in form and some 10 to 12 feet deep, is termed the hearth or the crucible; the second section, in the form of an inverted frustum of a cone, 9 to 12 feet in height, is called the bosh; and resting on the bosh, and extending up for a distance of about 7 feet, is the stack. Finally, the whole is capped by a furnace top, providing means for the introduction of the charge and withdrawal of the gas and the flue dust.

Foundations. - The foundations of a modern blast furnace must carry a total load of nearly 4000 tons. In view of this immense weight and the fact that a small amount of settling will crack the lining or throw the scip and the charging

devices out of line², the stability of this foundation is of great importance.

No generalization can be given as to size and depth; they will vary with the conditions of soil (sand, clay or rock) on which the furnace is built. On a proper bed, the foundation is built up with several feet of concrete, on top of which is laid common brick of good quality and strength except directly beneath the hearth and walls of the furnace, where the fire brick is used.

Notes:

1. The reduction of the iron ores is brought about by a reaction-
Восстановление железных руд является результатом реакции.
2. or will throw the skip and the charging device out of
line. - или выведет из соосности скиповое и загрузочное
устройство.

VIII. Закончите следующие предложения.

1. The changing industrial conditions have brought about radical changes
2. The advantages of the blast furnace lie in
3. In present-day practice the production of a ton of pig-iron involves
4. The modern 1000-ton blast furnace is circular in cross section, 90-100 feet high and lined with fire brick, held in
5. The bottom, cylindrical in form and some 10 feet deep, is termed... .
6. On a proper bed, the foundation is built up with
7. The process is a continuous one except for

IX. Ответьте на следующие вопросы.

1. What are the advantages of the blast furnace?
2. How can a mixture of ore fuel, and flux be charged into the blast furnace?
3. How is the heated air blown into the furnace?
4. How many parts is a steel shell of the blast furnace divided into?
5. What is the height of a modern blast furnace?
6. What load must the foundations of a modern blast furnace carry?

7. What is of great importance in view of the immense weight of the blast furnace?
 8. What materials are used for building foundations?
- X. Переведите следующие предложения.
1. Преимущество доменной печи в том, что практически из руды восстанавливается весь чугун.
 2. В то же время нагретый воздух вдвигается через отверстие, называемое фурмой, образуя окись углерода.
 3. Поперечное сечение доменной печи - круглое, высота ее от 90 до 100 футов и облицована она огнеупорным кирпичом.
 4. Для удобства стальной корпус доменной печи делится на три части: нижнюю - под или тигель, вторую - запячки и третью - шахту.
 5. Нагрузка, которую несут основания доменной печи, в целом составляет около 4000 тонн.
 6. Нет общих указаний относительно размера и глубины основания; они зависят от состояния почвы, на которой строится это основание.

LESSON 2

- I. Запомните следующие слова.
1. to reinforce - усиливать
2. jacket - кожух, обшивка
3. to fit - пригонять, укреплять
4. tapping tool - инструмент (бур или лом) для разделяния
летки (у домы)
5. tapping hole - летка для чугуна, выпускное отверстие
6. notch - паз
cinder notch - шлаковая летка
7. dam plate - железная плита передней огнеупорной стенки
домы
8. circumference - окружность, периферия
9. cooler - рубашка водяного охлаждения
10. gooseneck - изогнутая воздухопроводная трубка; колено фумен-
ного рукава, идущее от кольцевой воздушной трубки
11. stock - шихта, материал в доменной печи
12. bustle pipe - кольцевая (распределительная) трубка дом. печи
13. fire-clay - огнеупорная глина

14. mantle - кожух, крышка
15. molten - расплавленный, литой
16. refractory - огнеупорный
17. prevail - преобладать

II. Переведите предложения на русский язык.

1. This part of the furnace contains the molten metal; it is constructed of fire brick of the best quality.
2. These refractory bricks must be reinforced by heavy metal jackets.
3. A tuyere is an opening through which heated air is blown into the furnace.
4. The bustle pipe encircles the furnace just below the mantle and distributes the hot air to the tuyeres.
5. The outside dimensions are larger in order to allow the insertion of the tapping tools.

III. Обратите внимание на значение следующих слов и словосочет. by means of; in view of; within; because; because of; between; inside; outside; in order; in turn; at right angles; depending upon; namely.

IV. Подберите к словам синонимы из колонки "B".

A	B
1. hole	1. fire bricks
2. internal	2. part
3. jacket	3. to build
4. outside	4. to produce
5. portion	5. inner
6. to construct	6. external
7. by means of	7. hard
8. to create	8. with the help of
9. refractory bricks	9. shell
10. heavy	10. tuyere

V. Прочтите и переведите текст.

Construction of the Blast Furnace

Part II

Hearth or Crucible. - This portion of the furnace which contains the molten metal and slag is constructed of fire brick

of the best quality, usually 60 inches or more in thickness and reinforced by means of strong bands and protected in places with water-cooled plates. The bottom is given a cup-shaped cross section. In the large furnaces the hearth will be 22 to 28 feet in diameter and 11 feet in depth. In view of the fact that the 7 to 10 feet of slag and metal within the crucible creates a considerable pressure on this hearth (namely about 30 pounds per square inch) and because of the high temperature prevailing there these refractory bricks must be reinforced by heavy metal jackets made of riveted steel or plates of segmental iron castings that are closely fitted and bolted together. They are always water cooled: those of cast iron by internal circulating systems and those of steel by coolers set between the brick work of the jackets.

Tapping Hole or Cinder Notch. - The tapping hole or cinder notch is an opening about 6 to 8 inches on the inside, through which the molten metal may be drawn from the crucible. The outside dimensions are somewhat larger in order to permit the insertion of the tapping tools, and at this point the hearth jacket is usually protected by a water-cooled "dam plate". There is usually only one cinder notch, located about 6 feet from the floor of the hearth and 4 or 5 feet above the tapping hole, generally placed 45 degrees from this opening if there are two notches, or 90 degrees if there is only one.

Tuyeres. - Tuyeres, 10 to 16 in number, through which heated air is blown into the furnace, are distributed symmetrically about the upper circumference of the hearth just below the bosh. Indirectly, they also determine the height to which the slag in the furnace may rise above the slag notch; in most furnaces this is about 3 feet, allowing for the collection of 50 to 75 tons of slag. They are protected by tuyere coolers, similar to the cinder coolers. The tuyere which projects into the furnace, is usually made of copper or bronze, 4 to 7 inches internal diameter, and like the cooler, water-cooled to prevent corrosion and distortion. The tuyere stock connects with the nozzle of the gooseneck, to which it is clamped by means of keys, and that in turn meets at right angles the neck of the bustle pipe. The bustle pipe, about 4 feet in outside diameter, and lined with fire-clay brick, encircles the furnace just below

the mantle and distributes hot air to the tuyeres. The life of a tuyere will vary from a few days to 10 months, depending upon furnace conditions and irregularities, raw materials, and conditions of water.

Notes:

1. The brick work is stepped outward, externally, about 6 inches for each 12 inches of vertical rise. - Кирпичная кладка печи расширяется во внешнюю сторону, увеличиваясь приблизительно на 6 дюймов на каждые 12 дюймов вертикального подъема.

VI. Вставьте пропущенные слова.

1. The bottom is given a cup-shaped
2. In the large furnaces ... will be 22 to 28 feet in diameter and 11 feet in depth.
3. Because of the high temperature prevailing there these refractory bricks must be ... by heavy metal jackets.
4. The tapping hole or cinder notch is an ... about 6 to 8 inches on the inside.
5. There is only one, located about 6 feet from the floor of the hearth and 4 or 5 feet above the tapping hole.
6. Tuyeres, 10 to 16 in number, through which heated air is blown into the ..., are distributed symmetrically about the upper circumference of the hearth just below the
7. The bustle pipe, about 4 feet in outside diameter, and lined with fire-clay brick, encircles the furnace just below the ... and distributes hot air to the

VII. Найдите в тексте предложения, где говорится:

1. о размерах горна (пода) доменной печи;
2. о системе охлаждения;
3. о назначении фурмы;
4. о материалах, которые используются для изготовления фурмы;
5. о роли кольцевой (распределительной) трубы доменной печи.

VIII. Ответьте на следующие вопросы.

1. What is the role of the hearth?
2. What is the form of the hearth?
3. What are the dimensions of the hearth?

4. Why must the refractory bricks be reinforced by heavy metal jackets?
5. How many cinder notches are there in the furnace?
6. How many tuyeres are there in the furnace?
7. What for are they done?
8. What materials are the tuyeres made of?
9. What does the bustle pipe distribute to the tuyeres?

IX. Прочитайте текст еще раз. Постарайтесь рассказать:

1. О типе или горне и их назначении;
2. выпускных отверстиях для чугуна;
3. том, что собой представляет фурма.

LESSON 3

I. Постарайтесь запомнить следующие слова.

1. bosh - заплечики (доменной печи)
2. mantle - кожух, покрывка
3. brickwork - кирпичная кладка
4. bosh plate - холодильная плита заплечика
5. to stagger - располагать в шахматном порядке (уступами)
6. joint - соединение, стык
7. fusion - плавка, расплавление
8. stack - шахта печи
9. inwall - внутренняя кирпичная кладка шахты
10. lining - футеровка
11. bosh band - комут

II. Прочитайте следующие интернациональные слова:

limit; start; vertical; horizontal; thermal; mechanical; type; measure.

III. Переведите следующие предложения.

1. The bosh plates protect the brickwork.
2. It is likely to be corroded very rapidly by the hot slag because it is opposite the zone of fusion in the furnace.
3. The shaft is located above the bosh but below the bells and is divided into three almost equal parts called the upper, middle, and the lower inwalls.

4. The brickwork which forms the hearth, bosh, and inwalls, is called the lining.
5. Fire-clay brick is usually applied for the brickwork of the lining in the furnace.
6. The life of the furnace depends greatly upon the lining.

IV. Прочтите и переведите текст.

Construction of the Blast Furnace

Part III

Bosh. - The bosh is that part of the furnace, at the mantle level, just above the upper limits of the crucible, where the furnace attains its greatest diameter. Actually, it is the weakest part and must be very carefully constructed and maintained. Starting at the top of the hearth, the brickwork, which is normally about 27 inches in thickness, is stepped outward, about 6 inches for each 12 inches vertical rise. Each of these step-outs is supported by means of heavy steel "bosh bands". Between these bosh bands cooling plates are inserted; they are called bosh plates. These bosh plates are in horizontal rows about 2 feet vertically apart, the plates in each row being about 2 feet apart and the plates of different rows staggered vertically so as to avoid making weak joints in the brickwork. The bosh plates which are of course water-cooled serve to protect the brickwork, because this point, being opposite the zone of fusion in the furnace, is likely to be corroded very rapidly by the hot slag. At the upper limit of the bosh is the furnace. Upon it rests the weight of the stack and this in turn is supported by a series of cast iron or fabricated steel column which rests on the main furnace foundation.

Shaft or Stack. - This comprises that part of the furnace located above the bosh but below the bells, and, for convenience, is divided into three almost equal parts, called the upper, middle, and lower inwalls. The blast furnaces are lined with thick walls up to 5 feet in thickness. The brickwork forming the hearth, bosh, and inwalls is referred to as the lining; and obviously, because of the very different thermal and mechanical conditions existing at these different level, each

requires a different type of brick. Fire-clay brick is usually used and great care must be exercised because the life of the furnace depends in a large measure upon the lining.

V. Найдите начало или конец предложения.

1. The Bosh is that part of the furnace at the mantle level just above
2. Between these bosh bends cooling plates
3. ... being opposite the zone of fusion in the furnace, is likely to be corroded very rapidly by the hot slag.
4. Upon it rests the weight of the stack
5. ... with thick walls up to 5 feet in thickness.
6. ... each requires a different type of brick.
7. Fire-clay brick is usually used and great care

VI. Вставьте в предложения пропущенные слова.

1. It is the weakest part and must be very carefully ... and maintained.
2. Between these bosh ... cooling plates are inserted.
3. The plates in each row are about 2 feet apart and the ... of different rows are ... vertically.
4. At the upper ... of the bosh the furnace is located.
5. The blast furnaces are ... with walls up to 5 feet in thickness.
6. ... is usually used and great care must be exercised because the life of the furnace depends upon the lining.

fire-clay brick; lined; limit; staggered; plates; bands; constructed.

VII. Ответьте на вопросы по тексту.

1. What is the bosh?
2. Why must the bosh be carefully constructed?
3. What is there between the bosh bands?
4. What do the bosh plates serve for?
5. Where is the shaft located?
6. How many parts is the shaft divided into?
7. Why must great care be exercised while constructing the lining of the furnace?
8. What materials are used in the construction of the lining?

VIII. Просмотрите внимательно текст еще раз. Расскажите:

1. о заплечиках доменной печи;
2. о шахте доменной печи;
3. о футеровке доменной печи.

IX. Переведите следующие предложения на английский язык.

1. Заплечики - это самая слабая часть доменной печи. Эту часть домны нужно конструировать и эксплуатировать очень внимательно.
2. Холодильные плиты заплечиков защищают кирпичную кладку, потому что она, находясь напротив области плавки, корродирует очень быстро под влиянием горячего шлака.
3. Печь находится на верхнем уровне заплечиков.
4. Шахта домны располагается над заплечиками и для удобства ее разделяют на три равные части: верхнюю, среднюю и нижнюю.
5. Все доменные печи облицовываются толстыми стенками толщиной до 5 футов.
6. Обычно для футеровки доменных печей используется огнеупорная глина.

X. Дополните диалог.

A.: What can you say about the bosh of the blast furnace?

B.: _____

A.: _____

B.: There are cooling plates between the bosh bands.

A.: Do the bosh plates protect the brickwork?

B.: _____

A.: Why is the lining so important for the blast furnace?

B.: _____

LESSON 4

И. Догадайтесь о значении следующих интернациональных слов.

Operation; minimum; gas; atmosphere; economically; period; diameter; practice; basis; radiation.

II. Постарайтесь запомнить следующие слова.

1. to slide off - соскользнуть
2. bell - конус, колокол (засыпного устройства доменной печи)
3. hopper - бункер, загрузочный ковш, засыпная воронка
4. stock - шихта, материал в доменной печи
5. charging - загрузка (материала в доменную печь)

6. whence - откуда
7. sufficient - достаточный
8. stove - печь, кауцер, воздушонагреватель (для домен)
9. chamber - камера
10. blast - поток воздуха
11. checkerwork - решетка регенератора, шахматная насадка
12. reverse - обратный
13. leakage - утечка

III. Переведите предложения на русский язык.

1. An arrangement known as a bell and a hopper was put into use since 1850.
2. Much gas was lost during the charging period, so later this was improved by introducing a second bell.
3. A blast-furnace stove is a chamber where the blast or air for the blast furnace is heated.
4. The checkerwork is heated by the combustion of blast-furnace gas.
5. Common practice is to provide four stoves for each blast furnace.
6. These bells are usually made of cast steel with a slope.

IV. Прочтите и переведите текст.

Construction of the Blast Furnace

Part IV

Bell and Hopper. - Today every effort is made in top construction to equalize the distribution of the stock, to eliminate, or compensate for irregularities in operation, and to hold at a minimum the dust carried over with the gas, and the gas lost to atmosphere during charging. To collect the gas economically and easily an arrangement known as the bell and hopper was put into use since 1850. Considerable gas was lost during the charging period, so later this was improved by introducing a second bell. Essentially this consists of a lower large bell and just above it a smaller bell and a hopper, thus providing a gas-tight space between the two. The raw materials of the charge are first dropped into the upper hopper, whence it may fall into the lower one if the small bell is lowered. When sufficient charge has collected over the larger bell for charging into the furnace, the larger bell is lowered, permit-

ting the charge to fall into the furnace without escape of much gas. These bells are usually made of cast steel with a slope of 45 to 55 degrees, sufficient to permit the charge to slide off readily!

Stove. - A blast-furnace stove is a chamber where the blast or air for the blast-furnace is heated. A blast-furnace stove has the shape of a cylinder of boiler plate about 22 feet in diameter by 100 feet in height filled with a checkerwork of the fire-brick. This checkerwork is heated by the combustion of blast-furnace gas and gives up a part of its heat to air from the atmosphere, passed through it in the reverse direction. Common practice is to provide four stoves for each blast-furnace, on that basis that, as the number of stoves increases: 1) the velocity of the gas, and hence the rate of heat transfer, falls off; 2) the heat losses through radiation increase; 3) leakage increases.

Notes:

1. with a slope ... sufficient to permit the charge to slide off readily. - с наклоном ..., достаточным, чтобы шихта легко соскользнула (в печь).
- V. Вставьте пропущенные слова.
1. Considerable gas was lost during the
2. Essentially this consists of a lower large ... and just above it a smaller bell and a hopper.
3. The raw materials of the charge are first dropped into the upper
4. A blast-furnace ... has the shape of a cylinder of boiler plate about 22 feet in diameter by 100 feet in height.
5. The ... is heated by the combustion of blast-furnace gas and gives up a part of its heat to air from the atmosphere.
Checkerwork; stove; hopper; bell; charging period.

VI. Ответьте на вопросы по тексту.

1. What was put into use in 1850?
2. What was the arrangement known as a bell and a hopper designed for?
3. What parts does this arrangement consist of?
4. How does it operate?

5. What can you say about a blast-furnace stove?
6. What is the shape of the blast-furnace stove?
7. What is a checkerwork?
8. How many stoves are usually used in the blast furnace?

VII. Переведите следующие предложения на английский язык.

1. Печь домы - это камера, где нагревается воздух для доменной печи.
2. Обычно используются 4 печи в домне.
3. Значительная часть газа теряется в момент загрузки доменной печи.
4. Загрузочное сырье сначала падает в верхний бункер, откуда оно может попасть в нижний, если понизить положение малого конуса.
5. Печь домы по форме представляет собой цилиндр приблизительно 22 фута в диаметре и 100 футов высотой.

VIII. Переведите следующий текст без словаря.

The burning of blast-furnace gas in stoves for the regenerating heating of air for the blast-furnace is the oldest and, metallurgically, the most important of uses. It is universally performed with unmixed blast furnace gas and normally requires for a blast temperature 730°C not over 25 per cent of the total gas generated by the blast-furnace.

Найдите в тексте предложение, где говорится о самом важном применении газа доменной печи.

IX. Дополните диалог.

A.: When was the arrangement known as a bell and a hopper put into operation?

B.: _____

A.: _____

B.: Essentially this consists of a lower large bell and just above it a smaller bell and hopper, thus providing a gas-tight space between the two.

A.: What can you say about a stove?

B.: _____

A.:

B.: Usually there are four stoves in the blast furnace.

X..Просмотрите еще раз основной текст урока и расскажите о:

1. устройстве, известном как конус и бункер доменной печи.

2. печах и их количестве.

LESSON 5

I. Запомните следующие слова.

1. arc - дуга

2. suspend - подвешивать

3. lime - известь

4. bulk - основная масса, большая часть

5. distinguish - различать

6. high grade steel - высококачественная (инструментальная) сталь

7. to deoxidize - раскислять

8. to tap - отводить, выпускать плав

9. ladle - литейный ковш, ковш для разлива металла

10. to teem - разливать (слитки)

11. mold - мульда, литейная форма, изложница

12. ingot - слиток, болванка, чушкa, брусок металла

13. blowhole - раковина в слитке металла

14. segregation - расслоение (бетона), segregation, отделение

15. shrinkage - усадка, сжимание

II. Подберите русские значения английских слов.

1. bulk

I. дуга

2. high grade steel

2. отводить

3. to tap

3. литейный ковш

4. mold

4. раковина в слитке металла

5. blowhole

5. расслоение

6. segregation

6. мульда

7. ingot

7. известь

8. ladle

8. высококачественная сталь

9. lime

9. основная масса

10. arc

10. слиток, болванка

III. Переведите производные слова.

- to remove - removal - removable
- to apply - applied - application
- to equip - equipment
- to suit - suitable
- to line - lining

IV. Переведите следующие предложения.

1. There are three carbon or graphite electrodes suspended from the roof.
2. Some of arc-type electric furnaces include different methods of filling, various methods of applying removable roofs.
3. The lining of the furnace is very important; it is the main feature of the furnace.
4. The electric furnace may start with cold charge.
5. The steel made this way is spoken of as cold-melt electric furnace steel.
6. In the production of high grade steel for tools the slower and more expensive cold-melt method is used.
7. The resulting casting is called an ingot.

V. Прочтите и переведите текст.

Arc-type electric furnace

In most electric furnaces the heat is produced by means of an arc either above the bath, or by means of arcs between the slag and electrodes suspended above the bath, the latter being the more satisfactory and common method. There are generally three carbon or graphite electrodes suspended from the roof. Each of these electrodes is connected to one phase of a three-phase current and lowered into the bath in such a manner that an arc is formed between the slag and each electrode.

The modern arc-type electric furnace is cylindrical in shape and of the standard three phase, three electrode arc type as it was originally developed. Some of these include different methods of filling, various methods of applying removable roofs to medium-sized furnaces, and arrangement and application of electrical equipment.

The lining of the basic electric furnace is of extreme importance and one of the principal features of the furnace.

The hearth must be made from a magnesite or burned dolomite material to withstand the lime slags used in the basic process. The walls and roof may be made from a silicate brick and need not be basic, but must withstand extremely high temperatures.

In making up a heat of steel, the bulk of the charge is made up of carefully selected steel scrap of such a composition that upon melting down the bath will contain a smaller amount of the alloying elements than is required in the finished steel. The practice permits the addition of suitable ferroalloys and carbon for proper adjustment of the chemical analysis of the steel charge. Other melting methods such as open-hearth, may use pig-iron as a raw charge, whereas the electric furnace never starts out with a charge of pig-iron. Through the use of carefully selected raw materials a greater economy may be had in this process. The electric furnace may start with cold charge and the steel made this way is spoken of as cold-melt electric furnace steel to distinguish it from that resulting from the practice of using hot or molten charge previously melted in an open-hearth furnace and transferred to the electric furnace. In the manufacture of high grade steel for tools, the slower and more expensive cold-melt method is almost always used.

When the heat of steel has been properly deoxidized or killed and is of proper chemical composition, it is ready to tap into the ladle. The melt is tapped into the ladle and poured or teemed into a mold made from cast iron.

The resulting casting is called an ingot, and the mold used is the ingot mold. The tapping and pouring of the steel into the ingot molds is carried out with the greatest care. It is important that the cast ingot be as free from blowholes, shrinkage holes, segregation, etc., as is possible to ensure good ingots. No steel from an ingot is sounder than the ingot from which it was made.

VI. Подберите начало или конец предложения.

- | | |
|--|--|
| 1. The modern arc-type electric furnace is cylindrical in shape and of the | 1. suitable ferroalloys and carbon for proper adjustment of the chemical analysis of the steel charge. |
| 2. The lining of the basic electric furnace is of | 2. proper chemical composition, it is ready to tap |

- | | |
|--|---|
| | into the ladle and proved or teemed into a mold made from cast iron. |
| 3. Through the use of | 3. carefully selected raw materials a greater economy may be had in this process. |
| 4. The practice permits the addition of | 4. extreme importance and one of the principal features of the furnace. |
| 5. When the heat of steel has been properly deoxidized or killed and is of | 5. standard three phase, three electrode arc type as it was originally developed. |

VII. Ответьте на вопросы.

1. How is the heat produced in most electric furnaces?
2. How many electrodes are there suspended from the roof?
3. What is the shape of the modern arc-type electric furnace?
4. What is very important for any furnace?
5. What materials are used in the construction of the hearth?
6. Why may a greater economy be obtained in the arc-type electric furnaces?
7. What method is used in the production of high grade steel for tools?
8. How is the resulting casting called?

VIII. Переведите на английский язык.

1. К каждому из трех электродов подается однофазовый или трехфазовый ток.
2. Форма современной дуговой электрической печи цилиндрическая.
3. Футеровка печи — это одна из самых основных характеристик доменной печи.
4. Используя тщательно подобранное сырье можно достичь значительной экономии.
5. Электрическая печь может работать при охлажденном металле.
6. Расплавленная масса выливается (отводится) в мульд.
7. Литье, получаемое в результате, называется слиток (болванка).
8. Важно, чтобы отлитая болванка не имела раковин, усадки, расслоения.

IX. Просмотрите текст еще раз. Перескажите его.

LESSON 6

I. Постарайтесь запомнить следующие слова.

1. alloy - сплав
2. frequency - частота
3. current - ток
4. coil - катушка
5. to surround - окружать
6. stirring- помешивание, взбалтывание
7. open-hearth furnace - мартеновская печь, печь с открытым подом
8. particularly - в частности, в особенности
9. to require - требовать, нуждаться

II. Подберите синонимы.

- | | |
|------------------|-------------------|
| 1. to take place | 1. fast |
| 2. to make | 2. condition |
| 3. to cause | 3. amount |
| 4. rapid | 4. to need |
| 5. state | 5. to bring about |
| 6. quantity | 6. to occur |
| 7. to require | 7. to produce |

III. Подберите антонимы.

- | | |
|--------------|---------------|
| 1. different | 1. slow |
| 2. high | 2. solid |
| 3. directly | 3. discharge |
| 4. rapid | 4. cooling |
| 5. liquid | 5. low |
| 6. charge | 6. similar |
| 7. heating | 7. indirectly |

IV. Переведите производные слова.

1. to differ - difference - different
2. frequency - frequent - frequently
3. charge - discharge
4. control - controllable
5. heat - heating - heated - heater
6. cool - cooling - cooler

V. Переведите следующие предложения.

1. The high frequency induction furnaces differ greatly from electric furnaces.
2. Induction furnaces insure a thorough mixing of the molten metal.
3. Induction furnaces are more economical than the electric-arc type of furnace.
4. High melting temperatures are obtained using the induction method.
5. If small quantities of special alloys are needed, an induction furnace may replace the open-hearth furnace.

VI. Вставьте пропущенные слова.

1. An electric ... is induced within the metal charge from a coil of copper tubing carrying a high frequency current, which surrounds the crucible.
2. A fortunate phenomenon of ... insures a thorough mixing of the molten metal.
3. By the ... high melting temperatures are obtained.
4. This is a natural ... action which occurs in the liquid charge as soon as the molten state of the charge is obtained.

induction method, induction furnaces, current, stirring.

VII. Прочитайте и переведите текст.

Induction Furnace

A radically different type of electric furnace, sometimes used in making small tonnages of steel or special alloys, is the high frequency induction furnace. An electric current is induced within the metal charge from a coil of copper tubing carrying a high frequency current, which surrounds the crucible. The induced current is forced to flow directly through the charge, causing very rapid heating. A fortunate phenomenon of induction furnaces insures a thorough mixing of the molten metal. This is a natural stirring action which takes place in the liquid charge as soon as the molten state of the charge is reached. By the induction method high melting temperatures are obtained, as well as exact and controllable melting conditions.

It is more economical than the electric-arc type of furnace; in some instances it may replace the open-hearth furnace, particularly when small quantities of special alloys are required.

VIII. Ответьте на вопросы.

1. When is an induction furnace used?
2. How is the electric current induced in the induction furnace?
3. What does the induction furnace insure?
4. What is obtained by the induction method?
5. Is the induction method more economical than the electric-type of furnace?
6. What kind of furnace may the induction furnace replace?

IX. Просмотрите текст еще раз. Перескажите текст.

X. Additional text. Переведите текст.

Electric Furnace Steel

The electric furnace has proved to be an ideal melting and refining unit for the steel industry. Its advantages include the following: the monoxidizing condition of the carbon arc, which is pure heat, makes possible a tightly closed furnace and permits maintenance of reducing atmosphere; the temperature attainable is limited only by the refractory nature of the furnace lining; close limits of regulation and control are obtainable; the efficiency of the unit is extremely high; refining and alloying are readily accomplished and controlled. The steel industry has at its command a method of producing steel, which in competent bands, can operate on a tonnage basis and meet the most exacting specifications.

XI. Перечислите преимущества получения стали в электрической печи.

Text 1

Refining Period

The beginning of the refining period is usually taken as the time when the metallic charge has melted and the limestone has been partly calcined and has floated up from the bottom to the furnace. The time from the finish of charging to the point when the heat is melted varies with the size and condition of furnace, the fuel, and the type of charge.

The following description covers the practice for 150-ton furnaces using oil. In type 1, a charge consisting of lime, ore, and liquid iron, the melting time will be from 3 to 7 hr. In type 2, which is an entirely liquid metallic charge, the first liquid steel (Bessemer-blown metal) poured into the furnace freezes over the lime on the bottom, but the later additions remain molten. The chilled metal melts rapidly and releases the lime from the bottom so that this type of heat reaches the refining stage within 30 to 45 min. after the last ladle of liquid metal is added. In type 3 (cold steel scrap and liquid iron), the normal melting time is from 3 to 5 hr., but when ore is added with charge and a larger proportion of liquid iron is used, the time is usually decreased. In the case of types 4 and 5, which are wholly cold charges, the melting time varies from 4 to 8 hr.

Text 2

Charging the Furnace

The following description is based on the practice used for a 150-ton furnace charged with 55 per cent scrap and 45 per cent liquid iron (hot metal), with limestone as a flux. The solid material to be charged is brought on the top of the open hearth building in boxes which are carried on small railroad cars or buggies, each of which usually holds four boxes. Each box is picked up by a charging car which has a ram that fits a groove on the end of the box. The box is lifted from the car, inserted through the furnace door, and the contents are dumped inside the furnace.

The usual sequence in charging is to spread several boxes of light scrap on the bottom and place the limestone on top of

this scrap. The reason for charging some scrap first is to prevent the lime from adhering to the bottom. The remainder of the scrap is then charged on the top of the limestone. The flame is turned on partly while this material is being charged, and a full flame is carried after the charging is completed. The scrap is heated during the next period in the charging cycle, which lasts from 2 to 3 hr. This time varies with the type of scrap (light or heavy) and with the condition of the furnace. At the end of this heating period the scrap is partly melted and considerable iron oxide has been formed. An important feature of the furnace operation is to obtain the correct amount of oxidation, as this iron oxide is the principal agent for oxidizing the impurities in the hot metal (liquid iron) during the melting period.

The charge is completed by the addition of blast-furnace metal, which is brought to the furnaces in ladles of 40 to 60-ton capacity. A stand with a spout projecting into the furnace is placed at one of the doors, and the hot metal is poured into the furnace. Two ladles of hot metal are required, and the addition of this takes from 30 to 60 min. When the hot metal is being added, a vigorous boiling action often occurs as the metal mixes the scrap in the furnace, owing to the reaction between the iron oxide on the scrap and the carbon in the hot metal. This action may cause the slag to foam and run out over the sills of the doors¹ and is corrected by slowing down the rate of adding the hot metal until the action subsides. The addition of the last ladle of hot metal completes the charging period.

Notes:

1. This action may cause the slag to foam and run out over the sills of the doors. - Эта реакция может вызвать вспенивание шлака и передливание его через пороги рабочих окон.

Text 3

The Working Period

The stage in a heat following the charging and melting periods is the "working" or final refining period. This extends from the time the heat is melted to the deoxidation or

tapping time. It has been pointed out that during melting a certain proportion of the carbon, manganese, phosphorus and silicon was eliminated by oxidation. The oxygen during this period was obtained from the iron oxide present and formed on the scrap during charging and melting, from the furnace gases after the heat was "under cover", i.e., when the charge was covered by slag, and from the carbon deoxidation in the limestone. An additional source of oxygen during the melting period is iron ore in the types of practice where this is added with the charge. During the working period the refining is also accomplished by oxidation, but the sources of oxygen during this period are the furnace gases and iron ore added to the bath. The oxygen that comes from furnace gases is a relatively small proportion of the amount required to oxidize the elements in the bath within a reasonable length of time. Consequently, iron ore is used to control and accelerate the rate of oxidation. The ore also accelerates the "shaping up" or solution of the undissolved lime in the slag, and creates a boiling action in the bath which is advantageous in eliminating gases from the steel and controlling the temperature.

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